

## **Contents**

<b>1 Building Materials</b>	<b>1</b>
<b>2 Surveying</b>	<b>53</b>
<b>3 Soil Mechanics and Foundation Engineering</b>	<b>113</b>
<b>4 Applied Mechanics</b>	<b>157</b>
<b>5 RCC Structures Design</b>	<b>193</b>
<b>6 Construction Management</b>	<b>232</b>
<b>7 Theory of Structures</b>	<b>246</b>
<b>8 Estimating and Costing</b>	<b>276</b>
<b>9 UPSC Civil Service Exam Questions</b>	<b>291</b>
<b>10 Building Construction</b>	<b>503</b>
<b>11 Concrete Technology</b>	<b>538</b>
<b>12 Strength of Materials</b>	<b>574</b>
<b>13 Tunnelling</b>	<b>610</b>
<b>14 Engineering Economy</b>	<b>617</b>
<b>15 GATE Exam Questions</b>	<b>631</b>

# 1 Building Materials

## Section 1

1. In a mortar, the binding material is  
A. cement    B. sand    C. surkhi    D. cinder.
2. Lacquer paints  
A. are generally applied on structural steel  
B. are less durable as compared to enamel paints  
C. consist of resin and nitro-cellulose  
D. contain alcohol as thinner  
E. all the above.
3. Wrought iron contains carbon upto  
A. 0.25%    B. 1.0%    C. 1.5%    D. 2%.
4. Pick up the polyminerallie rock from the following:  
A. Quartz sand    B. Pure gypsum    C. Magnesite    D. Granite  
E. None of these.
5. Pick up the correct statement from the following:  
A. For thin structures subjected to wetting and drying, the water cement ratio should be 0.45  
B. For mass concrete structures subjected to wetting and drying, the water ratio should be 0.55  
C. For thin structures which remain continuously under water, the water-cement ratio by weight should be 0.55  
D. For massive concrete structures which remain continuously under water, the water cement ratio by weight should be 0.65  
E. All the above.
6. Ultimate strength to cement is provided by  
A. Tricalcium silicate  
B. Di-calcium silicate  
C. Tri-calcium aluminate  
D. Tetra calcium alumino ferrite.
7. Elastomers can extend upto  
A. five times their original dimensions  
B. seven times their original dimensions  
C. ten times their original dimensions  
D. three times their original dimensions.
8. Bitumen felt  
A. is used as water proofing material

- B. is used as damp proofing material
  - C. is made from bitumen and hessian fibres
  - D. all the above.
9. In the method of condensation polymerization,
- A. low-molecular substances are removed from the high molecular substance
  - B. the reaction proceeds with an evolution of ammonia
  - C. the reaction proceeds with an evolution of hydrogen chloride
  - D. all the above.
10. In the cement the compound quickest to react with water, is
- A. Tricalcium aluminate
  - B. Tetra-calcium aluminoferrite
  - C. Tricalcium silicate
  - D. Dicalcium silicate.
11. The initial setting time of lime-pozzolana, is
- A. 30 minutes      B. 60 minutes      C. 90 minutes      D. 120 minutes.
12. The clay to be used for manufacturing bricks for a large project, is dugout and allowed to weather throughout
- A. the monsoon      B. the winter      C. the summer      D. none of these.
13. The rocks which are formed due to cooling of magma at a considerable depth from earth's surface are called
- A. Plutonic rocks
  - B. Hypabyssal rocks
  - C. Volcanic rocks
  - D. Igneous rocks.
14. Quartzite is a
- A. metamorphic rock
  - B. argillaceous rock
  - C. calcareous rock
  - D. silicious rock.
15. The variety of pig iron used for manufacture of wrought iron, is
- A. Bessemer pig
  - B. Grey or foundry pig
  - C. White forge pig
  - D. Mottled pig.
16. Sand stone is

- A. sedimentary rock
  - B. metamorphic rock
  - C. igneous rock
  - D. volcanic rock.
17. If the furnace is provided with insufficient fuel at low temperatures, the type of pig iron produced, is called
- A. Bessemer pig
  - B. Grey or foundry pig
  - C. White or forge pig
  - D. Mottled pig.
18. Stainless steel contains
- A. 18% of chromuim and 8% nickel
  - B. 8% of chromium and 18% of nickel
  - C. 12% of chromium and 36% of nickel
  - D. 36% of chromium and 12% of nickel.
19. Pick up the hypabyssal rock from the following:
- A. Granite     B. Dolerite     C. Basalt     D. All the above.
20. Depending on the chemical composition and mechanical properties, iron may be classified as
- A. cast iron     B. wrought iron     C. steel     D. all the above.
21. Wrought iron contains carbon about
- A. 1.5% to 5.5%     B. 0.5% to 1.75%     C. 0.1% to 0.25%     D. none to these.
22. The main constituent of fly-ash, is
- A. aluminium oxide
  - B. silica
  - C. ferrous oxide
  - D. All of these.
23. Bitumen in
- A. solid state, is called asphalt
  - B. semi fluid state, is called mineral tar
  - C. fluid state, is called petroleum
  - D. all the above.
24. The plastics made from cellulose resin
- A. are as clear as glass
  - B. are tough and strong
  - C. possess excellent electrical properties

- D. All the above.
25. Kaolin is chemically classified as
- A. metamorphic rock
  - B. argillaceous rock
  - C. calcareous rock
  - D. silicious rock.
26. Which one of the following is acid resistant asbestos:
- A. actinolite asbestos
  - B. amosite asbestos
  - C. anthophyllite asbestos
  - D. crocidolite asbestos
  - E. All the above.
27. Due to attack of dry rot, the timber
- A. cracks
  - B. shrinks
  - C. reduces to powder
  - D. none of these.
28. Brittleness of cold is due to an excess of
- A. sulphur      B. carbon      C. phosphorus      D. silicon.
29. For the manufacture of Portland cement, the proportions of raw materials used, are
- A. lime 63% ; silica 22% ; other ingredients 15%
  - B. lime 22% ; silica 63% ; other ingredients 15%
  - C. silica 40% ; lime 40% ; other ingredients 20%
  - D. silica 70% ; lime 20% ; other ingredients 10%.
30. Asbestos cement
- A. is brittle
  - B. warps due to changes in humidity
  - C. strength is lowered when saturated by water
  - D. all the above.
31. Gniess is obtained from
- A. igneous rocks
  - B. metamorphic rocks
  - C. sedimentary rocks
  - D. sedimentary metamorphic rocks.
32. The rocks formed by gradual deposition, are called

- A. sedimentary rocks
  - B. igneous rocks
  - C. metamorphic rocks
  - D. none of these.
33. Galvanising means covering iron with a thin coat of  
A. tin    B. zinc    C. glaze    D. coal tar.
34. For preparing porcelains, the clay should be  
A. sufficiently pure  
B. of high degree of tenacity  
C. of good plasticity  
D. All the above.
35. Polymerization helps to improve the property of  
A. strength    B. rigidity    C. elasticity    D. all of these.
36. Good quality stones must  
A. be durable  
B. be free from clay  
C. resist action of acids  
D. all the above.
37. Sewer pipes are made of  
A. earthen ware  
B. stone ware  
C. refractory clay  
D. terracota  
E. all the above.
38. Fibre glass  
A. retains heat-longer  
B. has a higher strength to weight ratio  
C. is shock proof and fire retardant  
D. does not decay  
E. all the above.
39. Pick up the correct statement from the following:  
A. The theory of formation of concrete is based on the phenomena of formation of voids  
B. The bulking of sand is taken into account while volumetric proportioning of the aggregates  
C. The dry sand and the sand completely flooded with water, have practically the same volume

- D. The expansion and contraction joints are provided if concrete structures exceed 12 m in length
  - E. All the above.
40. Pick up the correct statement from the following:
- A. In stone arches, the stones are placed with their natural beds radial
  - B. In cornices, the stones are placed with their natural beds as vertical
  - C. In stone walls, the stones are placed with their natural beds as horizontal
  - D. All the above.
41. The commonly used colour pigment in paints, is
- A. ambers      B. carbon black      C. iron oxide      D. lamp black
  - E. all the above.
42. Varnish is a transparent or semi-transparent solution of resinuous substances in
- A. alcohol      B. linseed      C. turpentine      D. all the above.
43. Initial setting time of cement for asbestos cement products should be not less than
- A. 30 minutes      B. 50 minutes      C. 75 minutes      D. 90 minutes.
44. The variety of pig iron used for the manufacture of steel by Bessemer process, is
- A. Bessemer pig
  - B. Grey pig
  - C. White forge pig
  - D. Mottled pig.
45. For melting one tonne of cast iron
- A. 700 m<sup>3</sup> air is required
  - B. 20 kg limestone is required
  - C. one quintal coke is required
  - D. all the above.
46. For filling cracks in masonry structures, the type of bitumen used, is
- A. cut-back bitumen
  - B. bitumen-emulsion
  - C. blown bitumen
  - D. plastic bitumen.
47. Plastic
- A. is an organic substance

- B. consists of natural or synthetic binders
  - C. finished products are rigid and stable at normal temperature
  - D. is capable of flow when necessary heat and pressure are applied
  - E. All the above.
48. Vanadium steel is generally used for
- A. railway switches and crossing
  - B. bearing balls
  - C. magnets
  - D. axles and springs.
49. Pick up the correct statement from the following:
- A. In basic Bessemer process, the steel heats the converter
  - B. In open-hearth process, the furnace heats the steel
  - C. In Siemens process, the impurities of pig iron are oxidised by the oxygen of the ore
  - D. all the above.
50. The process of manufacturing steel by heating short lengths of wrought iron bars mixed with charcoal in fire clay crucibles and collecting the molten iron into moulds, is known as
- A. Cementation process
  - B. Crucible process
  - C. Bessemer process
  - D. Open hearth process.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	E	A	D	E	B	C	D	D	A
10	D	A	A	D	C	A	C	A	B	D
20	C	D	D	D	B	E	C	C	A	D
30	D	A	B	D	D	D	B	E	E	D
40	E	D	D	A	D	D	E	D	D	B



## Section 2

1. The rocks in which argil (or clay) predominates, are called
  - A. sillicious rocks
  - B. argillaceous rocks
  - C. calcareous rocks
  - D. igneous rocks.
2. A badly mixed cement concrete results in
  - A. segregation
  - B. bleeding
  - C. honey combing
  - D. none to these.
3. Pick up the correct statement regarding low heat cement from the following:
  - A. It possesses less compressive strength
  - B. Its initial setting time is about one hour
  - C. Its final setting time is about 10 hours
  - D. Its mainly used for mass concrete work
  - E. All the above.
4. Chemically, marble is known as
  - A. metamorphic rock
  - B. argillaceous rock
  - C. calcareous rock
  - D. silicious rock.
5. Inner part of a timber log surrounding the pith, is called
  - A. sapwood
  - B. cambium layer
  - C. heart wood
  - D. none to these.
6. The filler used in plastic bitumen, is
  - A. shale powder
  - B. talc powder
  - C. asbestos powder
  - D. plastic powder
  - E. none of these.
7. Resins are
  - A. not soluble in water
  - B. soluble in spirit
  - C. used in varnishes
  - D. left behind on evaporation of oil
  - E. all the above.
8. Refractory bricks are used for

- A. retaining walls
  - B. columns
  - C. piers
  - D. combustion chambers.
9. Expanded metal is
- A. manufactured from steel sheets
  - B. used for reinforced concrete in road pavements
  - C. measured in term of SWM (shortway mesh) and LWM (long way mesh)
  - D. all the above.
10. The rock generally used for roofing, is
- A. granite      B. basalt      C. slate      D. pumice.
11. A piece of sawn timber whose cross-sectional dimensions exceed 5 cm, in one direction and 20 cm in the other direction, is called a
- A. cant      B. deal      C. baulk      D. strip.
12. Quick lime (or caustic lime)
- A. is obtained by the calcination of pure lime stone
  - B. has great affinity to moisture
  - C. is amorphous
  - D. All the above.
13. Pick up the correct statement from the following:
- A. soft stones are required for carving
  - B. light stones are required for arches
  - C. hard stones are required to stand high pressure
  - D. All the above.
14. Name the type of cement from the following for canal linings :
- A. sulphate resisting cement
  - B. rapid hardening cement
  - C. quick setting cement
  - D. pozzuolana cement.
15. Mastic asphalt is generally used for
- A. damp proof course
  - B. water proof layer
  - C. partition walls
  - D. both (a) and (b).
16. Black marble is generally found in the district of
- A. Jodhpur      B. Jaipur      C. Jabalpur      D. Jaisalmer      E. Pune.

17. The most fire resistant paints are :
  - A. enamel paints
  - B. aluminium paints
  - C. asbestos paints
  - D. cement paints.
18. If  $P$  is the percentage of water required for normal consistency, water to be added for determination of initial setting time, is
  - A.  $0.70 P$
  - B.  $0.75 P$
  - C.  $0.80 P$
  - D.  $0.85 P$
  - E.  $0.90 P$ .
19. A pug mill is used for
  - A. softening brick earth
  - B. moulding brick earth
  - C. tempering brick earth
  - D. providing brick earth
  - E. all the above.
20. A good brick earth should contain :
  - A. about 20% to 30% of alumina
  - B. about 50% to 60% of silica
  - C. not more than 5% of lime
  - D. about 5 to 6% of oxide of lime
  - E. All the above.
21. The commonly used lime in white washing, is
  - A. white lime
  - B. fat lime
  - C. hydraulic lime
  - D. lime
  - E. quick lime.
22. Shingle is
  - A. decomposed laterite
  - B. crushed granite
  - C. water bound pebbles
  - D. air weathered rock.
23. Pick up the plutonic rock from the following:
  - A. Granite
  - B. Dolerite
  - C. Basalt
  - D. All the above.
24. The lime which contains mainly calcium oxide and slacks with water, is
  - A. fat lime
  - B. quick lime
  - C. hydraulic lime
  - D. poor lime
  - E. none of these.

25. Seasoning is
- A. a process of removing sap
  - B. creosoting
  - C. painting with sodium silicate
  - D. coating with tar.
26. Inhaling of fly-ash over a long period causes
- A. silicosis
  - B. fibrosis of lungs
  - C. bronchitis
  - D. pneumonitis
  - E. All of these.
27. Minimum required water cement ratio for a workable concrete, is
- A. 0.30    B. 0.40    C. 0.50    D. 0.60    E. 1.0.
28. Rocks formed due to alteration of original structure due to heat and excessive pressure are called
- A. sedimentary rocks
  - B. igneous rocks
  - C. metamorphic rocks
  - D. none of these.
29. The compound of Portland cement which contributes to the strength after two to three years is
- A. Tricalcium silicate
  - B. Di-calcium silicate
  - C. Tricalcium aluminate
  - D. Tetracalcium alumino ferrite.
30. For slaking of 10 kg of CaO, the theoretical amount of water is
- A. 2.2 kg    B. 1.5 kg    C. 3.2 kg    D. None of these.
31. Pick up the correct statement from the following: Method of sawing timber
- A. tangentially to annual rings, is known as tangential method.
  - B. in four quarters such that each board cuts annual rings at angles not less than  $45^\circ$ , is known as quarter sawing method.
  - C. cut out of quarter logs, parallel to the medullary rays and perpendicular to annual rings, is known as radial sawing.
  - D. all the above.
32. Clay and silt content in a good brick earth must be at least
- A. 50%    B. 40%    C. 30%    D. 25%    E. 20%.

33. Bessemer process is used for the manufacture of  
A. Pig iron    B. cast iron    C. Wrought iron    D. Steel.
34. The portion of the brick without a triangular corner equal to half the width and half the length, is called  
A. closer    B. queen closer    C. king closer    D. squint brick.
35. The standard size of masonry bricks, is  
A. 18 cm x 8 cm x 8 cm  
B. 19 cm x 9 cm x 9 cm  
C. 20 cm x 10 cm x 10 cm  
D. 21 cm x 11 cm x 11 cm  
E. none of these.
36. Which one of the following is an air binding material ?  
A. Gypsum  
B. Acid-resistant cement  
C. Quick lime  
D. All of these.
37. A good quality stone absorbs water less than  
A. 5%    B. 10%    C. 15%    D. 20%    E. 25%.
38. Pick up the correct statement from the following:  
A. Alexander Parkes, a Scottish chemist prepared a hard material by mixing camphor and alcohol with nitro cellulose and called it, as *Parkesite*  
B. Dr. L. Bakeland, a Belgian scientist prepared a product known as Bakelite  
C. Pollark, an Austrian scientist prepared a substance from urea and formaldehyde and called it *Plastic*  
D. All the above.
39. Plywood is made from  
A. common timber  
B. bamboo fibre  
C. teak wood only  
D. asbestos sheets.
40. Soundness test of cement determines  
A. quality of free lime  
B. ultimate strength  
C. durability  
D. initial setting  
E. all the above.

41. The slag which floats on the surface of the molten iron generally contains
- Lime ( $\text{CaO}$ ) 45%
  - Silica ( $\text{SiO}_2$ ) 35%
  - Alumina ( $\text{Al}_2\text{O}_3$ ) 12%
  - $\text{MgO}$ ,  $\text{CaSO}_4$ ,  $\text{KMnO}_2$  and  $\text{FeO}$  8%
  - all the above.
42. Minimum of 40% of iron, is available in
- Magnetite
  - Red haemetite
  - Limonite
  - Siderite
  - Black band.
43. If the iron ore contains clay as an impurity, the flux added during calcination, is
- clay
  - lime stone
  - argillaceous iron ore
  - all the above.
44. Cement is said to be of good quality if
- its colour is not greenish grey
  - one feels cool by thrusting one's hand in the cement bag
  - it is not smooth when rubbed in between fingers
  - a handful of cement thrown into a bucket of water does not float
  - none of these.
45. Cast steel is manufactured by
- Cementation process
  - Crucible process
  - Bessemer process
  - Open hearth process.
46. For the manufacture of plywood, veneers are placed so that grains of adjacent veneers
- run at right angles
  - parallel
  - inclined at  $45^\circ$
  - inclined at  $60^\circ$ .
47. A 1st class brick immersed in water for 24 hours, should not absorb water (by weight) more than
- 10%
  - 15%
  - 20%
  - 25%
  - 5%.

48. The proportions of charcoal, saltpetre and sulphur in gun powder by weight, are respectively:

- A. 15, 75, 10      B. 75, 10, 15      C. 10, 15, 75      D. 10, 75, 15.

49. Geologically, marble is known as

- A. sedimentary rock  
B. igneous rock  
C. metamorphic rock  
D. stratified rock.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	C	E	C	C	C	E	D	D	C
10	C	D	D	A	D	B	C	D	C	E
20	B	C	A	B	A	E	B	C	B	C
30	D	A	D	C	B	D	A	D	C	A
40	E	E	B	E	B	A	C	A	C	

### Section 3

1. The commonly used drying oil for oil paints, is
  - A. olive oil
  - B. linseed oil
  - C. kerosine oil
  - D. acetate of lead.
2. Initial setting of cement is caused due to
  - A. Tri-calcium silicate
  - B. Di-calcium silicate
  - C. Tri-calcium aluminate
  - D. Tetra calcium alumino ferrite.
3. The foliated structure is very common in
  - A. sedimentary rocks
  - B. igneous rocks
  - C. metamorphic rocks
  - D. none of these.
4. Turpentine oil is used in paints as
  - A. thinner
  - B. vehicle
  - C. base
  - D. drier.
5. The hardest rock is
  - A. marble
  - B. diamond
  - C. talc
  - D. quartz.
6. The silica is used for preparing
  - A. silica bricks
  - B. coke oven
  - C. lining for glass furnaces
  - D. all of these.
7. Wrought iron is manufactured from pig iron by
  - A. refining
  - B. puddling
  - C. shingling
  - D. rolling
  - E. all the above.
8. Pick up the correct statement from the following:
  - A. The phenol is carbolic acid
  - B. The phenol is either extracted from coal-tar or prepared from benzene
  - C. Phenol reacts with formaldehyde, to form phenol formaldehyde resin
  - D. The plastics prepared from phenol-formaldehyde are used for paints, varnishes, w.c. seats
  - E. All the above.



9. Fibre boards can be
- A. distempered
  - B. painted
  - C. painted and distempered
  - D. used for furniture.
10. Pick up the correct statement from the following:
- A. Catalysts are added to assist and accelerate the hardening of resin,
  - B. The fillers are inert materials and they impart strength and hardness
  - C. Fibrous fillers increase thermal resistance
  - D. All the above.
11. Portland pozzolana cement possesses
- A. higher resistance to chemical attack
  - B. lower heat of hydration
  - C. lower shrinkage on drying
  - D. water tightness
  - E. all the above.
12. Iron ore may contain
- A. carbon
  - B. silicon
  - C. sulphur
  - D. phosphorus and maganese
  - E. all the above.
13. Wrought iron is used for
- A. structural works in beams
  - B. small sized water pipes
  - C. columns and struts
  - D. none to these.
14. The timber having maximum resistance against white ants, is obtained from
- A. chir      B. shisham      C. sal      D. teak.
15. Knots in timber are
- A. defects caused by crushing fibres
  - B. splits radiating from the centre
  - C. speckled strains
  - D. signs of branches cut off.

16. Pick up the correct statement from the following:
- A. Solder material is an alloy which melts at a temperature above  $400^{\circ}\text{C}$
  - B. Brazing is done at temperature above  $600^{\circ}\text{C}$  to  $1100^{\circ}\text{C}$
  - C. Brazing joint is stronger than the solder joint
  - D. all the above.
17. Lime concrete is generally used for
- A. wall foundations
  - B. flooring at ground level
  - C. both (a) and (b)
  - D. neither (a) nor (b).
18. Bituminous fells are used for
- A. covering A.C. sheets
  - B. covering sloping roofs
  - C. D.P.C.
  - D. none to these.
19. The minimum compressive strength of IInd class bricks should be
- A.  $75 \text{ kg/cm}^2$
  - B.  $90 \text{ kg/cm}^2$
  - C.  $100 \text{ kg/cm}^2$
  - D.  $120 \text{ kg/cm}^2$
  - E.  $150 \text{ kg/cm}^2$ .
20. Stucco paints are suitable for
- A. stone masonry
  - B. brick walls
  - C. both (a) and (b)
  - D. neither (a) nor (b).
21. Pick up the correct statement from the following:
- A. Corrugated sheet iron is made by passing plain sheets between grooved rollers
  - B. Strength and stiffness of corrugated sheets are considerably increased
  - C. Corrugated sheets are generally gal-venised to protect iron from corrosion by rust
  - D. Corrugated sheets are generally used on slanting roofs
  - E. all the above.
22. Quick setting cement is produced by adding

- A. less amount of gypsum in very fine powdered form
  - B. more amount of gypsum in very fine powdered form
  - C. aluminium sulphate in very fine powdered form
  - D. pozzolana in very fine powdered form
  - E. none of these.
23. Duco is one of the patent forms of
- A. emulsion paints
  - B. plastic paints
  - C. bituminous paints
  - D. aluminium paints
  - E. cellulose paints.
24. Pick up the correct statement from the following:
- A. The substance which consists of one primary chemical, is known as monomer
  - B. The polymer consists of thousands of monomers joined together
  - C. The polymer molecule is called macro-molecule
  - D. A polymetric material consists of a large number of long-chain molecules
  - E. All the above.
25. Bulking of sand is caused due to
- A. surface moisture
  - B. air voids
  - C. viscosity
  - D. clay contents
  - E. all the above.
26. The normal curing period for lime mortar, is:
- A. one day    B. 3 days    C. 7 days    D. 10 days    E. 14 days.
27. The type of steel used for precision levelling staff, is
- A. Titanium steel
  - B. Carbon steel
  - C. Invar
  - D. Stainless steel.
28. During puddling
- A. molten metal is kept clear of the fuel
  - B. carbon is converted into carbonic acid gas
  - C. silicon forms a slag
  - D. metal is heated by the burning of gases

- E. all the above.
29. German silver is an alloy of
- zinc, lead and nickel
  - silver, gold and lead
  - copper, nickel and zinc
  - copper, brass and zinc
  - brass, silver and zinc.
30. Pick up the incorrect statement from the following:
- Plastics are chemical resistant
  - Plastics are durable
  - Plastics are ductile
  - Plastics are excellent electric insulators.
31. Pick up correct statement from the following:
- Fibre boards are used for thermal and acoustic control
  - Fibre boards are used for light weight standing members
  - Fibre boards are obtained by impregnating a resin product on fibres
  - all the above.
32. Quartzite, a metamorphic stone is
- hard
  - brittle
  - crystalline
  - compact
  - All the above.
33. Pick up the correct statement from the following:
- Plastics have generally low melting point
  - The coefficient of thermal expansion of plastics is about three times than that of steel
  - The acoustical boards prepared by impregnating fibre-glass with phenolic resins has absorption coefficient of about 0.67
  - All the above.
34. Dextrin is
- animal glue
  - starch glue
  - albumin glue
  - rubber based adhesive
  - none to these.
35. Formula for quick lime, is
- $\text{CaCO}_3$
  - $\text{CaO}$
  - $\text{CO}_2$
  - none to these.
36. For the manufacture of stainless steel, steel is mixed with
- chromium
  - nickel
  - tungsten
  - none of these.

37. Stones used for ornamental work must be  
A. soft    B. hard    C. light    D. heavy.
38. Pick up the correct statement from the following:  
A. Quick lime is obtained by burning pure lime stone:  
B. Hydraulic lime is obtained by burning lime stone containing clay 5% to 30%  
C. Poor lime is obtained by burning lime stone containing impurities more than 5%  
D. All the above.
39. The presence of original rounded surface on the manufactured piece of timber, is called  
A. Wane    B. Torn grain    C. Diagonal grain    D. Chipmark.
40. Smith's test of stones is performed to find out  
A. the presence of soluble matter of stone  
B. the compressive strength of the stone  
C. the hardness of the stone  
D. the toughness of the stone.
41. The cracks caused by shrinkage of the exterior surface of the wood exposed to atmosphere, are called:  
A. radial shakes  
B. heart shakes  
C. wind cracks  
D. twisted fibres.
42. The process of decarbonising the pig iron completely and then adding proper percentage of carbon for manufacturing steel, is called  
A. Cementation process  
B. crucible process  
C. Bessemer process  
D. Open hearth process.
43. In paints, the pigment is responsible for  
A. durability    B. colour    C. smoothness    D. glassy face    E. none of these.
44. The operation of removal of impurities or clay adhering to iron ores, is known as  
A. dressing    B. calcination    C. roasting    D. smelting.
45. If water required for 1 bag of cement is 30 litres, the water cement ratio is :  
A. 0.40    B. 0.50    C. 0.60    D. None of these.

46. Portland cement manufactured from pure white chalk and clay but free from iron-oxide, is known as
- quick setting cement
  - rapid hardening cement
  - white cement
  - low heat Portland cement.
47. Dry rot
- cracks the timber
  - reduces the strength of timber
  - reduces the timber to powder
  - shrinks the timber
  - spoils the appearance of timber.
48. Which one of the following polymers is obtained from condensation polymerization?
- phenol formaldehyde
  - carbamide
  - melamine-formaldehyde
  - all of these.
49. The weight of 1 m<sup>3</sup> of brick earth, is about
- A. 1200 kg      B. 1500 kg      C. 1800 kg      D. 2000 kg.
50. Pozzolana (or surkhi) is used in lime
- to impart hydraulicity
  - to prevent shrinkage
  - to decrease the cost of construction
  - to decrease the setting time.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	C	C	A	B	D	E	E	D	D
10	E	E	B	C	D	D	B	A	A	C
20	E	C	E	E	A	C	C	E	C	C
30	D	E	D	D	B	A	A	D	A	A
40	C	A	B	A	C	C	C	D	C	A

## Section 4

1. Mastic asphalt is normally used for
  - A. sound insulation
  - B. water proofing
  - C. fire proofing
  - D. none to these.
2. Lime stone is not a
  - A. sedimentary rock
  - B. stratified rock
  - C. aqueous rock
  - D. metamorphic rock.
3. The size of modular bricks, is
  - A. 10 x 10 x 9 cm
  - B. 19 x 9 x 9 cm
  - C. 22.5 x 10 x 8.5 cm
  - D. 22.5 x 8.0 x 9 cm.
4. A piece of timber whose thickness and width are respectively 5 cm and 10 cm is called
  - A. slate
  - B. plank
  - C. board
  - D. strip.
5. Pig iron is manufactured from the ores by
  - A. dressing
  - B. calcination and roasting
  - C. smelting
  - D. all the above.
6. Quick lime
  - A. generates heat when added to water
  - B. reacts with carbon dioxide
  - C. may be used for white-washing
  - D. when mixed with water forms slaked lime
  - E. all the above.
7. Age of a tree may be ascertained by
  - A. radius of its stem
  - B. circumference of its stem
  - C. number of branches
  - D. number of annual rings.

8. The portion of a brick cut to form angles other than right angles in plan, is known as  
A. queen closer      B. king closer      C. closer      D. squint brick.
9. Pick up the correct statement from the following:  
A. Slaked lime contains calcium hydroxide  
B. Quick lime contains calcium oxide  
C. Slaked lime may be obtained from quick lime  
D. Slaked lime is obtained by adding water to quick lime  
E. All the above.
10. Plywood is obtained by gluing wooden sheets at  
A. 100 to 150 N/cm<sup>2</sup>  
B. 100 to 130°C  
C. both (a) and (b)  
D. Neither (a) nor (b).
11. The low voltage porcelain is mainly used for  
A. switch block  
B. insulating tubes  
C. lamp sockets  
D. All of these.
12. Putty is  
A. made with finely powdered chalk and linseed oil  
B. used for fixing glass panes  
C. softened by a solution of pearl ash and quick-lime soaked in water  
D. all the above.
13. The initial setting time of hydraulic lime, is  
A. 30 minutes      B. 60 minutes      C. 90 minutes      D. 120 minutes  
E. 150 minutes.
14. PVC stands for  
A. plastic very compact  
B. polythene vinyl chloride  
C. polythene vinyl carbon  
D. polythene vanadium carbide.
15. Generally wooden moulds are made from  
A. ply wood      B. shisham wood      C. deodar wood      D. teak wood  
E. hard wood.
16. Cement paints usually  
A. contain hydrated lime



- B. contain 5% to 10% colour pigments
  - C. are prepared with white cement
  - D. contain 5% sodium chloride
  - E. all the above.
17. The cement becomes unsound by the presence of excess
- A. sulphur    B. magnesia    C. lime    D. All of these.
18. The kiln which may work throughout the year, is
- A. Clamp    B. Bull's kiln    C. Hoffman's kiln    D. none of these.
19. The minimum compressive strength of 1st class bricks should be
- A. 75 kg/cm<sup>2</sup>
  - B. 90 kg/cm<sup>2</sup>
  - C. 100 kg/cm<sup>2</sup>
  - D. 120 kg/cm<sup>2</sup>
  - E. 130 kg/cm<sup>2</sup>.
20. A volatile substance added to a paint to make its application easy and smooth, is known as
- A. base    B. solvent    C. vehicle    D. none to these.
21. The percentage of water for normal consistency, is
- A. 5% to 15%    B. 10% to 25%    C. 15% to 25%    D. 20% to 30%
  - E. 25% to 35%.
22. Pick up the correct statement from the following:
- A. The plywoods do not split or crack due to changes in atmosphere
  - B. The commercial plywoods are available upto 150 cm wide and upto 300 cm long
  - C. The plywoods possess uniform tensile strength in all directions
  - D. The plywoods are light in weight
  - E. All the above.
23. The main ingredient of a good quality brick earth, is
- A. magnesia    B. lime    C. silica    D. alumina.
24. Bitumen is generally obtained from
- A. organic material
  - B. synthetic material
  - C. petroleum product
  - D. coal.
25. For one cubic metre of brick masonry, number of bricks required, is
- A. 400    B. 425    C. 450    D. 500    E. 550.
26. The steel which contains fissures and cavities, is manufactured by

- A. Cementation process
  - B. Crucible process
  - C. Bessemer process
  - D. Open hearth process.
27. Pick up the volcanic rock from the following:  
 A. Granite    B. Dolerite    C. Basalt    D. All the above.
28. In stone masonry, stones (stratified rocks) are so placed that the direction of pressure to the plane of bedding is  
 A. right angles    B.  $45^\circ$     C.  $60^\circ$     D. parallel    E. None of these.
29. The most durable varnish is  
 A. water varnish  
 B. spirit varnish  
 C. turpentine varnish  
 D. oil varnish  
 E. none of these.
30. Softer variety of steel may be obtained by  
 A. Cementation process  
 B. crucible process  
 C. Bessemer process  
 D. Open hearth process.
31. Pick up the correct statement from the following:  
 A. The baked earth is called terra-cotta  
 B. The articles prepared from clay which is burnt at low temperature and cooled down slowly, are called earthen-ware  
 C. The articles prepared from refractory clays which are mixed with stone and crushed pottery, are called stone ware  
 D. The articles prepared from fine earthen ware which is white, thin and semi-transparent, are called porcelain  
 E. All the above.
32. Calcination of iron ores is done  
 A. to remove moisture  
 B. to remove carbonic acid  
 C. by roasting in heaps  
 D. after dressing  
 E. all the above.
33. Strength of cement concrete primarily depends upon

- A. quality of water
  - B. quantity of aggregate
  - C. quantity of cement
  - D. water-cement ratio.
34. Rapid hardening cement contains
- A. Tri-calcium silicate
  - B. Tri-calcium aluminate
  - C. Tetra-calcium alumino-ferrite
  - D. Dicalcium silicate.
35. Bitumen emulsion is
- A. a liquid containing bitumen in suspension
  - B. a paint
  - C. used as anti-corrosive paint
  - D. all the above.
36. The cast iron when heated to red heat with powdered red haemetite in an oven for increasing its toughness, is converted to
- A. grey cast iron
  - B. white cast iron
  - C. mottled cast iron
  - D. toughed cast iron.
37. Jhumb bricks are
- A. under burnt      B. over burnt      C. kutchra      D. none of these.
38. Plastic bitumen is generally used for
- A. road pavements
  - B. expansion joints
  - C. crack fillings
  - D. none to these.
39. Pick up the correct statement from the following:
- A. The heating of a material to redness in contact with air, is known as calcination
  - B. The property of lime by which it sets or hardens in damp places having no free circulation of air is called setting
  - C. The product that remains after calcination of limestone, is called lime
  - D. All the above.
40. The commonly used thinner in oil paints, is
- A. naptha

- B. turpentine
  - C. both (a) and (b)
  - D. neither (a) nor (b)
  - E. none the these.
41. Cast iron
- A. is obtained by purifying pig iron
  - B. is manufactured in required shapes
  - C. may contain 2 to 5 per cent of carbon with other impurities
  - D. is remelted in a cupola furnace
  - E. all the above.
42. Asbestos is
- A. corrugated sheet used for roofing
  - B. an incombustible fire proof material
  - C. an organic substance
  - D. a bad insulator for sound and heat
  - E. all the above.
43. In a rock calcium carbonate predominates. State whether it is :
- A. Sillicious rock
  - B. Argillaceous rock
  - C. Calcareous rock
  - D. None of these.
44. In order of increasing percentage of silica, the correct sequence is
- A. sandy clay, calcareous clay, pure clay
  - B. calcareous clay, pure clay, sandy clay
  - C. pure clay, sandy clay, calcareous clay
  - D. None of these.
45. The rocks which are formed due to pouring of magma at the earth's surface are called
- A. Plutonic rocks
  - B. Hypabyssal rocks
  - C. Volcanic rocks
  - D. Igneous rocks
46. Pick up the correct statement from the following:
- A. Steel produced by open hearth process is milder than that obtained by the bessemer process
  - B. Engineers prefer open hearth steel for structural purpose as it is more homogenous

- C. Basic Bessemer process is suitable for converting poor ore containing a large proportion of sulphur and phosphorus into steel
- D. all the above.
47. Pick up the correct statement from the following:
- A. The distinct plane of division along which a stone can easily be split, is called natural bed of stone
- B. The natural bed of sedimentary rocks is along the planes of stratification
- C. The natural bed of igneous rocks is not defined
- D. All the above.
48. Invar contains
- A. 12% of nickel      B. 24% of nickel      C. 30% to nickel      D. 36% of nickel.
49. Based on flow quality, the sequence of pipes is
- A. A.C. pipes, G.I. pipes, C.I. pipes, PVC pipes
- B. C.I. pipes, G.I. pipes, A.C. pipes, PVC pipes
- C. C.I. pipes, G.I. pipes, PVC pipes, A.C. pipes
- D. None of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	D	B	D	D	E	D	D	E	C
10	D	D	D	B	B	E	D	C	C	B
20	E	E	D	C	D	A	C	A	D	C
30	E	E	D	A	D	C	B	C	D	C
40	E	E	C	B	C	D	D	D	B	

## Section 5

1. The pigment used in paints for corrosive resistance, is  
A. white lead    B. ferrous oxide    C. zinc white    D. red lead  
E. gypsum.
2. A well seasoned timber may contain moisture up to  
A. 4 to 6%    B. 6 to 8%    C. 8 to 10%    D. 10 to 12%.
3. The stones obtained by blasting are used as  
A. ballast in railways  
B. aggregates for concrete  
C. roadmetal  
D. All the above.
4. Distemper is  
A. a paint consisting of powdered chalk, pigments, and water  
B. a water proofing agent  
C. a paint consisting of coloured cement and water  
D. a drying agent.
5. Oil varnish generally consists of  
A. synthetic resin and spirit  
B. oil, wax and resin  
C. resin, oil and turpentine  
D. spirit, oil and wax.
6. Pick up the correct statement from the following:  
A. The average crushing strength of hand moulded bricks is 6000  $\text{t/m}^2$   
B. The average tensile strength of hand moulded brick is 200  $\text{t/m}^2$   
C. The average shearing strength of hand moulded brick is 600  $\text{t/m}^2$   
D. All the above.
7. The cracks which extend from bark towards the sap wood in the cross section of a tree, are called  
A. radial shakes    B. star shakes    C. heart shakes    D. cup shakes.
8. Sea sand used in structures causes  
A. dampness    B. efflorescence    C. disintegration    D. All of these.
9. The compound of Portland cement which reacts immediately with water and also sets first is  
A. Tri-calcium silicate  
B. Di-calcium silicate

- C. Tri-calcium aluminate
  - D. Tetra calcium alumino ferrite.
10. Refractory bricks resist
- A. high temperature
  - B. chemical action
  - C. dampness
  - D. all the above.
11. When a brick is immersed in water for 24 hours and then dried, if
- A. no grey or white deposits appear on the surface, the brick is free from soluble salts
  - B. 10 per cent surface is covered with grey or white deposits, the brick has slight efflorescence
  - C. 50 per cent surface is covered with grey or white deposits, the brick has serious efflorescence
  - D. All the above.
12. In arches, stratified stones are placed so that their planes are
- A. parallel
  - B. perpendicular
  - C. radial
  - D. none of these.
13. Pick up the correct statement from the following:
- A. Acid test is done to find out the weathering quality of stones
  - B. Attrition test is done to find out the rate of wear of stones which are used in road construction
  - C. Crushing test is done to find out the compressive strength of the stone
  - D. Impact test is done to determine toughness of a stone
  - E. All the above.
14. The fire clay contains pure
- A. lime
  - B. oxide of iron
  - C. hydrated aluminium silicate
  - D. magnesium.
15. Pick up the correct characteristic of Pyroxene from the following:
- A. It forms octagonal crystals
  - B. It converts to chlorine by hydration
  - C. Its density is 2.3 to 3.6 g/cm<sup>2</sup>
  - D. Its hardness is 5 to 6
  - E. All the above.
16. For sanitary pipes and chemical stonewares,

- A. salt glazing is used
  - B. lead glazing is used
  - C. opaque glazing is used
  - D. None of these.
17. The steel used for rails under heavy traffic and on sharp curves, is
- A. Nickel steel
  - B. Chrome steel
  - C. Magnese steel
  - D. Vanadium steel.
18. The weight of a good quality brick when immersed in water for a period of 16 hours should not exceed the weight of dry brick
- A. 20%    B. 15%    C. 10%    D. None of these.
19. Snowcrete is one of the patent forms of
- A. distempers
  - B. water proof cement paints
  - C. enamel paints
  - D. cellulose paints.
20. The usual percentages of clay and metal in cermet are :
- A. 50%, 50%    B. 60%, 40%    C. 70%, 30%    D. 80%, 20%.
21. Pick up the correct statement from the following:
- A. Horn blende mineral is brittle
  - B. Muscovite is also known as white mica and potashmica
  - C. Biotite is also known as blackmica
  - D. All the above.
22. The rocks which are formed due to cooling of magma at a relatively shallow depth from the earth's surface are called
- A. Plutonic rocks
  - B. Hypabyssal rocks
  - C. Volcanic rocks
  - D. Igneous rocks.
23. The base material for distemper, is
- A. chalk    B. lime    C. lime putty    D. cement wash.
24. The thermosetting plastic
- A. becomes rigid when moulded at suitable pressure and temperature
  - B. at 127°C to 177°C permanently set and further application of heat does not soften it



- C. chars at 343°C
  - D. All the above.
25. Pick up the synthetic resin from the following:
- A. Malamine resin
  - B. Phenolic resin
  - C. Resorcinol resin
  - D. Urea resin
  - E. All of these.
26. Slacking of lime is affected by
- A. keeping it exposed to air
  - B. immersing the lime in water
  - C. crushing the lime lumps
  - D. none of these.
27. The steel used in R.C.C. work is
- A. stainless steel
  - B. mild steel
  - C. high carbon steel
  - D. wrought iron.
28. Mastic asphalt is
- A. water proof    B. fire proof    C. elastic    D. all the above.
29. Non acid-resistant asbestos is :
- A. tremolite asbestos
  - B. chrysolite asbestos
  - C. amosite asbestos
  - D. none of these.
30. Stones used for the construction of retaining walls must be
- A. soft    B. hard    C. light    D. heavy.
31. Permanent magnets are made of high carbon steel and
- A. 15% of cobalt    B. 20% of cobalt    C. 35% of cobalt    D. 45% of cobalt.
32. Plastics are compounds of carbon with element
- A. hydrogen    B. nitrogen    C. oxygen    D. All of these.
33. Pick up the correct statement from the following:
- A. The plastic bottles are made by the process of blowing
  - B. The plastic sheets are made by the calendering process in which the plastic material is allowed to pass between cylindrical rollers

- C. The application of thermo-setting resins on sheets of paper, is called laminating process
  - D. The plastic articles made by placing raw material in the desired moulds, is known as moulding process
  - E. All the above.
34. Pick up the constituent of good brick earth whose excess causes the raw bricks shrink and warp during drying and burning, from the following:  
A. Alumina    B. Lime    C. Ironoxide    D. Magnesia.
35. Cast iron is used for
- A. structural works in beams
  - B. small sized water pipes
  - C. columns and struts
  - D. none to these.
36. Stainless steel resists corrosion due to  
A. carbon    B. sulphur    C. vanadium    D. chromium    E. manganese.
37. Commonly used thinner in
- A. lacquer paints, is alcohol
  - B. cellulose paints is ethyle acetate
  - C. oil paints, is naptha
  - D. distemper, is water
  - E. all the above.
38. Good quality sand is never obtained from  
A. river    B. nala    C. sea    D. gravel powder.
39. Pick up the rock which is not a sedimentary rock from the following:  
A. gravel    B. sand stone    C. gypsum    D. dolerite    E. lignite.
40. For a good building stone, its specific gravity should be greater than  
A. 1.5    B. 1.7    C. 2.2    D. 2.7.
41. Blister steel
- A. is obtained by cementation process
  - B. is full of fissures and cavities
  - C. can not be forged
  - D. can be easily welded
  - E. all the above.
42. The most important constituent of varnish, is  
A. drier    B. solvent    C. resin    D. all the above.

43. A ferrous metal is  
A. cast iron    B. wrought iron    C. steel    D. all the above.
44. For making fly-ash building bricks, the following mix of fly-ash, sand and lime, is  
A. 80 : 13 : 7    B. 70 : 20 : 10    C. 60 : 35 : 5    D. none of these.
45. Pick up the correct statement from the following:  
A. Lime is available in free state  
B. Lime is available by dissolving calcium carbonate in water  
C. Lime is available by calcining calcium carbonate at 900°C  
D. Lime is nothing but calcium chloride  
E. None of these.
46. Water paint is a  
A. white wash    B. colour wash    C. whiting    D. distemper    E. all the above.
47. Seasoning of timber is done  
A. to make it water proof  
B. to paint its surface  
C. to increase its temperature  
D. to remove water.
48. The specific gravity of marble, is  
A. 2.50    B. 2.60    C. 2.66    D. 2.72    E. 3.00.
49. The rocks having alumina or clay as their major constituents, are known as  
A. siliceous rocks  
B. argillaceous rocks  
C. calcareous rocks  
D. sedimentary rocks  
E. igneous rocks.
50. The curved swellings from the growth of layers or wounds left after branches are cut off in an irregular manner, are known as  
A. knots    B. rindgalls    C. burls    D. none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	D	A	C	D	B	D	C	A
10	D	C	E	C	E	A	C	A	B	D
20	D	B	A	D	E	B	B	D	B	D
30	D	D	E	A	C	D	E	C	D	D
40	E	D	D	A	C	E	D	D	B	B

## Section 6

1. Pick up the correct statement from the following:
  - A. The percentage of absorption for firebricks varies from 5 to 10
  - B. The percentage of silica in silica bricks is to the extent of about 95 to 97 percent
  - C. Roughly 1 to 2 percent of lime in silica bricks is added to act as binding material
  - D. The compressive strength of silica bricks is about  $150 \text{ kg/cm}^2$
  - E. All the above.
2. Spirit varnish generally consists of
  - A. oil, wax and resin
  - B. alcohol, wax and turpentine
  - C. pigment and synthetic resin
  - D. spirit and shellac
  - E. none of these.
3. Pick up the correct statement from the following:
  - A. Roasting is not necessary if iron ore is an oxide
  - B. Impurities float on the molten iron as slag
  - C. The slag contains lime about 45%
  - D. The molten iron is made to run, in a long channel formed in sand called 'sow'
  - E. All the above.
4. The tendency of a stone is, to split along:  
A. texture    B. fracture    C. cleavage    D. structure    E. all the above.
5. Acrylic is the name of
  - A. cellulose resin
  - B. alkyd resin
  - C. methyl methacrylate
  - D. cumarone-indene.
6. Glazing of clay products, is done
  - A. to improve their appearance
  - B. to protect them from atmospheric effect
  - C. to protect them from corrosive action
  - D. all the above.
7. Lime mortar is generally made with  
A. quick lime    B. fat lime    C. hydraulic lime    D. plain lime  
E. none of these.

8. Duco paints are
  - A. plastic paints
  - B. cellulose paints
  - C. emulsion paints
  - D. bituminous paints
  - E. oil paints.
9. Pick up the correct statement from the following:
  - A. Melamine is obtained from calcium carbide
  - B. Formaldehyde is prepared synthetically from methane
  - C. The melamine when reacted with formaldehyde forms the melamine-formaldehyde resin
  - D. The plastics made from melamine formaldehyde resin, are used for electrical insulators
  - E. All the above.
10. Steel contains carbon approximately
  - A. 1.50% to 5.6%
  - B. 0.05% to 1.75%
  - C. 0.25%
  - D. none to these.
11. Cast iron contains carbon approximately
  - A. 1.5% to 5.5%
  - B. 0.05% to 1.75%
  - C. 0.250%
  - D. none to these.
12. Plastic asphalt is
  - A. used as a water proofing layer over roof
  - B. a mixture of cement and asphalt
  - C. a natural asphalt
  - D. a refinery product.
13. For obtaining vinyl chloride acetate, the method used, is
  - A. addition polymerization
  - B. condensation polymerization
  - C. co-polymerization
  - D. none of these.
14. The yield strength and tensile strength of low carbon steel may be improved by the addition of
  - A. manganese
  - B. chromium
  - C. nickel
  - D. vanadium
  - E. tungsten.
15. Bitumen completely dissolves in
  - A. carbon bisulphide
  - B. chloroform
  - C. benzol

- D. coaltar
  - E. All of these.
16. Good quality cement contains higher percentage of
- A. Tricalcium silicate
  - B. Di-calcium silicate
  - C. Tri-calcium aluminate
  - D. Tetra calcium alumino ferrite
  - E. all the above.
17. Soundness of cement is tested by
- A. Vicat's apparatus
  - B. Le-chatelier apparatus
  - C. compressive strength testing apparatus
  - D. none of the these.
18. The PVC doors and windows are preferred as they are
- A. rust proof    B. rot proof    C. termile proof    D. water proof
  - E. all of these.
19. Based on its dry weight, a freshly felled tree may contain water
- A. 25%    B. 50%    C. 75%    D. 100%.
20. Forge pig may be converted to wrought iron by
- A. rolling    B. puddling    C. shingling    D. refining.
21. To give a brilliant finish, the type of varnish used, is
- A. water varnish
  - B. spirit varnish
  - C. turpentine varnish
  - D. oil varnish
  - E. none of these.
22. Pick up the correct statement from the following:
- A. Bull's trench kiln a trench excavated in ground
  - B. Hoffman's kiln is constructed overground
  - C. Tunnel Kiln is constructed as a tunnel
  - D. All the above.
23. The softest rock is
- A. marble    B. diamond    C. talc    D. quartz.
24. Bitumen may be dissolved in
- A. carbondioxide
  - B. water
  - C. sodium chloride

- D. carbon disulphide
  - E. none of these.
25. Pick up the correct statement from the following:
- A. Rusting is caused due to combined action of air, moisture and carbon dioxide
  - B. During rusting, first ferrous bicarbonates are formed
  - C. On further oxidation ferrous bicarbonates get converted to ferric bicarbonates
  - D. Ultimately hydrated ferric oxide is formed during rusting and carbon dioxide gets liberated
  - E. All the above.
26. Whitworth compressed steel is obtained when molten steel is subjected to a pressure of
- A. 5 kg/mm<sup>2</sup>
  - B. 9 kg/mm<sup>2</sup>
  - C. 13 kg/mm<sup>2</sup>
  - D. 15 kg/mm<sup>2</sup>
  - E. 10 kg/mm<sup>2</sup>.
27. Asbestos
- A. is an excellent insulator for heat and electricity
  - B. is fire-proof and acid proof
  - C. has sp. gravity equal to 3.10
  - D. is smooth like glass and silk
  - E. All the above.
28. Mild steel is used for
- A. structural works in beams, joints and girders
  - B. small sized water pipes
  - C. columns and struts
  - D. none of these.
29. The sequence of refractory materials according to increasing melting points is :
- A. Dolomite, Magnesite, Bauxite, Chromite
  - B. Bauxite, Chromite, Dolomite, Magnesite
  - C. Magnesite, Bauxite, Dolomite, Chromite.
30. Veneering means
- A. carving out designs on timber planks
  - B. chemically treating timber planks

- C. thick layer of superior wood glued to inferior wood
  - D. thin layer of superior wood glued to inferior wood.
31. Laterite is a/an
- A. volcanic rock
  - B. argillaceous rock
  - C. calcareous rock
  - D. silicious rock.
32. A stone is rejected if it absorbs water more than
- A. 5%    B. 10%    C. 15%    D. 20%    E. 25%.
33. The most valuable timber may be obtained from
- A. chir    B. shisham    C. sal    D. teak.
34. Pick up the correct statement from the following:
- A. Blisters in the finished wrought iron, are caused due to the reaction between oxide of iron and carbon
  - B. The edges of a finished wrought iron, are rough due to red short-age
  - C. Pig iron (charcoal) is manufactured from magnetic ore ( $\text{Fe}_3\text{O}_4$ )
  - D. For the manufacture of wrought iron, non-sulphurous fuel is not necessary
  - E. All the above.
35. Pick up the compound responsible for early strength of cement from the following:
- A. Tetra-calcium alumino-ferrite
  - B. Tricalcium silicate
  - C. Tricalcium aluminate
  - D. Dicalcium silicate.
36. Mastic asphalt is
- A. acid resisting material
  - B. non-corrosive material
  - C. corrosive material
  - D. heating-resisting material.
37. Which one of the following is used for preparing porcelain
- A. clay    B. feldspar    C. quartz    D. minerals    E. All of these.
38. The commonly used base for iron and steel work, is
- A. red lead
  - B. zinc white



- C. white lead
  - D. titanium white.
39. Laterite is found in  
A. U.P.      B. Punjab      C. West Bengal      D. Kerala.
40. Lacquer is  
A. oil paint      B. distemper      C. spirit varnish      D. none to these.
41. Upto a maximum of 72% of iron, is available in  
A. Magnetite      B. Red haemetite      C. Limonite      D. Siderite  
E. Iron pyrites.
42. For lime concrete,  
A. slump is 50 to 75 mm  
B. flexural strength at 90 days is  $0.2 \text{ N/mm}^2$   
C. compressive strength at 90 days is  $1.5 \text{ N/mm}^2$   
D. compressive strength at 26 days is  $1.2 \text{ N/mm}^2$   
E. all the above.
43. Pig iron made from heamatite ores free from sulphur, phosphorus and copper, is known as  
A. Bessemer pig  
B. Grey or foundry pig  
C. White or forge pig  
D. Mottled pig  
E. All the above.
44. Pick up the correct statement from the following:  
A. Blistering may be cured by applying water paint finished with oil paint dried with a little copal varnish  
B. Cracked paints may be cured by removing paint and giving a fresh coat of paint  
C. Crawling paints may be cured by sand preparing the surface and giving a fresh coat with plenty of turps  
D. All the above.
45. The material generally not used as extender in paints, is  
A. powdered silica  
B. gypsum  
C. talc  
D. zinc white.
46. Pick up the non-inflammable plastic from the following:  
A. Cellulose acetate plastics

- B. Polyvinyl chloride plastics  
 C. Phenol formaldehyde plastic  
 D. Urea formaldehyde plastic.
47. The most commonly used synthetic abrasive is  
 A. aluminium carbide  
 B. boric acid  
 C. silicon  
 D. All of these.
48. For light and ornamental casting, the most unsuitable pig iron, is  
 A. Bessemer pig  
 B. Grey or foundry pig  
 C. White or forge pig  
 D. Mottled pig.
49. Seasoning of timber is essential to remove  
 A. knots from timber  
 B. sap from timber  
 C. twisted fibre from timber  
 D. roughness of timber.
50. The melting point of silica is :  
 A. 1570°C      B. 1630°C      C. 1730°C      D. 1850°C.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	E	D	E	C	C	D	C	E	E	B
10	A	B	C	D	E	A	B	E	D	B
20	B	D	C	D	E	B	E	A	B	C
30	B	B	D	E	B	B	E	A	A	C
40	A	E	A	D	D	B	D	D	B	C

## Section 7

1. A bull nose brick is not used for
  - A. rounding off sharp corners
  - B. pillars
  - C. decoration purpose
  - D. arches.
2. Red short iron cracks when bent due to the presence of
  - A. sulphur
  - B. carbon
  - C. phosphorus
  - D. silicon.
3. Linseed oil is used in paints as
  - A. thinner
  - B. vehicle
  - C. base
  - D. drier.
4. Plaster of Paris is obtained by calcining
  - A. bauxite
  - B. gypsum
  - C. kankar
  - D. lime stone
  - E. none of these.
5. For high grade instruments the steel preferred to, is
  - A. cast steel
  - B. bessemer steel
  - C. mild steel
  - D. whitworth compressed steel.
6. If the ore impurities is
  - A. clay, lime stone is used as flux
  - B. lime stone, clay is used as flux
  - C. quartz, lime stone and argillaceous iron ores are used as flux
  - D. All the above.
7. The plastics prepared from Vinyl resin are
  - A. odourless
  - B. non-toxic
  - C. transparent
  - D. colourless
  - E. all of these.
8. Chlorite, a green colour mineral is mainly derived from the decomposition of
  - A. augite
  - B. biotite
  - C. horn blende
  - D. All of these.
9. During smelting process, the combination of fuel in the furnace
  - A. forms carbon dioxide
  - B. carbon dioxide with carbon forms carbon mono-oxide
  - C. carbon mono-oxide reacts with  $\text{Fe}_2\text{O}_3$  to form iron and liberates  $\text{CO}_2$
  - D. all the above.
10. Lime stones are generally known as
  - A. aqueous rocks

- B. sedimentary rocks
  - C. stratified rocks
  - D. all the above.
11. The method of addition polymerization is used for obtaining:
- A. polythylene
  - B. polypropylene
  - C. polyvinylchloride
  - D. polystyrene
  - E. All of these.
12. Pick up the correct statement from the following:
- A. The lime in excess makes the cement unsound and causes the cement to expand and disintegrate
  - B. The silica in excess makes the cement stronger but its setting time also increases
  - C. The excess amount of alumina weakens the cement
  - D. The addition of gypsum increases the initial setting time of cement
  - E. All the above.
13. A rock contains only one mineral. It is called
- A. homogeneous
  - B. non-homogeneous
  - C. monomineralic
  - D. polymineralic.
14. Asbestos
- A. is a natural fibrous mineral substance
  - B. is composed of hydrous silicates of calcium and magnesium ( $\text{Ca-SiO}_3$ ,  $3\text{MgSiO}_3$ )
  - C. contains iron oxide and alumina
  - D. all the above.
15. Pegmatite is a/an
- A. intrusive igneous rock
  - B. extrusive igneous rock
  - C. sedimentary rock
  - D. metamorphic rock.
16. The percentage of alumina and silica in good fire clay vary respectively is
- A. 25, 75      B. 30, 70      C. 35, 65      D. All of these.

17. The term frog means
- A. an apparatus to lift the stone
  - B. a depression on a face of brick
  - C. vertical joint in a brick work
  - D. soaking brick in water.
18. Asphalt is obtained from
- A. petroleum distillation
  - B. bitumen distillation
  - C. plastic distillation
  - D. none of these.
19. To retard the initial setting time of cement, the compound responsible, is
- A. Tricalcium silicate
  - B. Gypsum
  - C. Di-calcium silicate
  - D. Tri calcium aluminate.
20. Dorry's testing machine is used for
- A. crushing test of stone
  - B. hardness test of stone
  - C. impact test of stone
  - D. water absorption test.
21. Stones used for rubble masonry must be
- A. soft    B. hard    C. light    D. heavy.
22. Index number expressing the relative sizes of both coarse and fine aggregates, is called
- A. proportioning of aggregates
  - B. fineness modulus
  - C. grading of aggregates
  - D. none of these.
23. Dolomite is a lime stone which contains carbonate of magnesia upto
- A. 15%    B. 20%    C. 25%    D. 35%    E. 45%.
24. Priming consists of
- A. one part of white lead, 8 parts of chalk and four parts of twice boiled linseed oil
  - B. 8 parts of white lead, one part of chalk and four parts of twice boiled linseed oil
  - C. one part of white lead, 8 parts of chalk and one part of linseed oil

- D. none to these.
25. The portion of the brick cut across its width and having its length equal to that of a full brick, is known as  
 A. closer    B. queen closer    C. king closer    D. prince closer  
 E. none of these.
26. Seasoning of timber is done for  
 A. increasing moisture content  
 B. decreasing moisture content  
 C. increasing strength of timber  
 D. none to these.
27. Bitumen felt is used for  
 A. water proofing  
 B. damp proofing  
 C. both (a) and (b)  
 D. neither (a) nor (b).
28. According to ISI, bitumen is classified into  
 A. 2 grades    B. 4 grades    C. 6 grades    D. 8 grades.    E. 10 grades.
29. Lime putty  
 A. is made from hydraulic lime  
 B. is made by adding lime to water  
 C. can be used only upto three days  
 D. may be obtained from drying lime water mix passing through IS sieve No. 300  
 E. all of above.
30. The minimum percentage of silica, alumina and ferric oxide in lime for white washing, is  
 A. 20    B. 15    C. 10    D. 5    E. 0.
31. For a 50 kg cement bag water required, is  
 A. 16.5 litres    B. 18.5 litres    C. 20.5 litres    D. 22.5 litres    E. 25 litres.
32. The presence of sand in brick earth prevents:  
 A. cracking of bricks  
 B. shrinkage of bricks  
 C. warping of bricks  
 D. none of these.
33. The property by virtue of which lime sets under water, is known as  
 A. slacking    B. setting    C. hydraulicity    D. calcining.

34. Percentage content of silica in window glass, is  
A. 40 to 45      B. 50 to 55      C. 60 to 65      D. 70 to 75.
35. The coefficient of hardness of stones used in road work should be greater than  
A. 10      B. 12      C. 15      D. 17.
36. Pick up the correct statement from the following:  
A. Air bubbles in casting produce a dull sound by tapping their surfaces lightly with a hammer  
B. Cupola furnace is used for the manufacture of cast iron  
C. Red short iron is of no value for welding purpose  
D. All the above.
37. The steel used for the manufacture of rails, is  
A. Bessemer steel  
B. mild steel  
C. cast steel  
D. stainless steel.
38. Slump test for concrete is carried out, to determine  
A. strength      B. durability      C. workability      D. water content.
39. Basalt is  
A. sedimentary rock  
B. metamorphic rock  
C. extrusive igneous rock  
D. intrusive igneous rock.
40. The frog of a brick is normally made on its  
A. top face      B. bottom face      C. longer face      D. shorter side.
41. The most important constituent of an oil paint, is  
A. thinner      B. vehicle      C. pigment      D. base      E. all the above.
42. Granite mainly composed of quartz and felsper particles, is obtained from  
A. sedimentary rocks  
B. metamorphic rocks  
C. igneous rocks  
D. all the above.
43. Bullet proof glass is made of thick glass sheet sandwiched by a layer of  
A. steel  
B. stainless steel

- C. high test plastic
  - D. chromium plate.
44. Pig iron obtained from the furnace which is properly provided with fuel at a very high temperature, is called
- A. Bessemer pig
  - B. Grey or foundry pig
  - C. White or forge pig
  - D. Mottled pig
  - E. None of the above.
45. Refractory bricks are
- A. neutral refractory bricks
  - B. acid refractory bricks
  - C. basic refractory bricks
  - D. all the above.
46. Porcelain is used as :
- A. sanitary wares
  - B. electric insulators
  - C. storage vessels
  - D. reactor chambers
  - E. All of the above.
47. Durability of building stone is affected by its
- A. chemical composition
  - B. texture
  - C. resistance to atmosphere
  - D. location in structure
  - E. all the above.
48. Magnese steels
- A. are non-magnetic
  - B. possess high electrical resistance
  - C. possess low coefficient of expansion
  - D. are used for the manufacture of rails
  - E. all the above.
49. Pick up the metal refractory from the following:
- A. Molybdenum      B. Tungsten      C. Zirconium      D. All of these.
50. According to IS 399-1963, the weight of the timber is specified at
- A. 8% moisture content
  - B. 10% moisture content



C. 12% moisture content

D. 14% moisture content.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	A	D	B	A	D	E	A	D	D
10	E	E	C	D	A	A	B	A	B	B
20	B	B	E	A	B	B	C	E	E	E
30	D	C	C	D	D	D	A	C	C	A
40	E	C	C	B	D	E	E	E	D	C

## Section 8

1. The size of mould for bricks, is generally kept
  - A. a little large to specified size
  - B. a little small to specified size
  - C. equal to specified size
  - D. 10% larger than specified size
  - E. 20% larger than specified size.
2. Most commonly used solvent in oil paints, is
  - A. petroleum
  - B. spirit
  - C. coaltar
  - D. turpentine.
3. Acrylic sheets
  - A. possess 10 to 17 times greater breakage resistance than that of glass of equivalent thickness
  - B. are generally unaffected by most household detergents
  - C. possess the light transmission rate of 93%
  - D. are available in various shapes
  - E. all the above.
4. With storage, strength of cement
  - A. increases
  - B. decreases
  - C. remains the same
  - D. none to these.
5. The commonly used raw material in the manufacture of cement, is
  - A. slate
  - B. sand stone
  - C. lime stone
  - D. basalt.
6. Pick up the correct statement from the following:
  - A. The free quartz suddenly expands at a temperature lower than  $600^{\circ}\text{C}$
  - B. The lime stone resists fire upto about  $800^{\circ}\text{C}$  and at higher temperature it splits into  $\text{CaO}$  and  $\text{CO}_2$
  - C. The sand stone with silicates resist a fire in a better way
  - D. The argillaceous stone though poor in strength can resist fire quite weak
  - E. All the above.
7. The most commonly used base for timber painting, is
  - A. red lead
  - B. zinc white
  - C. white lead
  - D. titanium white.

8. Pick up the most favourable condition for the rapid growth of fungus for dry rot from the following:
  - A. absence of sun light
  - B. dampness
  - C. presence of sap
  - D. stagnant air
  - E. All the above,
9. The rocks formed from molten magma, are called
  - A. sedimentary rocks
  - B. igneous rocks
  - C. metamorphic rocks
  - D. none of these.
10. Bitumen paints offer
  - A. pleasing surface
  - B. hard surface
  - C. smooth surface
  - D. protective surface
  - E. rough surface.
11. Pick up the correct statement from the following:
  - A. Styrene resin is produced from ethylene which is made from petroleum
  - B. Styrene resin is light in weight
  - C. Styrene resin transmits ultraviolet waves of light
  - D. Styrene resin is used to manufacture utensils which are unaffected by chemicals
  - E. All the above.
12. The lime which contains high percentage of calcium oxide, is generally called
  - A. fat lime
  - B. rich lime
  - C. white lime
  - D. All of these.
13. For construction of structures under water, the type of lime used, is
  - A. hydraulic lime
  - B. fat lime
  - C. quick lime
  - D. pure lime
  - E. none of these.
14. Pick up the correct statement from the following:
  - A. Rust is due to formation of oxides
  - B. Cast iron oxidises less
  - C. Steel oxidises most
  - D. Wrought iron oxidises moderately
  - E. All the above.

15. A prime coat is given to steel work with
- A. an oxide of iron paint
  - B. a mixture of white lead and lead paint
  - C. a special paint
  - D. cement paint.
16. Ground glass
- A. is made by grinding its one side
  - B. is made by melting powdered glass paints surface
  - C. is used for getting light without transparency
  - D. all the above.
17. The harmonious mixing of the clay ingredients, is known as
- A. weathering
  - B. blending
  - C. tempering
  - D. None of these.
18. Brass is an alloy of
- A. copper and zinc
  - B. zinc and lead
  - C. tin and silver
  - D. zinc and nickel
  - E. tin and lead.
19. The wedging is adopted for quarrying costly stratified rock such as
- A. laterite
  - B. marble
  - C. limestone
  - D. sandstone
  - E. All the above.
20. Rapid hardening cement attains early strength due to
- A. larger proportion of lime grounded finer than normal cement
  - B. lesser proportion of lime grounded coarser than normal cement
  - C. lesser proportion of lime grounded finer than normal cement
  - D. larger proportion of lime grounded coarser than normal cement
  - E. excess percentage of gypsum.
21. The colour of statuary marble used for sculptor's work, is
- A. red
  - B. blue
  - C. white
  - D. green
  - E. yellow
22. Second class bricks
- A. are of dark brown colour
  - B. produce a metallic sound when struck
  - C. are well burnt
  - D. are under burnt.
23. Pick up the correct statement from the following:
- A. The low voltage porcelain is prepared by wet process
  - B. The high voltage porcelain is prepared by dry process

- C. The low voltage porcelain is prepared by dry process  
D. None of the above.
24. Pick up the correct statement from the following:
- A. Adding 5% to 6% of moisture content by weight, increases the volume of dry sand from 18% to 38%  
B. The bulking of fine sand is more than that of coarse sand  
C. If the percentage content of moisture exceeds 10%, increase in bulk of sand starts increasing  
D. The volume of fully saturated sand equals that of dry sand  
E. All the above.
25. Teak wood is suitable for
- A. sports articles  
B. furnitures  
C. railway sleepers  
D. all the above.
26. Plywood is normally available
- A. 1 mm thick  
B. 2 mm thick  
C. 2 to 3 mm thick  
D. 3 mm to 4 mm thick.
27. French polish is
- A. oil paint      B. distemper      C. spirit varnish      D. none to these.
28. In stone masonry, if stones are so placed that their layers are parallel to the direction of load, they
- A. split easily  
B. are affected by moisture  
C. both (a) and (b)  
D. none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	A	E	B	C	E	C	E	B	D
10	E	D	A	E	B	D	B	A	E	A
20	C	B	C	E	B	D	C	C		

## 2 Surveying

### Section 1

1. Hydrographic surveys deal with the mapping of
  - A. large water bodies
  - B. heavenly bodies
  - C. mountaineous region
  - D. canal system
  - E. movement of clouds.
2. If  $h$  is the difference in level between end points separated by  $l$ , then the slope correction is . The second term may be neglected if the value of  $h$  in a 20 m distance is less than
  - A.  $\frac{1}{2}$  m
  - B. 1 m
  - C. 2 m
  - D. 3 m
3. An ideal vertical curve to join two gradients, is
  - A. circular
  - B. parabolic
  - C. elliptical
  - D. hyperbolic
  - E. none of these.
4. Pick up the correct statement from the following :
  - A. the eyepiece plays no part in defining the line of sight
  - B. the diaphragm plays no part in defining the line of sight
  - C. the optical centre of the objective plays no part in defining the line of sight
  - D. none of these.
5. The intercept of a staff
  - A. is maximum if the staff is held truly normal to the line of sight.
  - B. is minimum if the staff is held truly normal to the line of sight.
  - C. decreases if the staff is tilted away from normal
  - D. increases if the staff is tilted towards normal.
6. The radius of curvature of the arc of the bubble tube is generally kept
  - A. 10 m
  - B. 25 m
  - C. 50 m
  - D. 100 m
7. If  $S$  is the length of a subchord and  $R$  is the radius of simple curve, the angle of deflection between its tangent and sub-chord, in minutes, is equal to
  - A.  $573 S/R$
  - B.  $573 R/S$
  - C.  $171.9 S/R$
  - D.  $1718.9 R/S$
  - E.  $1718.9 S/R$ .

8. The real image of an object formed by the objective, must lie
  - A. in the plane of cross hairs
  - B. at the centre of the telescope
  - C. at the optical centre of the eye-piece
  - D. anywhere inside the telescope.
9. In chain surveying tie lines are primarily provided
  - A. to check the accuracy of the survey
  - B. to take offsets for detail survey
  - C. to avoid long offsets from chain lines
  - D. to increase the number of chain lines.
10. Pick up the correct statement from the following :
  - A. the tangent screw enables to give small movement under conditions of smooth and positive control
  - B. standing on the tripod is the levelling head or tribrach
  - C. the levelling screws are used to tilt the instrument so that its rotation axis is truly vertical
  - D. all the above.
11. One of the Lehmann's rules of plane tabling, is
  - A. location of the instrument station is always distant from each of the three rays from the known points in proportion to their distances
  - B. when looking in the direction of each of the given points, the instrument station will be on the right side of one and left side of the other ray
  - C. when the instrument station is outside the circumscribing circle its location is always on the opposite side of the ray to the most distant point as the intersection of the other two rays
  - D. none of these.
12. If  $f_1$  and  $f_2$  are the distances from the optical centre of a convex lens of focal length  $f$  to conjugate two points P1 and P2 respectively, the following relationship holds good
  - A.  $f = f_1 + f_2$
  - B.  $f = \frac{1}{2} (f_1 + f_2)$
  - C.  $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$
  - D. none of these.
13. The accuracy of measurement in chain surveying, does not depend upon

- A. length of the offset  
 B. scale of the plotting  
 C. importance of the features  
 D. general layout of the chain lines.
14. If arithmetic sum of latitudes of a closed traverse is  $\sum \text{Lat}$  and closing error in latitude is  $dx$ , the correction for a side whose latitude is  $l$ , as given by Transit Rule, is
- A.  $l \times \frac{dx}{\sum \text{Lat}}$     B.  $l \times \frac{\sum \text{Lat}}{dx}$     C.  $\sum \text{Lat} \times \frac{dx}{l}$     D. none of these.
15. Closed contours of decreasing values towards their centre, represent
- A. a hill  
 B. a depression  
 C. a saddle or pass  
 D. a river bed.
16. If a 30 m chain diverges through a perpendicular distance  $d$  from its correct alignment, the error in length, is
- A.  $\frac{d^2}{60}$  m    B.  $\frac{d^2}{30}$  m    C.  $\frac{d^2}{40}$  m    D.  $\frac{d}{30}$  m    E.  $\frac{d}{20}$  m .
17. Diopter is the power of a lens having a focal length of
- A. 25 cm    B. 50 cm    C. 75 cm    D. 100 cm    E. 125 cm
18. An imaginary line joining the points of equal elevation on the surface of the earth, represents
- A. contour surface  
 B. contour gradient  
 C. contour line  
 D. level line  
 E. none of these.
19. The 'fix' of a plane table station with three known points, is bad if the plane table station lies
- A. in the great triangle  
 B. outside the great triangle  
 C. on the circumference of the circumscribing circle  
 D. none of these.
20. If  $R$  is the radius of the main curve,  $\theta$  the angle of deflection,  $S$  the shift and  $L$  the length of the transition curve, then, total tangent length of the curve, is
- A.  $(R - S) \tan \theta/2 - L/2$   
 B.  $(R + S) \tan \theta/2 - L/2$



- C.  $(R + S) \tan \theta/2 + L/2$   
 D.  $(R - S) \tan \theta/2 + L/2$   
 E.  $(R - S) \cos \theta/2 + L/2$
21. In chain surveying field work is limited to  
 A. linear measurements only  
 B. angular measurements only  
 C. both linear and angular measurements  
 D. all the above.
22. Two concave lenses of 60 cm focal length are cemented on either side of a convex lens of 15 cm focal length. The focal length of the combination is  
 A. 10 cm      B. 20 cm      C. 30 cm      D. 40 cm
23. If  $\theta$  is the vertical angle of an inclined sight,  $\delta$  is the angle of tilt of the staff, the error  
 A.  $E = 1 - \frac{\cos (\theta \pm \delta)}{\cos \theta}$       B.  $E = 1 - \frac{\sin (\theta \pm \delta)}{\sin \theta}$       C.  $E = 1 - \frac{\tan (\theta \pm \delta)}{\tan \theta}$   
 D. none of these.
24. One of the tacheometric constants is additive, the other constant, is  
 A. subtractive constant  
 B. multiplying constant  
 C. dividing constant  
 D. indicative constant.
25. The limiting length of an offset does not depend upon  
 A. accuracy of the work  
 B. method of setting out perpendiculars  
 C. scale of plotting  
 D. indefinite features to be surveyed.
26. In quadrantal bearing system, back bearing of a line may be obtained from its forward bearing, by  
 A. adding  $180^\circ$ , if the given bearing is less than  $180^\circ$   
 B. subtracting  $180^\circ$ , if the given bearing, is more than  $180^\circ$   
 C. changing the cardinal points, i.e. substituting N for S and E for W and vice-versa  
 D. none of these.
27. If L is the perimeter of a closed traverse,  $\Delta D$  is the closing error in departure, the correction for the departure of a traverse side of length l, according to Bowditch rule, is  
 A.  $\Delta D \times \frac{L}{l}$       B.  $\Delta D \times \frac{l^2}{L}$       C.  $L \times \frac{l}{\Delta D}$       D.  $\Delta D \times \frac{l}{L}$  .

28. Pick up the correct statement from the following:
- A. the theodolite in which telescope can be rotated in vertical plane is called a *transit*
  - B. when the vertical circle is to the left of the telescope during observation, it is called to be in left face
  - C. when the vertical circle is to the right of the telescope during observation, it is called to be in right face
  - D. all the above.
29. Pick up the method of surveying in which field observations and plotting proceed simultaneously from the following
- A. chain surveying
  - B. compass surveying
  - C. plan table surveying
  - D. tacheometric surveying.
30. While viewing through a level telescope and moving the eye slightly, a relative movement occurs between the image of the levelling staff and the cross hairs. The instrument is
- A. correctly focussed
  - B. not correctly focussed
  - C. said to have parallax
  - D. free from parallax.
31. Accuracy of 'fix' by two point problem, is
- A. bad    B. good    C. not reliable    D. unique.
32. A bearing of a line is also known as
- A. magnetic bearing
  - B. true bearing
  - C. azimuth
  - D. reduced bearing
33. True meridians are generally preferred to magnetic meridians because
- A. these converge to a point
  - B. these change due to change in time
  - C. these remain constant.
  - D. None of these.
34. Pick up the correct statement from the following :
- A. the apparent error on reversal is twice the actual error
  - B. the correction may be made equal to half the observed discrepancy.

- C. the good results may be obtained from a defective instrument by reversing and taking the mean of two erroneous results  
 D. all the above.
35. If  $\theta$  is the slope of the ground and  $l$  is the measured distance, the correction is  
 A.  $2l \sin^2 \theta/2$   
 B.  $2l \cos^2 \theta/2$   
 C.  $2l \tan^2 \theta/2$   
 D.  $2l \cot^2 \theta/2$ .
36. The most reliable method of plotting a theodolite traverse, is  
 A. by consecutive co-ordinates of each station  
 B. by independent co-ordinates of each station  
 C. by plotting included angles and scaling off each traverse leg  
 D. by the tangent method of plotting.
37. The difference of level between a point below the plane of sight and one above, is the sum of two staff readings and an error would be produced equal to  
 A. the distance between the zero of gradient and the foot of the staff  
 B. twice the distance between the zero of graduation and the foot of the staff  
 C. thrice the distance between the zero of graduation and the foot of the staff  
 D. none of the above.
38. Offsets are measured with an accuracy of 1 in 40. If the point on the paper from both sources of error (due to angular and measurement errors) is not to exceed 0.05 cm on a scale of 1 cm = 20 m, the maximum length of offset should be limited to  
 A. 14.14      B. 28.28 m      C. 200 m      D. none of these.
39. The probable error of the adjusted bearing at the middle is  
 A.  $\frac{1}{2} r_n$   
 B.  $\frac{1}{3} r_n$   
 C.  $\frac{1}{4} r_n$   
 D.  $\frac{1}{5} r_n$ .
40. The bearings of the lines AB and BC are  $146^\circ 30'$  and  $68^\circ 30'$ . The included angle ABC is  
 A.  $102^\circ$       B.  $78^\circ$       C.  $45^\circ$       D. none of these.

41. For a closed traverse the omitted measurements may be calculated
  - A. length of one side only
  - B. bearing of one side only
  - C. both length and bearing of one side
  - D. length or bearing of adjacent side
  - E. all the above.
42. The slope correction for a length of 30 m along a gradient of 1 in 20, is
  - A. 3.75 cm
  - B. 0.375 cm
  - C. 37.5 cm
  - D. 2.75 cm.
43. The main principle of surveying is to work
  - A. from part to the whole
  - B. from whole to the part
  - C. from higher level to the lower level
  - D. from lower level to higher level.
44. For the construction of highway (or railway)
  - A. longitudinal sections are required
  - B. cross sections are required
  - C. both longitudinal and cross sections are required
  - D. none of these.
45. If the radius of a simple curve is  $R$ , the length of the chord for calculating offsets by the method of chords produced, should not exceed.
  - A.  $R/10$
  - B.  $R/15$
  - C.  $R/20$
  - D.  $R/25$ .
46. The sensitiveness of a level tube decreases if
  - A. radius of curvature of its inner surface is increased
  - B. diameter of the tube is increased
  - C. length of the vapour bubble is increased
  - D. both viscosity and surface tension are increased.
47. For true difference in elevations between two points  $A$  and  $B$ , the level must be set up
  - A. at any point between  $A$  and  $B$
  - B. at the exact mid point of  $A$  and  $B$
  - C. near the point  $A$
  - D. near the point  $B$ .
48. ABCD is a regular parallelogram plot of land whose angle BAD is  $60^\circ$ . If the bearing of the line AB is  $30^\circ$ , the bearing of CD, is
  - A.  $90^\circ$
  - B.  $120^\circ$
  - C.  $210^\circ$
  - D.  $270^\circ$

49. Keeping the instrument height as 1.5 m, length of staff 4 m, the slope of the ground as 1 in 10, the sight on the down-slope, must be less than  
 A. 30 m      B. 25 m      C. 20 m      D. 15 m
50. Pick up the correct statement from the following :  
 A. Box sextant is used for the measurement of horizontal angles  
 B. Cross staff is used for setting out right angles  
 C. Gradiometer is used for setting out any required gradient  
 D. Line ranger is used for locating intermediate stations on a survey line  
 E. All the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	D	B	A	B	D	E	A	C	D
10	A	C	D	A	B	A	D	C	C	C
20	A	C	A	B	D	C	D	D	C	C
30	C	B	C	D	A	B	B	B	A	A
40	E	A	B	C	C	D	B	C	B	E

## Section 2

1. An ideal transition curve is
  - A. cubic parabola
  - B. cubic spiral
  - C. clothoid spiral
  - D. true spiral.
2. Pantagraph is used for
  - A. measuring distances
  - B. measuring areas
  - C. enlarging or reducing plans
  - D. setting out right angles
3. If the angular measurements of a traverse are more precise than its linear measurements, balancing of the traverse, is done by
  - A. Bowditch's rule
  - B. Transit rule
  - C. Empirical rule
  - D. all of the above.
4. The branch of surveying in which both horizontal and vertical positions of a point, are determined by making instrumental observations, is known
  - A. tacheometry
  - B. tachemetry
  - C. telemetry
  - D. all the above.
5. In levelling operation
  - A. when the instrument is being shifted, the staff must not be moved
  - B. when the staff is being carried forward, the instrument must remain stationary
  - C. both (a) and (b)
  - D. neither (a) nor (b).
6. If the rate of gain of radial acceleration is  $0.3 \text{ m per sec}^3$  and full centrifugal ratio is developed. On the curve the ratio of the length of the transition curve of same radius on road and railway, is
  - A. 2.828
  - B. 3.828
  - C. 1.828
  - D. 0.828.
7. The angle between two plane mirrors of optical square, is
  - A.  $20^\circ$
  - B.  $30^\circ$
  - C.  $45^\circ$
  - D.  $60^\circ$
  - E.  $90^\circ$ .
8. The latitude of a traverse leg is obtained by multiplying its length by
  - A. tangent of its reduced bearing
  - B. sign of its reduced bearing
  - C. cosine of its reduced bearing

- D. cosecant of its reduced bearing.
9. For a curve of radius 100 m and normal chord 10 m, the Rankine's deflection angle, is  
 A.  $0^{\circ}25'.95$     B.  $0^{\circ}35'.95$     C.  $1^{\circ}25'.53$     D.  $1^{\circ}35'.95$     E.  $2^{\circ}51'.53$ .
10. A uniform slope was measured by the method of stepping. If the difference in level between two points is 1.8 m and the slope distance between them is 15 m, the error is approximately equal to  
 A. cumulative, + 0.11 m  
 B. compensating,  $\pm$  0.11 m  
 C. cumulative, - 0.11 m  
 D. none of these
11. In optical reading instruments  
 A. the vertical circle is usually continuous from  $0^{\circ}$  to  $359^{\circ}$   
 B. the readings increase when the telescope is elevated in the face left position  
 C. the readings decrease when the telescope is elevated in the face right position  
 D. all the above.
12. For setting out a simple curve, using two theodolites.  
 A. offsets from tangents are required  
 B. offsets from chord produced are required  
 C. offsets from long chord are required  
 D. deflection angles from Rankine's formula are required  
 E. none of these.
13. Geodetic surveying is undertaken  
 A. for production of accurate maps of wide areas  
 B. for developing the science of geodesy  
 C. making use of most accurate instruments and methods of observation  
 D. for determination of accurate positions on the earth's surface of system of control points  
 E. all the above.
14. The desired sensitivity of a bubble tube with 2 mm divisions is  $30''$ . The radius of the bubble tube should be  
 A. 13.75 m    B. 3.44 m    C. 1375 m    D. none of these.
15. A dumpy level was set up at the midpoint between two pegs A and B, 50 m apart and the staff readings at A and B were 1.22 and 1.06. With the level set up at A, the readings at A and B were 1.55 and 1.37. The collimation error per 100 m length of sight is

- A. 0.02 m inclined upwards  
 B. 0.04 m inclined downwards  
 C. 0.04 m inclined upward  
 D. none of these.
16. Keeping the instrument height as 1 m, length of staff 4 m, the up gradient of the ground 1 in 10, the sight on the up slope must be less than  
 A. 25 cm      B. 20 m      C. 45 m      D. 10 m
17. True meridian of different places  
 A. converge from the south pole to the north pole  
 B. converge from the north pole to the south pole  
 C. converge from the equator to the poles  
 D. run parallel to each other.
18. Let angular value of one graduation of a tube of length  $x$  be  $\phi$  seconds and  $R$  be the radius of its internal curved surface, then  
 A.  $\phi = \frac{x}{206265 R}$       B.  $\phi = \frac{R}{206265 x}$       C.  $\phi = \frac{206265}{x.R}$       D.  $\phi = \frac{x.R}{206265}$
19. Pick up the correct statement from the following :  
 A. the length of the brass handle is included in the length of chain  
 B. the handles are on swivel joints to prevent twisting of the chain  
 C. the fifth tag from either end of the chain is numbered 5  
 D. the length of the Gunter's chain is 66 ft.  
 E. all the above.
20. Two hill tops A and B 20 km apart are intervened by a third top C. If the top most contour of the three hill tops are of the same value, state whether the line of sight AB  
 A. passes clear of hill top  $C$   
 B. passes below the hill top  $C$   
 C. grazes the hill top  $C$   
 D. none of these.
21. The diaphragm of a stadia theodolite is fitted with two additional  
 A. horizontal hairs  
 B. vertical hairs  
 C. horizontal and two vertical hairs  
 D. none of these.
22. Centering error of a theodolite produces an error



- A. in all angles equally  
 B. which does not vary with the direction or pointing  
 C. which varies with the direction of pointing and inversely with the length of sight  
 D. none of these.
23. In levelling operation  
 A. if second reading is more than first, it represents a rise  
 B. if first reading is more than second, it represents a rise  
 C. if first reading is less than second, it represents a fall  
 D. if second reading is less than first, it represents a fall  
 E. both (b) and (c).
24. A tape of length  $l$  and weight  $W$  kg/m is suspended at its ends with a pull of  $P$  kg, the sag correction is  
 A.  $\frac{l^3 W^2}{24 P^2}$       B.  $\frac{l^2 W^3}{24 P^2}$       C.  $\frac{l^2 W^2}{24 P^3}$       D.  $\frac{l W^2}{24 P}$  .
25. Pick up the correct statement from the following :  
 A. in astronomical telescope, the rays from the object after refraction at the objective are brought to a focus before entering the eyepiece to produce a real inverted image in front of the eye piece  
 B. in Galileo's telescope, the rays from the object get refracted at the objective and are intercepted by the eyepiece before a real image is formed  
 C. a line passing through the optical centre of the objective traversing through the eyepiece, is called line of sight  
 D. the line of sight which passes through the intersection of cross-lines marked on a diaphragm fixed in front of the eyepiece in a plane at right-angles to the axis, is called the line of collimation  
 E. all the above.
26. The operation of making the algebraic sum of latitudes and departures of a closed traverse, each equal to zero, is known  
 A. balancing the sights  
 B. balancing the departures  
 C. balancing the latitudes  
 D. balancing the traverse.
27. If the sight distance ( $S$ ) is equal to the length of the vertical-curve ( $2l$ ) joining two grades  $g_1\%$  and  $-g_2\%$ , the height of the apex will be  
 A.  $\frac{(S-l)}{400} (g_1 - g_2)$       B.  $\frac{(g_1 - g_2)}{400}$       C.  $\frac{(g_1 - g_2) S^2}{1600 l}$       D. none of these.

28. Orientation of a plane table by solving two point problem is only adopted when
- saving of time is a main factor
  - better accuracy is a main factor
  - given points are inaccessible
  - none of these.
29. A back sight
- is always taken on a point of known elevation or can be computed
  - is added to the known level to obtain the instrument height
  - taken on an inverted staff is treated as negative
  - all the above.
30. If the area calculated from the plan plotted with measurements by an erroneous chain, accurate area of the plan is
- $\text{measured area} \times \frac{\text{length of chain used}}{\text{nominal chain length}}$
  - $\text{measured area} \times \frac{\text{nominal chain length}}{\text{length of chain used}}$
  - $\text{measured area} \times \left( \frac{\text{nominal chain length}}{\text{length of chain used}} \right)^2$
  - $\text{measured area} \times \left( \frac{\text{length of chain used}}{\text{nominal chain length}} \right)^2$
  - none of the above
31. The sum of the interior angles of a geometrical figure laid on the surface of the earth differs from that of the corresponding plane figure only to the extent of one second for every
- 100 sq. km of area
  - 150 sq. km of area
  - 200 sq. km of area
  - none of these.
32. The systematic errors which persist and have regular effects in the performance of a survey operation, are due to
- carelessness
  - faulty instrument
  - inattention
  - none of these.

33. If  $\theta$  is the probable error of an observed bearing of a line of length  $l$ , the error over the whole length of the traverse of  $n$  lines of length  $l$  is
- A.  $l n$       B.  $\frac{\theta}{l} n$       C.  $\theta \sqrt[3]{n}$       D.  $\frac{1}{3} \theta n$
34. The best method of interpolation of contours, is by
- A. estimation  
B. graphical means  
C. computation  
D. all of these.
35. Pick up the correct specification of Ramsden eyepiece from the following :
- A. it consists of two equal plano convex lenses  
B. the curved surfaces of plano-convex lenses face each other  
C. the two lenses are separated by a distance equal to  $2/3$  of the focal length of either lens.  
D. the distance between the diaphragm and the front lens of the eyepiece is kept equal to  $1/4$  th of the focal length of a lens so that rays from a point on the diaphragm enter the eye as a parallel beam  
E. all the above.
36. The conventional sign shown in below figure represents a
- A. bridge carrying railway below road  
B. bridge carrying road below railway  
C. bridge carrying road and railway at the same level  
D. a level crossing.
37. Deviation of the actual road gradient from the proposed contour gradient up hill side, involves
- A. embankment on the centre line  
B. excavation on the centre line  
C. earth work on the centre line  
D. none of these.
38. Measuring with a 30 m chain, 0.01 m too short, introduces
- A. positive compensating error  
B. negative compensating error  
C. positive cumulative error  
D. negative cumulative error.
39. Setting out a curve by two theodolite method, involves
- A. linear measurements only

- B. angular measurements only  
 C. both linear and angular measurements  
 D. none of these.
40. When the bubble of the level tube of a level, remains central  
 A. line of sight is horizontal  
 B. axis of the telescope is horizontal  
 C. line of collimation is horizontal  
 D. geometrical axis of the telescope is horizontal.
41. Pick up the correct statement from the following :  
 A. the power of a lens is the reciprocal of its focal length  
 B. the unit of power of the lens is diopter  
 C. the power of two or more thin lenses in contact is the power of the combination of the lenses  
 D. all the above.
42. The area of a plane triangle ABC, having its base AC and perpendicular height h, is  
 A.  $\frac{1}{2} bh$   
 B.  $\frac{1}{2} ba \sin C$   
 C.  $\frac{1}{2} bc \sin A$   
 D.  $S(S - a)(S - b)(S - c)$   
     where  $S$  is  $\frac{a + b + c}{2}$   
 E. all the above
43. The vertical angle between longitudinal axis of a freely suspended magnetic needle and a horizontal line at its pivot, is known  
 A. declination    B. azimuth    C. dip    D. bearing.
44. A relatively fixed point of known elevation above datum, is called  
 A. bench mark  
 B. datum point  
 C. reduced level  
 D. reference point.
45. Cross hairs in surveying telescopes, are fitted  
 A. in the objective glass  
 B. at the centre of the telescope  
 C. at the optical centre of the eye piece

- D. in front of the eye piece.
46. Metric chains are generally available in
- 10 m and 20 m length
  - 15 m and 20 m length
  - 20 m and 30 m length
  - 25 m and 100 m length
47. On a diagonal scale, it is possible to read up to
- one dimension
  - two dimensions
  - three dimensions
  - four dimensions.
48. Plotting of inaccessible points on a plane table, is done by
- intersection
  - traversing
  - radiation
  - none of these.
49. A dumpy level is set up with its eye-piece vertically over a peg A. The height from the top of peg A to the centre of the eye-piece is 1.540 m and the reading on peg B is 0.705 m. The level is then setup over B. The height of the eye-piece above peg B is 1.490 m and a reading on A is 2.195 m. The difference in level between A and B is
- 2.900 m
  - 3.030 m
  - 0.770 m
  - 0.785 m
  - 1.770 m.
50. Probable systematic error in precise levelling as recommended by International Geodetic Association should not exceed (where k is in kilometers.)
- $\pm 0.1$  k mm
  - $\pm 0.2$  k mm
  - $\pm 0.1$  k
  - 0.2 k mm.

### Answer Key

	1	2	3	4	5	6	7	8	9	0
0	C	C	B	D	C	A	C	C	E	A
10	D	E	E	A	B	C	C	A	E	B
20	A	C	E	A	E	D	B	C	D	D
30	C	B	A	C	E	A	B	C	B	A
40	D	E	C	A	D	C	C	A	C	D

### Explanation

1.

IRC recommends Spiral or clothoid as the ideal transition curve due to following reasons: 1. It satisfies that rate of change of centrifugal acceleration is constant i.e.,  $L_s \cdot R = \text{constant}$ . Where  $L_s$  = length of transition curve  $R$  = radius of curve. 2. The calculation and field implementation of spiral curve is simple and easy. 3. It enhances aesthetics also.

### Section 3

1. The curve composed of two arcs of different radii having their centres on the opposite side of the curve, is known
  - A. a simple curve
  - B. a compound curve
  - C. a reverse curve
  - D. a vertical curve.
2. The ratio of the angles subtended at the eye, by the virtual image and the object, is known as telescope's
  - A. resolving power
  - B. brightness
  - C. field of view
  - D. magnification.
3. The bubble tube is nearly filled with
  - A. alcohol or chloroform
  - B. a liquid which is very mobile
  - C. a liquid having low freezing point
  - D. all the above.
4. Simpson's rule for calculating areas states that the area enclosed by a curvilinear figure divided into an even number of strips of equal width, is equal to
  - A. half the width of a strip, multiplied by the sum of two extreme offsets, twice the sum of remaining odd offsets, and thrice the sum of the even offsets
  - B. one third the width of a strip, multiplied by the sum of two extreme offsets, twice the sum of remaining odd offsets and four times the sum of the even offsets
  - C. one third the width of a strip, multiplied by the sum of two extreme offsets, four times the sum of the remaining odd offsets, and twice the sum of the even offsets
  - D. one sixth the width of a strip, multiplied by the sum of the two extreme offsets, twice the sum of remaining odd offsets and four times the sum of the even offsets
  - E. none of these
5. In a constant level tube, size of the bubble remains constant because upper wall is
  - A. of relatively larger radius
  - B. of relatively smaller radius

- C. flat
  - D. convex downwards.
6. Prismatic compass is considered more accurate than a surveyor's compass, because
- A. it is provided with a better magnetic needle
  - B. it is provided with a sliding glass in the object vane
  - C. its graduations are in whole circle bearings
  - D. it is provided with a prism to facilitate reading of its graduated circle
  - E. both (c) and (d).
7. In reciprocal levelling, the error which is not completely eliminated, is due to
- A. earth's curvature
  - B. non-adjustment of line of collimation
  - C. refraction
  - D. non-adjustment of the bubble tube.
8. In tacheometrical observations, vertical staff holding is generally preferred to normal staffing, due to
- A. ease of reduction of observations
  - B. facility of holding
  - C. minimum effect of careless holding on the result
  - D. none of these.
9. Removal of parallax, may be achieved by focussing
- A. the objective
  - B. the eye-piece
  - C. the objective and the eye-piece
  - D. none of these.
10. Pick up the correct statement from the following :
- A. A level surface is perpendicular at all points to the direction of gravity
  - B. A level line lies in level surface
  - C. A horizontal surface is normal to the direction of gravity at only one point
  - D. A horizontal line is tangential to the level surface
  - E. All the above.
11. The direction of steepest slope on a contour, is
- A. along the contour

- B. at an angle of  $45^\circ$  to the contour
  - C. at right angles to the contour
  - D. none of these.
12. Back bearing of a line is equal to
- A. Fore bearing  $\pm 90^\circ$
  - B. Fore bearing  $\pm 180^\circ$
  - C. Fore bearing  $\pm 360^\circ$
  - D. Fore bearing  $\pm 270^\circ$
13. In an internal focusing telescope
- A. the objective is at a fixed distance from the diaphragm
  - B. the focusing is done by the sliding of a divergent lens.
  - C. the focusing divergent lens is situated at about the middle of the tube
  - D. all the above.
14. The longitudinal section of the surface of bubble tube is
- A. straight      B. circular      C. parabolic      D. elliptic.
15. Imaginary line passing through points having equal magnetic declination is termed as
- A. isogon      B. agonic line      C. isoclinic line      D. none of these.
16. In case of reduction of levels by the height of instrument method,
- A.  $\sum \text{B.S.} - \sum \text{F.S.} = \text{difference in R.L.S of the first station and last station}$
  - B.  $\sum (\text{R.L.} + \text{I} + \text{F.S.}) - \text{first R.L} = \sum (\text{H.I.} + \text{No. of R.L.s.})$
  - C. both (a) and (b) above
  - D. neither (a) nor (b).
17. A theodolite is said to be in perfect adjustment if
- A. rotation axis is vertical to the transit axis
  - B. transit axis is perpendicular to line of collimation
  - C. line of collimation sweeps out a vertical plane while the telescope is elevated or depressed
  - D. all the above.
18. While rotating the theodolite in the horizontal plane, the bubble of the bubble tube takes up the same position in its tube, it indicates
- A. the rotation axis is vertical
  - B. the trummion axis is horizontal
  - C. the line of collimation is perpendicular to vertical axis
  - D. none of the above



19. The main plate of a transit is divided into 1080 equal divisions. 60 divisions of the vernier coincide exactly with 59 divisions of the main plate. The transit can read angles accurate upto  
 A. 5"    B. 10"    C. 15"    D. 20"    E. 30"
20. Pick up the correct statement from the following :
- A. the lines of sight while observing back sight and fore sight lie in the same horizontal plane
  - B. the staff readings are measurements made vertically downwards from a horizontal plane
  - C. the horizontal plane with reference to which staff readings are taken, coincides with the level surface through the telescope axis
  - D. all the above.
21. A traverse deflection angle is
- A. less than  $90^\circ$
  - B. more than  $90^\circ$  but less than  $180^\circ$
  - C. the difference between the included angle and  $180^\circ$
  - D. the difference between  $360^\circ$  and the included angle.
22. While measuring a chain line between two stations A and B intervened by a raised ground
- A. vision gets obstructed
  - B. chaining gets obstructed
  - C. both vision and chaining get obstructed
  - D. all the above.
23. The Random errors tend to accumulate proportionally to
- A. numbers of operations involved
  - B. reciprocal of operations involved
  - C. square root of the number of operation involved
  - D. cube root of the number of operation involved.
24. The true meridian of a place is the line in which earth's surface is intersected by a plane through
- A. east and west points
  - B. zenith and nadir points
  - C. north and south geographical poles
  - D. north and south magnetic poles.
25. The least count of a vernier scale is
- A. sum of the smallest divisions of main and vernier scales
  - B. value of one division of the primary scale divided by total number of divisions of vernier scale

- C. value of one division of vernier scale divided by total number of divisions of primary scale
  - D. none of these.
26. Which one of the following procedures for getting accurate orientation is the most distinctive feature of the art of plane tabling
- A. radiation    B. intersection    C. traversing    D. resection.
27. A clinometer is used for
- A. measuring angle of slope
  - B. correcting line of collimation
  - C. setting out right angles
  - D. defining natural features.
28. Diurnal variation of magnetic declination is
- A. greater at equator than nearer the poles
  - B. less at equator than nearer the poles
  - C. less in summer than in winter
  - D. same at all latitudes and during different months.
29. The 'fix' of a plane table from three known points, is good, if
- A. middle station is nearest
  - B. middle station is farthest
  - C. either the right or left station is nearest
  - D. none of these.
30. The construction of optical square is based, on the principle of optical
- A. reflection
  - B. refraction
  - C. double refraction
  - D. double reflection.
31. If the smallest division of a vernier is longer than the smallest division of its primary scale, the vernier is known as
- A. direct vernier
  - B. double vernier
  - C. retrograde vernier
  - D. simple vernier.
32. Cross-staff is used for
- A. setting out right angles
  - B. measuring contour gradient
  - C. taking levels
  - D. measuring distances

- E. none of these
33. The 'point of curve' of a simple circular curve, is
- point of tangency
  - point of commencement
  - point of intersection
  - mid-point of the curve
34. For orientation of a plane table with three points A, B and C, Bessel's drill is
- Align *b* through *a* and draw a ray towards *c*, align *a* through *b* and draw a ray towards *c*, finally align *c* through the point of intersection of the previously drawn rays
  - Align *c* through *a* and draw a ray towards *b*, align *a* through *c* and draw a ray towards *b*, finally align *b* through the point of intersection of the previously drawn rays
  - Align *c* through *b* and draw a ray towards *a*, align *b* through *c* and draw a ray towards *a*, finally align *a*, through the point of intersection of the previously, drawn rays
  - In the first two steps any two of the points may be used and a ray drawn towards the third point, which is sighted through the point of intersection of previously drawn rays in the final step.
35. The minimum range for sliding the focusing lens in the internal focusing telescope for focusing at all distances beyond 4 m is
- A. 5 mm    B. 10 mm    C. 15 mm    D. 20 mm.
36. Pick up the correct statement from the following :
- in the earth's magnetic field, a magnetic needle rests in magnetic meridian
  - the angle between the true meridian and the magnetic meridian is called magnetic variation
  - one end of the magnetic needle supported at its centre of gravity tends to dip down towards the. nearer magnetic pole of the earth
  - the magnet properly pivoted is balanced by means of riding weight movable along the needle
  - all the above.
37. The formula for the horizontal distances for inclined sights, on staff held normal is  $s \cos \theta + (f + d) \cos \theta \pm h \sin \theta$
- minus sign is used for angle of depression
  - plus sign is used for angle of depression
  - minus sign is used for angle of elevation
  - non of these.

38. Ramsden eye-piece consists of
- two convex lenses short distance apart
  - two concave lenses short distance apart
  - one convex lens and one concave lens short distance apart
  - two plano-convex lenses short distance apart, with the convex surfaces facing each other.
39. The distance between steps for measuring down hill to obtain better accuracy
- decreases with decrease of slope
  - increases with increase of slope
  - decreases with increase of slope
  - decreases with decrease of weight of the chain.
40. The tangent to the liquid surface in a level tube, is parallel to the axis of the level tube at
- every point of the bubble
  - either end of the bubble
  - the mid-point of the bubble
  - no where.
41. If  $\alpha$  is the angle between the polar ray and the tangent at the point of commencement of a lemniscate curve, the equation of the curve, is
- $l = k \sin \alpha$
  - $l = k \sin 2\alpha$
  - $l = k \sin 3\alpha$
  - $l = k \tan 2\alpha$
  - $l = k \cos 2\alpha$
42. Pick up the correct statement from the following :
- If the slope of the curve of a mass diagram in the direction of increasing abscissa is downward, it indicates an embankment
  - The vertical distance between a maximum ordinate and the next forward maximum ordinate represents the whole volume of the embankment
  - The vertical distance between a minimum ordinate and the next forward maximum ordinate represents the whole volume of a cutting
  - The area enclosed by a loop of the curve and balancing line, measures the haul in that direction.
  - all the above.
43. Pick up the correct statement from the following :

- A. if the image of the object does not fall on the plane of the cross-lines, parallax exists
  - B. parallax has nothing to do with the eyepiece
  - C. the eyepiece is adjusted for clear vision of the cross hairs
  - D. all the above.
44. The slope correction may be ignored if
- A. the slope of the ground is less than  $3^\circ$
  - B. to slope of the ground is say 1 in 19
  - C. both (a) and (b)
  - D. neither (a) nor (b)
45. If  $\Delta$  is the angle of deflection of the curve, T1 and T2 are its points of tangencies, the angle between the tangent at T1 and long chord T1 T2 will be
- A.  $\frac{\Delta}{4}$       B.  $\frac{\Delta}{3}$       C.  $\frac{\Delta}{2}$       D.  $\Delta$       E.  $2\Delta$ .
46. If a tachometer is fitted with an anal-latic lens
- A. additive constant is 100, multiplying constant is zero
  - B. multiplying constant is 100, additive constant is zero
  - C. both multiplying and additive constants are 100
  - D. both multiplying and additive constants are 50.
47. Volume of the earth work may be calculated by
- A. mean areas
  - B. end areas
  - C. Prismoidal formula
  - D. Trapezoidal
  - E. all the above.
48. Which one of the following mistakes/errors may be cumulative + or - :
- A. bad ranging
  - B. bad straightening
  - C. erroneous length of chain
  - D. sag.
49. The orthographical projection of a traverse leg upon the reference meridian, is known as
- A. departure of leg
  - B. latitude to the leg
  - C. co-ordinate of the leg
  - D. bearing of the leg.

50. The whole circle bearing of a line is  $290^\circ$ . Its reduced bearing is  
 A. N  $20^\circ$  E      B. N  $20^\circ$  W      C. N  $70^\circ$  W      D. S  $70^\circ$  E

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	D	D	B	A	D	C	C	C	E
10	C	B	D	B	A	D	D	A	D	D
20	C	A	C	C	B	D	A	B	A	D
30	C	A	B	D	D	E	A	D	C	C
40	B	E	D	C	C	B	E	C	B	C

## Section 4

- The reduced bearing of a line is N 87° W. Its whole circle bearing is  
A. 87°      B. 273°      C. 93°      D. 3°
- Surveys which are carried out to depict mountains, rivers, water bodies, wooded areas and other cultural details, are known as  
A. cadastral surveys  
B. city surveys  
C. topographical surveys  
D. guide map surveys  
E. plane surveys.
- If  $d$  is the distance between equidistant odd ordinates, the Simpson's rule for the areas, is

A.  $\frac{d}{2} [h_1 + h_n + 2(h_3 + h_5 + \dots + h_{n-2}) + 4(h_2 + h_4 + \dots + h_{n-1})]$

B.  $\frac{d}{3} [h_1 + h_n + 2(h_3 + h_5 + \dots + h_{n-2}) + 4(h_2 + h_4 + \dots + h_{n-1})]$

C.  $\frac{d}{6} [h_1 + h_n + 2(h_2 + h_4 + \dots + h_{n-1}) + 4(h_3 + h_5 + \dots + h_{n-2})]$

D.  $\frac{d}{6} [h_1 + h_n + 2(h_3 + h_5 + \dots + h_{n-2}) + 4(h_2 + h_4 + \dots + h_{n-1})]$

E. none of these.

- To set out a parallel from a given inaccessible point to a given line AB, the following observations are made Distance AB and angle PAM =  $a$  and angle PBA =  $b$  are measured where M is a point on the line BA produced. The perpendicular to the desired parallel line from A and B are :

A.  $\frac{AB}{\cot b - \cot a}$       B.  $\frac{AB}{\cos b - \cos a}$       C.  $\frac{AB}{\cot a - \cot b}$       D.  $\frac{AB}{\cot a - \cos b}$

- Which of the following introduces an error of about 1 in 1000 if 20 m chain is used  
A. length of chain 20 mm wrong  
B. one end of the chain 0.9 m off the line  
C. one end of chain 0.9 m higher than the other  
D. middle of the chain 0.45 m off the line

- E. all the above.
6. The distance between the point of intersection of an up grade + g1% and downgrade g2% and the highest point of the vertical curve of length L, is
- A.  $\frac{L(g_1 - g_2)}{400}$       B.  $\frac{L(g_1 + g_2)}{400}$       C.  $\frac{L(g_1 + g_2)}{800}$       D.  $\frac{L(g_1 - g_2)}{800}$
7. The total change in level along the line is equal to total back sights
- A. minus total fore sights  
 B. the total rises minus total falls  
 C. the reduced level of last point minus reduced level of the first point  
 D. all the above.
8. ABCD is a rectangular plot of land. If the bearing of the side AB is  $75^\circ$ , the bearing of DC is
- A.  $75^\circ$       B.  $255^\circ$       C.  $105^\circ$       D.  $285^\circ$
9. Grid lines are parallel to
- A. magnetic meridian of the central point of the grid  
 B. line representing the central true meridian of the grid  
 C. geographical equator  
 D. none of these.
10. Total latitude of a point is positive if it lies
- A. north of the reference parallel  
 B. south of the reference parallel  
 C. east of the reference parallel  
 D. west of the reference parallel.
11. In levelling operation,
- A. The first sight on any change point is a back sight  
 B. The second sight on any change point is a fore sight  
 C. The line commences with a fore sight and closes with a back sight  
 D. The line commences with a back sight and closes with a foresight.
12. The apparent error on reversal is
- A. equal to the actual error  
 B. twice the actual error  
 C. thrice the actual error  
 D. none of these.
13. Magnetic declination at any place



- A. remains constant
  - B. does not remain constant
  - C. fluctuates
  - D. changes abruptly.
14. Systematic errors are those errors
- A. which cannot be recognised
  - B. whose character is understood
  - C. whose effects are cumulative and can be eliminated
  - D. none of these.
15. If  $L$  is in kilometres, the curvature correction is
- A.  $58.2 L^2$  mm
  - B.  $64.8 L^2$  mm
  - C.  $74.8 L^2$  mm
  - D.  $78.4 L^2$  mm.
16. With usual notations, the expression represents
- A. centrifugal force
  - B. centrifugal ratio
  - C. super elevation
  - D. radial acceleration.
17. An angle of deflection right, may be directly obtained by setting the instrument to read
- A. zero on back station
  - B.  $180^\circ$  on back station
  - C.  $90^\circ$
  - D.  $270^\circ$  on back station.
18. The method of finding out the difference in elevation between two points for eliminating the effect of curvature and refraction, is
- A. reciprocal levelling
  - B. precise levelling
  - C. differential levelling
  - D. flying levelling
19. Transition curves are introduced at either end of a circular curve, to obtain
- A. gradually decrease of curvature from zero at the tangent point to the specified quantity at the junction of the transition curve with main curve

- B. gradual increase of super-elevation from zero at the tangent point to the specified amount at the junction of the transition curve with main curve
  - C. gradual change of gradient from zero at the tangent point to the specified amount at the junction of the transition curve with main curve
  - D. none of these.
20. The horizontal angle between true meridian and magnetic meridian, is known
- A. bearing
  - B. magnetic declination
  - C. dip
  - D. convergence.
21. Accuracy of elevation of various points obtained from contour map is limited to
- A.  $\frac{1}{2}$  of the contour interval
  - B.  $\frac{1}{4}$  th of the contour interval
  - C.  $\frac{1}{3}$  rd of the contour interval
  - D.  $\frac{1}{5}$  th of the contour interval.
22. Magnetic bearing of a survey line at any place
- A. remains constant
  - B. changes systematically
  - C. varies differently in different months of the year
  - D. is always greater than true bearing.
23. Perpendicularity of an offset may be judged by eye, if the length of the offset is
- A. 5 m      B. 10 m      C. 15 m      D. 20 m.
24. The bearings of two traverse legs AB and BC are N52° 45' E and N34° 30' E respectively. The deflection angle is
- A. 18° 15' E      B. 18° 15' N      C. 18° 15' W      D. 18° 15' R  
E. 18° 15' L
25. A lemniscate curve will not be transitional throughout, if its deflection angle, is
- A. 45°      B. 60°      C. 90°      D. 120°      E. 180°

26. In a lemniscate curve the ratio of the angle between the tangent at the end of the polar ray and the straight, and the angle between the polar ray and the straight, is  
 A. 2    B. 3    C. 4    D. 5    E. 3/2
27. If V is the speed of a locomotive in km per hour, g is the acceleration due to gravity, G is the distance between running faces of the rails and R is the radius of the circular curve, the required super elevation is  
 A.  $\frac{gV^2}{GR}$     B.  $\frac{Rg}{GV^2}$     C.  $\frac{GR}{gV^2}$     D.  $\frac{GV^2}{gR}$
28. Ranging in chain survey means  
 A. looking at an isolated point not on the line  
 B. establishing an intermediate point on the line  
 C. determining the distance between end points  
 D. determining the offset distance  
 E. none of these
29. Accurate measurement of deflection angles with a transit not properly adjusted may be made by  
 A. setting the vernier A at zero at back station and then plunging the telescope  
 B. setting the vernier A at zero at back station and turning the instrument to the forward station  
 C. taking two back sights one with the telescope normal and the other with telescope inverted  
 D. none of these.
30. If whole circle bearing of a line is  $120^\circ$ , its reduced bearing is  
 A. S  $20^\circ$  E    B. S  $60^\circ$  E    C. N  $120^\circ$  E    D. N  $60^\circ$  E.
31. Greater accuracy in linear measurements, is obtained by  
 A. tacheometry  
 B. direct chaining  
 C. direct taping  
 D. all the above.
32. From any point on the surface with a given inclination  
 A. only one contour gradient is possible  
 B. two contour gradients are possible  
 C. indefinite contour gradients are possible  
 D. all the above.
33. Angles to a given pivot station observed from a number of traverse stations when plotted, the lines to the pivot station intersect at a common point

- A. angular measurements are correct and not the linear measurements
  - B. linear measurements are correct and not the angular measurements
  - C. angular and linear measurements are correct and not the plotting of traverse
  - D. angular and linear measurements and also plotting of the traverse are correct.
34. Reduced bearing of a line is an angle between
- A. north line and given line measured clockwise
  - B. north line and given line measured anticlockwise
  - C. east or west and the given line
  - D. given line and the part of the meridian whether N end or S end, lying adjacent to it.
35. While measuring with a metallic tape of 30 m length pull should be applied
- A. 1 kg      B. 2 kg      C. 3 kg      D. 4 kg
36. The ratio of the radius and apex distance of a curve deflecting through  $\Delta^\circ$ , is
- A.  $\left( \sec \frac{\Delta}{2} - 1 \right)$       B.  $\left( 1 - \sec \frac{\Delta}{2} \right)$       C.  $\left( \cos \frac{\Delta}{2} - 1 \right)$       D.  $\left( \tan \frac{\Delta}{2} - 1 \right)$
37. The ratio of the linear displacement at the end of a line, subtended by an arc of one second to the length of the line, is
- A. 1:206 300      B. 1:3440      C. 1:57      D. 1:100.
38. The co-ordinate of a point measured perpendicular to the parallel, is called
- A. total latitude
  - B. meridian distance
  - C. total departure
  - D. consecutive co-ordinate.
39. The magnetic meridian at any point, is the direction indicated by a freely suspended
- A. magnetic needle
  - B. and properly balanced magnetic needle
  - C. properly balanced and uninfluenced by local attractive force
  - D. magnetic needle over an iron pivot.
40. If the radius of a simple curve is 600 m, the maximum length of the chord for calculating offsets, is taken
- A. 10 m      B. 15 m      C. 20 m      D. 25 m      E. 30 m.

41.  $\alpha, \beta$  are the horizontal angles measured at the ends of a base line AB to a hill top whose angle of elevation from station A is  $\theta^\circ$ . The height of the hill top above the trunnion axis of the theodolite station, is
- A.  $\frac{AB \sin \beta \tan \theta}{\sin [180^\circ - (\alpha + \beta)]}$       B.  $\frac{AB \sin \theta \tan \alpha}{\sin [180^\circ - (\alpha + \theta)]}$       C.  $\frac{AB \sin \theta \tan \beta}{\sin [180^\circ - (\alpha + \beta)]}$
- D.  $\frac{AB \sin \alpha \tan \theta}{\sin [180^\circ - (\alpha + \beta)]}$
42. Correct distance obtained by an erroneous chain is:
- A.  $\frac{\text{Erroneous chain length}}{\text{Correct chain length}} \times \text{Observed distance}$
- B.  $\frac{\text{Correct chain length}}{\text{Erroneous chain length}} \times \text{Observed distance}$
- C.  $\frac{\text{Correct chain length}}{\text{Observed distance}} \times \text{Erroneous chain length}$
- D. none of these.
43. For preparation of a contour plan for a route survey
- A. method of squares is used
- B. method of trace contour is used
- C. method of cross profile is used
- D. indirect method of contouring is used.
44. Flint glass
- A. has slightly the greater refracting power than crown glass
- B. has roughly double refracting power than that of crown
- C. and crown glass proportions yield the required focal length and neutralise the dispersion produced by the convex lens at the emergence from the concave
- D. all the above.
45. The zero of the graduated circle of a prismatic compass is located at
- A. north end      B. east end      C. south end      D. west end.
46. A standard steel tape of length 30 m and cross-section 15 x 1.0 mm was standardised at  $25^\circ\text{C}$  and at 30 kg pull. While measuring a base line at the same temperature, the pull applied was 40 kg. If the modulus of elasticity of steel tape is  $2.2 \times 10^6 \text{ kg/cm}^2$ , the correction to be applied is
- A. - 0.000909 m      B. + 0.0909 m      C. 0.000909 m      D. none of these
47. The bearing of AB is  $190^\circ$  and that of CB is  $260^\circ 30'$ . The included angle ABC, is
- A.  $80^\circ 30'$       B.  $99^\circ 30'$       C.  $70^\circ 30'$       D. none of these

48. The power of a lens
- is reciprocal of its focal length
  - is positive if it is a convex lens
  - is negative if it is a concave lens
  - is measured in diopter.
49. In an adjusted level, when the bubble is central, the axis of the bubble tube becomes parallel to
- line of sight
  - line of collimation
  - axis of the telescope
  - None of these.
50. If  $h$  is the difference in height between end points of a chain of length  $l$ , the required slope correction is
- $\frac{h^2}{2l}$
  - $\frac{h}{2l}$
  - $\frac{h^2}{l}$
  - $3 \frac{h^2}{2l}$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	C	B	A	E	D	D	A	B	A
10	D	B	B	C	D	B	A	A	B	B
20	A	C	C	E	A	E	D	B	C	B
30	C	C	D	D	C	A	A	A	C	E
40	D	A	C	D	C	A	C	D	A	A

## Section 5

1. The ratio of the distances at which a stated length can be distinguished by the telescope and the human eye, respectively, is called
  - A. brightness of telescope
  - B. magnification of telescope
  - C. resolving power of telescope
  - D. none of these.
2. Bergchrund is a topographical feature in
  - A. plains
  - B. water bodies
  - C. hills
  - D. glaciated region
3. To orient a plane table at a point P roughly south of the mid-point of two inaccessible conical hill stations A and B in the plains, a point C is selected in line with AB and table is oriented at C by bringing ab in line with AB. A ray is then drawn towards P and at P the table is oriented by back ray method. The orientation so obtained, is
  - A. unique and correct
  - B. incorrect
  - C. manifold and correct
  - D. not reliable.
4. Which one of the following statements is correct ?
  - A. when the axes of rotation of the graduated circle and the verniers are not coincident, the instrument possesses eccentricity
  - B. the mean of the readings of the two verniers gives correct reading free from the eccentricity
  - C. one vernier may be used if the readings of two verniers differ by a constant
  - D. all the above.
5. Pick up the correct statement from the following
  - A. 1 second of arc corresponds to a displacement ratio of 1:206, 300
  - B. 1 degree of arc corresponds to a displacement ratio of 1:57
  - C. the angular errors tend to propagate themselves along a traverse as the square root of the number of stations
  - D. the errors arising from the linear measures tend to be roughly proportional to the lengths of the lines
  - E. all the above.
6. The chaining on sloping ground is

- A. easier along the falling gradient  
 B. easier along the up gradient  
 C. equally convenient along falling as well as up gradient  
 D. all the above.
7. Profile levelling is usually done for determining  
 A. contours of an area  
 B. capacity of a reservoir  
 C. elevations along a straight line  
 D. boundaries of property
8. The conventional sign shown in below figure represents a  
 A. road bridge    B. railway bridge    C. canal bridge    D. aquaduct.
9. For indirect ranging, number of ranging rods required, is  
 A. 1    B. 2    C. 3    D. 4    E. 5
10. Correction per chain length of 100 links along a slope having a rise of 1 unit in n horizontal units, is  
 A.  $\frac{100}{n^2}$     B.  $100 n^2$     C.  $\frac{100}{n^3}$     D.  $\frac{100}{n}$  .
11. The operation of resection involves the following stepsrough orientation of the plane tablethe three lines form a triangle of errordrawing lines back through the three control pointsselect a point in the triangle of error such that each ray is equally rotated either clockwise or anti clockwise the points obtained by three rays is the correct location. The correct sequence is  
 A. 1, 3, 2, 4, 5    B. 1, 2, 3, 4, 5    C. 1, 4, 3, 2, 5    D. 1, 4, 2, 3, 5
12. The ratio of the length of long chord and the tangent length of a circular curve of radius R deflecting through angle  $\Delta$ , is  
 A.  $\sin \frac{\Delta}{2}$     B.  $\cos \frac{\Delta}{2}$     C.  $\tan \frac{\Delta}{2}$     D.  $2 \sin \frac{\Delta}{2}$     E.  $2 \cos \frac{\Delta}{2}$  .
13. To avoid large centering error with very short legs, observations are generally made  
 A. to chain pins  
 B. by using optical system for centering the theodolite  
 C. to a target fixed on theodolite tripod on which theodolite may be fitted easily  
 D. all the above.
14. During secular variation of magnetic meridian at different places  
 A. range of oscillations is constant



- B. period of oscillation is constant
  - C. range and period of oscillation both vary
  - D. period of oscillation only varies.
15. Designation of a curve is made by :
- A. angle subtended by a chord of any length
  - B. angle subtended by an arc of specified length
  - C. radius of the curve
  - D. curvature of the curve.
16. If a linear traverse follows a sharp curve round a large lake where it is difficult to have long legs, the accuracy of the traverse may be improved by
- A. taking short legs
  - B. making repeated observations of angular and linear measurements
  - C. making a subsidiary traverse to determine the length of a long leg
  - D. all the above.
17. Perpendicular offset from a tangent to the junction of a transition curve and circular curve is equal to
- A. shift
  - B. twice the shift
  - C. thrice the shift
  - D. four times the shift.
18. Rankine's deflection angle in minutes is obtained by multiplying the length of the chord by
- A. degree of the curve
  - B. square of the degree of the curve
  - C. inverse of the degree of the curve
  - D. none of these.
19. The approximate formula for radial or perpendicular offsets from the tangent, is
- A.  $\frac{x}{2R}$       B.  $\frac{x^2}{2R}$       C.  $\frac{x}{R}$       D.  $\frac{x^2}{R}$
20. The line of collimation method of reduction of levels, does not provide a check on
- A. intermediate sights
  - B. fore sights
  - C. back sights

- D. reduced levels.
21. If L is the specified length of a tape, L<sub>1</sub> its actual length and S the measured distance, then, the true distance is given by the formula,
- A.  $\frac{L_1}{L} \times S$       B.  $\frac{L}{L_1} \times S$       C.  $\frac{L - L_1}{L} \times S$       D.  $\left(\frac{L_1}{L}\right)^2 \times S$ .
22. The method of reversal
- A. is usually directed to examine whether a certain part is truly parallel or perpendicular to another  
 B. makes the erroneous relationship between parts evident  
 C. both (a) and (b)  
 D. neither (a) nor (b).
23. You have to observe an included angle with better accuracy than what is achievable by a vernier, you will prefer the method of
- A. repetition  
 B. reiteration  
 C. double observations  
 D. exactness.
24. If the plane table is not horizontal in a direction at right angles to the alidade, the line of sight is parallel to the fiducial edge only for
- A. horizontal sights  
 B. inclined sights upward  
 C. inclined sight downward  
 D. none of these.
25. If the whole circle bearing of a line is 180°, its reduced bearing is
- A. S 0° E      B. S 0° W      C. S      D. N.
26. The chord of a curve less than peg interval, is known as
- A. small chord      B. sub-chord      C. normal chord      D. short chord.
27. Mistakes which may produce a very serious effect upon the final results arise due to
- A. in attention      B. in experience      C. carelessness      D. all of these.
28. A well conditioned triangle has no angle less than
- A. 20°      B. 30°      C. 45°      D. 60°.
29. Contour lines of different elevations can unite to form one line, only in the case of
- A. a vertical cliff  
 B. a saddle

- C. a water shed line  
D. a hill top.
30. The line of sight is kept as high above ground surface as possible to minimise the error in the observed angles due to  
A. shimmering  
B. horizontal refraction  
C. vertical refraction  
D. both shimmering and horizontal refraction.
31. The smaller horizontal angle between the true meridian and a survey line, is known  
A. declination    B. bearing    C. azimuth    D. dip.
32. The distance between terminal points computed from a subsidiary traverse run between them, is generally known, as  
A. traverse leg    B. a base    C. traverse base    D. all the above.
33. For locating a distant object visible from two transit stations, the method usually preferred to, is  
A. Angles and distances from transit stations  
B. Angles from two transit stations  
C. distance from two transit stations  
D. Angle from one transit station and distance from the other.
34. Accidental or compensating errors of length  $L$  are proportional to  
A.  $L$     B.  $L$     C.  $\sqrt[3]{L}$     D.  $1/L$ .
35. Tacheometric formula for horizontal distances using horizontal sights can also suitable be employed for inclined sights through  $\theta$  by multiplying  
A. the constants by  $\sin^2 \theta$   
B. the constants by  $\cos^2 \theta$   
C. the constants by  $\cos \theta$   
D. the constants by  $\sin \theta$   
E. the multiplying constant by  $\cos^2 \theta$  and additive constant by  $\cos \theta$ .
36. Number of subdivisions per metre length of a levelling staff is  
A. 100    B. 200    C. 500    D. 1000
37. A lemniscate curve between the tangents will be transitional throughout if the polar deflection angle of its apex, is  
A.  $\frac{\Delta}{2}$     B.  $\frac{\Delta}{3}$     C.  $\frac{\Delta}{4}$     D.  $\frac{\Delta}{5}$     E.  $\frac{\Delta}{6}$
38. Pick up the wrong statement from the following :

- A. the diaphragm is placed between the eyepiece and the objective but nearer to the former
  - B. the diaphragm is placed between the eyepiece and the objective but nearer to the later
  - C. the outer component of the objective is a double-convex lens of crown glass
  - D. the inner component of the objective is a flint glass, convexo-concave
  - E. all the above.
39. Prolongation of chain line across an obstruction in chain surveying, is done by
- A. making angular measurements
  - B. drawing perpendiculars with a chain
  - C. solution of triangles
  - D. all the above.
40. Check lines (or proof lines) in Chain Surveying, are essentially required
- A. to plot the chain lines
  - B. to plot the offsets
  - C. to indicate the accuracy of the survey work
  - D. to increase the out-turn
41. While measuring the distance between two points along upgrade with the help of a 20 m chain, the forward end of the chain is shifted forward through a distance
- A.  $20 (\sin \theta - 1)$
  - B.  $20 (\cos \theta - 1)$
  - C.  $20 (\sec \theta - 1)$
  - D.  $20 (\operatorname{cosec} \theta - 1)$ .
42. Subtense tacheometry is generally preferred to if ground is
- A. flat      B. undulating      C. mountaineous      D. deserts.
43. For high sensivity of the bubble tube
- A. a liquid of low viscosity is used
  - B. a liquid of low surface tension is used
  - C. the bubble space should be long
  - D. the bubble tube should not be too narrow
  - E. all the above.
44. Short offsets are measured with
- A. an ordinary chain
  - B. an invar tape

- C. a metallic tape  
D. a steel tape.
45. The operation of revolving a plane table about its vertical axis so that all lines on the sheet become parallel to corresponding lines on the ground, is known  
A. levelling    B. centering    C. orientation    D. setting.
46. There are two stations A and B. Which of the following statements is correct :  
A. the fore bearing of  $AB$  is  $AB$   
B. the back bearing of  $AB$  is  $BA$   
C. the fore and back bearings of  $AB$  differ by  $180^\circ$   
D. all the above.
47. Chain surveying is well adopted for  
A. small areas in open ground  
B. small areas with crowded details  
C. large areas with simple details  
D. large areas with difficult details.
48. In a closed traverse, sum of south latitudes exceeds the sum of north latitudes and the sum of east departures exceeds the sum of west departures, then, the closing line will lie in  
A. north-west quadrant  
B. north east quadrant  
C. south-east quadrant  
D. south-west quadrant.
49. A sewer is laid from a manhole A to a manhole B, 250 m away along a gradient of 1 in 125. If the reduced level of the invert at A is 205.75 m and the height of the boning rod is 3 m, the reduced level of the sight rail at B, is  
A. 208.75 m    B. 202.75 m    C. 206.75 m    D. 211.75 m
50. The Huygen's telescope eye piece  
A. is aplanatic  
B. achromatic  
C. both (a) and (b)  
D. neither (a) nor (b).

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	D	C	D	E	A	C	A	D	A
10	A	E	C	C	C	C	D	A	B	A
20	A	C	A	A	C	B	D	B	A	D
30	C	C	B	B	E	B	E	B	B	C
40	C	B	E	A	C	D	A	A	C	C

## Section 6

1. The first reading from a level station is
  - A. foresight
  - B. intermediate sight
  - C. back-sight
  - D. any sight.
2. If the length of a transition curve to be introduced between a straight and a circular curve of radius 500 m is 90 m, the maximum deflection angle to locate its junction point, is
  - A.  $1^{\circ}43' 08''$
  - B.  $1^{\circ}43' 18''$
  - C.  $1^{\circ}43' 28''$
  - D.  $1^{\circ}43' 38''$
3. The length of a traverse leg may be obtained by multiplying the latitude and
  - A. secant of its reduced bearing
  - B. sine of its reduced bearing
  - C. cosine of its reduced bearing
  - D. tangent of its reduced bearing.
4. Pick up the correct statement from the following :
  - A. a refracting telescope consists optically of two lenses
  - B. the principal axes of both the lenses coincide the optical axis of the telescope
  - C. the lens nearer the object to be viewed is convex and is called objective
  - D. the lens nearer the eye is called eyepiece
  - E. all the above.
5. An internal focussing type surveying telescope, may be focussed by the movement of
  - A. objective glass of the telescope
  - B. convex-lens in the telescope
  - C. concave lens in the telescope
  - D. plano-convex lens in the telescope.
6. is the conventional sign of
  - A. temple
  - B. mosque
  - C. idgah
  - D. church
  - E. fort.
7. In chain surveying, perpendiculars to the chain line, are set out by
  - A. a theodolite
  - B. a prismatic compass
  - C. a level
  - D. an optical square

8. The difference in the lengths of an arc and its subtended chord on the earth surface for a distance of 18.2 km, is only  
 A. 1 cm      B. 5 cm      C. 10 cm      D. 100 cm.
9. The boundary of water of a still lake, represents  
 A. level surface  
 B. horizontal surface  
 C. contour line  
 D. a concave surface.
10. Diaphragm of a surveying telescope is held inside  
 A. eye-piece  
 B. objective  
 C. telescope tube at its mid point  
 D. telescope at the end nearer the eye-piece  
 E. telescope at its end nearer the objective.
11. While surveying a plot of land by plane tabling, the field observations  
 A. and plotting proceed simultaneously  
 B. and plotting do not proceed simultaneously  
 C. and recorded in field books to be plotted later  
 D. all the above.
12. If  $\alpha$  and  $\beta$  be the elevations of two objects A and B respectively,  $\theta$  be the angle observed by a sextant. The correct horizontal angle is  
 A.  $\cos \phi = \frac{(\cos \theta - \sin \alpha \sin \beta)}{\cos \alpha \cdot \cos \beta}$       B.  $\cos \phi = \frac{(\sin \theta - \sin \alpha \sin \beta)}{\cos \alpha \cdot \cos \beta}$       C.  $\cos \phi = \frac{(\cos \theta - \sin \alpha \sin \beta)}{\sin \alpha \cdot \sin \beta}$   
 D. none of these.
13. If vertical angles of inclined sights do not exceed  $10^\circ$  and non-verticality of the staff remains within  $1^\circ$ , stadia system of tacheometric observations are made on  
 A. staff normal  
 B. staff vertical  
 C. staff normal as well as vertical  
 D. none of these.
14. If the length of a chain line along a slope of  $\theta^\circ$  is  $l$ , the required slope correction is  
 A.  $2l \cos^2 \theta/2$   
 B.  $2l \sin^2 \theta/2$   
 C.  $l \tan^2 \theta/2$   
 D.  $l \cos^2 \theta/2$ .

15. The sag of 50 m tape weighing 4 kg under 5 kg tension is roughly  
 A. 0.043 m    B. 0.053 m    C. 0.063 m    D. 0.073 m    E. 0.083 m
16. The angle of intersection of a contour and a ridge line, is  
 A.  $30^\circ$     B.  $45^\circ$     C.  $60^\circ$     D.  $90^\circ$ .
17. The area of any irregular figure of the plotted map is measured with  
 A. pentagraph    B. sextant    C. clinometer    D. planimeter    E. optical square
18. is a conventional sign of  
 A. mosque    B. temple    C. church    D. idgah.
19. Probable accidental error in precise levelling as recommended by International Geodetic Association, should not exceed (where k is in kilometers.)  
 A.  $\pm 0.1$  k mm  
 B.  $\pm 0.5$  k mm  
 C.  $\pm 1$  k mm  
 D.  $\pm 2$  k mm  
 E.  $\pm 5$  k mm.
20. The curvature of the earth's surface, is taken into account only if the extent of survey is more than  
 A. 100 sq km    B. 160 sq km    C. 200 sq km    D. 260 sq km.
21. The slope correction for a  $3^\circ$  slope for a length of 100 m, is  
 A. -0.11 m    B. -0.12 m    C. -1.87 m    D. -0.137 m
22. In horizontal angles, the error due to imperfect levelling of the plate bubble is  
 A. large when sights are nearly level  
 B. large for long sights  
 C. less for steeply inclined sights  
 D. large for steeply inclined sights.
23. Pick up the correct statement from the following :  
 A. to locate a gross error in bearing that may exist in controlled theodolite traverse, we may plot the traverse from each end. The traverse station having the same coordinates by each route is the one where the error lies  
 B. to locate a gross error in bearing, in a controlled traverse, we plot the traverse and the station through which perpendicular to sector of the closing line passes is the station at which the error was made



- C. to locate a gross error due to taping in a controlled traverse, we plot the traverse to a convenient scale. The bearing of the closing error will be approximately the same as that of the leg in which the gross error consists
- D. all the above.
24. Pick up the correct statement from the following :
- A. The horizontal angle between magnetic meridian and true meridian at a place is called *magnetic declination* or variance of the compass
- B. the imaginary lines which pass through points at which the magnetic declinations are equal at a given time are called isogonic lines
- C. the isogonic lines through places at which the declination is zero are termed *agonic lines*
- D. all the above.
25. The distances AC and BC are measured from two fixed points A and B whose distance AB is known. The point C is plotted by intersection. This method is generally adopted in
- A. chain surveying
- B. traverse method of surveys
- C. triangulation
- D. none of these.
26. In a precision traverse, included angles are measured by setting the vernier
- A. to read zero exactly on back station
- B. to read  $5^\circ$  exactly on back station
- C. some where near zero and reading both verniers on back station
- D. all the above.
27. If  $\Delta$  is the angle of deflection of a simple curve of radius R, the length of the curve is :
- A.  $\frac{\pi R \Delta}{90^\circ}$       B.  $\frac{\pi R \Delta}{180^\circ}$       C.  $\frac{\pi R \Delta}{270^\circ}$       D.  $\frac{\pi R \Delta}{360^\circ}$  .
28. Pick up the correct statement from the following :
- A. the framework which consists of a series of connected lines, the lengths and directions of which are found from measurements, is called a traverse.
- B. the system of a series of lines which forms a circuit which ends at the starting point, is called a closed traverse

- C. the traverse that starts from a point already fixed in some survey system and ends on another such point, is called a controlled traverse
  - D. the traverse that is not controlled is called a fly traverse
  - E. all the above.
29. If the length of a transition curve to be introduced between a straight and a circular curve of radius 500 m is 90 m, the maximum perpendicular offset for the transition curve, is
- A. 0.70 m      B. 1.70 m      C. 2.70 m      D. 3.70 m      E. 4.70 m
30. The magnetic bearing of a line is  $32^\circ$  and the magnetic declination is  $10^\circ 15' \text{ W}$ . The true bearing is
- A.  $21^\circ 45'$       B.  $42^\circ 15'$       C.  $42^\circ 15' \text{ W}$       D.  $21^\circ 45' \text{ W}$
31. An imaginary line lying throughout on the surface of the earth and preserving a constant inclination to the horizontal, is called
- A. contour line
  - B. contour gradient
  - C. level line
  - D. line of gentle slope.
32. An angles of  $45^\circ$  with a chain line may be set out with
- A. optical square
  - B. open cross staff
  - C. Fench cross staff
  - D. prismatic square.
33. Pick up the correct statement from the following :
- A. spherical aberration may be reduced by diminishing the aperture
  - B. spherical aberration may be minimised by replacing the single lens by a combination of the lenses.
  - C. in telescope objectives, a combination of convex lens and concave lens is used.
  - D. in eyepieces, two plano-convex lenses placed at a certain distance apart are used
  - E. all the above.
34. The imaginary line passing through the intersection of cross hairs and the optical centre of the objective, is known as
- A. line of sight
  - B. line of collimation
  - C. axis of the telescope
  - D. none of these.

35. A dumpy level was set up at mid-point between pegs A and B, 80 m apart and the staff readings were 1.32 and 1.56. When the level was set up at a point 10 m from A on BA produced, the staff readings obtained at A and B were 1.11 and 1.39. The correct staff reading from this set up at S should be  
 A. 1.435    B. 1.345    C. 1.425    D. none of these.
36. The bearing of C from A is N 30° E and from B, 50 metres east of A, is N 60° W. The departure of C from A is  
 A. 50 m    B. 50 3 m    C. 25 3 m    D. 25 m
37. Pick up the correct statement from the following :  
 A. it is difficult to eliminate an error completely at first trial  
 B. instability of the instrument makes it almost impossible to adjust it satisfactorily  
 C. adjustment screws must be left bearing firmly but should never be forced  
 D. all the above.
38. The rise and fall method of reduction of levels, provides a check on  
 A. back sights  
 B. fore sights  
 C. intermediate sights  
 D. all of these.
39. In tangential tacheometry, an ordinary level staff is used  
 A. leaning towards the instrument for inclined sights upward  
 B. leaning away from the instrument for inclined sights downwards  
 C. vertical in all cases  
 D. none of these.
40. The instrument which is used in plane tabling for obtaining horizontal and vertical distances directly without resorting to chaining, is known as  
 A. Plane alidade  
 B. telescopic alidade  
 C. clinometer  
 D. tacheometer.
41. The staff intercept will be  
 A. greater farther off the staff is held  
 B. smaller, farther off the staff is held  
 C. smaller, nearer the staff is held  
 D. same, wherever the staff is held.

42. Horizontal distances obtained tacheometrically are corrected for
- A. slope correction
  - B. temperature correction
  - C. refraction and curvature correction
  - D. all the above.
43. If the long chord and tangent length of a circular curve of radius  $R$  are equal the angle of deflection, is
- A.  $30^\circ$     B.  $60^\circ$     C.  $90^\circ$     D.  $120^\circ$     E.  $150^\circ$ .
44. Pick up the correct statement from the following :
- A. an observation or the resulting reading with the level on a levelling staff is called sight
  - B. a back sight is the first sight taken after setting up the instrument in any position
  - C. the first sight on each change point is a fore sight
  - D. the second sight on each change point is a back sight
  - E. all the above.
45. In setting up a plane table at any station
- A. levelling is done first
  - B. centering is done first
  - C. both levelling and centering are done simultaneously
  - D. orientation is done first.
46. Ranging is an operation of
- A. reconnaissance
  - B. judging the distance
  - C. determination of slope
  - D. establishing intermediate points between terminals.
47. Pick up the correct statement from the following :
- A. mistakes arise from inattention, inexperience or carelessness
  - B. systematic errors persist and have regular effects in the survey performances
  - C. accidental errors occur inspite of every precaution is taken
  - D. all the above.
48. Surveys which are carried out to provide a national grid of control for preparation of accurate maps of large areas, are known
- A. plane surveys
  - B. geodetic surveys
  - C. geographical surveys

- D. topographical surveys.
49. In a theodolite
- the telescope axis is perpendicular to transit axis
  - the axis of rotation is perpendicular to transit axis
  - the telescope axis, the transit axis and the rotation axis pass through the centre of theodolite
  - all the above.
50. Whole circle bearing of a line is preferred to a quadrantal bearing merely because
- bearing is not completely specified by an angle
  - bearing is completely specified by an angle
  - Sign of the correction of magnetic declination is different in different quadrants
  - its trigonometrical values may be extracted from ordinary tables easily.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	C	A	E	C	A	D	C	C	D
10	A	A	A	B	E	D	D	D	C	D
20	D	D	D	D	A	C	B	E	C	A
30	B	C	E	B	B	D	D	D	C	B
40	B	C	D	E	C	D	D	B	D	B

**Explanation**

21.

Slope correction =  $-L(1-\cos \alpha)$ . Where L Slope Distance,  $\alpha$  Slope angle  
(Slope correction is always negative).

$$= -100(1-\cos 3^\circ)$$

$$= -0.137$$

## Section 7

1. Tilt of the staff in stadia tacheometry increases the intercept if it is
  - A. away from the telescope pointing down hill
  - B. towards the telescope pointing up-hill
  - C. away from the telescope pointing up-hill
  - D. none of these.
2. The conventional sign shown in below figure represents a
  - A. bridge carrying railway below road
  - B. bridge carrying road below railway
  - C. bridge carrying road and railway at the same level
  - D. a level crossing.
3. To orient a plane table at a point with two inaccessible points, the method generally adopted, is
  - A. intersection
  - B. resection
  - C. radiation
  - D. two point problem.
4. The combined effect of curvature and refraction over a distance  $L$  kilometres is
  - A.  $67.2 L^2$  mm
  - B.  $76.3 L^2$  mm
  - C.  $64.5 L^2$  mm
  - D. none of these.
5. Number of links per metre length of a chain are
  - A. 2
  - B. 5
  - C. 8
  - D. 10
  - E. 20
6. The method generally preferred to for contouring an undulating area, is
  - A. chain surveying
  - B. plane table surveying
  - C. tacheometrical surveying
  - D. compass surveying.
7. If the declination of the needle is  $10^\circ$  W
  - A. each of the whole circle reckoning has to be minus by  $10^\circ$
  - B. in the quadrantal method, the correction is positive in the 1st and 3rd quadrants
  - C. in the quadrantal method, the corrections is negative in 2nd and 4th quadrants

- D. all the above.
8. A level when set up 25 m from peg A and 50 m from peg B reads 2.847 on a staff held on A and 3.462 on a staff held on B, keeping bubble at its centre while reading. If the reduced levels of A and B are 283.665 m and 284.295 m respectively, the collimation error per 100 m is  
A. 0.015 m      B. 0.030 m      C. 0.045 m      D. 0.060 m
  9. For taking offsets with an optical square on the right hand side of the chain line, it is held  
A. by right hand upside down  
B. by left hand upright  
C. by right hand upright  
D. by left hand up side down.
  10. If the whole circle bearing of a line is  $270^\circ$ , its reduced bearing is  
A. N  $90^\circ$  W      B. S  $90^\circ$  W      C. W  $90^\circ$       D.  $90^\circ$  W.
  11. A lens or combination of lenses in which the following defect is completely eliminated is called aplanatic  
A. spherical aberration  
B. chromatic aberration  
C. coma  
D. astigmatism.
  12. While setting a plane table at a station it was found that the error in centering was 30 cm away from the ray of length 40 m drawn from the station. If the scale of the plan is 1 cm = 2 cm, the displacement of the end of the ray in plan from the true position will be  
A. 0.02 cm      B. 0.15 cm      C. 0.2 cm      D. 0.1 cm
  13. In precision theodolite traverse if included angles are read twice and the mean reading accepted using both verniers having a least count of  $30''$ . Assuming the instrument to be in perfect adjustment, linear measurements correct to 6 mm per 30 metre tape duly corrected for temperature, slope and sag, the angular error of closure not to exceed (where n is the number of traverse legs)  
A.  $50''$  n      B.  $30''$  n      C.  $60''$  n.
  14. Straight, parallel and widely spaced contours represent  
A. a steep surface  
B. a flat surface  
C. an inclined plane surface  
D. curved surface.
  15. The theodolites used for making tacheometric observations by optical wedge system, are

- A. provided with stadia hairs in front of eye piece  
 B. not provided with stadia hairs at all  
 C. fitted with a glass wedge inside the telescope  
 D. fitted with a glass wedge in front of telescope.
16. Resolving power of a telescope depends on  
 A. the diameter of the aperture  
 B. the pupil aperture of the eye  
 C. the diameter of the object glass  
 D. all the above.
17. If 50 m point of a 100 m tape is 50 cm off line, and 50 m sections are straight, an error is generated equal to  
 A.  $\frac{1}{10,000}$       B.  $\frac{1}{15,000}$       C.  $\frac{1}{20,000}$       D.  $\frac{1}{25,000}$  .
18. Pick up the correct statement from the following :  
 A. with both handles in his left hand, the chain man throws out the chain with his right hand and the second chain man assists him to free it from knots  
 B. the follower of the chaining operation should be more experienced than the leader  
 C. at the end of the tenth chain length, the two chain men meet and the ten arrows are handed over to the leader  
 D. all the above.
19. If  $\Delta$  is the angle of deflection of a simple curve of radius R, the distance between the mid-point of the curve and long chord, is  
 A.  $R \left( 1 - \sin \frac{\Delta}{2} \right)$       B.  $R \left( 1 + \sin \frac{\Delta}{2} \right)$       C.  $R \left( 1 + \cos \frac{\Delta}{2} \right)$       D.  $R \left( 1 - \cos \frac{\Delta}{2} \right)$  .
20. The 10 mm markings on a levelling staff placed at 20 m are separated by  
 A.  $\frac{1}{1000}$  radian      B.  $\frac{1}{1500}$  radian      C.  $\frac{1}{2000}$  radian      D.  $\frac{1}{2500}$  radian.
21. Staff readings on pegs x and y from X station are 1.755 m and 2.850 m, and from station Y on staff head at Y and X are 0.655 m and 1.560 m. If reduced level of X is 105.5 m, the reduced level of Y is  
 A. 104.0 m      B. 104.5 m      C. 105.0 m      D. 105.5 m
22. The constant vertical distance between two adjacent contours, is called  
 A. horizontal interval



- B. horizontal equivalent
  - C. vertical equivalent
  - D. contour interval
  - E. contour gradient.
23. The reduced level of a floor is 99.995 m, the staff reading on the floor is 1.505 m. If the inverted staff reading against the roof is 1.795 m, the floor level below the slab, is  
 A. 3.290 m      B. 3.300 m      C. 3.275 m      D. 2.790 m
24. The correction to be applied to each 30 metre chain length along  $\theta^\circ$  slope, is  
 A.  $30 (\sec \theta - 1)$  m  
 B.  $30 (\sin \theta - 1)$  m  
 C.  $30 (\cos \theta - 1)$  m  
 D.  $30 (\tan \theta - 1)$  m  
 E.  $30 (\cot \theta - 1)$  m.
25. If  $F$  is the pull applied at the ends of tape in kg,  $l$  is the length of tape between end marks in metres,  $w$  is the weight of the tape in kg per metre run, then sag correction  
 A.  $C = \frac{w^2 l^3}{24 F^2}$       B.  $C = \frac{w^3 l^2}{24 F^2}$       C.  $C = \frac{w^2 l^3}{24 F^3}$       D.  $C = \frac{24 w^2 l^3}{80 F^3}$
26. Under ordinary conditions, the precision of a theodolite traverse is affected by  
 A. systematic angular errors  
 B. accidental linear errors  
 C. systematic linear errors  
 D. accidental angular errors.
27. Pick up the incorrect statement from the following :  
 A. while measuring a distance with a tape of length 100.005 m, the distance to be increasing by 0.005 m for each tape length  
 B. an increase in temperature causes a tape to increase in length and the measured distance is too large  
 C. the straight distance between end points of a suspended tape is reduced by an amount called the *sag correction*  
 D. a 100 m tape of cross section 10 mm x 0.25 mm stretches about 10 mm under 5 kg pull.
28. Stadia techeometry was discovered by James Watt in the year.  
 A. 1670      B. 1770      C. 1870      D. 1900.

29. The bearing of lines OA and OB are  $16^\circ 10'$  and  $332^\circ 18'$ , the value of the included angle BOA is  
 A.  $316^\circ 10'$     B.  $158^\circ 28'$     C.  $348^\circ 08'$     D.  $43^\circ 52'$
30. The properties of autogenous curve for automobiles are given by  
 A. true spiral  
 B. cubic parabola  
 C. Bernoulli's Lemniscate  
 D. clothoid spiral.
31. If  $+0.8\%$  grade meets  $-0.7\%$  grade and the rate of change of grade for 30 m distance is 0.05, the length of the vertical curve will be  
 A. 600 m    B. 700 m    C. 800 m    D. 900 m    E. 1000 m
32. The included angles of a theodolite traverse, are generally measured  
 A. clockwise from the forward station  
 B. anti-clockwise from the back station  
 C. anti-clockwise from the forward station  
 D. clockwise from the back station.
33. Location of contour gradient for a high way is best set out from  
 A. ridge down the hill  
 B. saddle down the hill  
 C. bottom to the ridge  
 D. bottom to the saddle.
34. If  $h_1$  and  $h_2$  are the differences in level between ground and the formation levels,  $m$  is the slope of the sloping sides.  $D$  is the distance between the cross sections then, prismoidal correction for a level section is  
 A.  $D/2m(h_1 - h_2)$   
 B.  $D/3m(h_1 - h_2)$   
 C.  $D/6m(h_1 - h_2)^2$   
 D.  $D/6m(h_1 - h_2)^3$   
 E.  $D/6m(h_1 + h_2)^2$
35. In a telescope the object glass of focal length 14 cm, is located at 20 cm from the diaphragm. The focussing lens is midway between them when a staff 16.50 m away is focussed. The focal length of the focussing lens, is  
 A. 5.24 cm    B. 6.24 cm    C. 7.24 cm    D. 8.24 cm
36. The line normal to the plumb line is known as  
 A. horizontal line  
 B. level line

- C. datum line
  - D. vertical line.
37. The angle of intersection of a curve is the angle between
- A. back tangent and forward tangent
  - B. prolongation of back tangent and forward tangent
  - C. forward tangent and long chord
  - D. back tangent and long chord.
38. Planimeter is used for measuring
- A. volume
  - B. area
  - C. contour gradient
  - D. slope angle
  - E. none of these
39. In a perfect prismatic compass
- A. magnetic axis and geometric axis of the needle coincide
  - B. ends of the needle and pivot are in same vertical and horizontal planes
  - C. pivot is vertically over the centre of the graduated circle
  - D. needle is always kept sensitive
  - E. all the above.
40. The defect of a lens whereby rays of white light proceeding from a point get dispersed into their components and conveyed to various foci, forming a blurred and coloured image is known as
- A. chromatic aberration
  - B. spherical aberration
  - C. astigmatism
  - D. coma.
41. The staff reading at a distance of 80 m from a level with the bubble at its centre is 1.31 m. When the bubble is moved by 5 divisions out of the centre, the reading is 1.39 m. The angular value of the one division of the bubble, is
- A. 28.8 secs      B. 41.25 secs      C. 14.52 secs      D. 25.05      E. none of these
42. If  $i$  is the stadia distance,  $f$  is the focal length and  $d$  is the distance between the objective and vertical axis of the theodolite, the multiplying constant, is
- A.  $f/i$
  - B.  $i/f$

- C.  $(f + d)$   
D.  $f/d$ .
43. The back staff reading on a B.M. of R.L. 500.000 m is 2.685 m. If foresight reading on a point is 1.345 m, the reduced level of the point, is  
A. 502.685 m      B. 501.345 m      C. 501.340 m      D. 504.030 m  
E. 502.585 m.
44. It is more difficult to obtain good results while measuring horizontal distance by stepping  
A. up-hill  
B. down-hill  
C. in low undulations  
D. in plane areas.
45. The additional lines which are measured to show the correctness of the chain surveying are called:  
A. check lines      B. proof lines      C. tie lines      D. all of these.
46. If deflection angles are measured in a closed traverse, the difference between the sum of the right-hand and that of the left hand angles should be equal to  
A.  $0^\circ$       B.  $90^\circ$       C.  $180^\circ$       D.  $360^\circ$
47. Locating the position of a plane table station with reference to three known points, is known as  
A. intersection method  
B. radiation method  
C. resection method  
D. three point problem.
48. If  $D$  is the degree of the curve of radius  $R$ , the exact length of its specified chord, is  
A. radius of the curve  $\times$  sine of half the degree  
B. diameter of the curve  $\times$  sine of half the degree  
C. diameter of the curve  $\times$  cosine of half the degree  
D. diameter of the curve  $\times$  tangent of half the degree.
49. Correction per chain length of 100 links along a slope of  $\alpha^\circ$  is  
A.  $\frac{1.5\alpha^2}{100}$       B.  $\frac{1.5\alpha}{100}$       C.  $\frac{1.5\alpha^3}{100}$       D.  $1.5\alpha^3$ .
50. If the chain line which runs along N-S direction is horizontal and the ground in E-W direction is sloping  
A. it is possible to set offsets correctly on east side

- B. it is possible to set offsets correctly on east side
- C. it is not possible to set offsets correctly on west side
- D. it is possible to set offsets correctly on both sides.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	B	D	A	B	C	D	D	B	C
10	A	B	A	C	D	D	C	D	D	C
20	B	D	B	A	A	C	B	B	D	C
30	D	D	B	C	C	B	A	B	E	A
40	B	A	C	A	D	D	D	B	A	D

## Section 8

1. Pick up the correct statement from the following :
  - A. The directions of plumb lines suspended at different points in a survey are not strictly parallel
  - B. In surveys of small extent, the effect of curvature may be ignored and the level surface of the earth is assumed as horizontal
  - C. In surveys of large extent, the effect of curvature of the earth must be considered
  - D. All the above.
2. If  $\Delta$  is the angle of deflection of a simple curve of radius R, the length of its long chord, is
  - A.  $R \cos \frac{\Delta}{2}$
  - B.  $2R \cos \frac{\Delta}{2}$
  - C.  $R \sin \frac{\Delta}{2}$
  - D.  $2R \sin \frac{\Delta}{2}$  .
3. In geodetic surveys higher accuracy is achieved, if
  - A. curvature of the earth surface is ignored
  - B. curvature of the earth surface is taken into account
  - C. angles between the curved lines are treated as plane angles
  - D. none of these.
4. Determining the difference in elevation between two points on the surface of the earth, is known as
  - A. levelling
  - B. simple levelling
  - C. differential levelling
  - D. longitudinal levelling.
5. Contours of different elevations may cross each other only in the case of
  - A. an over hanging cliff
  - B. a vertical cliff
  - C. a saddle
  - D. an inclined plane.
6. Permanent adjustments of a level are
  - A. 2 in number
  - B. 3 in number
  - C. 4 in number
  - D. 6 in number

7. The radius of a simple circular curve is 300 m and length of its specified chord is 30 m. The degree of the curve is  
 A.  $5.73^\circ$     B.  $5.37^\circ$     C.  $3.57^\circ$     D.  $3.75^\circ$ .
8. During levelling if back sight is more than foresight  
 A. The forward staff is at lower point  
 B. The back staff is at lower point  
 C. The difference in level, cannot be ascertained.  
 D. none of these.
9. Two contour lines, having the same elevation  
 A. cannot cross each other  
 B. can cross each other  
 C. cannot unite together  
 D. can unite together.
10. The Trapezoidal rule of volumes  $V$  of an embankment divided into a number of sections equidistant  $D$ , is given by  
 A. 
$$V = D \left[ \frac{A_1 + A_n}{2} + A_2 + A_3 + \dots + A_{n-1} \right]$$
  
 B. 
$$V = \frac{D}{2} \left[ \frac{A_1 + A_n}{4} + A_2 + A_3 + \dots + A_{n-1} \right]$$
  
 C. 
$$V = \frac{D}{2} [A_1 + A_n + 2(A_2 + A_4 + \dots + A_{n-1}) + 4(A_3 + A_5 + \dots + A_{n-2})]$$
  
 D. 
$$V = \frac{D}{2} [A_1 + A_n + 4(A_2 + A_4 + \dots + A_{n-1}) + 4(A_3 + A_5 + \dots + A_{n-2})].$$
11. The surface of zero elevation around the earth, which is slightly irregular and curved, is known as  
 A. mean sea level  
 B. geoid surface  
 C. level surface  
 D. horizontal surface.
12. The lens equation is applicable  
 A. when the thickness of the lens is small  
 B. only to conjugate distances along the principal axis  
 C. the computed quantities are accurate enough for geometrical optics of simple distances  
 D. all the above.

13. The representation of general topography of a very flat terrain is possible only
  - A. by drawing contours at large interval
  - B. by drawing contours at small interval
  - C. by giving spot levels at large interval
  - D. by giving spot levels to salient features at close interval.
14. The bearing of line AB is  $152^{\circ} 30'$  and angle ABC measured clockwise is  $124^{\circ} 28'$ . The bearing of BC is
  - A.  $27^{\circ} 52'$
  - B.  $96^{\circ} 58'$
  - C.  $148^{\circ} 08'$
  - D.  $186^{\circ} 58'$
15. A transit is oriented by setting its vernier A to read the back azimuth of the preceding line. A back sight on the preceding transit station taken and transit is rotated about its vertical axis. The vernier A reads
  - A. azimuth of the forward line
  - B. bearing of the. forward line
  - C. back bearing of the forward line
  - D. equal to  $360^{\circ}$ -azimuth of the forward line.
16. Correction per chain length of 100 links along a slope of  $\alpha$  radians, is
  - A.  $100 \alpha^2$
  - B.  $100 \alpha$
  - C.  $100 \alpha^3$
  - D.  $100 \alpha^{-1}$ .
17. While working on a plane table, the correct rule is :
  - A. Draw continuous lines from all instrument stations
  - B. Draw short rays sufficient to contain the points sought
  - C. Intersection should be obtained by actually drawing second rays
  - D. Take maximum number of sights as possible from each station to distant objects.
18. Pick up the correct statement from the following
  - A. the contour lines having the same elevation cannot unite and continue as one line
  - B. a contour can not end abruptly, but must ultimately close itself not necessarily within the limits of map.
  - C. the direction of steepest slope at a point on a contour is at right angles to the contour
  - D. all the above.
19. In case of a double line river, contours are
  - A. stopped at the banks of the river



- B. stopped at the edge of the river
- C. drawn across the water
- D. drawn by parabolic curves having their vertex at the centre of the water.

20. In case of a direct vernier scale

- A. graduations increase in opposite direction in which graduations of the main scale increase
- B. smallest division is longer than smallest division of the main scale
- C. graduations increase in the same direction in which graduations of the main scale increase
- D. none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	B	C	A	A	A	B	D	A
10	B	D	D	B	A	B	B	D	B	C

### 3 Soil Mechanics and Foundation Engineering

#### Section 1

1. In a liquid limit test, the moisture content at 10 blows was 70% and that at 100 blows was 20%. The liquid limit of the soil, is  
A. 35%    B. 50%    C. 65%    D. none of these.
2. The active earth pressure of a soil is proportional to (where  $\phi$  is the angle of friction of the soil)  
A.  $\tan (45^\circ - \phi)$   
B.  $\tan^2 (45^\circ + \phi/2)$   
C.  $\tan^2 (45^\circ - \phi/2)$   
D.  $\tan (45^\circ + \phi)$
3. The minimum water content at which the soil just begins to crumble when rolled into threads 3 mm in diameter, is known  
A. liquid limit  
B. plastic limit  
C. shrinkage limit  
D. permeability limit.
4. Pick up the correct statement from the following:  
A. The rise of the ground surface due to frost action is called frost heave.  
B. The freezing of water is accompanied by a volume increase of 9%.  
C. Below freezing point, higher soil suction develops.  
D. The magnitude of frost heave decreases as the degree of saturation of soil decreases  
E. All the above.
5. Which one of the following statements is true ?  
A. Clays are more porous than sands  
B. Pressure of organic matter in a soil decreases the bearing capacity of the soil  
C. Aluminous cement is used for foundations in soils with chemical deposits  
D. All the above.
6. The lateral earth pressure on a retaining wall  
A. is equal to mass of the soil retained  
B. proportional to the depth of the soil  
C. proportional to the square of the depth of the soil  
D. proportional to the internal friction of the soil

- E. none of these.
7. The internal molecular attraction of a soil, the cohesion
- decreases as the moisture content increases
  - increases as the moisture content decreases
  - is more in well compacted clays
  - depends upon the external applied load.
8. The quantity of seepage of water through soils is proportional to
- coefficient of permeability of soil
  - total head loss through the soil
  - neither (a) nor (b)
  - both (a) and (b).
9. When drainage is permitted under initially applied normal stress only and full primary consolidation is allowed to take place, the test is known as
- quick test
  - drained test
  - consolidated undrained test
  - none of these.
10. The minimum water content at which the soil retains its liquid state and also possesses a small shearing strength against flowing, is known
- liquid limit
  - plastic limit
  - shrinkage limit
  - permeability limit.
11. Minimum size of the particles of silt soil, is
- A. 0.002 mm    B. 0.04 mm    C. 0.06 mm.    D. 0.08 mm    E. 1 mm
12. The maximum value of effective stress in the past divided by the present value, is defined as over consolidation ratio (OCR). The O.C.R. of an over consolidated clay is
- A. less than 1    B. 1    C. more than 1    D. None of these.
13. If  $N_f$ ,  $N_d$  and  $H$  are total number flow channels, total number of potential drops and total hydraulic head differences respectively, the discharge  $q$  through the complete flow is given by (where  $K$  is a constant)

A.  $q = \sqrt{H} \cdot \frac{N_f}{N_d}$     B.  $q = KH \cdot \frac{N_d}{N_f}$     C.  $q = KH \cdot \frac{N_f}{N_d}$     D.  $q = KH \sqrt{\frac{N_f}{N_d}}$

14. A flow line makes angles  $\theta_1$  and  $\theta_2$  with the normal to the interface of the soils having permeabilities  $k_1$ ,  $k_2$  before and after deflection. According to the law of deflection of the flow lines at the interface of the dissimilar soils
- A.  $\frac{\sin \theta_1}{\sin \theta_2} = \frac{k_1}{k_2}$       B.  $\frac{\cos \theta_1}{\cos \theta_2} = \frac{k_1}{k_2}$       C.  $\frac{\tan \theta_1}{\tan \theta_2} = \frac{k_1}{k_2}$       D.  $\frac{\tan \theta_2}{\tan \theta_1} = \frac{k_1}{k_2}$
15. Under-reamed piles are generally
- A. driven piles      B. bored piles      C. precast piles      D. all the above.
16. Pick up the clay soil group which does not swell when wet from the following :
- A. Kaolinite group  
B. Illite group  
C. Vermiculite group  
D. Montmorillonite group.
17. Factor of safety against sliding of a slope, is the ratio of
- A. actual cohesion to that required to maintain stability of slope  
B. shear strength to shear stress along the surface  
C. neither (a) nor (b)  
D. both (a) and (b).
18. The ratio of the volume of voids to the volume of soil solids in a given soil mass, is known
- A. porosity  
B. specific gravity  
C. void ratio  
D. water content.
19. A compacted soil sample using 10% moisture content has a weight of 200 g and mass unit weight of 2.0 g/cm<sup>3</sup>. If the specific gravity of soil particles and water are 2.7 and 1.0, the degree of saturation of the soil is
- A. 11.1%      B. 55.6%      C. 69.6%      D. none of these.
20. A partially saturated sample of soil has a unit weight of 2.0 g/cm<sup>3</sup> and specific gravity of soil particles is 2.6. If the moisture content in the soil is 20%, the degree of saturation is
- A. 20%      B. 77%      C. 92%      D. none of these.
21. Minimum depth of a footing carrying a heavy load, is calculated by the formula

A.  $d = \sqrt{\frac{3W}{4fL}} (L + 1)$       B.  $d = \sqrt{\frac{3W}{4fL}} (L - 1)$       C.  $d = (L - 1) \sqrt{\frac{4fL}{3W}}$   
D.  $d = (L - 1) \sqrt{\frac{2W}{3fL}}$

22. According to Coulomb's wedge theory, the active earth pressure slides the wedge
- down and outwards on a slip surface
  - up and inwards on a slip surface
  - horizontal upward and parallel to base
  - horizontal inward and parallel to base.
23. The coefficient of curvature is defined
- $\frac{D_{60}}{D_{10}}$
  - $\frac{D_{10}}{D_{60}}$
  - $\frac{D_{30}^2}{D_{60}D_{10}}$
  - $\frac{D_{10}^2}{D_{30}D_{60}}$
24. The effective size of particles of soil is denoted by
- D<sub>10</sub>
  - D<sub>20</sub>
  - D<sub>30</sub>
  - D<sub>60</sub>
25. Degree of saturation of a natural soil deposit having water content 15%, specific gravity 2.50 and void ratio 0.5, is
- 50%
  - 60%
  - 75%
  - 80%
26. The coefficient of compressibility of soil, is the ratio of
- stress to strain
  - strain to stress
  - stress to settlement
  - rate of loading to that of settlement.
27. If the failure of a finite slope occurs through the toe, it is known as
- slope failure
  - face failure
  - base failure
  - toe failure.
28. Rankine's theory of active earth pressure assumes
- soil mass is homogeneous, dry and cohesionless
  - ground surface is a plane which may be horizontal or inclined
  - back of the wall is vertical and smooth
  - wall yields about the base
  - all the above.
29. The water content of soil is defined as the ratio of
- volume of water to volume of given soil
  - volume of water to volume of voids in soil
  - weight of water to weight of air in voids
  - weight of water to weight of solids of given mass of soil.

30. Accurate determination of water content, is made by
- calcium carbide method
  - sand bath method
  - alcohol method
  - oven-drying method.
31. Stoke's law states that the velocity at which a grain settles out of suspension, the other factors remaining constant, is dependent upon
- shape of grain
  - weight of grain
  - size of grain
  - shape and size of grain
  - shape, size and weight of grain.
32. Pick up the correct statement from the following:
- When water table is above the base of a footing, the dry weight  $m$  should be used for soil below water table
  - When water table is located somewhat below the base of a footing, the elastic wedge is partly of moist soil and partly of submerged soil, and a suitable reduction factor is used
  - When water table is just at the base of the footing, no reduction factor is used
  - None of these.
33. Pick up the correct statement from the following :
- In soils, the flow index indicates variation in shear strength with water content
  - Liquid limit minus plastic limit, is known as plasticity index of the soil
  - Plastic limit minus shrinkage limit, is known as shrinkage index of the soil
  - The ratio of the plasticity index to the flow limit, is known as toughness index of the soil
  - All the above.
34. If  $S$ ,  $L$  and  $R$  are the arc length, long chord and radius of the sliding circle then the perpendicular distance of the line of the resultant cohesive force, is given by
- $a = \frac{S \cdot R}{L}$
  - $a = \frac{L \cdot S}{R}$
  - $a = \frac{L \cdot R}{S}$
  - none of these.
35. The liquid limit and plastic limit exist in
- sandy soils
  - silty soils
  - gravel soils
  - clay soils.

36. Back fill with a sloping surface exerts a total active pressure  $P_a$  on the wall of height  $H$  and acts at
- $H/4$  above the base parallel to base
  - $H/2$  above the base parallel to base
  - $H/3$  above the base parallel to base
  - $H/5$  above the base parallel to base.
37. The ratio of the weight of given volume of soil solids to the weight of an equal volume of distilled water at the given temperature, is known
- porosity
  - specific gravity
  - void ratio
  - water content.
38. The ultimate Settlement of a soil is directly proportional to:
- depth of the compressible soil strata
  - compressive index
  - void ratio
  - both (a) and (b)
  - none of these.
39. The seepage force in a soil, is
- perpendicular to the equipotential lines
  - proportional to the exit gradient
  - proportional to the head loss
  - all the above.
40. A soil has bulk density  $2.30 \text{ g/cm}^3$  and water content 15 per cent, the dry density of the sample, is
- $1.0 \text{ g/cm}^2$
  - $1.5 \text{ g/cm}^3$
  - $2.0 \text{ g/cm}^3$
  - $2.5 \text{ g/cm}^3$
41. Pick up the correct statement from the following:
- Sandy clayloam contains highest percentage of sand
  - Silty clayloam contains highest percentage of silt
  - Stiff boulder clay offers maximum shear strength
  - Soft chalk carries least safe load
  - All the above.
42. The clay soil mainly consists of
- Kaolinites .
  - Montomorillonite
  - Illites
  - Vermiculite

- E. All the above.
43. The liquidity index is defined as a ratio expressed as percentage of
- plastic limit minus the natural water content, to its plasticity index
  - natural water content minus its plastic limit to its plasticity index
  - natural water content plus its plastic limit to its plasticity index
  - liquid limit minus the natural water content to the plasticity index.
44. The fluid generally used for grouting is
- cement and water mix
  - clay suspension
  - sodium silicate
  - bitumen emulsion
  - all the above.
45. A coarse-grained soil has a voids ratio 0.75, and specific gravity as 2.75. The critical gradient at which quick sand condition occurs, is
- A. 0.25    B. 0.50    C. 0.75    D. 1.00
46. The relationship between void ratio (e) and porosity ratio (n) is :
- A.  $n = \frac{1+e}{1-e}$     B.  $e = \frac{1+n}{1-e}$     C.  $n = \frac{e}{1-e}$     D.  $e = n/(1-n)$
47. Failure of the stability of slopes, generally occurs along
- slip plane
  - a horizontal surface
  - a curved surface
  - all the surfaces.
48. Pick up the correct statement from the following:
- Failure plane carries maximum shear stress
  - Failure plane does not carry maximum shear stress
  - Failure plane carries shear stress equal to maximum shear stress
  - None of these.
49. Geologic cycle for the formation of soil, is
- Upheaval → transportation → deposition → weathering
  - Weathering → upheaval → transportation → deposition
  - Transportation → upheaval → weathering → deposition
  - Weathering → transportation → deposition → upheaval
  - None of these.



50. The weight of a pycnometer containing 400 g sand and water full to the top is 2150 g. The weight of pycnometer full of clean water is 1950 g. If specific gravity of the soil is 2.5, the water content is  
 A. 5%      B. 10%      C. 15%      D. 20%

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	C	B	E	D	D	C	D	C	A
10	A	C	C	C	B	B	D	C	B	C
20	B	A	C	A	C	B	D	E	D	D
30	E	B	E	A	D	C	B	D	D	C
40	B	E	B	E	D	D	C	B	D	D

## Section 2

1. The maximum shear stress occurs on the filament which makes an angle with the horizontal plane equal to  
A.  $30^\circ$     B.  $45^\circ$     C.  $60^\circ$     D.  $90^\circ$
2. For determining the moisture content of a soil sample, the following data is available Weight of container = 260 g, Weight of soil sample and = 320 g container, Weight of soil sample (dried) and = 310 g container. The moisture content of the soil sample, is  
A. 15%    B. 18%    C. 20%    D. 25%
3. Buoyant unit weight equals the saturated density  
A. multiplied by unit weight of water  
B. divided by unit weight of water  
C. plus unit weight of water  
D. minus unit weight of water.
4. Pick up the correct statement from the following:  
A. An unconfined compression test is a special case of triaxial compression test  
B. An unconfined compression test is a special case of direct shear test  
C. The confining pressure is maximum during an unconfined compression test  
D. The cylindrical specimen of a soil is subjected to major principal stress till it fails due to shearing along the plane of the failure.
5. A partially saturated soil is classified as  
A. one phase soil  
B. two phase soil  
C. three phase soil  
D. four phase soil.
6. Pick up the in-correct statement from the following: The soils which contain montmorillonite minerals  
A. swell more when wet  
B. shrink more when dry  
C. possess high plasticity  
D. possess high coefficient of internal coefficient  
E. None of these.
7. For determining the specific gravity of soil solids, using a pycnometer of 500 cc., the following data is available : Weight of dry empty pycnometer = 125 g Weight of dried soil and pycnometer = 500 g Weight

of dried soil and distilled = 850 g water filled in pycnometer up to top  
The specific gravity of soil solids, is

- A. 2.0      B. 2.25      C. 2.50      D. 2.75

8. Pick up the correct statement from the following:

- A. Kaolinite is most stable clay
- B. Kaolinite shows a very little sign of swelling on wetting
- C. Kaolinite when wet, becomes moderately plastic because negative electro magnetic charges on platelets attract water
- D. Kaolinite is also called China clay
- E. All the above.

9. A pile is being driven with a drop hammer weighing 1800 kg and having a free fall of 1.00 m. If the penetration with last blow is 5 mm, the load carrying capacity of the pile, -according to the Engineering News formula, is

- A. 100 tonnes      B. 50 tonnes      C. 20 tonnes      D. 10 tonnes.

10. If the specific gravity and voids in soil sample are G and e respectively, the hydraulic gradient i, is

- A.  $\frac{G-1}{1+e}$       B.  $\frac{G+1}{1-e}$       C.  $\frac{1-G}{1+e}$       D.  $\frac{1+G}{1+e}$

11. Pick up the correct statement from the following :

- A. To an agriculturist, soil is the substance existing on the earth's surface, which grows and develops plants
- B. To a geologist, soil is the material in a relatively thin surface zone within which roots occur, and rest of the crust is termed as rock irrespective of hardness
- C. To an engineer, soil is the unaggregated and uncemented deposits of minerals and organic particles covering the earth's crust
- D. All the above.

12. The ratio of settlement at any time 't' to the final settlement, is known as

- A. co-efficient of consolidation
- B. degree of consolidation
- C. consolidation index
- D. consolidation of undisturbed soil.

13. The Westergaard analysis is used for

- A. sandy soils
- B. cohesive soils
- C. stratified soils

- D. clayey soils.
14. If L and B are the length and breadth of a footing, e the eccentricity along the length and P and Q are the axial force and bearing capacity of the soil, then, to avoid tension,
- A.  $BL = \frac{P}{Q} \left( 1 + \frac{6e}{L} \right)$       B.  $BL = \frac{Q}{P} \left( 1 + \frac{6e}{L} \right)$       C.  $BL = \frac{P}{Q} \left( 1 - \frac{6e}{L} \right)$
- D.  $BL = \frac{P}{Q} \left( 1 - \frac{3e}{L} \right)$
15. 260 g of wet soil was taken in a pycnometer jar of weight 400 g in order to find the moisture content in the soil, with specific gravity of soil particles 2.75. The weight of soil and remaining water filled in pycnometer without air bubbles was 1415 g and the weight of pycnometer filled with water alone was 1275 g. The moisture content in the soil is  
A. 24.2%      B. 18.2%      C. 53.8%      D. none of these.
16. The earth pressure of a soil at rest, is proportional to (where  $\phi$  is the angle of internal friction of the soil)
- A.  $\tan (45^\circ - \phi)$   
B.  $\tan (45^\circ + \phi)$   
C.  $\tan^2 (45^\circ - \phi)$   
D.  $\tan^2 (45^\circ + \phi)$   
E. none of these
17. A fundamental equation of void ratio(e), specific gravity (G), water content ( $\omega$ ) and degree of saturation ( $S_r$ ) is
- A.  $e = \frac{\omega G}{S_r}$       B.  $\omega = \frac{eG}{S_r}$       C.  $G = \frac{e\omega}{S}$       D.  $S_r = \frac{e\omega}{G}$
18. The critical exist gradient of seepage water in soils, is
- A. directly proportional to the voids ratio  
B. inversely proportional to the specific gravity  
C. directly proportional to the specific gravity  
D. inversely proportional to the voids ratio  
E. none of these.
19. Water content of a soil sample is the difference of the weight of the given sample at the given temperature and the weight determined after drying it for 24 hours at temperature ranging from  
A.  $80^\circ$  to  $90^\circ\text{C}$       B.  $90^\circ$  to  $95^\circ\text{C}$       C.  $95^\circ$  to  $100^\circ\text{C}$       D.  $103^\circ$  to  $105^\circ\text{C}$   
E.  $105^\circ$  to  $110^\circ\text{C}$
20. The ratio of the volume of voids to the total volume of the given soil mass, is known

- A. porosity
  - B. specific gravity
  - C. void ratio
  - D. water content.
21. The compression index of a soil
- A. decreases with an increase in the liquid limit
  - B. increases with an increase in the liquid limit
  - C. decreases with an increase in the plastic limit
  - D. is not related with plastic limit.
22. Pick up the correct statement from the following:
- A. The void space between the soil grains, is filled partly with air and partly with water
  - B. In perfectly saturated soil, the voids are completely filled with water
  - C. In dry soil, the voids are completely filled with air
  - D. all the above.
23. For a homogeneous earth dam 50 m high having 2 m free broad, a flow net was constructed and the results were : Number of potential drops = 2.4 Number of flow channels = 0.4. If coefficient of permeability of the dam material is  $3 \times 10^{-3}$  cm<sup>3</sup>/sec, the discharge per metre length of dam, is
- A.  $12 \times 10^{-5}$  m<sup>3</sup>/sec
  - B.  $24 \times 10^{-3}$  m<sup>3</sup>/sec
  - C.  $6 \times 10^{-5}$  m<sup>3</sup>/sec
  - D.  $24 \times 10^{-5}$  m<sup>3</sup>/sec
24. W is the weight of soil having a moisture content  $\omega$ . If V is the volume of proctor's mould, the dry density of the soil is
- A.  $\frac{WV}{1 + w}$       B.  $\frac{V}{w(1 + w)}$       C.  $\frac{W}{V(1 + w)}$       D.  $\frac{V(1 + w)}{W}$
25. For shear strength, triaxial shear test is suitable because
- A. it can be performed under all three drainage conditions
  - B. precise measurement of the pore pressure and volume change during the test is possible
  - C. stress distribution on the failure plane, is uniform
  - D. state of stress within the specimen during any stage of the test as well as at failure, is completely determined
  - E. all the above.

26. The degree of saturation of the soil sample stated in Q. No, 216, is  
 A. 60%    B. 62%    C. 64%    D. 66%
27. Number of piles required to support a column, is  
 A. 1    B. 2    C. 3    D. 4
28. The soil moisture driven off by heat, is called  
 A. free water  
 B. hygroscopic water  
 C. gravity water  
 D. none of these.
29. If the specific gravity of a soil particle of 0.05 cm diameter is 2.67, its terminal velocity while settling in distilled water of viscosity, 0.01 poise, is  
 A. 0.2200 cm/sec    B. 0.2225 cm/sec    C. 0.2250 cm/sec    D. 0.2275 cm/sec  
 E. 0.2300 cm/sec
30. The direct shear test suffers from the following disadvantage:  
 A. Drain condition cannot be controlled  
 B. Pore water pressure cannot be measured  
 C. Shear stress on the failure plane is not uniform.  
 D. The area under the shear and vertical loads does not remain constant throughout the test  
 E. All the above.
31. For a clay slope of height of 10 m, the stability number is 0.05,  $\gamma = 2.0 \text{ t/m}^3$ ,  $C = 2.5 \text{ t/m}^2$ , the critical height of the slope of the soil, is  
 A. 4.0 m    B. 12.5 m    C. 25.0 m    D. 15.0 m
32. If  $\sigma_0'$  and  $\sigma'$  represent initial and increased pressure ;  $e_0$  and  $e$  void ratios corresponding to initial and increased pressure ; and  $C_c$  the compression index (dimensionless), then, the virgin compression curve as expressed by Terzaghi empirical formula is  
 A.  $e = e_0 + C_c \log_{10} \sigma' / \sigma_0'$   
 B.  $e = e_0 - C_c \log_{10} \sigma' / \sigma_0'$   
 C.  $e_0 = e - C_c \log_{10} \sigma' / \sigma_0'$   
 D.  $e_0 = e + C_c \log_{10} \sigma_0' / \sigma'$
33. The equation  $\tau = C + \sigma \tan \phi$  is given by  
 A. Rankine    B. Coulomb    C. Culaman    D. Mohr.
34. You are given a sample of soil containing coarse grains to determine its water content, you will use  
 A. pycnometer  
 B. oven-drying method

- C. calcium carbide method  
D. alcohol method.
35. Pick up the incorrect statement from the following:
- Compaction has no effect on the structure of a soil
  - Permeability decreases with increase in the dry density of a compacted soil
  - A wet side compacted soil is more compressible than a dry side compacted soil
  - Dry side compaction soils swell more when given access to moisture
  - None of the these.
36. The maximum load carried by a pile, when it continues to sink without further increase of load, is known as
- ultimate load carrying capacity
  - ultimate bearing capacity
  - ultimate bearing resistant
  - all the above.
37. The soil which contains finest grain particles, is
- coarse sand
  - fine sand
  - silt
  - clay.
38. The general relationship between specific gravity ( $G$ ), weight of water ( $\gamma_w$ ), degree of saturation ( $S_r$ ), void ratio ( $e$ ) and bulk density ( $\gamma$ ), is
- $\gamma = \frac{(S - eS_r)\gamma_w}{1 + e}$
  - $\gamma = \frac{(G + eS_r)\gamma_w}{1 + e}$
  - $\gamma = \frac{(1 + e)\gamma_w}{G + S_r}$
  - $\gamma = \frac{(1 + S_r)e}{G + S_r}$
39. If  $C$  is cohesion,  $F$  is factor of safety,  $\gamma$  is unit weight of soil and  $H$  is the maximum height of embankment, the stability number, is
- $\frac{F}{C\gamma H}$
  - $\frac{C}{F\gamma H}$
  - $\frac{H}{CF\gamma}$
  - $\frac{\gamma}{CFH}$
  - $\frac{CF}{\gamma H}$
40. The angle between the directions of the failure and the major principal plane, is equal to

- A.  $90^\circ +$  effective angle of shearing resistance
  - B.  $90^\circ +$  half of the angle of shearing resistance
  - C.  $45^\circ -$  half of the angle of shearing resistance
  - D.  $45^\circ +$  half of the angle of shearing resistance.
41. The compressibility of clays, is caused due to:
- A. expulsion of double layer water from in between the grains
  - B. slipping of particles to new positions of greater density
  - C. bending of particles as elastic sheets
  - D. all the above.
42. A phreatic line is defined as the line within a dam section below which there are
- A. positive equipotential lines
  - B. positive hydrostatic pressure
  - C. negative hydrostatic pressure
  - D. negative equipotential lines
  - E. none of these.
43. The ratio of the difference between the void ratio of the soil in its loosest state and its natural void ratio ( $e$ ) to the difference between the void ratios in the loosest and fully dense state, is generally termed as
- A. degree of density
  - B. relativity
  - C. density index
  - D. all the above.
44. Pick up the correct statement from the following:
- A. The property of a soil that enables it to become stiff in a relatively short time on standing is called *thixotropy*
  - B. The ratio of shear strength in natural state to the remoulded shear strength under undrained conditions, is called *degree of sensitivity*.
  - C. The difference between the undisturbed shear strength and remoulded shear strength is known *remoulding loss*
  - D. The tendency of dense sand to expand on application of shearing load, is known as *dilatancy*
  - E. All the above.
45. According to the Indian Standards the specific gravity is the ratio of the unit weight of soil solids to that of water at a temperature of
- A.  $17^\circ\text{C}$       B.  $23^\circ\text{C}$       C.  $27^\circ\text{C}$       D.  $30^\circ$



46. Pick up the correct statement from the following:
- Illite bond is weaker than Kaolinite bond
  - Illite bond is stronger than montmorillonite bond
  - Illites do not swell when wet
  - Illites are composed of two silica tetrahedralsheets with a central octahedral sheet
  - All the above.
47. Determination of water content of a soil sample suspected to contain gypsum is made by drying the sample for longer period at a temperature not more than
- A. 60°C      B. 80°C      C. 100°C      D. 110°C
48. Water formed transported soil is
- A. alluvial      B. marine      C. lacustrine      D. loess.
49. A decrease in water content results in a reduction of the volume of a soil in
- liquid state
  - plastic state
  - semi solid state
  - all of these.
50. Pick up the correct statement from the following:
- If the ratio of depth to width is less than 2, it is shallow foundation
  - If the ratio of depth to width is more than 2, it is deep foundation
  - If the ratio of the length to width is between 1 and 2, it is spread foundation
  - If the length is large as compared to width, it is a strip foundation
  - All the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	C	D	A	C	D	C	E	D	A
10	D	B	C	A	B	E	A	E	E	A
20	B	D	D	C	E	C	C	B	D	C
30	C	B	B	A	A	D	D	B	B	D
40	D	B	D	E	C	E	B	A	D	E

### Section 3

- The vane shear test is used for the in-situ determination of the undrained strength of the intact fully saturated
  - sands
  - clays
  - gravels
  - highly organic soils.
- Fundamental relationship between dry density ( $\gamma_d$ ), bulk density ( $\gamma$ ) and water content ( $\omega$ ), is :
  - $\gamma = \frac{\gamma_d}{1 + \omega}$
  - $\gamma_d = \frac{\gamma}{1 + \omega}$
  - $\omega = \frac{\gamma}{1 + \gamma_d}$
  - $\omega = \frac{\gamma}{1 - \gamma_d}$
- The specific gravity of quartz, is
  - 2.65
  - 2.72
  - 2.85
  - 2.90
- If the cohesive force, (c), is 1.5 t/m<sup>2</sup>, the density ( $\gamma$ ) of the soil is 2.0 t/m<sup>3</sup>, factor of safety (F) is 1.5 and stability factor (Sn) is 0.05, the safe height of the slope, is
  - 5 metres
  - 8 metres
  - 10 metres
  - 12 metres
- Pick up the correct statement from the following:
  - The phenomenon of quicksand generally occurs in the cohesionless soil
  - At critical hydraulic gradient, the saturated sand becomes quick
  - The critical gradient depends on the void ratio and the specific gravity
  - The quick sand occurs more in fine sand and silt than coarse material
  - All the above.
- If W<sub>1</sub>, W<sub>2</sub>, W<sub>3</sub> and W<sub>4</sub> are the sequential weights obtained during observations in pycnometer method for determining water content, the formula to be used, is

$$\text{A. } W = \left[ \left( \frac{W_2 + W_1}{W_3 + W_4} \right) \left( \frac{G - 1}{G} \right) - 1 \right] \times 100$$

$$\text{B. } W = \left[ \left( \frac{W_3 + W_1}{W_3 + W_4} \right) \left( \frac{G - 1}{G} \right) + 1 \right] \times 100$$

$$\text{C. } W = \left[ \left( \frac{W_2 - W_1}{W_3 - W_4} \right) \left( \frac{G - 1}{G} \right) - 1 \right] \times 100$$

$$\text{D. } W = \left[ \left( \frac{W_2 - W_1}{W_3 - W_4} \right) \left( \frac{G + 1}{G} \right) - 1 \right] \times 100$$

7. Si particles
  - A. show dilatancy
  - B. swell when moist
  - C. possess high strength when dry
  - D. disintegrate easily.
8. Flow net is used for the determination of
  - A. quantity of seepage
  - B. hydrostatic pressure
  - C. seepage pressure
  - D. exit gradient
  - E. all the above.
9. If the back fill is having a uniform surcharge of intensity  $q$  per unit area, the lateral pressure will be
  - A.  $q$  times the lateral pressure within the surface
  - B.  $1/q$  times the lateral pressure within the surface
  - C. equal to a fill of height  $Z$  equal to  $q/r$ , where  $r$  is the density of the backfill
  - D. none of these.
10. Pick up the correct statement from the following:
  - A. Isotropic consolidation of clay can be obtained in the triaxial apparatus under equal all-round pressure.
  - B. If the present effective stress is the maximum to which the clay has ever been subjected, it is called normally consolidated clay
  - C. If the present effective stress in the past was more than present effective stress, it is called over-consolidated clay
  - D. All the above.
11. Through a point in a loaded soil, the principal stress is maximum on
  - A. minor principal plane
  - B. intermediate principal plane
  - C. major principal plane
  - D. none of these.

12. Maximum size of clay particles, is :  
 A. 0.002 mm    B. 0.04 mm    C. 0.06 mm    D. 0.08 mm    E. 1 mm
13. The capillary rise of water  
 A. depends upon the force responsible  
 B. increases as the size of the soil particles increases  
 C. decreases as the size of the soil particles decreases  
 D. is less in wet soil than in dry soil.
14. Coulomb's wedge theory assumes that  
 A. back fill is dry, cohesionless, homogeneous and isotropic  
 B. slip surface is the plane which passes through the heel of the wall  
 C. sliding wedge itself acts as a rigid body and the value of earth pressure is obtained by considering the limiting equilibrium of the wedge  
 D. position and direction of the resultant earth pressure, are known  
 E. all the above.
15. If dry density, water density and specific gravity of solids of a given soil sample are 1.6 g/cc, 1.84 g/cc and 2.56 respectively, the porosity of the soil sample, is  
 A. 0.375    B. 0.370    C. 0.380    D. 0.390
16. Pick up the correct statement applicable to plate load test  
 A. Width of the test pit for plate load test is made five times the width of the plate  
 B. At the centre of the test pit, a hole is dug out whose size is kept equal to the size of the test plate  
 C. Bottom level of the hole dug at the centre of the test pit, is kept at the level of the actual formation  
 D. Ratio of the depth of the hole to the width of the test plate is the same as the ratio of the depth of the actual formation to the width of the formation  
 E. All the above.
17. Terzaghi's analysis assumes :  
 A. soil is homogeneous and isotropic  
 B. elastic zone has straight boundaries inclined at  $\psi = \phi$  to the horizontal and plastic zones fully developed  
 C. failure zones do not extend above the horizontal plane through the base of the footing  
 D. all the above.

18. The fundamental equation of air content (ac), degree of saturation (Sr) and void ratio (e), is

$$\begin{aligned} \text{A. } ac &= \frac{e(1 - S_r)}{1 - e} \\ \text{B. } ac &= \frac{e(1 + S_r)}{1 + e} \\ \text{C. } ac &= \frac{e(1 - S_r)}{1 + e} \\ \text{D. } ac &= 1 + e/S_r \end{aligned}$$

19. A soil sample has passing 0.075 mm sieve = 60% liquid limit = 65% and plastic limit = 40%. The group index of the soil, is

A. 5      B. 20      C. 40      D. none of these.

20. The plasticity index is the numerical difference between

- A. liquid limit and plastic limit
- B. plastic limit and shrinkage limit
- C. liquid limit and shrinkage limit
- D. none of these.

21. The fundamental equation of specific gravity (G), dry density ( $\gamma_d$ ), unit weight of water ( $\gamma_w$ ) and void ratio (e), is

$$\begin{aligned} \text{A. } e &= \frac{G \gamma_w}{1 + \gamma_d} \\ \text{B. } G &= \frac{\gamma_d \cdot \gamma_w}{1 + e} \\ \text{C. } \gamma_d &= \frac{G \cdot \gamma_w}{1 + e} \\ \text{D. } \gamma_w &= \frac{G \cdot \gamma_d}{1 + e} \end{aligned}$$

22. Negative skin friction on piles

- A. is caused due to relative settlement of the soil
- B. is caused in soft clays
- C. decreases the pile capacity
- D. all of the above.

23. The ultimate bearing capacity of a soil, is

- A. total load on the bearing area

- B. safe load on the bearing area
  - C. load at which soil fails
  - D. load at which soil consolidates.
24. Transporting and redepositing soils, is done by  
 A. water    B. glacier    C. gravity    D. wind    E. all the above.
25. A moist soil sample of volume 60 cc. weighs 108 g and its dried weight is 86.4 g. If its absolute density is 2.52, the degree of saturation is  
 A. 54%    B. 64%    C. 74%    D. 84%
26. Pick up the correct statement from the following:
- A. O.M.C. refers to the moisture corresponding to the maximum point on the moisture content dry density curve
  - B. The line which shows moisture content dry density relation for soil containing a constant percentage of air voids, is known as air void line
  - C. The weight of hammer used for compaction test is 25 kg
  - D. The free fall of hammer for compaction is 30.5 cm
  - E. All the above.
27. The passive earth pressure of a soil, is proportional to (where  $\phi$  is the angle of internal friction of the soil.)  
 A.  $\tan (45^\circ - \phi)$   
 B.  $\tan (45^\circ + \phi)$   
 C.  $\tan^2 (45^\circ - \phi)$   
 D.  $\tan^2 (45^\circ + \phi)$
28. If a soil undergoes a change in shape and volume by application of external loads over it, but recovers its shape and volume immediately after removal of the load, the property of the soil is said to be  
 A. Resilience of soils  
 B. Elasticity of soils  
 C. Compressibility of soils  
 D. None of these.
29. If the unit weight of sand particles is 2.696 g/cc. and porosity in loose state is 44%, the critical hydraulic gradient for quick sand condition, is  
 A. 0.91    B. 0.92    C. 0.93    D. 0.94    E. 0.95
30. The void ratio of a soil sample decreases from 1.50 to 1.25 when the pressure is increased from 25 tonnes/m<sup>2</sup> to 50 tonnes/m<sup>2</sup>, the coefficient of compressibility is  
 A. 0.01    B. 0.02    C. 0.05    D. 0.001
31. Pick up the incorrect statement from the following:

- A. The smaller the size of the pores, the higher the water can rise above the water table.
  - B. Below the water table, the pore water may be static.
  - C. The hydrostatic pressure depends on the depth below the water level.
  - D. The attractive forces between the particles, caused due to negative pressure of water held above the water table is called soil suction.
  - E. None of these.
32. The maximum water content at which a reduction in water content does not cause a decrease in volume of a soil mass, is known
- A. liquid limit
  - B. plastic limit
  - C. shrinkage limit
  - D. permeability limit.
33. A sample of saturated soil has 30% water content and the specific gravity of soil grains is 2.6. The dry density of the soil mass in g/cm<sup>3</sup>, is
- A. 1.47      B. 1.82      C. 1.91      D. none of these.
34. The specific gravity of sands, is approximately
- A. 1.6      B. 2.0      C. 2.2      D. 2.4      E. 2.6
35. If the coefficients of volume change and compressibility of a soil sample are respectively  $6.75 \times 10^{-2}$  and  $3 \times 10^{-2}$ , the void ratio of the soil sample, is
- A. 1.10      B. 1.15      C. 1.20      D. 1.25      E. 1.30
36. The minimum centre to centre distance of friction piles of 1 m diameter, is
- A. 2 m      B. 2 m to 3 m      C. 3 m to 4 m      D. 5 m
37. Over-consolidation of soils is caused due to
- A. erosion of over burden
  - B. melting of ice sheets after glaciation
  - C. permanent rise of water table
  - D. all the above.
38. Darcy's law is applicable to seepage if a soil is
- A. homogeneous      B. isotropic      C. incompressible      D. all the above.
39. An infinite slope is inclined at angle  $i$  and has its angle of internal friction  $\phi$ , the stability number  $S_a$ , is

- A.  $\frac{\cos^2 i}{\tan i - \tan \phi}$
- B.  $\frac{\sin^2 i}{\tan i - \tan \phi}$
- C.  $(\tan i - \tan \phi) \cos^2 i$
- D.  $(\tan i - \tan \phi) \sin^2 i$
40. Depending upon the properties of a material, the failure envelope may
- be either straight or curved
  - pass through the origin of stress
  - intersect the shear stress axis
  - all the above.
41. A stratum of clay 2 m thick will get consolidated 80% in 10 years. For the 80% consolidation of 8 m thick stratum of the same clay, the time required is
- A. 100 years      B. 120 years      C. 140 years      D. 160 years      E. 180 years.
42. The maximum net pressure intensity causing shear failure of soil, is known
- safe bearing capacity
  - net safe bearing capacity
  - net ultimate bearing capacity
  - ultimate bearing capacity.
43. The factor which affects the compaction, is
- moisture content
  - compacting content
  - method of compaction
  - type of soil
  - All the above.
44. The compression resulting from a long term static load and consequent escape of pore water, is known as
- A. compaction      B. consolidation      C. swelling      D. none of these.
45. Soil classification of composite soils, exclusively based on the particle size distribution, is known
- particle classification
  - textural classification
  - High Way Research Board classification
  - unified soil classification.



46. The coefficient of curvature for a well graded soil, must be between  
 A. 0.5 to 1.0    B. 1.0 to 3.0    C. 3.0 to 4.0    D. 4.0 to 5.0
47. Fundamental relationship between dry density ( $\gamma_d$ ), specific gravity (G), water content ( $\omega$ ) and percentage of air voids ( $n_a$ ) is :

A.  $\gamma_d = \frac{(1 - n_a)G \gamma \omega}{1 + \omega G}$

B.  $\gamma_d = \frac{(1 + n_a)G \gamma \omega}{1 + \omega G}$

C.  $\gamma_d = \frac{(1 + n_a)G \gamma \omega}{1 - \omega G}$

D.  $\gamma_d = \frac{(1 - n_a)G \gamma \omega}{1 - \omega G}$

48. A moist soil sample weighing 108 g has a volume of 60 cc. If water content is 25% and value of  $G = 2.52$ , the void ratio is  
 A. 0.55    B. 0.65    C. 0.75    D. 0.80
49. The shear resistance of a soil is constituted basically of the following component.
- A. The frictional resistance to translocation between the individual soil particles at their contact point
  - B. To the structural relation to displacement of the soil because of the interlocking of the particles
  - C. Cohesion and adhesion between the surfaces of the soil particles
  - D. All the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	B	A	C	E	C	A	E	C	D
10	C	A	A	E	A	E	D	C	D	A
20	C	D	C	E	D	E	D	B	E	A
30	E	C	A	E	D	C	D	D	C	D
40	D	C	E	B	B	B	A	C	D	

**Explanation**

35.

Coeff.compressibility = Coeff.volume change/(1 + e).

(1 + e) = Coeff.volume change/Coeff.compressibility.

e = (Coeff.volume change/Coeff.compressibility) - 1.

e = ((6.75 x 10<sup>-2</sup>)/(3 x 10<sup>-2</sup>)) - 1.

e = 2.25 - 1.

e = 1.25.

## Section 4

1. The method of the slices is applicable to
  - A. homogenous soils
  - B. stratified soils
  - C. saturated soils
  - D. non-uniform slopes
  - E. all the above.
2. When the seepage pressure becomes equal to the pressure due to submerged weight of a soil, the effective pressure is reduced to zero and the soil particles have a tendency to move up in the direction of flow. This phenomenon is generally known
  - A. quick condition
  - B. boiling condition
  - C. quick sand
  - D. all the above.
3. The phreatic line in an earth dam may be
  - A. circular
  - B. elliptical
  - C. parabolic
  - D. a straight line
  - E. all the above.
4. Pick up the correct statement from the following:
  - A. A maximum value of dry density is obtained at optimum water content
  - B. At low value of water content most soils tend to be stiff.
  - C. At high water content, the dry density decreases with an increase of water content.
  - D. An airless soil will have maximum possible value of dry density for the given water content
  - E. All the above.
5. The shearing strength of a cohesion-less soil depends upon
  - A. dry density
  - B. rate of loading
  - C. confining pressure
  - D. nature of loading.
6. According to IS : 2720 - 1965, the composition of a dispersing solution used in pipette analysis for determining the size of particles, is

- A. sodium-hexametaphosphate 33 g, sodium carbonate 7 g and distilled water one litre
  - B. sodium-hexametaphosphate 7 g, sodium carbonate 33 g and distilled water one litre
  - C. sodium-hexametaphosphate 23 g, sodium carbonate 17 g and distilled water one litre
  - D. none of these.
7. Cohesive soils are generally
- A. plastic and also compressible
  - B. elastic and also compressible
  - C. plastic but incompressible
  - D. none of these.
8. If the coefficient of the active pressure  $K_a$  is  $1/3$ , the coefficient of passive pressure  $K_p$ , is
- A.  $1/3$     B.  $2/3$     C. 1    D.  $3/2$     E. 3
9. The inventor of the term soil mechanics, was
- A. Kray
  - B. Dr. Karl Terzaghi
  - C. Leygue
  - D. Fellenius.
10. Compression of soil occurs rapidly if voids are filled with
- A. air
  - B. water
  - C. partly with air and partly with water
  - D. none of these.
11. If drainage is permitted throughout the test, during the application of both normal, and shear stresses so that full consolidation occurs and no excess pore pressure is set up at any stage of the test, is known as
- A. quick test
  - B. drained test
  - C. consolidated undrained test
  - D. none of these.
12. A soil sample of mass specific gravity 1.92, has a moisture content 30%. If the specific gravity of solids is 2.75, the degree of saturation, is
- A. 95.4%    B. 95.5%    C. 95.6%    D. 95.7%
13. For slopes of limited extent the surface of slippage, is usually along
- A. a parabolic arc

- B. an elliptical arc
  - C. a straight line
  - D. a circular arc.
14. For a base failure of a slope, depth factor
- A.  $Df = 1$
  - B.  $Df < 1$
  - C.  $Df > 1$
  - D. none of these.
15. A critical hydraulic gradient may occur when
- A. flow is in upward direction
  - B. seepage pressure is in upward direction
  - C. effective pressure is zero
  - D. all the above.
16. Plasticity index is defined as the range of water content between
- A. liquid and plastic limit
  - B. plastic limit and semi solid limit
  - C. semi-solid limit and liquid limit
  - D. liquid limit and solid limit.
17. The minimum depth of building foundations on
- A. sandy soils is 80 cm to 100 cm
  - B. clay soils is 90 cm to 160 cm
  - C. rocky soils is 5 cm to 50 cm
  - D. all the above.
18. The ratio of the undrained strength in the undrained state to the undrained strength, at the same water content, in the remoulded state, is called the sensitivity of the clay. Its value for quick clays is
- A. 4
  - B. 8
  - C. 12
  - D. 16
  - E. 20
19. The total weight of a pycnometer with water and oven dried soil 20 (g) is 1600 g. The pycnometer filled with water alone weighs 1500 g. The specific gravity of the soil, is
- A. 1.0
  - B. 1.5
  - C. 2.0
  - D. 2.5
20. The consolidation time for soils
- A. increases with increasing compressibility
  - B. decreases with increasing permeability
  - C. increases rapidly with increasing size of soil mass
  - D. is independent of the magnitude of the stress change.
  - E. All the above.
21. The zero atmospheric pressure is at
- A. sea level
  - B. mean sea level

- C. water table
  - D. phreatic surface
  - E. both (c) and (d) of the above.
22. A soil mass coated with a thin layer of paraffin weighs 460 g. When immersed, it displaces 299 cc of water. The weight of paraffin is 10 g. If specific gravity of solids is 2.5 and that of paraffin 0.9, the void ratio of soil, is  
 A. 0.55     B. 0.60     C. 0.65     D. 0.70
23. Pick up the incorrect definition from the following:
- A. Ratio of the compressive strength of unconfined undisturbed soil to that of remoulded soil, is known as the sensitivity of the soil sample
  - B. The rotation of soil particles into stable state while remoulding, is known as the thiostrropy of soil
  - C. The water content at which a soil changes from the liquid state to solid state, is known liquid limit of the soil
  - D. The water content at which a soil flows, is known plastic limit of the soil
  - E. None of these.
24. In a flow net
- A. flow lines and equipotential lines cross each other at right angles
  - B. fields are rectangles whose length is twice the breadth
  - C. smaller the dimensions of the field, smaller will be the hydraulic gradient and velocity of flow through it
  - D. for homogeneous soil, the curves are smooth and circular.
25. The ratio of the volume of water present in a given soil mass to the total volume of its voids, is known
- A. porosity
  - B. void ratio
  - C. percentage voids
  - D. degree of saturation.
26. Stoke's law does not hold good if the size of particle is smaller than  
 A. 0.0002 mm     B. 0.002 mm     C. 0.02 mm     D. 0.2 mm
27. In a purely cohesive soil, the critical centre lies at the intersection of
- A. perpendicular bisector of slope and the locus of the centre
  - B. perpendicular drawn at  $1/3$ rd slope from toe and the locus of the centre
  - C. perpendicular drawn at  $2/3$ rd slope from toe and the locus of the centre

- D. directional angles
  - E. none of these.
28. The angle of internal friction, is least for
- A. angular-grained loose sand
  - B. angular -grained dense sand
  - C. round-grained loose sand
  - D. round-grained loose sand
  - E. clays.
29. In non-cohesive soil in passive state of plastic equilibrium
- A. major principal stress is horizontal
  - B. minor principal stress is vertical
  - C. major principal stress is vertical
  - D. minor and major principal stresses are equally inclined to the horizontal.
30. In active state of plastic equilibrium in a non cohesive soil with horizontal ground surface
- A. major principal stress is horizontal
  - B. minor principal stress is vertical
  - C. major principal stress is vertical
  - D. minor and major principal stresses are equally inclined to horizontal.
31. The reduction in volume of soil due to squeezing out of water from the voids, is termed
- A. primary consolidation
  - B. primary compression
  - C. primary time effect
  - D. all the above.
32. 'Drift' is the material picked up, mixed, disintegrated, transported and redeposited by
- A. wind
  - B. gravitational force
  - C. glaciated water
  - D. all the above.
33. The consistency index of a soil is defined as the ratio of
- A. liquid limit plus the natural water content to the plasticity index of the soil
  - B. liquid limit minus the natural water content to the plasticity index of the soil

- C. natural water content of a soil minus plastic limit to the plasticity index of the soil
- D. natural water content of a soil plus its plastic limit to the plasticity index of the soil.
34. The weight of a container is  $W_1$  and that of container with soil sample, is  $W_2$ . If the weight of the container and oven dried soil sample is  $W_3$ , the moisture content of the soil, is
- A.  $\frac{W_2 - W_3}{W_3 - W_1} \times 100$       B.  $\frac{W_3 - W_2}{W_1 - W_2} \times 100$       C.  $\frac{W_1 - W_2}{W_2 - W_3} \times 100$       D.  $\frac{W_2 - W_1}{W_1 - W_3} \times 100$
35. The shear strength in plastic undrained clay, is due to
- A. inter-granular friction
- B. internal friction
- C. cohesion
- D. none of these.
36. The Terzaghi's general bearing capacity equation for a continuous footing is given by (where  $N_c$ ,  $2V\gamma$  and  $N_\gamma$  are bearing capacity factors.)
- A.  $q_f = cN_c + \gamma DN_q + 0.5\gamma BN_\gamma$
- B.  $q_f = cN_c - \gamma DN_q + 0.5\gamma BN_\gamma$
- C.  $q_f = cN_c + \gamma DN_q - 0.5\gamma BN_\gamma$
- D.  $q_f = cN_c - \gamma DN_q - 0.5\gamma BN_\gamma$
37. A clay subjected to pressure in excess to its present over-burden, is said to be
- A. pre-compressed
- B. pre-consolidated
- C. over-consolidated
- D. all the above.
38. The expression  $\rho_w$  is used for
- A. dry density
- B. bulk density
- C. degree of saturation
- D. optimum water content.
39. If  $C_v$  is the coefficient of consolidation,  $t$  is the time and  $d$  is drainage path of one dimensional consolidation of soil, the time factor  $T_v$ , is given by
- A.  $T_v = \frac{d^2}{C_v t}$       B.  $T_v = \frac{t^2}{d^2 C_v}$       C.  $T_v = \frac{C_v^3}{d^2 t}$       D.  $T_v = \frac{C_v t}{d^2}$

40. The total active earth pressure due to dry back fill with no surcharge, acts at  $H/3$  above the base of the wall and is directly proportional to  
 A.  $H$     B.  $\sqrt{H}$     C.  $H^2$     D.  $H^3$ .
41. If  $e_0$ ,  $e$ ,  $\sigma'$ ,  $\sigma_0'$  have their usual meanings, the coefficient of compressibility ( $a_c$ ), is given by  
 A.  $a_c = \frac{e - e_0}{e' + e_0'}$     B.  $a_c = \frac{e_0 - e}{\sigma' - \sigma_0'}$     C.  $a_c = \frac{\sigma' - \sigma_0'}{e_0 - e}$     D.  $a_c = \frac{\sigma_0' - \sigma'}{e - e_0}$
42. A saturated soil sample has water content of 40% and specific gravity of soil particles 2.7. The void ratio of the soil, is  
 A. 0.4    B. 0.52    C. 1.08    D. none of these.
43. For testing a saturated clay for shear strength, the test recommended, is  
 A. direct shear test  
 B. triaxial compression test  
 C. unconfined compression test  
 D. all the above.
44. The critical exist gradient of seepage water in soils, increases with  
 A. an increase in specific gravity  
 B. a decrease in specific gravity  
 C. a decrease in void ratio  
 D. both (a) and (c)  
 E. none of these.
45. The coefficient  $k_a$  of the active earth pressure, is given by  
 A.  $k_a = \frac{1 - \tan \phi}{1 + \tan \phi}$     B.  $k_a = \frac{1 + \tan \phi}{1 - \tan \phi}$     C.  $k_a = \frac{1 + \sin \phi}{1 - \sin \phi}$   
 D.  $k_a = \frac{1 - \sin \phi}{1 + \sin \phi}$
46. Pick up the correct statement from the following:  
 A. The void ratio in soils is defined as the ratio of the volume of voids to the volume of solids  
 B. The porosity of a soil is defined as the ratio of the volume of voids to the gross volume of the soil  
 C. The bulk density of a soil is defined as the unit weight of the soil  
 D. The dry density of a soil is defined as weight of solids to the total volume of the soil  
 E. All the above.
47. The shear strength of a soil



- A. increases with an increase in the normal stress  
 B. is proportional to the cohesion of the soil  
 C. is generally known as the strength of the soil  
 D. is proportional to the tangent of the angle of internal friction  
 E. all the above.
48. The property of a soil which permits water to percolate through it, is called  
 A. moisture content  
 B. permeability  
 C. capillarity  
 D. none of these.
49. The triaxial apparatus is usually used for  
 A. unconsolidated-undrained test  
 B. consolidated-undrained test  
 C. drained test  
 D. all the above tests.
50. A pycnometer is used to determine  
 A. voids ratio      B. dry density      C. water content      D. density index.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	D	C	E	C	A	A	E	B	A
10	B	D	D	C	D	A	D	E	C	E
20	E	B	D	A	D	A	D	E	B	C
30	D	C	B	A	C	A	D	A	D	C
40	B	C	C	D	D	E	E	B	D	C

## Section 5

1. Soils containing organic matters
  - A. are of spongy nature
  - B. swell with decrease of moisture
  - C. shrink with increase of moisture content
  - D. none of these.
2. A soil not fully consolidated under the existing over-burden pressure, is called
  - A. pre-consolidated
  - B. normally consolidated
  - C. under-consolidated
  - D. none of these.
3. The angle of internal friction is maximum for
  - A. angular-grained loose sand
  - B. angular-grained dense sand
  - C. round-grained dense sand
  - D. round-grained loose sand
  - E. clays.
4. If  $G$  is specific gravity of sand particles,  $e$  is porosity, the critically hydraulic gradient
  - A.  $i_c = \frac{G+1}{1-e}$
  - B.  $i_c = \frac{G+1}{1+e}$
  - C.  $i_c = \frac{G-1}{1+e}$
  - D.  $i_c = \frac{G-1}{1-e}$
5. A grillage foundation
  - A. is provided for heavily loaded isolated columns
  - B. is treated as spread foundation
  - C. consists of two sets of perpendicularly placed steel beams
  - D. all the above.
6. The plasticity of fine soils may be assessed by means of
  - A. dry strength test
  - B. toughness test
  - C. dilatancy test
  - D. all of these.
7. The density of soil can be increased
  - A. by reducing the space occupied by air

- B. by elastic compression of soil grains  
 C. by expelling water from pores  
 D. All the above.
8. The length/diameter ratio of cylindrical specimens used in triaxial test, is generally  
 A. 1      B. 1.5      C. 2      D. 2.5      E. 3
9. Pick up the correct statement from the following:  
 A. The object of classifying soils is to arrange them into groups according to their properties and behaviour  
 B. A soil classification system is meant to provide an accepted and systematic method of describing the various types of soils eliminating personal factors  
 C. The first category of soil classification is based on grain size of the soil  
 D. The second category of soil classification is based on fine as well as coarse grains  
 E. All the above.
10. A suspended particle falls through a height H cm in water in t minutes. If the viscosity of water is  $\eta$  and specific gravity of the particle is G, the diameter of the particle is (where M is a constant factor)
- A.  $10^3 M \sqrt{\frac{H}{t}}$   
 B.  $10^4 M \sqrt{\frac{H}{t}}$   
 C.  $10^5 M \sqrt{\frac{H}{t}}$   
 D.  $10^2 M \sqrt{\frac{H}{t}}$
11. Laplacian fundamental equation for a non-compressible flow in three dimensions, is
- A.  $\frac{\delta u}{\delta x} + \frac{\delta v}{\delta y} + \frac{\delta w}{\delta z} = 0$       B.  $\frac{\delta^2 h}{\delta x^2} + \frac{\delta^2 h}{\delta y^2} + \frac{\delta^2 h}{\delta z^2} = 0$       C.  $\frac{\delta^2 \phi}{\delta x^2} + \frac{\delta^2 \phi}{\delta y^2} + \frac{\delta^2 \phi}{\delta z^2} = \Phi$   
 D. none of these.
12. The bearing capacity of a soil depends upon  
 A. size of the particles  
 B. shape of the particles  
 C. cohesive properties of particles

- D. internal frictional resistance of particles
  - E. all the above.
13. A direct shear test possesses the following disadvantage:
- A. A relatively thin thickness of sample permits quick drainage
  - B. A relatively thin thickness of sample permits quick dissipation of pore pressure developed during the test
  - C. As the test progresses the area under shear, gradually changes
  - D. none of these.
14. Through a point in a loaded soil mass, there exists  $n$  typical planes mutually orthogonal on which the stress is wholly normal and no shear stress acts, if  $n$  is
- A. 1      B. 2      C. 3      D. 4
15. The pressure that builds up in pore water due to load increment on the soil, is termed
- A. excess pore pressure
  - B. excess hydrostatic pressure
  - C. hydrodynamic pressure
  - D. all the above.
16. The ratio of  $e_{max}$  and  $e_{min}$  of silty sand, is
- A. 2.0      B. 5      C. 3.0      D. 3.5      E. 4.0
17. A flow net may be utilised for the determination of
- A. exit gradient
  - B. seepage
  - C. hydrostatic pressure
  - D. seepage pressure
  - E. all the above.
18. The neutral stress in a soil mass is
- A. force per neutral area
  - B. force per effective area
  - C. stress taken up by the pore water
  - D. stress taken up by solid particles.
19. If voids ratio is 0.67, water content is 0.188 and specific gravity is 2.68, the degree of saturation of the soil, is
- A. 25%      B. 40%      C. 60%      D. 75%
20. If water content of a soil is 40%,  $G$  is 2.70 and void ratio is 1.35, the degree of saturation is
- A. 70%      B. 75%      C. 80%      D. 85%      E. 90%

21. If  $\beta$  is the surcharge angle of a backfill with an angle of internal friction  $\phi$ , the coefficient of active earth pressure given by Rankine's theory, is :
- A.  $K_a = \sin \beta \frac{\sin \beta - \sqrt{\sin^2 \beta - \sin^2 \phi}}{\sin \beta + \sqrt{\sin^2 \beta - \sin^2 \phi}}$
- B.  $K_a = \cos \beta \frac{\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \phi}}{\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \phi}}$
- C.  $K_a = \tan \beta \frac{\tan \beta - \sqrt{\tan^2 \beta - \tan^2 \phi}}{\tan \beta + \sqrt{\tan^2 \beta - \tan^2 \phi}}$
- D. none of these.
22. A structure is erected on an impervious clay whose thickness is 12 m. Drainage is possible both at upper and lower surfaces. Coefficient of consolidation is 0.015 cm<sup>2</sup> per minute. For attaining 50% consolidation with a time factor 0.20, the number of days required
- A. 3233    B. 3123    C. 33331    D. 3313
23. Which one of the following statements is true for Mohr-Coulomb envelope ?
- A. Coulomb suggests that the relationship between shear strength and normal stress, is adequately represented by the straight line
- B. The generalised Mohr theory suggests that, though the shear stress depends on the normal stress, the relation is not linear
- C. Coulomb and Mohr suggest that a definite relationship exists among the principal stress and the angle of internal friction
- D. For an ideal pure friction material, the straight line passes through the origin.
- E. All the above.
24. The intensity of active earth pressure at a depth of 10 metres in dry cohesionless sand with an angle of internal friction of 30° and with a weight of 1.8 t/m<sup>3</sup>, is
- A. 4 t/m<sup>2</sup>    B. 5 t/m<sup>2</sup>    C. 6 t/m<sup>2</sup>    D. 7 t/m<sup>2</sup>    E. 8 t/m<sup>2</sup>
25. On wetting, cohesive soils,
- A. loose permeability
- B. gain shear strength
- C. loose elasticity
- D. decrease their shear strength.
26. Pick up the correct statement from the following:

- A. The range of water content between the liquid limit and plastic limit, is called *plasticity index*.
  - B. The ratio of the liquid limit minus the natural water content to the plasticity index of soils, is called *consistency index*
  - C. The ratio of natural water content minus its plastic limit to its plasticity index is called *liquidity index*
  - D. The ratio between plasticity index and flow index (*i.e.* slope of flow curve in case of liquid limit), is called *toughness index*
  - E. All the above.
27. 'Talus' is the soil transported by
- A. wind
  - B. water
  - C. glacier
  - D. gravitational force.
28. A triaxial shear test is preferred to direct shear test, because
- A. it can be performed under all three drainage conditions with complete control
  - B. precise measurement of pore pressure and change in volume during test, is not possible
  - C. stress distribution on the failure plane, is non uniform
  - D. none of these.
29. Pick up the correct statement from the following:
- A. When stress decreases, void, ratio decreases
  - B. When stress decreases, coefficient of permeability decreases
  - C. When stress decreases, coefficient of volume change decreases
  - D. When stress decreases void ratio, co-efficients of permeability and volume change decrease.
30. Chemical weathering of soil is caused due to
- A. oxidation    B. carbonation    C. hydration    D. leaching    E. all the above.
31. The Mohr's straight theory is based on the following fact :
- A. Material fails essentially by shear
  - B. Ultimate strength of the material is determined by the stress in the plane of slip
  - C. Failure criterion is independent of the intermediate principal stress
  - D. All the above.
32. Hydrometer readings are corrected for:
- A. temperature correction

- B. meniscus correction
  - C. dispersing agent correction
  - D. meniscus and dispersing agent corrections
  - E. temperature, meniscus and dispersing agent corrections.
33. Tergazhi's theory of one dimensional consolidation assumes
- A. soil is homogeneous and fully saturated
  - B. water and soil particles are incompressible
  - C. deformation of the soil, is entirely due to change in volume
  - D. Darcey's law for the velocity of flow of water through soil, is perfectly valid
  - E. all the above.
34. An unsaturated 100 cm<sup>3</sup> sample of soil weighs 190 g. If its dried weight is 160 g, water content of the soil, is
- A. 0.188      B. 0.288      C. 0.388      D. 0.488      E. 0.588
35. If the natural moisture content, the liquid limit and plastic limit of a soil sample are stated as 30.5%, 42.5% and 22.5% respectively, the ratio of liquidity index and plastic index, is
- A.  $\frac{1}{3}$       B.  $\frac{1}{2}$       C. 2      D.  $2\frac{1}{2}$
36. The specific gravity of Calcite is
- A. 2.65      B. 2.72      C. 2.85      D. 2.90
37. The ratio of volume of air voids to the volume of total voids, is known as
- A. air content
  - B. percentage air voids
  - C. percentage voids
  - D. porosity.
38. A plane inclined at an angle  $\phi$  to the horizontal at which the soil is expected to stay in the absence of any lateral support, is known as
- A. natural slope line
  - B. repose line
  - C. the  $\phi$  line
  - D. all the above.
39. Tergazhi's theory of one dimensional consolidation assumes
- A. load is applied in one direction
  - B. coefficient of permeability is constant
  - C. excess pore water drains out only in the vertical direction

- D. time lag in consolidation is due entirely to permeability
  - E. all the above.
40. Pick up the correct statement from the following:
- A. The dry density reduces by addition of water after attaining optimum moisture content
  - B. The line joining the peak of three moisture content graphs obtained by using three compactive energies, is called line of optimum
  - C. Well graded coarse grained soils can be compacted to a very high density as compared to fine grained soils
  - D. All the above. .
41. A soil mass is said to be in plastic equilibrium if
- A. it is stressed to maximum
  - B. it is on the verge of failure
  - C. it is in plastic stage
  - D. it starts flowing.
42. Pick up the correct statement from the following:
- A. The permeability of the coarse-grained soils may be reduced by grouting.
  - B. The process of injecting fluids (*i.e.* grouts) into the pores space of the soil, is called grouting.
  - C. The grouting increases the soil strength.
  - D. All the above.
43. A soil sample of mass specific gravity 1.92, has a moisture content 30%. If the specific gravity of solids is 2.75, the void ratio, is
- A. 0.858    B. 0.860    C. 0.862    D. 0.864
44. The ratio of the weight of water to the weight of solids in a given mass of soil, is known
- A. porosity
  - B. specific gravity
  - C. void ratio
  - D. water content.
45. During seepage through a soil, direction of seepage is always
- A. parallel to equipotential lines
  - B. perpendicular to stream lines
  - C. perpendicular to equipotential lines
  - D. none of these.
46. The slip at critical angle, is generally known
- A.  $\delta$  1-line    B. rupture plane    C. slip plane    D. all the above.



47. The property of a soil which allows it to be deformed rapidly without rupture, elastic rebound and also a volume change, is known  
 A. porosity      B. plasticity      C. permeability      D. ductility.
48. According to Rankine's formula, the minimum depth of foundation

A.  $h = \frac{P}{W} \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$       B.  $h = \frac{w}{P} \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$       C.  $h = \frac{P}{w} \left( \frac{1 - \sin \phi}{1 + \tan \phi} \right)^2$

D.  $h = \frac{P}{w} \left( \frac{1 - \tan \phi}{1 + \tan \phi} \right)^2$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	C	B	C	D	D	D	C	E	C
10	C	E	C	C	D	C	E	C	D	C
20	B	C	E	C	D	E	D	A	D	E
30	D	E	E	A	C	B	A	D	E	D
40	B	D	C	D	C	D	B	A		

## Section 6

1. Pick up the cohesive soil from the following:
  - A. Red earth
  - B. Clay
  - C. Black cotton soil
  - D. Compacted ground.
2. Pile foundations are generally preferred to for
  - A. bridge foundations
  - B. sky scrapper buildings
  - C. residential buildings
  - D. runways.
3. The angle of internal friction of clays, is usually
  - A.  $0^\circ$  to  $5^\circ$
  - B.  $5^\circ$  to  $20^\circ$
  - C.  $20^\circ$  to  $30^\circ$
  - D.  $30^\circ$  to  $45^\circ$
4. If the bulk density of the soil is  $\rho$  and water content  $\omega$ , then dry density of the soil, is
  - A.  $1 + \frac{\omega}{\rho}$
  - B.  $\frac{1 + \rho}{\omega}$
  - C.  $\frac{\rho}{1 + \omega}$
  - D.  $\frac{\omega}{1 + \rho}$
5. The specific yield of soil depends upon
  - A. compaction of stratum
  - B. distribution of pores
  - C. shape and size of particles
  - D. all the above.
6. The area of cross-section A at failure or during any stage of Triaxial Compression Test and its initial length (L) and volume (V), are related by the equation
  - A.  $A = \frac{V + \Delta V}{L - \Delta L}$
  - B.  $A = \frac{V - \Delta V}{V + \Delta L}$
  - C.  $A = \frac{V - \Delta V}{L - \Delta L}$
  - D.  $A = \frac{V + \Delta V}{L + \Delta L}$
7. Pick up the correct statement from the following:
  - A. In hydrometer method, weight  $Wd$  per ml of suspension is found directly
  - B. In pipette analysis, weight  $Wd$  per ml of suspension is found indirectly
  - C. In pipette analysis, weight  $Wd$  per ml of suspension is found directly
  - D. None of these.
8. Pick up the correct statement from the following:

- A. Coefficient of compressibility is the decrease in void ratio per unit increase of pressure
  - B. The percent settlement at any time is called degree of consolidation
  - C. Time factor is a dimensionless quantity
  - D. The initial curve on either side of the point of unloading and reloading is called 'virgin curve'
  - E. All the above.
9. 'Loess' is silty clay formed by the action of
- A. water
  - B. glacier
  - C. wind
  - D. gravitational force.
10. The maximum possible value of dry density is referred to as
- A. dry density
  - B. zero air voids
  - C. saturation dry density
  - D. all the above.
11. Failure of a slope occurs only when total shear force is
- A. equal to total shearing strength
  - B. greater than total shearing strength
  - C. less than total shearing strength
  - D. none of these.
12. Pick up the correct statement from the following:
- A. A soil having pH value more than 7 is an acidic soil
  - B. A soil having pH value less than 7 is an acidic soil
  - C. A soil having pH value more than 7 is an alkaline soil
  - D. A soil containing chemicals for the manufacture of portland cement is preferred.
13. Cohesionless soil is
- A. sand      B. silt      C. clay      D. clay and silt.
14. The shearing force acting along the slice of a curved surface of slippage, causes the soil to slide
- A. down at the centre
  - B. down at the toe
  - C. upward at the centre
  - D. none of these.

15. The seepage exit gradient in a soil is the ratio of
- A. total head to the length of seepage
  - B. flow line to slope
  - C. head upstream to that at downstream
  - D. head loss to the length of the seepage
  - E. none of these.
16. Sedimentation analysis is based on the assumption:
- A. soil particles are spherical
  - B. particles settle independent of other particles
  - C. walls of the jar do not affect the settlement .
  - D. all the above.
17. The maximum pressure which a soil can carry without shear failure, is called
- A. safe bearing capacity
  - B. net safe bearing capacity
  - C. net ultimate bearing capacity
  - D. ultimate bearing capacity.
18. For general engineering purposes, soils are classified by
- A. particle size classification system
  - B. textural classification system
  - C. High Way Research Board (HRB), classification system
  - D. unified soil classification system.
19. If there is no impervious boundary at the bottom of a hydraulic structure, stream lines tend to follow :
- A. a straight line
  - B. a parabola
  - C. a semi-ellipse
  - D. a semi-circle.
20. The change of moisture content of soils, changes the
- A. value of the angle of repose
  - B. amount of compaction required
  - C. cohesive strength of soil
  - D. all the above.
21. A failure wedge develops if a retaining wall
- A. moves away from the backfill
  - B. moves towards the backfill
  - C. sinks downwards

- D. stresses equally by vertical and horizontal forces.
22. For determining the ultimate bearing capacity of soil, the recommended size of a square bearing plate to be used in load plate test should be 30 to 75 cm square with a minimum thickness of  
 A. 5 mm      B. 10 mm      C. 15 mm      D. 20 mm      E. 25 mm
23. The water content in a soil sample when it continues to loose weight without losing the volume, is called  
 A. Shrinkage limit  
 B. Plastic limit  
 C. liquid limit  
 D. semi-solid limit.
24. The intensity of vertical pressure at a depth Z directly below the point load Q on its axis of loading is :  
 A.  $\frac{0.4775 Q}{Z}$       B.  $\frac{0.4775 Q}{Z^2}$       C.  $\frac{0.4775 Q}{Z^3}$       D.  $\frac{0.4775 Q}{\sqrt{Z}}$
25. When a cohesionless soil attains quick condition, it loses  
 A. shear strength  
 B. bearing capacity  
 C. both (a) and (b)  
 D. neither (a) nor (b).
26. Pick up the correct definition from the following:  
 A. The lateral pressure exerted by the soil when the retaining wall moves away from the back fill, is generally known as active earth pressure of the soil  
 B. The lateral pressure exerted by the soil when the retaining wall moves towards the soil, is generally known as 'Passive earth pressure of the soil'  
 C. The lateral pressure exerted by the soil when the retaining wall has no movement relative to the back fill, is known as 'earth pressure at rest of the soil'  
 D. All the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	B	B	C	D	C	C	E	C	D
10	B	B	A	A	D	D	A	D	C	D
20	A	E	A	B	C	D				

## 4 Applied Mechanics

### Section 1

- The centre of gravity of a triangle is at the point where three
  - medians of the triangle meet
  - perpendicular bisectors of the sides of the triangle meet
  - bisectors of the angle of the triangle meet
  - none of these.
- The forces which meet at one point and have their lines of action in different planes are called
  - coplaner non-concurrent forces
  - non-coplaner concurrent forces
  - non-coplaner non-current forces
  - intersecting forces
  - none of these.
- At a given instant ship A is travelling at 6 km/h due east and ship B is travelling at 8 km/h due north. The velocity of B relative to A is
  - 7 km/hrs
  - 2 km/hrs
  - 1 km/hrs
  - 10 km/hrs
  - 14 km/hrs.
- The equation of motion of a particle starting from rest along a straight line is  $x = t^3 - 3t^2 + 5$ . The ratio of the accelerations after 5 sec and 3 sec will be
  - 2
  - 3
  - 4
  - 5
- The locus of the instantaneous centre of a moving rigid body, is
  - straight line
  - involute
  - centroid
  - spiral.
- A projectile is thrown at an angle  $\alpha$  to the horizontal with  $\alpha$  velocity  $v$ . It will have the maximum centripetal acceleration
  - at the start
  - at the top of the trajectory
  - as it strikes the ground
  - else where.
- The c.g. of the shaded area of the below figure whose curve OM is a parabola from y-axis, is
  - $\frac{a}{4}$
  - $\frac{3a}{4}$
  - $\frac{3b}{10}$
  - $\frac{3a}{10}$
  - $\frac{3a}{5}$
- The unit of Moment of Inertia of a body, is
  - m
  - $m^2$
  - $m^3$
  - $m^4$
  - none of these.
- If a body moves in such a way that its velocity increases by equal amount in equal intervals of time, it is said to be moving with

- A. a uniform retardation
  - B. a uniform acceleration
  - C. a variable acceleration
  - D. a variable retardation
  - E. none of these.
10. If the gravitational acceleration at any place is doubled, the weight of a body, will
- A. be reduced to half
  - B. be doubled
  - C. not be affected
  - D. none of these.
11. A cable loaded with 0.5 tonne per horizontal metre span is stretched between supports in the same horizontal line 400 m apart. If central dip is 20 m, the minimum tension in the cable, will be
- A. 200 tonnes at the centre
  - B. 500 tonnes at the centre
  - C. 200 tonnes at the right support
  - D. 200 tonnes at the left support.
12. A particle moves along a straight line such that distance  $x$  traversed in  $t$  seconds is given by  $x = t^2(t + 1)$ , the acceleration of the particle, will be
- A.  $3t^3 - 2t$
  - B.  $3t^2 + 2t$
  - C.  $6t - 2$
  - D.  $6t + 2$
  - E.  $3t - 2$
13. The Law of Polygon of Forces states that
- A. if a polygen representing the forces acting at point in a body is closed, the forces are in equilibrium
  - B. if forces acting on a point can be represented in magnitde and direction by the sides of a polygon taken in order, then the resultant of the forces will be represented in magnitude and direction by the closing side of the polygon
  - C. if forces acting on a point can be represented of a polygon taken in order, their sides of a polygon taken in order, their resultant will be represented in magnitude and direction by the closing side of the polygon, taken in opposite order
  - D. if forces acting on a point can be represented in magnitude and direction by the sides of a polygon in order, the forces are in equilibrium.

14. Parallelogram Law of Forces states, "if two forces acting simultaneously on a particle be represented in magnitude and direction by two adjacent sides of a parallelogram, their resultant may be represented in magnitude and direction by
  - A. its longer side"
  - B. its shorter side"
  - C. the diagonal of the parallelogram which does not pass through the point of intersection of the forces"
  - D. the diagonal of the parallelogram which passes through the point of intersection of the forces"
  - E. half the sum of the diagonals".
15. Which one of the following statements is true ?
  - A. The tangent of the angle of friction is equal to coefficient of friction
  - B. The angle of repose is equal to angle of friction
  - C. The tangent of the angle of repose is equal to coefficient of friction
  - D. All the above.
16. The beam shown in below figure is supported by a hinge at A and a roller at B. The reaction  $R_A$  of the hinged support A of the beam, is
  - A. 10.8 t
  - B. 10.6 t
  - C. 10.4 t
  - D. 10.2 t.
17. The product of mass and velocity of a moving a body, is called
  - A. moment
  - B. momentum
  - C. power
  - D. impulse.
18. Engineer's units of force, is
  - A. Newton in absolute units
  - B. Dyne in absolute units
  - C. Newton and dyne in absolute units
  - D. All the above.
19. Joule is the unit of
  - A. work
  - B. force
  - C. power
  - D. torque
  - E. none of these.
20. The maximum velocity of a body vibrating with a simple harmonic motion of amplitude 150 mm and frequency 2 vibrations/sec, is
  - A. 188.5 m/sec
  - B. 18.85 m/sec
  - C. 1.885 m/sec
  - D. 0.18845 m/sec.
21. If the tension in a cable supporting a lift moving upwards is twice the tension when the lift is moving downwards, the acceleration of the lift,



is

- A.  $\frac{g}{2}$       B.  $\frac{g}{3}$       C.  $\frac{g}{4}$       D.  $\frac{g}{5}$

22. One Newton force, is  
 A.  $10^3$  dynes  
 B.  $10^4$  dynes  
 C.  $10^5$  dynes  
 D.  $10^6$  dynes  
 E.  $10^7$  dynes.
23. The masses of two balls are in the ratio of 2 : 1 and their respective velocities are in the ratio of 1 : 2 but in opposite direction before impact. If the coefficient of restitution is , the velocities of separation of the balls will be equal to  
 A. original velocity in the same direction  
 B. half the original velocity in the same direction  
 C. half the original velocity in the opposite direction  
 D. original velocity in the opposite direction
24. The angle which an inclined surface makes with the horizontal when a body placed on it is on the point of moving down, is called  
 A. angle of repose  
 B. angle of friction  
 C. angle of inclination  
 D. none of these.
25. Work may be defined as  
 A. force x distance  
 B. force x velocity  
 C. force x acceleration  
 D. none of these.
26. A square hole is punched out of a circular lamina, the diagonal of the square being the radius of the circle. If  $r$  is the radius of the circle, the C.G. of the remainder from the corner of the square on the circumference will be  
 A.  $\frac{r(n + 0.25)}{n - 0.5}$       B.  $\frac{r(n - 0.5)}{n + 0.25}$       C.  $\frac{r(n - 0.25)}{n - 0.5}$       D.  $\frac{r(n + 0.25)}{n + 0.5}$
27. A bullet weighing 200 g is fired horizontally with a velocity of 25 m/sec from a gun carried on a carriage which together with the gun weighs 100 kg. The velocity of recoil of the gun, will be  
 A. 0.01 m/sec      B. 0.05 m/sec      C. 1.00 m/sec      D. 1.5 m/sec.
28. The tension in a cable supporting a lift

- A. is more when the lift is moving downwards  
 B. is less when the lift is moving upwards  
 C. remains constant whether it moves downwards or upwards  
 D. is less when the lift is moving downwards.
29. A satellite moves in its orbit around the earth due to  
 A. Gravitational force  
 B. Centripetal force  
 C. Centrifugal force  
 D. none of these.
30. If  $g_1$  and  $g_2$  are the gravitational accelerations on two mountains A and B respectively, the weight of a body when transported from A to B will be multiplied by  
 A.  $g_1$     B.  $g_2$     C.  $\frac{g_1}{g_2}$     D.  $\frac{g_2}{g_1}$
31. If three rigid rods are hinged together to form a triangle and are given rotary as well as translatory motion, the number of instantaneous centres of the triangle, will be  
 A. 1    B. 2    C. 3    D. 4    E. 5.
32. The mechanical advantage of an ideal machine is 100. For moving the load through 2 m, the effort moves through  
 A. 0.02 m    B. 2 m    C. 2.5 m    D. 20 m.
33. When a body in equilibrium undergoes an infinitely small displacement, work imagined to be done, is known as  
 A. imaginary work    B. negative work    C. virtual work    D. none of these.
34. The resultant of two forces P and Q acting at an angle  $\theta$ , is  
 A.  $P^2 + Q^2 + 2P \sin \theta$   
 B.  $P^2 + Q^2 + 2PQ \cos \theta$   
 C.  $P^2 + Q^2 + 2PQ \tan \theta$   
 D.  $\sqrt{P^2 + Q^2 + 2PQ \cos \theta}$   
 E.  $\sqrt{P^2 + Q^2 + 2PQ \sin \theta}$
35. To attain the synchronous orbit, the launch of a satellite, is done from a place  
 A. on equator  
 B. on  $30^\circ$  latitude  
 C. on  $45^\circ$  latitude  
 D. on  $60^\circ$  latitude

- E. on the poles.
36. The vertical reaction at the support A of the structure shown in below figure, is  
 A.  $1\ t$       B.  $2\ t$       C.  $3\ t$       D.  $2.5\ t$ .
37. Pick up the correct statement from the following :  
 A. Nature plays an important role in the launch of a satellite  
 B. The earth's gravity reduces the speed of a satellite by 32 km per second  
 C. The gravitational force relents as the satellite climbs higher  
 D. The gravitational intensity declines with height  
 E. All the above.
38. If the radius of the earth is 600 km the height of a mountain above sea level at the top of which a beat seconds pendulum at sea level, loses 27 seconds a day, is  
 A. 500 metres      B. 1000 metres      C. 1500 metres      D. 2000 metres  
 E. 25000 metres.
39. The total time of collision and restitution of two bodies, is called  
 A. time of collision  
 B. period of collision  
 C. period of impact  
 D. all the above.
40. The length of a Second's pendulum, is  
 A. 99.0 cm      B. 99.4 cm      C. 100 cm      D. 101 cm      E. 101.10 cm.
41. A load of 500 kg was lifted through a distance of 13 cm. by an effort of 25 kg which moved through a distance of 650 cm. The efficiency of the lifting machine is  
 A. 50%      B. 40%      C. 55%      D. 30%.
42. Maximum efficiency of a screw jack for the angle of friction  $\phi$ , is  
 A.  $\frac{\sin \theta}{1 + \sin \theta}$       B.  $\frac{1 - \sin \theta}{\sin \theta}$       C.  $\frac{1 + \sin \theta}{1 - \sin \theta}$       D.  $\frac{1 - \sin \theta}{1 + \sin \theta}$
43. A string of length 90 cm is fastened to two points A and B at the same level 60 cm apart. A ring weighing 120 g is slid on the string. A horizontal force P is applied to the ring such that it is in equilibrium vertically below B. The value of P is :  
 A. 40 g      B. 60 g      C. 80 g      D. 100 g.
44. The reaction at the support A of the beam shown in below figure is  
 A.  $2\ t$       B.  $5.8\ t$       C.  $0.2\ t$       D.  $3.5\ t$ .

45.  $u_1$  and  $u_2$  are the velocities of approach of two moving bodies in the same direction and their corresponding velocities of separation are  $v_1$  and  $v_2$ . As per Newton's law of collision of elastic bodies, the coefficient of restitution ( $e$ ) is given by
- A.  $e = \frac{v_1 - v_2}{u_2 - u_1}$     B.  $e = \frac{u_2 - u_1}{v_1 - v_2}$     C.  $e = \frac{v_2 - v_1}{u_1 - u_2}$     D.  $e = \frac{v_1 - v_2}{u_2 + u_1}$
46. The c.g. of a thin hollow cone of height  $h$ , above its base lies on the axis, at a height of
- A.  $\frac{h}{3}$     B.  $\frac{h}{4}$     C.  $\frac{2h}{3}$     D.  $\frac{3h}{4}$
47. Two forces act an angle of  $120^\circ$ . If the greater force is 50 kg and their resultant is perpendicular to the smaller force, the smaller force is
- A. 20 kg    B. 25 kg    C. 30 kg    D. 35 kg    E. 40 kg.
48. The C.G. of a right circular cone lies on its axis of symmetry at a height of
- A.  $h/2$     B.  $h/3$     C.  $h/4$     D.  $h/5$     E.  $h/6$ .
49. A uniform rod 9 m long weighing 40 kg is pivoted at a point 2 m from one end where a weight of 120 kg is suspended. The required force acting at the end in a direction perpendicular to rod to keep it equilibrium, at an inclination  $60^\circ$  with horizontal, is
- A. 40 kg    B. 60 kg    C. 10 kg    D. 100 kg.
50. If a particle is projected inside a horizontal tunnel which is 554 cm high with a velocity of 60 m per sec, the angle of projection for maximum range, is
- A.  $8^\circ$     B.  $9^\circ$     C.  $10^\circ$     D.  $11^\circ$     E.  $12^\circ$ .

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	B	D	A	C	A	B	D	C	B
10	B	D	C	D	D	D	B	A	A	C
20	B	C	D	A	A	C	B	D	B	D
30	C	A	C	D	A	C	E	D	D	B
40	B	D	C	A	C	C	B	C	C	C

## Section 2

- The following factor affects the orbit of a satellite up to an altitude of 720 km from the earth's surface
  - uneven distribution of the gravitational field
  - gravity of the sun and the moon
  - aerodynamic forces
  - none of these.
- If  $\alpha$  and  $u$  are the angle of projection and initial velocity of a projectile respectively, the horizontal range of the projectile, is
  - $\frac{u^2 \sin \alpha}{g}$
  - $\frac{u^2 \sin^2 \alpha}{g}$
  - $\frac{u^2 \sin \alpha}{2g}$
  - $\frac{u^2 \sin^2 \alpha}{2g}$
- Newton's law of Collision of elastic bodies states that when two moving bodies collide each other, their velocity of separation
  - is directly proportional to their velocity of approach
  - is inversely proportional to their velocity of approach
  - bears a constant ratio to their velocity of approach
  - is equal to the sum of their velocities of approach.
- Two forces of 6 Newtons and 8 Newtons which are acting at right angles to each other, will have a resultant of
  - 5 Newtons
  - 8 Newtons
  - 10 Newtons
  - 12 Newtons.
- A projectile is fired with a velocity of 100.3 m/sec. at an elevation of  $60^\circ$ . The velocity attained by the projectile when it is moving at a height of 100 m, is
  - 70 m/sec.
  - 75 m/sec.
  - 80 m/sec.
  - 85 m/sec.
  - 90 m/sec.
- A body is said to move with Simple Harmonic Motion if its acceleration, is
  - always directed away from the centre, the point of reference
  - proportional to the square of the distance from the point of reference
  - proportional to the distance from the point of reference and directed towards it
  - inversely proportion to the distance from the point of reference
  - none of these.
- One end of a light string 4 m in length is fixed to a point on a smooth wall and the other end fastened to a point on the surface of a smooth sphere of diameter 2.25 m and of weight 100 kg. The reaction between the sphere and the wall of the arrangement made is
  - 102.5 kg
  - 105.5 kg
  - 108.5 kg
  - 110 kg.

8. Which one of the following laws is not applicable to a simple pendulum ?.
- The time period does not depend on its magnitude
  - The time period is proportional to its length  $l$
  - The time period is proportional to  $l$  where  $l$  is length
  - The time period is inversely proportional to  $g$  where  $g$  is the acceleration due to gravity.
9. The ratio of the reactions RA and RB of a simply supported beam shown in below figure is
- A. 0.50    B. 0.40    C. 0.67    D. 1.00    E. 1.50
10. Effect of a force on a body depends upon its
- A. direction    B. magnitude    C. position    D. all the above.
11. The resultant of the forces acting on a body will be zero if the body
- rotates
  - moves with variable velocity in a straight line
  - moves along a curved path
  - does not move at all.
12. A ball moving with a velocity of 5 m/sec impinges a fixed plane at an angle of  $45^\circ$  and its direction after impact is equally inclined to the line of impact. If the coefficient of restitution is 0.5, the velocity of the ball after impact will be
- A. 0.5 m/sec    B. 1.5 m/sec    C. 2.5 m/sec    D. 3.5 m/sec    E. 4.5 m/sec.
13. A pilot flies a small plane in a vertical loop of radius  $r$ . At the top of its trajectory he experiences weightlessness. If the acceleration due to gravity is  $g$ , the speed of the plane at the top of its trajectory would be
- A. zero    B. infinite    C.  $gr$     D.  $2gr$ .
14. The distance of the c.g. of a semi-circular arc of radius  $r$  from its diameter along the radius of symmetry, is
- A.  $\frac{3r}{\pi}$     B.  $\frac{2r}{3\pi}$     C.  $\frac{2\pi}{r}$     D.  $\frac{2\pi}{\pi}$
15. A Seconds pendulum executes
- 0.5 beat per second
  - 1.0 beat per second
  - 2.0 beats per second
  - 2.5 beats per second
  - 3 beats per second.

16. The ratio of the ranges on the inclined plane with motion upward and with motion downward for a given velocity, angle of projection will be  
 A.  $\frac{\sin(\alpha + \beta)}{\sin(\alpha - \beta)}$     B.  $\frac{\sin(\alpha - \beta)}{\sin(\alpha + \beta)}$     C.  $\frac{\cos(\alpha - \beta)}{\cos(\alpha + \beta)}$     D.  $\frac{\tan(\alpha - \beta)}{\tan(\alpha + \beta)}$
17. For maximum range of a projectile, the angle of projection should be  
 A.  $30^\circ$     B.  $45^\circ$     C.  $60^\circ$     D. none of these.
18. M.I. of a thin ring (external diameter  $D$ , internal diameter  $d$ ) about an axis perpendicular to the plane of the ring, is  
 A.  $\frac{\pi}{64} (D^4 + d^4)$   
 B.  $\frac{\pi}{32} (D^4 - d^4)$   
 C.  $\frac{\pi}{32} (D^4 + d^4)$   
 D.  $\frac{\pi}{32} (D^4 \times d^4)$
19. Pick up the correct statement from the following for the structure shown in below figure.  
 A. The horizontal reaction at  $A$  is  $23t \leftarrow$   
 B. The horizontal reaction at  $C$  is  $23t \rightarrow$   
 C. The vertical reaction at  $A$  is zero  
 D. The vertical reaction at  $C$  is  $2t \uparrow$   
 E. All the above.
20. A particle moves with a velocity of 2 m/sec in a straight line with a negative acceleration of 0.1 m/sec<sup>2</sup>. Time required to traverse a distance of 1.5 m, is  
 A. 40 sec    B. 30 sec    C. 20 sec    D. 15 sec    E. 10 sec.
21. When a body of mass  $M_1$  is hanging freely and an other of mass  $M_2$  lying on a smooth inclined plane( $\alpha$ ) are connected by a light inextensible string passing over a smooth pulley, the acceleration of the body of mass  $M_1$ , will be given by  
 A.  $\frac{g(M_1 + M_2 \sin \alpha)}{M_1 + M_2} \text{ m/sec}$     B.  $\frac{g(M_1 - M_2 \sin \alpha)}{M_1 + M_2} \text{ m/sec}^2$     C.  $\frac{g(M_2 + M_1 \sin \alpha)}{M_1 + M_2} \text{ m/sec}^2$   
 D.  $\frac{g(M_2 \times M_1 \sin \alpha)}{M_2 - M_1} \text{ m/sec}^2$
22. According to Law of Triangle of Forces  
 A. three forces acting at a point, can be represented by the sides of a triangle, each side being in proportion to the force

- B. three forces acting along the sides of a triangle are always in equilibrium
  - C. if three forces acting on a point can be represented in magnitude and direction, by the sides of a triangle taken in order, these will be in equilibrium
  - D. if three forces acting at a point are in equilibrium each force is proportional to the sine of the angle between the other two
  - E. if the forces acting on a particle be represented in magnitude and direction by the two sides of a triangle taken in order, their resultant will be represented in magnitude and direction by the third side of the triangle, taken in opposite order.
23. A Second's pendulum gains 2 minutes a day. To make it to keep correct time its length
- A. must be decreased
  - B. must be increased
  - C. is not changed but weight of the bob is increased
  - D. is not changed but weight of the bob is decreased
  - E. none of these.
24. The following is not a law of static friction :
- A. The force of friction always acts in a direction opposite to that in which the body tends to move
  - B. The force of friction is dependent upon the area of contact
  - C. The force of friction depends upon the roughness of the surface
  - D. The magnitude of the limiting friction bears a constant ratio to the normal reaction between two surfaces.
25. The velocity of a moving body, is
- A. a vector quantity
  - B. a scalar quantity
  - C. a scalar as well as a vector quantity
  - D. none of these.
26. A spring scale in a stationary lift shows a reading of 60 kg for a man standing on it. If the lift starts descending at an acceleration of  $g/5$ , the scale reading would be
- A. 48 kg      B. 60 kg      C. 72 kg      D. none of these.
27. The resolved part of the resultant of two forces inclined at an angle  $\theta$  in a given direction is
- A. algebraic sum of the resolved parts of the forces in the direction
  - B. arithmetical sum of the resolved parts of the forces in the direction
  - C. difference of the forces multiplied by cosine  $\theta^\circ$



- D. sum of the forces multiplied by the sine  $\theta$   
 E. sum of the forces multiplied by the tangent  $\theta^\circ$ .
28. The velocity ratio of the differential wheel and axle is  
 A.  $\frac{R}{r_1 - r_2}$     B.  $\frac{2R}{r_1}$     C.  $\frac{3R}{r_1 - r_2}$     D.  $\frac{2R}{r_1 + r_2}$
29. The following statement is one of the laws of Dynamic friction  
 A. The force of friction always acts in a direction opposite to that in which a body is moving  
 B. The magnitude of the kinetic friction bears a constant ratio to the normal reaction between two surfaces. The ratio being slightly less than that in the case of limiting friction  
 C. For moderate speeds the force of friction remains constant but decreases slightly with the increase of speed  
 D. all the above.
30. A 50 kg boy climbs up a 8 m rope in gymnasium in 10 sec. The average power developed by the boy is approximately  
 A. 400 watts    B. 500 watts    C. 4000 watts    D. none of these.
31. Lami's theorem states that  
 A. three forces acting at a point are always in equilibrium  
 B. if three forces acting on a point can be represented in magnitude and direction by the sides of a triangle, the point will be in the state of equilibrium  
 C. three coplanar forces acting at a point will be in equilibrium, if each force is proportional to the sine of the angle between the other two  
 D. three coplanar forces acting at a point will be in equilibrium if each force is inversely proportional to the sine of the angle between the other two  
 E. none of these.
32. Pick up the incorrect statement from the following. In case of suspension bridge due to rise in temperature,  
 A. dip of the cable increases  
 B. length of the cable increases  
 C. dip of the cable decreases  
 D. none of these.
33. If two forces acting at a point are in equilibrium, they must be equal in magnitude and their line of action must be along  
 A. the same line in the same sense  
 B. the same line in opposite sense

- C. the perpendicular to both the lines  
D. none of these.
34. For lifting a load of 50 kg through a distance of 2.5 cm, an effort of 12.5 kg is moved through a distance of 40 cm. The efficiency of the lifting machine, is  
A. 60%    B. 65%    C. 70%    D. 25%.
35. Power can be expressed as  
A. work/energy    B. work/time    C. work x time    D. work/distance.
36. The ends of a string weighing  $w$ /metre are attached to two points at the same horizontal level. If the central dip is very small, the horizontal tension of the string throughout is  
A.  $\frac{wl}{4d}$     B.  $\frac{wl^2}{4d}$     C.  $\frac{wl^2}{8d}$     D.  $\frac{wl^2}{16d}$
37. If two forces  $P$  and  $Q$  ( $P < Q$ ) act on the same straight line but in opposite direction, their resultant, is  
A.  $P + Q$   
B.  $P/Q$   
C.  $Q/P$   
D.  $P - Q$   
E.  $Q - P$ .
38. If the angle between the applied force and the direction of motion of a body, is between  $90^\circ$  and  $180^\circ$ , the work done, is called  
A. virtual work    B. imaginary work    C. zero work    D. negative work.
39. The units of moment of inertia of an area, are  
A. kg/m    B. kg/m<sup>2</sup>    C. m<sup>4</sup>    D. m<sup>3</sup>    E. kg-m<sup>2</sup>.
40. To avoid bending action at the base of a pier,  
A. suspension and anchor cables are kept at the same level  
B. suspension and anchor cables are fixed to pier top  
C. suspension cable and anchor cables are attached to a saddle mounted on rollers on top of the pier  
D. none the these.
41. For a body moving with simple harmonic motion, the number of cycles per second, is known as its  
A. oscillation    B. amplitude    C. periodic time    D. beat    E. frequency.
42. If the horizontal range is 2.5 times the greatest height, the angle of projection of the projectile, is  
A.  $57^\circ$     B.  $58^\circ$     C.  $59^\circ$     D.  $60^\circ$ .

43. The shape of a suspended cable under its own weight, is  
A. parabolic    B. circular    C. catenary    D. elliptical.
44. Time required to stop a car moving with a velocity 20 m/sec within a distance of 40 m, is  
A. 2 sec    B. 3 sec    C. 4 sec    D. 5 sec    E. 6 sec.
45. The characteristic of a couple, is :  
A. algebraic sum of forces, constituting a couple is zero  
B. algebraic sum of moments of forces, constituting a couple, about any point, is same  
C. a couple can be balanced only by a couple but of opposite sense  
D. a couple can be never be balanced by a single force  
E. all the above.
46. Ball A of mass 250 g moving on a smooth horizontal table with a velocity of 10 m/s hits an identical stationary ball B on the table. If the impact is perfectly elastic, the velocity of the ball B just after impact would be  
A. zero    B. 5 m/sec    C. 10 m/sec    D. none of these.
47. Equation of motion of a point in a straight line, is  
A.  $v = u + ft$   
B.  $S = ut + \frac{1}{2} ft^2$   
C.  $2fS = v^2 - u^2$   
D. all the above.
48. For the system of the loads shown in below figure, the time required for the 6.6 kg load to fall on the edge, is  
A. 1 sec.    B. 2 sec.    C. 3 sec.    D. 4 sec.    E. 5 sec.
49. One end of a light string 4 m in length is fixed to a point on a smooth wall and the other end fastened to a point on the surface of a smooth sphere of diameter 2.25 m and of weight 100 kg. The tension in the string is  
A. 17.5 kg    B. 19.5 kg    C. 22.5 kg    D. 25 kg.
50. The inherent property of a body which offers reluctance to change its state of rest or uniform motion, is  
A. weight    B. mass    C. inertia    D. momentum.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	A	C	C	E	C	A	B	D	D
10	D	C	C	D	C	B	B	B	E	C
20	B	E	B	A	A	A	A	B	D	A
30	C	C	B	D	B	C	D	D	C	B
40	E	B	C	C	E	C	D	C	C	C

### Section 3

1. If two bodies of masses  $M_1$  and  $M_2$  ( $M_1 < M_2$ ) are connected by a light inextensible string passing over a smooth pulley, the tension in the string, will be given by

A.  $T = \frac{g(M_1 - M_2)}{M_1 + M_2}$       B.  $T = \frac{g(M_1 + M_2)}{M_1 \times M_2}$       C.  $T = \frac{g(M_2 - M_1)}{M_1 + M_2}$       D.  $T = \frac{g(M_2 + M_1)}{M_2 - M_1}$

2. For a simple pendulum, the period of one oscillation is

- A.  $2\pi l/2g$   
 B.  $2\pi 2g/l$   
 C.  $2\pi l/g$   
 D.  $2\pi g/2l$ .

3. A load of 500 kg was lifted through a distance of 13 cm. by an effort of 25 kg which moved through a distance of 650 cm. The velocity ratio of the lifting machine is

- A. 50      B. 55      C. 60      D. 65      E. 70.

4. The angle of friction is :

- A. The ratio of the friction and the normal reaction  
 B. The force of friction when the body is in motion  
 C. The angle between the normal reaction and the resultant of normal reaction and limiting friction  
 D. The force of friction at which the body is just about to move.

5. The resultant of two forces acting at right angles is 5 kgf and if they act at an angle of  $60^\circ$ , it is 37 kgf. The magnitudes of the forces are :

- A. 2 kgf, 3 kgf      B. 3 kgf, 4 kgf      C. 4 kgf, 5 kgf      D. 5 kgf, 3 kgf.

6. A body A of mass 6.6 kg which is lying on a horizontal platform 4.5 m from its edge is connected to the end of a light string whose other end is supporting a body of mass 3.2 kg as shown in below figure. If the friction between the platform and the body A is  $1/3$ , the acceleration is

- A.  $0.5 \text{ m/sec}^2$   
 B.  $0.75 \text{ m/sec}^2$   
 C.  $1.00 \text{ m/sec}^2$   
 D.  $1.25 \text{ m/sec}^2$ .

7. The motion of a particle is described by the relation  $x = t^2 - 10t + 30$ , where  $x$  is in metres and  $t$  in seconds. The total distance travelled by the particle from  $t = 0$  to  $t = 10$  seconds would be

- A. zero      B. 30 m      C. 50 m      D. 60 m      E. none of these.

8. Three forces which act on a rigid body to keep it in equilibrium. The forces must be coplanar and
- concurrent
  - parallel
  - concurrent parallel
  - none of these.
9. A square hole is made in a circular lamina, the diagonal of the square is equal to the radius of the circle as shown in below figure the shift in the centre of gravity is
- $\frac{r(n - 0.75)}{(n - 0.5)}$
  - $\frac{r(n - 0.25)}{(n - 0.75)}$
  - $\frac{r(n - 0.5)}{(n - 0.75)}$
  - $\frac{r(n - 0.5)}{(n - 0.25)}$
10. For perfectly elastic bodies, the value of coefficient of restitution is
- zero
  - 0.5
  - 1.0
  - between 0 and 1.
11. Time of flight of a projectile on a horizontal plane, is
- $\frac{2u \sin \alpha}{g}$
  - $\frac{2u \cos \alpha}{g}$
  - $\frac{2u \tan \alpha}{g}$
  - $\frac{2u \cot \alpha}{g}$
12. The reaction  $R_B$  of the roller support B of the beam shown in below figure is
- 10.8 t
  - 10.6 t
  - 10.4 t
  - 10.2 t.
13. The acceleration of a train starting from rest at any instant is where  $V$  is the velocity of the train in m/sec. The train will attain a velocity of 36 km/hour after travelling a distance of
- 2000 m
  - 2100 m
  - 2200 m
  - 2300 m
  - 2500 m.
14. The maximum frictional force which comes into play, when a body just begins to slide over the surface of another body, is known
- sliding friction
  - rolling friction
  - limiting friction
  - none of these.
15. If  $G$  is the Gauge of track,  $v$  is velocity of the moving vehicle,  $g$  is the acceleration due to gravity and  $r$  is the radius of a circular path, the

required superelevation is

- A.  $\frac{gv^2}{Gr}$     B.  $\frac{Gr^2}{gr}$     C.  $\frac{Gr^2}{gv^2}$     D.  $\frac{Gv^2}{gv}$

16. If  $v$  and  $\omega$  are linear and angular velocities, the centripetal acceleration of a moving body along the circular path of radius  $r$ , will be

- A.  $\frac{r}{v^2}$     B.  $\frac{v^2}{r}$     C.  $\frac{r}{\omega^2}$     D.  $\frac{\omega^2}{r}$     E.  $r\omega$ .

17. If two forces of 3 kg and 4 kg act at right angles to each other, their resultant force will be equal to

- A. 7 kg    B. 1 kg    C. 5 kg    D.  $1/7$  kg    E. none of these.

18. The c.g. of the shaded area of the below figure from the x-axis is

- A.  $\frac{a}{4}$     B.  $\frac{3a}{4}$     C.  $\frac{3b}{10}$     D.  $\frac{3a}{10}$     E.  $\frac{3a}{5}$

19. Two shots fired simultaneously from the top and bottom of a vertical tower with elevations of  $30^\circ$  and  $45^\circ$  respectively strike a target simultaneously. If horizontal distance of the target from the tower is 1000 m, the height of the tower is

- A. 350 m    B. 375 m    C. 400 m    D. 425 m.

20. For the given values of initial velocity of projection and angle of inclination of the plane, the maximum range for a projectile projected upwards will be obtained, if the angle of projection is

- A.  $\alpha = \frac{n}{4} - \frac{\beta}{2}$     B.  $\alpha = \frac{n}{2} + \frac{\beta}{2}$     C.  $\alpha = \frac{\beta}{2} - \frac{n}{2}$     D.  $\alpha = \frac{n}{4} - \frac{\beta}{4}$   
E.  $\alpha = \frac{n}{2} - \frac{\beta}{2}$

21. A stone of mass 1 kg is tied to a string of length 1 m and whirled in a horizontal circle at a constant angular speed 5 rad/sec. The tension in the string is,

- A. 5 N    B. 10 N    C. 15 N    D. 25 N    E. None of these.

22. For a simple pendulum, time period for a beat, is

- A.  $\pi l/g$     B.  $\pi 2l/g$     C.  $\pi g/2l$     D.  $\pi l/2g$     E.  $\pi 2g/l$ .

23. The ratio of the moment of inertia of a rectangle about its centroidal axis to the moment of inertia about its base, is

- A.  $1/4$     B.  $1/2$     C.  $3/4$     D. 2.

24. The apparent weight of a man in a moving lift is less than his real weight when it is going down with

- A. uniform speed  
B. an acceleration  
C. linear momentum

- D. retardation.
25.  $P$  is the force acting on a body whose mass is  $m$  and acceleration is  $f$ . The equation  $P - mf = 0$ , is known as
- equation of dynamics
  - equation of dynamic equilibrium
  - equation of statics
  - none of these.
26. Newton's Law of Motion is :
- Every body continues in its state of rest or of uniform motion, in a straight line, unless it is acted upon by some external force
  - The rate of change of momentum is directly proportional to the impressed force, and takes place in the same direction, in which the force acts
  - To every action, there is always an equal and opposite reaction
  - All the above.
27. The member which does not carry zero force in the structure shown in below figure, is
- A.  $ED$     B.  $DC$     C.  $BC$     D.  $BD$ .
28. The equation of motion of a particle starting from rest along a straight line is  $x = t^3 - 3t^2 + 5$ . The ratio of the velocities after 5 sec and 3 sec will be
- A. 2    B. 3    C. 4    D. 5    E. 4.5
29. The moment of inertia of a hollow circular section whose external diameter is 8 cm and internal diameter is 6 cm, about centroidal axis, is
- $437.5 \text{ cm}^4$
  - $337.5 \text{ cm}^4$
  - $237.5 \text{ cm}^4$
  - $137.5 \text{ cm}^4$
  - $37.5 \text{ cm}^4$ .
30. The height at which the end of a rope of length  $l$  should be tied so that a man pulling at the other end may have the greatest tendency to overturn the pillar, is
- A.  $\frac{3}{4} l$     B.  $\frac{1}{2}$     C.  $\frac{l}{\sqrt{2}}$     D.  $\frac{2}{\sqrt{3}} l$     E. none of these.
31. The resultant of two forces acting at right angles is 34 kg and acting at  $60^\circ$  is 70 kg. The forces are
- 1 kg and 4 kg

- B. 2 kg and 3 kg  
 C. 3 kg and 5 kg  
 D. 3 kg and 5 kg  
 E. 3 kg and 5 kg.
32. The velocity of a body fallen from height  $h$ , on reaching the ground is given by  
 A.  $v = 2gh$   
 B.  $v = 2gh^2$   
 C.  $v = 2gh$   
 D.  $v = 1/2gh$   
 E.  $h^2/2g$
33. Two particles have been projected at angles  $64^\circ$  and  $45^\circ$  to the horizontal. If the velocity of projection of first is 10 m/sec, the velocity of projection of the other for equal horizontal ranges is  
 A. 9.3 m/sec    B. 8.3 m/sec    C. 7.3 m/sec    D. 6.3 m/sec.
34.  $\mu$  is coefficient of friction. A wheeled vehicle travelling on a circular level track will slip and overturn simultaneously if the ratio of its wheel distance to the height of its centroid, is  
 A.  $\mu$     B.  $2\mu$     C.  $3\mu$     D.  $\frac{1}{2}\mu$ .
35. The necessary condition of equilibrium of a body, is :  
 A. algebraic sum of horizontal components of all the forces must be zero  
 B. algebraic sum of vertical components of all the forces must be zero  
 C. algebraic sum of the moments of the forces about a point must be zero  
 D. all (a), (b) and (c).
36. A trolley wire weighs 1 kg per metre length. The ends of the wire are attached to two poles 20 m apart. If the horizontal tension is 1000 kg, the central dip of the cable is  
 A. 2 cm    B. 3 cm    C. 4 cm    D. 5 cm.
37. Principle of Transmissibility of Forces states that, when a force acts upon a body, its effect is  
 A. maximum if it acts at the centre of gravity of the body  
 B. different at different points on its line of  
 C. same at every point on its line of action  
 D. minimum if it acts at the C.G. of the body  
 E. none of these.



38. A ball is dropped from a height of 2.25 m on a smooth floor and rises to a height of 1.00 m after the bounce. The coefficient of restitution between the ball and the floor is  
A. 0.33    B. 0.44    C. 0.57    D. 0.67
39. The centre of gravity of the trapezium as shown in below figure from the side is at a distance of  
A.  $\frac{h}{3} \times \left( \frac{b+2a}{b+a} \right)$     B.  $\frac{h}{3} \times \left( \frac{2b+a}{b+a} \right)$     C.  $\frac{h}{2} \times \left( \frac{b+2a}{b+2a} \right)$     D.  $\frac{h}{2} \times \left( \frac{2b+a}{b+a} \right)$
40. If the linear velocity of a point on the rim of a wheel of 10 m diameter, is 50 m/sec, its angular velocity will be  
A. 20 rad/sec    B. 15 rad/sec    C. 10 rad/sec    D. 5 rad/sec.
41. A marble ball is rolled on a smooth floor of a room to hit a wall. If the time taken by the ball in returning to the point of projection is twice the time taken in reaching the wall, the coefficient of restitution between the ball and the wall, is  
A. 0.25    B. 0.50    C. 0.75    D. 1.0
42. A number of forces acting simultaneously on a particle of a body  
A. may not be replaced by a single force  
B. may be replaced by a single force  
C. may be replaced by a single force through C.G. of the body  
D. may be replaced by a couple  
E. none of these.
43. The moment of inertia of the shaded portion of the area shown in below figure about the X-axis, is  
A. 229.34 cm<sup>4</sup>  
B. 329.34 cm<sup>4</sup>  
C. 429.34 cm<sup>4</sup>  
D. 529.34 cm<sup>4</sup>.
44. The force acting on a point on the surface of a rigid body may be considered to act  
A. at the centre of gravity of the body  
B. on the periphery of the body  
C. on any point on the line of action of the force  
D. at any point on the surface normal to the line of action of the force.
45. A satellite is said to move in a synchronous orbit if it moves at an altitude of 36, 000 km with a maximum velocity of about  
A. 7000 km per hour

- B. 8000 km per hour  
 C. 9000 km per hour  
 D. 10, 000 per hour  
 E. 11, 000 km per hour.
46. Pick up the incorrect statement from the following :
- A. The C.G. of a circle is at its centre  
 B. The C.G. of a triangle is at the intersection of its medians  
 C. The C.G. of a rectangle is at the intersection of its diagonals  
 D. The C.G. of a semicircle is at a distance of  $r/2$  from the centre  
 E. The C.G. of an ellipse is at the intersection of axes.
47. A 49 kg lady stands on a spring scale in an elevator. During the first 5 sec, starting from rest, the scale reads 69 kg. The velocity of the elevator will be  
 A. 10 m/sec    B. 15 m/sec    C. 20 m/sec    D. 25 m/sec.
48. Pick up the correct statement from the following. A rubber ball when strikes a wall rebounds but a lead ball of same mass and velocity when strikes the same wall, falls down
- A. rubber and lead balls undergo equal changes in momentum  
 B. change in momentum suffered by lead ball is less that of rubber ball  
 C. momentum of rubber ball is less than that of lead ball  
 D. none of these.
49. The instantaneous centre of a member lies at the point of intersection of two lines drawn at the ends of the member such that the lines are inclined to the direction of motion of the ends at  
 A.  $30^\circ$     B.  $45^\circ$     C.  $60^\circ$     D.  $90^\circ$
50. A rod 5 m in length is moving in a vertical plane. When it is inclined at  $60^\circ$  to horizontal, its lower end is moving horizontally at 3 m/sec and upper end is moving in vertical direction. The velocity of its upper end, is  
 A. 0.5 m/sec    B. 1.0 m/sec    C. 1.5 m/sec    D. 2.5 m/sec    E. 3.0 m/sec

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	C	A	C	B	C	A	A	A	C
10	A	A	D	C	D	B	C	C	D	B
20	D	A	A	B	A	D	D	D	D	C
30	E	C	A	B	D	D	C	D	A	D
40	B	B	C	C	E	D	C	D	D	B

## Section 4

1. A retarding force on a body does not
  - A. change the motion of the body
  - B. retard the motion of the body
  - C. introduce the motion of the body
  - D. none of these.
2. The unit of force in C.G.S. system of units, is called
  - A. dyne
  - B. Newton
  - C. kg
  - D. all the above.
3. A block of weight 50 kg is placed on a horizontal plane. When a horizontal force of 18 kg is applied, the block is just on the point of motion. The angle of friction is
  - A.  $17^\circ 48'$
  - B.  $18^\circ 48'$
  - C.  $19^\circ 48'$
  - D.  $20^\circ 48'$
  - E.  $21^\circ 48'$ .
4. From a circular plate of a diameter 6 cm is cut out a circle whose diameter is equal to the radius of the plate. The C.G. of the remainder from the centre of circular plate is at a distance of
  - A. 2.0 cm
  - B. 1.5 cm
  - C. 1.0
  - D. 0.5 cm.
5. The force which produces an acceleration of  $1 \text{ m/sec}^2$  in a mass of one kg, is called
  - A. dyne
  - B. Netwon
  - C. joule
  - D. erg.
6. The units of inertia of mass, are
  - A.  $\text{kg/m}$
  - B.  $\text{kg/m}^2$
  - C.  $\text{m}^4$
  - D.  $\text{m}^3$
  - E.  $\text{kg-m}^2$ .
7. A sphere is resting on two planes BA and BC which are inclined at  $45^\circ$  and  $60^\circ$  respectively with the horizontal. The reaction on the plane BA will be
  - A. less than that on  $BC$
  - B. more than that of  $BC$
  - C. equal to that on  $BC$
  - D. zero
  - E. none of these.
8. A projectile is fired at an angle  $\theta$  to the vertical. Its horizontal range will be maximum when  $\theta$  is
  - A.  $0^\circ$
  - B.  $30^\circ$
  - C.  $45^\circ$
  - D.  $60^\circ$
  - E.  $90^\circ$ .
9. A load of 500 kg was lifted through a distance of 13 cm. by an effort of 25 kg which moved through a distance of 650 cm. The mechanical advantage of the lifting machine is
  - A. 15
  - B. 18
  - C. 20
  - D. 26.
10. The centre of gravity of a trapezoidal dam section whose top width is a, bottom width is b and the vertical side is a, from its vertical face is

- A.  $\frac{a^2 + ab + b^2}{3(a + b)}$       B.  $\frac{b^2 + bc + c^2}{3(b + c)}$       C.  $\frac{a^2 + ab + c^2}{3(a + c)}$       D. none of these.
11. One half of a vibration of a body, is called  
A. period time      B. oscillation      C. beat      D. amplitude.
12. On a ladder resisting on a smooth ground and leaning against a rough vertical wall, the force of friction acts  
A. towards the wall at its upper end  
B. away from the wall at its upper end  
C. upwards at its upper end  
D. downwards at its upper end  
E. none of these.
13. The acceleration of a particle moving along the circumference of a circle with a uniform speed, is directed  
A. radially  
B. tangentially at that point  
C. away from the centre  
D. towards the centre.
14. From the circular plate of a diameter 6 cm is cut out a circular plate whose diameter is equal to radius of the plate. The c.g. of the remainder shifts from the original position through  
A. 0.25 cm      B. 0.50 cm      C. 0.75 cm      D. 1.00 cm.
15. If a particle moves with a uniform angular velocity  $\omega$  radians/sec along the circumference of a circle of radius  $r$ , the equation for the velocity of the particle, is  
A.  $v = \omega \sqrt{y^2 - r^2}$   
B.  $y = \omega y - r$   
C.  $v = \omega \sqrt{r^2 + y^2}$   
D.  $v = \omega \sqrt{r^2 - y^2}$
16. In simple harmonic motion, acceleration of a particle is proportional to  
A. rate of change of velocity  
B. displacement  
C. velocity  
D. direction  
E. none of these.

17. A heavy ladder resting on a floor and against a vertical wall may not be in equilibrium, if
- floor is smooth and the wall is rough
  - floor is rough and the wall is smooth
  - floor and wall both are smooth surfaces
  - floor and wall both are rough surfaces.
18. In a simple screw jack, the pitch of the screw is 9 mm and length of the handle operating the screw is 45 cm. The velocity ratio of the system is
- 1.5
  - 5
  - 25
  - 314
19. To double the period of oscillation of a simple pendulum
- the mass of its bob should be doubled
  - the mass of its bob should be quadrupled
  - its length should be quadrupled
  - its length should be doubled.
20. For a particle moving with a simple harmonic motion, the frequency is
- directly proportional to periodic time
  - inversely proportional to periodic time
  - inversely proportional to its angular velocity
  - directly proportional to its angular velocity
  - none of these.
21. According to Kennedy's theorem, if three bodies have plane motions, their instantaneous centres lie on
- a point
  - a straight line
  - two straight lines
  - a triangle.
22. A ball of mass 250 g moving on a smooth horizontal table with a velocity of 10 m/sec hits an identical stationary ball B on the table. If the impact is perfectly plastic, the velocity of the ball B just after impact would be
- zero
  - 5 m/sec
  - 10 m/sec
  - none of these.
23. If  $\alpha$  is the angular acceleration of a compound pendulum whose angular displacement is  $\theta$ , the frequency of the motion is
- $2\pi\alpha/\theta$
  - $\frac{1}{2\pi} \sqrt{\frac{\alpha}{\theta}}$

- C.  $4\pi\alpha/\theta$   
D.  $2\pi\alpha - \theta$ .
24. If two forces each equal to  $T$  in magnitude act at right angles, their effect may be neutralised by a third force acting along their bisector in opposite direction whose magnitude will be  
A.  $2 T$     B.  $1/2 T$     C.  $2 T$     D.  $3 T$     E. none of these.
25. Energy may be defined as  
A. power of doing work  
B. capacity of doing work  
C. rate of doing work  
D. all the above.
26. The intrinsic equation of catenary is  
A.  $S = c \tan \psi$   
B.  $y = c \cosh x/c$   
C.  $y = c \cosh \psi$   
D.  $y = c \sinh \psi$ .
27. A ball which is thrown upwards, returns to the ground describing a parabolic path during its flight  
A. vertical component of velocity remains constant  
B. horizontal component of velocity remains constant  
C. speed of the ball remains constant  
D. kinetic energy of the ball remains constant.
28. Angular acceleration of a particle may be expressed as  
A. radians/sec<sup>2</sup>  
B. degrees/sec<sup>2</sup>  
C. revolutions/sec  
D. all the above.
29. Two loads of 50 kg and 75 kg are hung at the ends of a rope passing over a smooth pulley shown in below figure. The tension in the string is :  
A. 50 kg    B. 75 kg    C. 25 kg    D. 60 kg.
30. Total no of instantaneous centres of a machine having  $n$  links, is  
A.  $n/2$   
B.  $n$   
C.  $(n - 1)$   
D.  $\frac{n(n - 1)}{2}$

31. A weight of 100 kg is supported by a string whose ends are attached to pegs A and B at the same level shown in below figure. The tension in the string is  
 A. 50 kg    B. 75 kg    C. 100 kg    D. 120 kg.
32. A train weighing 196 tonnes experiences a frictional resistance of per tonne. The speed of the train at the top of a down gradient 1 in 78.4 is 36 km/hour. The speed of the train after running 1 km down the slope, is  
 A. 510 m/sec  
 B. 105 m/sec  
 C. 53 m/sec  
 D. 35 m/sec.
33. The reaction at the support B of the beam shown in below figure is  
 A. 1.6 t    B. 9.6 t    C. 8.5 t    D. 0.5 t.
34. A stone is whirled in a vertical circle, the tension in the string, is maximum  
 A. when the string is horizontal  
 B. when the stone is at the highest position  
 C. when the stone is at the lowest position  
 D. at all the positions.
35. If the velocity of projection is 4 m/sec and the angle of projection is  $\alpha^\circ$ , the maximum height of the projectile from a horizontal plane, is  
 A.  $\frac{u^2 \cos^2 \alpha}{2g}$     B.  $\frac{u^2 \sin^2 \alpha}{2g}$     C.  $\frac{u^2 \tan^2 \alpha}{2g}$     D.  $\frac{u^2 \sin 2\alpha}{2g}$
36. If a spherical body is symmetrical about its perpendicular axes, the moment of inertia of the body about an axis passing through its centre of gravity as given by Routh's rule is obtained by dividing the product of the mass and the sum of the squares of two semi-axes by n where n is  
 A. 2    B. 3    C. 4    D. 5.
37. The angle of projection for a range is equal to the distance through which the particle would have fallen in order to acquire a velocity equal to the velocity of projection, will be  
 A.  $30^\circ$     B.  $45^\circ$     C.  $60^\circ$     D.  $75^\circ$ .
38. A particle executes a simple harmonic motion. While passing through the mean position, the particle possesses  
 A. maximum kinetic energy and minimum potential energy  
 B. maximum kinetic energy and maximum potential energy  
 C. minimum kinetic energy and maximum potential energy

- D. minimum kinetic, energy and minimum potential energy  
E. none of these.
39. A body of weight  $w$  placed on an inclined plane is acted upon by a force  $P$  parallel to the plane which causes the body just to move up the plane. If the angle of inclination of the plane is  $\theta$  and angle of friction is  $\phi$ , the minimum value of  $P$ , is
- A.  $\frac{w \sin (\phi - \theta)}{\cos \phi}$       B.  $\frac{w \sin (\theta - \phi)}{\cos \phi}$       C.  $\frac{w \cos (\theta + \phi)}{\cos \phi}$       D.  $\frac{w \sin \theta \cos (\theta - \phi)}{\sin \phi}$
40. Varignon's theorem of moments states
- A. arithmetical sum of the moments of two forces about any point, is equal to the moments of their resultant about that point  
B. algebraic sum of the moments of two forces about any point, is equal to the moment of their resultant about that point  
C. arithmetical sum of the moments of the forces about any point in their plane, is equal to the moment of their resultant about that point  
D. algebraic sum of the moments of the forces about any point in their plane, is equal to the moment of their resultant about that point.
41. If the angle of projection is double the angle of inclination ( $\alpha$ ) of the plane on which particle is projected, the ratio of times of flight up the inclined plane and down the inclined plane, will be
- A.  $\frac{1}{2 \cos \alpha}$       B.  $\frac{1}{2 \sin \alpha}$       C.  $\frac{1}{2 \tan \alpha}$       D.  $2 \cos \alpha$ .
42. A smooth cylinder lying on its convex surface remains
- A. in stable equilibrium  
B. in unstable equilibrium  
C. in neutral equilibrium  
D. out of equilibrium  
E. none of these.
43. A weight  $W$  is suspended at the free end of a light member hinged to a vertical wall. If the angle of inclination of the member with the upper wall is  $\theta^\circ$ , the force introduced in the member, is
- A.  $W \sec \theta$       B.  $W \cos \theta$       C.  $W \sin \theta$       D.  $W \operatorname{cosec} \theta$       E.  $W \tan \theta$ .
44. A satellite goes on moving along its orbit round the earth due to
- A. gravitational force  
B. centrifugal force  
C. centripetal force



- D. none of these.
45. The phenomenon of collision of two elastic bodies takes place because bodies
- immediately after collision come momentarily to rest
  - tend to compress each other till they are compressed maximum possible
  - attempt to regain its original shape due to their elasticities
  - all the above.
46. A glass ball is shot to hit a wall from a point on a smooth floor. If the ball returns back to the point of projection in twice the time taken in reaching the wall, the coefficient of restitution between the glass ball and the wall is
- A. 0.25    B. 0.33    C. 0.40    D. 0.50    E. 0.55
47. In case of S.H.M. the period of oscillation(T), is given by
- A.  $T = \frac{2\omega}{\pi^2}$     B.  $T = \frac{2\pi}{\omega}$     C.  $T = \frac{2}{2\omega}$     D.  $T = \frac{\pi}{2\omega}$
48. Kinetic friction may be defined as
- friction force acting when the body is just about to move
  - friction force acting when the body is in motion
  - angle between normal reaction and resultant of normal reaction and limiting friction
  - ratio of limiting friction and normal reaction.
49. If  $\alpha$  and  $u$  are angle of projection and initial velocity of a projectile respectively, the total time of flight, is given by
- A.  $T = \frac{u \sin 2\alpha}{g}$     B.  $T = \frac{u \sin^2 \alpha}{g}$     C.  $T = \frac{u \sin^2 \alpha}{2g}$     D.  $T = \frac{2u \sin \alpha}{g}$
50.  $\omega$  rad/sec is the angular velocity of a crank whose radius is  $r$ . If it makes  $\theta^\circ$  with inner dead centre and obliquity of the connecting rod  $l$  is  $\phi$ , the velocity  $v$  of the piston, is given by the equation
- $\omega^2(l \cos \phi + r \sin \phi \tan \theta)$
  - $\omega^2(l \sin \phi + r \cos \phi \tan \theta)$
  - $\omega(l \sin \phi + r \cos \phi \tan \theta)$
  - $\omega^2(l \sin \phi - r \cos \theta \tan \phi)$ .

Answer Key

	1	2	3	4	5	6	7	8	9	0
0	B	A	C	D	B	E	B	C	C	A
10	C	C	B	B	D	B	C	D	C	B
20	B	A	B	C	B	A	B	D	D	D
30	C	A	C	C	B	D	D	A	B	D
40	A	B	A	B	D	D	B	B	D	C

## Section 5

1. The centre of gravity of a homogenous body is the point at which the whole
  - A. volume of the body is assumed to be concentrated
  - B. area of the surface of the body is assumed to be concentrated
  - C. weight of the body is assumed to be concentrated
  - D. all the above.
2. Pick up the correct statement from the following :
  - A. If two equal and perfectly elastic smooth spheres impinge directly, they interchange their velocities.
  - B. If a sphere impinges directly on an equal sphere which is at rest, then a fraction  $\frac{1}{2} (1 - e^2)$  the original kinetic energy is lost by the impact.
  - C. If a smooth sphere impinges on another sphere, which is at rest, the latter will move along the line of centres.
  - D. If two equal spheres which are perfectly elastic impinge at right angles, their direction after impact will still be at right angles.
  - E. All the above.
3. Centre of gravity of a thin hollow cone lies on the axis of symmetry at a height of
  - A. one-half of the total height above base
  - B. one-third of the total height above base
  - C. one-fourth of the total height above base
  - D. none of these.
4. A ball of mass 1 kg moving with a velocity of 2 m/sec collides a stationary ball of mass 2 kg and comes to rest after impact. The velocity of the second ball after impact will be
  - A. zero
  - B. 0.5 m/sec
  - C. 1.0 m/sec
  - D. 2.0 m/sec.
5. Periodic time of a particle moving with simple harmonic motion is the time taken by the particle for
  - A. half oscillation
  - B. quarter oscillation
  - C. complete oscillation
  - D. none of these.
6. The reaction at the central support B of the beam ABC hinged at D shown in below figure is
  - A. 2 t
  - B. 5.8 t
  - C. 0.2 t
  - D. 3.5 t.

7. The motion of a bicycle wheel is
- translatory
  - rotary
  - rotary and translatory
  - curvilinear
8. The displacement of a particle which moves along a straight line is given by  $S = 4t^3 + 3t^2 - 10$  where  $S$  is in meters and  $t$  is in seconds. The time taken by the particle to acquire a velocity of 18 m/sec from rest, is
- $\frac{1}{2}$  sec
  - 1 sec
  - 1.5 sec
  - 1.5 sec.
9. If the resultant of two forces  $P$  and  $Q$  acting at an angle  $\theta$  makes an angle  $\alpha$  with  $P$ , then  $\tan \alpha$  equals
- $\frac{P \sin \theta}{P - Q \cos \theta}$
  - $\frac{Q \sin \theta}{P + Q \cos \theta}$
  - $\frac{P \sin \theta}{P + Q \tan \theta}$
  - $\frac{Q \sin \theta}{P + Q \sin \theta}$
10. Pick up the correct statement from the following. The kinetic energy of a body
- before impact is equal to that after impact
  - before impact is less than that after impact
  - before impact is more than that after impact
  - remains constant
  - none of these.
11. A particle moving with a simple harmonic motion, attains its maximum velocity when it passes
- the extreme point of the oscillation
  - through the mean position
  - through a point at half amplitude
  - none of these.
12. The moment of inertia of a circular lamina of diameter  $d$ , about an axis perpendicular to the plane of the lamina and passing through its centre, is
- $\frac{\pi d^4}{12}$
  - $\frac{\pi d^4}{16}$
  - $\frac{\pi d^4}{24}$
  - $\frac{\pi d^4}{32}$
  - $\frac{\pi d^4}{36}$
13. The unit of impulse, is
- kg.m/sec
  - kg.m/sec<sup>3</sup>
  - kg.m/sec<sup>2</sup>
  - kg.m<sup>2</sup>/sec.

14. If  $l$  is the span of a light suspension bridge whose each cable carries total weight ( $w$ ) and the central dip is  $y$ , the horizontal pull at each support, is  
 A.  $\frac{wl}{4y}$     B.  $\frac{wl}{8y}$     C.  $\frac{wl}{2y}$     D.  $wl$ .
15. The practical units of work, is  
 A. erg    B. joule    C. Newton    D. dyne.
16. The rate of change of displacement of a body with respect to its surrounding, is known  
 A. velocity    B. acceleration    C. speed    D. none of these.
17. The C.G. of a hemisphere from its base measured along the vertical radius is at a distance of  
 A.  $\frac{4R}{3\pi}$     B.  $\frac{3R}{8}$     C.  $\frac{3\pi R}{4}$     D.  $\frac{8R}{3}$     E.  $R/2$ .
18. The Centre of gravity of a 10 x 15 x 5 cm T section from its bottom, is  
 A. 7.5 cm    B. 5.0 cm    C. 8.75 cm    D. 7.85 cm    E. none of above.
19. For a self-locking machine, the efficiency should be  
 A. less than 60%    B. 50%    C. more than 50%    D. None of these.
20. When a body moves round a fixed axis, it has  
 A. a rotary motion  
 B. a circular motion  
 C. a translatory  
 D. a rotary motion and translatory motion.
21. Power developed by a torque, is  
 A.  $2\pi NT$  kg m/min  
 B.  $\frac{2\pi NT}{4500}$  h.p.  
 C.  $\frac{2\pi NT}{60}$  watts  
 D. all the above.
22. From a solid cylinder of height 8 cm and radius 4 cm, a right circular cone is scooped out on the same base and having the same height as that of the cylinder. The c.g. of the remainder is at a height of  
 A. 4.5 cm    B. 5.0 cm    C. 5.25 cm    D. 5.5 cm.
23. The unit of moments in M.K.S system, is  
 A. kgm    B. kg/m<sup>2</sup>    C. kg/sec<sup>2</sup>    D. kg/sec.

24. The rotational velocity of a satellite is increased by 450 m per second if its launch is done from equator  
 A. eastward    B. northward    C. westward    D. southward    E. upward.
25. On a mass  $m$  describing a circular path of radius  $r$ , the centrifugal force  
 A. acts tangentially to the circular path  
 B. acts towards the centre of rotation  
 C. acts away from the centre of rotation  
 D. is  $\frac{mw^2r}{g}$  kfg
26. In the structure shown in below figure, the member which carries zero force, is  
 A.  $AB$     B.  $BC$     C.  $BE$     D.  $BD$     E. All the above.
27. When a body falls freely under gravitational force, it possesses  
 A. maximum weight  
 B. minimum weight  
 C. no weight  
 D. no effect on its weight.
28. A rigid body suspended Vertically at a point and oscillating with a small amplitude under the action of the force of gravity, is called  
 A. simple pendulum  
 B. compour pendulum  
 C. Second's pendulum  
 D. none of these.
29. If a ball which is dropped from a height of 2.25 m on a smooth floor attains the height of bounce equal to 1.00 m, the coefficient of the restitution between the ball and floor, is  
 A. 0.25    B. 0.50    C. 0.67    D. 0.33    E. 0.75
30. The piston of a steam engine moves with a simple harmonic motion. The crank rotates 120 r.p.m. and the stroke length is 2 metres. The linear velocity of the piston when it is at a distance of 0.5 metre from the centre, is  
 A. 5.88 m/sec    B. 8.88 m/sec    C. 10.88 m/sec    D. 12.88 m/sec.
31. The frequency of oscillation on moon as compared to that on earth, will be  
 A. 2.44 times more  
 B. 2.44 times less

- C. 3 times less  
D. 3 times more.
32. Moment of inertia of a square of side  $a$  about an axis through its centre of gravity, is  
A.  $\frac{b^3}{4}$     B.  $\frac{b^4}{12}$     C.  $\frac{b^4}{3}$     D.  $\frac{b^4}{8}$     E.  $\frac{b^4}{36}$ .
33. The reaction at the support D of the continuous beam ABCD, hinged at two points shown in below figure is  
A.  $1.6 \text{ t} \uparrow$   
B.  $1.6 \text{ t} \downarrow$   
C.  $0.5 \text{ t} \uparrow$   
D.  $0.5 \text{ t} \downarrow$   
E.  $8.5 \text{ t} \uparrow$
34. When a body slides down an inclined surface, the acceleration ( $f$ ) of the body, is given by  
A.  $f = g$   
B.  $f = g \sin \theta$   
C.  $f = g \cos \theta$   
D.  $f = g \tan \theta$ .
35. The velocity ratio of an inclined plane of inclination  $\theta$  with horizontal for lifting a load is  
A.  $\sin \theta$     B.  $\cos \theta$     C.  $\tan \theta$     D.  $\sec \theta$     E.  $\operatorname{cosec} \theta$ .
36. Pick up the incorrect statement from the following. In a simple harmonic motion  
A. velocity is maximum at its mean position  
B. velocity is minimum at the end of the stroke  
C. acceleration is minimum at the end of the stroke  
D. acceleration is zero at the mean position.
37. The gravitational force makes a satellite go round the earth in a circular orbit, if it is projected with an initial velocity of  
A. 8.04 km/sec at a height of 285 km  
B. 11.11 km/sec at a height of 37, 400 km  
C. 11.26 km/sec, the satellite escapes the pull of the earth  
D. all the above.
38. The point about which combined motion of rotation and translation of a rigid body takes place, is known as  
A. Virtual centre  
B. Instantaneous centre  
C. Instantaneous axis

- D. Point of rotation  
E. All the above.
39. A particle is dropped from the top of a tower 60 m high and another is projected upwards from the foot of the tower to meet the first particle at a height of 15.9 m. The velocity of projection of the second particle is  
A. 16 m/sec    B. 18 m/sec    C. 20 m/sec    D. 22 m/sec.
40. A point subjected to a number of forces will be in equilibrium, if  
A. sum of resolved parts in any two directions at right angles, are both zero  
B. algebraic sum of the forces is zero  
C. two resolved parts in any two directions at right angles are equal  
D. algebraic sum of the moments of the forces about the point is zero  
E. none of these.
41. The moment of inertia of a triangular section (base  $b$ , height  $h$ ) about centroidal axis parallel to the base, is  
A.  $\frac{b^3h}{12}$     B.  $\frac{bh^3}{3}$     C.  $\frac{bh^3}{36}$     D.  $\frac{bh^3}{2}$     E.  $\frac{bh^3}{8}$
42. The horizontal reaction at the support A of the structure shown in below figure, is  
A. zero    B.  $1\ t$     C.  $2\ t$     D.  $3\ t$     E.  $2.5\ t$ .
43. Periodic time of body moving with simple harmonic motion, is  
A. directly proportional to its angular velocity  
B. directly proportional to the square of its angular velocity  
C. inversely proportional to the square of its angular velocity  
D. inversely proportional to its angular velocity.
44. On a ladder resting on a rough ground and leaning against a smooth vertical wall, the force of friction acts  
A. downwards at its upper end  
B. upwards at its upper end  
C. perpendicular to the wall at its upper end  
D. zero at its upper end  
E. none of these.
45. The centre of gravity of a plane lamina will not be at its geometrical centre if it is a  
A. circle  
B. equilateral triangle

- C. rectangle
  - D. square
  - E. right angled triangle.
46. The motion of a particle moving with S.H.M. from an extremity to the other, constitutes
- A. half an oscillation
  - B. one full oscillation
  - C. two oscillations
  - D. none of these.
47. Two parallel forces 20 kg and 15 kg act. In order that the distance of the resultant from 20 kg force may be the same as that of the former resultant was from 15 kg, the 20 kg force is diminished by
- A. 5.5 kg    B. 6.25 kg    C. 8.75 kg    D. 10.5 kg.
48. The velocity of a moving body, is
- A. a vector quantity
  - B. a scalar quantity
  - C. a constant quantity
  - D. none of these.
49. If two equal forces of magnitude  $P$  act at an angle  $\theta$ , their resultant, will be
- A.  $P \cos \theta/2$
  - B.  $2P \sin \theta/2$
  - C.  $P \tan \theta/2$
  - D.  $2P \cos \theta/2$
  - E.  $P \sin \theta/2$ .
50. A body of weight 14 g appears to weight 13 g when weighed by a spring balance in a moving lift. The acceleration of the lift at that moment was
- A.  $0.5 \text{ m/sec}^2$
  - B.  $0.7 \text{ m/sec}^2$
  - C.  $1 \text{ m/sec}^2$
  - D.  $1 \text{ cm/sec}^2$ .
51. The centre of gravity of a quadrant of a circle lies along its central radius at a distance of
- A.  $0.2 R$     B.  $0.3 R$     C.  $0.4 R$     D.  $0.5 R$     E.  $0.6 R$ .
52. A geo-stationary satellite is one which orbits the earth with a velocity of rotation of
- A. moon    B. earth    C. sun    D. pole.



53. The direction of projection should bisect the angle between the inclined plane and the vertical for a range of a projectile on inclined plane
- to be zero
  - to be maximum
  - to be minimum
  - none of the these.
54. The load shared by the member BC of the structure shown in below figure is
- $23t$
  - $32t$
  - $4t$
  - $3t$
55. A vehicle weighing  $w$  kg is to run on a circular curve of radius  $r$ . If the height of its centre of gravity above the road level is  $h$  and the distance between the centres of wheels is  $2a$ , the maximum velocity, in order to avoid over turning, will be
- $\frac{gra}{h}$
  - $\sqrt{\frac{gra}{h}}$
  - $\sqrt[3]{\frac{rga}{h}}$
  - $\sqrt[4]{\frac{gra}{h}}$
56. If a body is acted upon by a number of coplaner non-concurrent forces, it may
- rotate about itself without moving
  - move in any one direction
  - move in any one direction rotating about itself
  - be completely at rest
  - all the above.
57. M.I. of solid sphere, is
- $\frac{2}{3} Mr^2$
  - $\frac{2}{5} Mr^2$
  - $Mr^2$
  - $\pi r^4/2$
  - $\frac{1}{2} Mr^2$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	E	B	C	C	B	C	B	B	C
10	B	D	A	B	B	C	B	C	A	B
20	D	B	A	A	B	E	C	B	B	C
30	B	B	B	B	E	C	D	B	C	A
40	C	A	D	D	E	A	C	A	D	B
50	E	B	B	C	B	E	C			

## 5 RCC Structures Design

### Section 1

1. In a combined footing if shear stress exceeds 5 kg/cm<sup>2</sup>, the nominal stirrups provided are:  
A. 6 legged    B. 8 legged    C. 10 legged    D. 12 legged    E. none of these.
2. The maximum area of tension reinforcement in beams shall not exceed  
A. 0.15%    B. 1.5%    C. 4%    D. 1%
3. As per I.S. 456 - 1978, the pH value of water shall be  
A. less than 6  
B. equal to 6  
C. not less than 6  
D. equal to 7
4. The minimum number of main steel bars provided in R.C.C.  
A. rectangular columns is 4  
B. circular columns is 6  
C. octagonal columns is 8  
D. all the above.
5. Post tensioning system  
A. was widely used in earlier days  
B. is not economical and hence not generally used  
C. is economical for large spans and is adopted now a days  
D. none of these.
6. An R.C.C. column is treated as long if its slenderness ratio is greater than  
A. 30    B. 35    C. 40    D. 50    E. 60
7. The width of the flange of a T-beam should be less than  
A. one-third of the effective span of the T-beam  
B. distance between the centres of T-beam  
C. breadth of the rib plus twelve times the thickness of the slab  
D. least of the above.
8. A prestressed rectangular beam which carries two concentrated loads W at L/3 from either end, is provided with a bent tendon with tension P such that central one-third portion of the tendon remains parallel to the longitudinal axis, the maximum dip h is  
A.  $\frac{WL}{P}$     B.  $\frac{WL}{2P}$     C.  $\frac{WL}{3P}$     D.  $\frac{WL}{4P}$     E.  $\frac{3WL}{5P}$

9. Pick up the correct statement from the following:
- A pile is a slender member which transfers the load through its lower end on a strong strata
  - A pile is a slender member which transfers its load to the surrounding soil
  - A pile is a slender member which transfers its load by friction
  - A pile is a cylindrical body of concrete which transfers the load at a depth greater than its width.
10. Cantilever retaining walls can safely be used for a height not more than
- 3 m
  - 4 m
  - 5 m
  - 6 m
  - 8 m
11. If  $W$  is the load on a circular slab of radius  $R$ , the maximum circumferential moment at the centre of the slab, is
- $\frac{WR^2}{16}$
  - $\frac{2WR^2}{16}$
  - $\frac{3WR^2}{16}$
  - zero
  - none of these.
12. If a bent tendon is required to balance a concentrated load  $W$  at the centre of the span  $L$ , the central dip  $h$  must be at least
- $\frac{WL}{P}$
  - $\frac{WL}{2P}$
  - $\frac{WL}{3P}$
  - $\frac{WL}{4P}$
  - $\frac{3WL}{5P}$
13. For M 150 mix concrete, according to I.S. specifications, local bond stress, is
- 5 kg/cm<sup>2</sup>
  - 10 kg/cm<sup>2</sup>
  - 15 kg/cm<sup>2</sup>
  - 20 kg/cm<sup>2</sup>
  - 25 kg/cm<sup>2</sup>
14. If the average bending stress is 6 kg/cm<sup>2</sup> for M 150 grade concrete, the length of embedment of a bar of diameter  $d$  according to I.S. 456 specifications, is
- 28  $d$
  - 38  $d$
  - 48  $d$
  - 58  $d$
  - 95  $d$
15. Bottom bars under the columns are extended into the interior of the footing slab to a distance greater than
- 42 diameters from the centre of the column
  - 42 diameters from the inner edge of the column
  - 42 diameters from the outer edge of the column
  - 24 diameter from the centre of the column
16. The diameter of longitudinal bars of a column should never be less than
- 6 mm
  - 8 mm
  - 10 mm
  - 12 mm
  - none of these.
17. The design of a retaining wall assumes that the retained earth

- A. is dry
  - B. is free from moisture
  - C. is not cohesives
  - D. consists of granular particles
  - E. all the above.
18. Dimensions of a beam need be changed if the shear stress is more than  
 A.  $10 \text{ kg/cm}^2$     B.  $15 \text{ kg/cm}^2$     C.  $20 \text{ kg/cm}^2$     D.  $25 \text{ kg/cm}^2$
19. The thickness of base slab of a retaining wall generally provided, is  
 A. one half of the width of the stem at the bottom  
 B. one-third of the width of the stem at the bottom  
 C. one fourth of the width of the steam at the bottom  
 D. width of the stem at the bottom  
 E. twice the width of the steam at the bottom.
20. For a circular slab carrying a uniformly distributed load, the ratio of the maximum negative to maximum positive radial moment, is  
 A. 1    B. 2    C. 3    D. 4    E. 5
21. Thickened part of a flat slab over its supporting column, is technically known as  
 A. drop panel    B. capital    C. column head    D. none of these.
22. An R.C.C. beam not provided with shear reinforcement may develop cracks in its bottom inclined roughly to the horizontal at  
 A.  $25^\circ$     B.  $35^\circ$     C.  $45^\circ$     D.  $55^\circ$     E.  $60^\circ$
23. The effective span of a simply supported slab, is  
 A. distance between the centres of the bearings  
 B. clear distance between the inner faces of the walls plus twice the thickness of the wall  
 C. clear span plus effective depth of the slab  
 D. none of these.
24. Pick up the incorrect statement from the following:  
 A. In the stem of a retaining wall, reinforcement is provided near the earth side  
 B. In the toe slab of a retaining wall, rein forcement is provided at the bottom of the slab  
 C. In the heel slab of a retaining wall, rein forcement is provided at the top of the slab  
 D. None of these.
25. The minimum cube strength of concrete used for a prestressed member, is

- A. 50 kg/cm<sup>2</sup>    B. 150 kg/cm<sup>2</sup>    C. 250 kg/cm<sup>2</sup>    D. 350 kg/cm<sup>2</sup>    E. 400 kg/cm<sup>2</sup>
26. The number of treads in a flight is equal to
- risers in the flight
  - risers plus one
  - risers minus one
  - none of these.
27. A short column 20 cm x 20 cm in section is reinforced with 4 bars whose area of cross section is 20 sq. cm. If permissible compressive stresses in concrete and steel are 40 kg/cm<sup>2</sup> and 300 kg/cm<sup>2</sup>, the Safe load on the column, should not exceed
- 4120 kg
  - 41, 200 kg
  - 412, 000 kg
  - none of these.
28. The reinforced concrete beam which has width 25 cm, lever arm 40 cm, shear force 6t/cm<sup>2</sup>, safe shear stress 5 kg/cm<sup>2</sup> and B.M. 24 mt,
- is safe in shear
  - is unsafe in shear
  - is over safe in shear
  - needs redesigning.
29. In a beam the local bond stress  $S_b$ , is equal to
- $$\frac{\text{Shear force}}{\text{Lever arm} \times \text{Total perimeter of reinforcement}}$$
  - $$\frac{\text{Total perimeter of reinforcement}}{\text{Lever arm} \times \text{Shear force}}$$
  - $$\frac{\text{Lever arm}}{\text{Shear force} \times \text{Total perimeter of reinforcement}}$$
  - $$\frac{\text{Lever arm}}{\text{Bending moment} \times \text{Total perimeter}}$$
  - None of these.
30. According to I.S. : 456 specifications, the safe diagonal tensile stress for M 150 grade concrete, is
- 5 kg/cm<sup>2</sup>
  - 10 kg/cm<sup>2</sup>
  - 15 kg/cm<sup>2</sup>
  - 20 kg/cm<sup>2</sup>
  - 25 kg/cm<sup>2</sup>
31. A foundation rests on
- base of the foundation
  - subgrade
  - foundation soil

- D. both (b) and (c)
32. For initial estimate for a beam design, the width is assumed
- 1/15th of span
  - 1/20th of span
  - 1/25th of span
  - 1/30th of span
  - 1/40th of span.
33. If R and T are rise and tread of a stair spanning horizontally, the steps are supported by a wall on one side and by a stringer beam on the other side, the steps are designed as beams of width
- $R + T$
  - $T - R$
  - $R^2 + T^2$
  - $R - T$
34. The advantage of a concrete pile over a timber pile, is
- no decay due to termites
  - no restriction on length
  - higher bearing capacity
  - not necessary to cut below the water mark
  - all the above.
35. If the permissible compressive stress for a concrete in bending is  $C$  kg/m<sup>2</sup>, the modular ratio is
- $2800/C$
  - $2300/2C$
  - $2800/3C$
  - $2800/C^2$
36. If  $d$  and  $n$  are the effective depth and depth of the neutral axis respectively of a singly reinforced beam, the lever arm of the beam, is
- $d$
  - $n$
  - $d + \frac{n}{3}$
  - $d - \frac{n}{3}$
  - $d - \frac{n}{2}$
37. To have pressure wholly compressive under the base of a retaining wall of width  $b$ , the resultant of the weight of the wall and the pressure exerted by the retained, earth should have eccentricity not more than
- $\frac{b}{3}$
  - $\frac{b}{4}$
  - $\frac{b}{5}$
  - $\frac{b}{6}$
  - $\frac{b}{8}$
38. The width of the flange of a T-beam, which may be considered to act effectively with the rib depends upon
- breadth of the rib
  - overall thickness of the rib
  - centre to centre distance between T-beams

- D. span of the T-beam
  - E. all the above.
39. Design of a two way slab simply supported on edges and having no provision to prevent the corners from lifting, is made by
- A. Rankine formula
  - B. Marcus formula
  - C. Rankine Grashoff formula
  - D. Grashoff formula
  - E. Rankine-Marcus formula.
40. Design of R.C.C. simply supported beams carrying U.D.L. is based on the resultant B.M. at
- A. supports      B. mid span      C. every section      D. quarter span.
41. The transverse reinforcements provided at right angles to the main reinforcement
- A. distribute the load
  - B. resist the temperature stresses
  - C. resist the shrinkage stress
  - D. all the above.
42. The amount of reinforcement for main bars in a slab, is based upon
- A. minimum bending moment
  - B. maximum bending moment
  - C. maximum shear force
  - D. minimum shear force.
43. If the effective length of a 32 cm diameter R.C.C. column is 4.40 m, its slenderness ratio, is
- A. 40      B. 45      C. 50      D. 55      E. 60
44. The percentage of minimum reinforcement of the gross sectional area in slabs, is
- A. 0.10%      B. 0.12%      C. 0.15%      D. 0.18%      E. 0.20%
45. A continuous beam shall be deemed to be a deep beam if the ratio of effective span to overall depth, is
- A. 2.5      B. 2.0      C. less than 2      D. less than 2.5
46. If T and R are tread and rise respectively of a stair, then
- A.  $2R + T = 60$       B.  $R + 2T = 60$       C.  $2R + T = 30$       D.  $R + 2T = 30$       E.  $3R + 2T = 30$
47. If k is wobble correction factor,  $\mu$  is coefficient of friction between the duct surface and the curve of tendon of radius R, the tension ratio at a distance x from either end, is

- A.  $1 + kx - \frac{\mu x}{R}$       B.  $1 - kx + \frac{\mu x}{R}$       C.  $1 - kx - \frac{\mu x}{R}$       D.  $1 + kx + \frac{\mu x}{R}$   
 E.  $1 + \frac{k}{R} - \frac{\mu x}{R}$

48. In a prestressed beam carrying an external load  $W$  with a bent tendon is having angle of inclination  $\theta$  and prestressed load  $P$ . The net downward load at the centre is  
 A.  $W - 2P \cos \theta$   
 B.  $W - P \cos \theta$   
 C.  $W - P \sin \theta$   
 D.  $W - 2P \sin \theta$   
 E.  $W + 2P \sin \theta$
49. The effective width of a column strip of a flat slab, is  
 A. one-fourth the width of the panel  
 B. half the width of the panel  
 C. radius of the column  
 D. diameter of the column  
 E. none of these.
50. High strength concrete is used in prestressed member  
 A. to overcome high bearing stresses developed at the ends  
 B. to overcome bursting stresses at the ends  
 C. to provide high bond stresses  
 D. to overcome cracks due to shrinkage  
 E. all the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	C	C	D	C	D	D	C	B	D
10	C	D	B	D	C	D	E	C	D	B
20	A	C	B	D	D	C	B	B	A	A
30	D	D	C	E	C	D	D	E	C	B
40	D	B	D	C	D	A	C	D	B	E



## Section 2

1. A T-beam behaves as a rectangular beam of a width equal to its flange if its neutral axis
  - A. remains within the flange
  - B. remains below the slab
  - C. coincides the geometrical centre of the beam
  - D. none of these.
2. The weight of a foundation is assumed as
  - A. 5% of wall weight
  - B. 7% of wall weight
  - C. 10% of wall weight
  - D. 12% of wall weight
3. The maximum shear stress ( $q_{max}$ ) in a rectangular beam is
  - A. 1.25 times the average
  - B. 1.50 times the average
  - C. 1.75 times the average
  - D. 2.0 times the average
  - E. 2.5 times the average.
4. For stairs spanning horizontally, the minimum waist provided is
  - A. 4 cm
  - B. 6 cm
  - C. 8 cm
  - D. 10 cm
  - E. 12 cm.
5. Total pressure on the vertical face of a retaining wall of height  $h$  acts parallel to free surface and from the base at a distance of
  - A.  $h/4$
  - B.  $h/3$
  - C.  $h/2$
  - D.  $2h/3$
6. If the permissible compressive and tensile stresses in a singly reinforced beam are  $50 \text{ kg/cm}^2$  and  $1400 \text{ kg/cm}^2$  respectively and the modular ratio is 18, the percentage area  $A_t$  of the steel required for an economic section, is
  - A. 0.496%
  - B. 0.596%
  - C. 0.696%
  - D. 0.796%
  - E. none of these.
7. The live load to be considered for an inaccessible roof, is
  - A. Nil
  - B.  $75 \text{ kg/m}^2$
  - C.  $150 \text{ kg/cm}^2$
  - D.  $200 \text{ kg/m}^2$
8. If the maximum shear stress at the end of a simply supported R.C.C. beam of 6 m effective span is  $10 \text{ kg/cm}^2$ , the share stirrups are provided for a distance  $x$  from either end where  $x$  is
  - A. 50 cm
  - B. 100 cm
  - C. 150 cm
  - D. 200 cm
9. The radius of a bar bend to form a hook, should not be less than
  - A. twice the diameter
  - B. thrice the diameter

- C. four times the diameter  
 D. five times the diameter  
 E. none of these.
10. With usual notations the depth of the neutral axis of a balanced section, is given by
- A.  $\frac{mc}{t} = \frac{d-n}{n}$       B.  $t/mc = n/(d-n)$       C.  $\frac{t}{mc} = \frac{d+n}{n}$       D.  $\frac{mc}{t} = \frac{n}{d-n}$
11. In a simply supported slab the minimum spacing of distribution reinforcement, should be four times the effective thickness of the slab or  
 A. 20 cm      B. 30 cm      C. 40 cm      D. 50 cm      E. 60 cm
12. A reinforced concrete cantilever beam is 3.6 m long, 25 cm wide and has its lever arm 40 cm. It carries a load of 1200 kg at its free end and vertical stirrups can carry 1800 kg. Assuming concrete to carry one-third of the diagonal tension and ignoring the weight of the beam, the number of shear stirrups required, is  
 A. 30      B. 35      C. 40      D. 45      E. 50
13. If the sides of a slab simply supported on edges and spanning in two directions are equal, the maximum bending moment is multiplied by  
 A. 0.2      B. 0.3      C. 0.4      D. 0.5      E. 0.7
14. An R.C.C. beam of 25 cm width and 50 cm effective depth has a clear span of 6 metres and carries a U.D.L. of 3000 kg/m inclusive of its self weight. If the lever arm constant for the section is 0.865, the maximum intensity of shear stress, is  
 A. 8.3 kg/cm<sup>2</sup>  
 B. 7.6 kg/cm<sup>2</sup>  
 C. 21.5 kg/cm<sup>2</sup>  
 D. 11.4 kg/cm<sup>2</sup>
15. If the ratio of the span to the overall depth does not exceed 10, the stiffness of the beam will ordinarily be satisfactory in case of a  
 A. simply supported beam  
 B. continuous beam  
 C. cantilever beam  
 D. none of these.
16. The toe projection of foundation slabs is taken  
 A. as one third of the base  
 B. as one sixth of overall height of the wall  
 C. equal to heel slab  
 D. below ground surface.

17. For stairs spanning 1 metres longitudinally between supports at the bottom and top of a flight carrying a load  $w$  per unit horizontal area, the maximum bending moment per metre width, is
- A.  $\frac{wl^2}{4}$       B.  $\frac{wl^2}{8}$       C.  $\frac{wl^2}{10}$       D.  $\frac{wl^2}{12}$       E.  $\frac{wl^2}{16}$
18. Steel beam theory is used for
- A. design of simple steel beams  
 B. steel beams encased in concrete  
 C. doubly reinforced beams ignoring compressive stress in concrete  
 D. beams if shear exceeds 4 times allowable shear stress.
19. The advantage of reinforced concrete, is due to
- A. monolithic character  
 B. fire-resisting and durability  
 C. economy because of less maintenance cost  
 D. moulding in any desired shape  
 E. All the above.
20. The shear reinforcement in R.C.C. is provided to resist
- A. vertical shear  
 B. horizontal shear  
 C. diagonal compression  
 D. diagonal tension.
21. An R.C.C. column of 30 cm diameter is reinforced with 6 bars 12 mm  $\phi$  placed symmetrically along the circumference. If it carries a load of 40, 000 kg axially, the stress is
- A. 49.9 kg/cm<sup>2</sup>  
 B. 100 kg/cm<sup>2</sup>  
 C. 250 kg/cm<sup>2</sup>  
 D. 175 kg/cm<sup>2</sup>
22. According to I.S.: 456, 1978 the thickness of reinforced concrete footing on piles at its edges, is kept less than
- A. 20 cm      B. 30 cm      C. 40 cm      D. 50 cm      E. 75 cm
23. The width of the rib of a T-beam, is generally kept between
- A.  $\frac{1}{7}$  to  $\frac{1}{3}$  of rib depth      B.  $\frac{1}{3}$  to  $\frac{1}{2}$  of rib depth      C.  $\frac{1}{2}$  to  $\frac{3}{4}$  of rib depth  
 D.  $\frac{1}{3}$  to  $\frac{2}{3}$  of rib depth
24. Pick up the true statement from the following:

- A. Plain ceiling provides the best property diffusing light  
 B. In the absence of beams, it is easier to install piping  
 C. In the absence of beams, it is easier to paint  
 D. A flat slab is capable to withstand concentrated loads  
 E. All the above.
25. A pile of length  $L$  carrying a uniformly distributed load  $W$  per metre length is suspended at two points, the maximum, B.M. at the centre of the pile or at the points of suspension, is  
 A.  $\frac{WL}{8}$       B.  $\frac{WL^2}{24}$       C.  $\frac{WL^2}{47}$       D.  $\frac{WL^2}{26}$       E.  $\frac{WL^2}{16}$
26. If bending moment is  $M$ , shear force is  $F$  effective depth is  $d$ , lever arm is  $l_a$  area of reinforcement is  $A_s$  and sum of the circumferences of main reinforcement is  $\phi$ , the bond stress based on working stress method, is  
 A.  $\frac{F}{l_a \phi}$       B.  $\frac{M}{l_a A_s}$       C.  $\frac{M}{d \phi}$       D.  $\frac{F}{A_s \cdot d}$
27. The horizontal portion of a step in a stairs case, is known as  
 A. rise      B. flight      C. winder      D. tread.
28. The length of lap in tension reinforcement should not be less than the bar diameter  $\times$  (actual tension / four times the permissible average bond stress) if it is more than  
 A. 18 bar diameters  
 B. 24 bar diameters  
 C. 30 bar diameters  
 D. 36 bar diameters
29. If  $K$  is a constant depending upon the ratio of the width of the slab to its effective span  $l$ ,  $x$  is the distance of the concentrated load from the nearer support,  $bw$  is the width of the area of contact of the concentrated load measured parallel to the supported edge, the effective width of the slab be is  
 A.  $\frac{K}{x} \left( 1 + \frac{x}{d} \right) + bw$       B.  $Kx \left( 1 - \frac{x}{l} \right) + bw$       C.  $Kx \left( 1 + \frac{x}{l} \right) - bw$   
 D.  $Kx \left( 1 + \frac{x}{l} \right) + bw$       E. All the above.
30. If  $W$  is total load per unit area on a panel,  $D$  is the diameter of the column head,  $L$  is the span in two directions, then the sum of the maximum positive bending moment and average of the negative bending moment for the design of the span of a square flat slab, should

not be less than

- A.  $\frac{WL}{12}\left(L - \frac{2D}{3}\right)^2$       B.  $\frac{WL}{10}\left(L + \frac{2D}{3}\right)^2$       C.  $\frac{WL}{10}\left(L - \frac{2D}{3}\right)^2$   
D.  $\frac{WL}{12}\left(L - \frac{D}{3}\right)^2$

31. Distribution reinforcement in a simply supported slab, is provided to distribute
- load
  - temperature stress
  - shrinkage stress
  - all the above.
32. To ensure that the hogging bending moment at two points of suspension of a pile of length  $L$  equals the sagging moment at its centre, the distances of the points of suspension from either end, is
- $0.107 L$
  - $0.207 L$
  - $0.307 L$
  - $0.407 L$
33. The thickness of the topping of a ribbed slab, varies between
- 3 cm to 5 cm
  - 5 cm to 8 cm
  - 8 cm to 10 cm
  - 12 cm to 15 cm
  - 12 cm to 18 cm
34. To ensure uniform pressure distribution, the thickness of the foundation, is
- kept uniform throughout
  - increased gradually towards the edge
  - decreased gradually towards the edge
  - kept zero at the edge.
35. The maximum ratio of span to depth of a cantilever slab, is
- 8
  - 10
  - 12
  - 14
  - 16
36. Pick up the incorrect statement from the following. The intensity of horizontal shear stress at the elemental part of a beam section, is directly proportional to
- shear force
  - area of the section
  - distance of the C.G. of the area from its neutral axis
  - moment of the beam section about its neutral axis
  - width of the beam.
37. In a singly reinforced beam, the effective depth is measured from its compression edge to
- tensile edge

- B. tensile reinforcement  
C. neutral axis of the beam  
D. longitudinal central axis.
38. If a rectangular prestressed beam of an effective span of 5 meters and carrying a total load 3840 kg/m, is designed by the load balancing method, the central dip of the parabolic tendon should be  
A. 5 cm    B. 10 cm    C. 15 cm    D. 20 cm    E. 25 cm
39. The depth of the centre of gravity ( $\bar{y}$ ) of the resultant compressive stress from the compression edge of the T-beam specified in Q. 13.52 is given by  
A.  $\bar{y} = \frac{3n + 2ds}{2n + ds} \times \frac{ds}{3}$     B.  $\bar{y} = \frac{3n - 2ds}{2n + ds} \times \frac{ds}{3}$     C.  $\bar{y} = \frac{3n + 2ds}{2n - ds} \times \frac{ds}{3}$   
D.  $\bar{y} = \frac{3n - 2ds}{2n - ds} \times \frac{ds}{3}$
40. If the maximum shear stress at the end of a simply supported R.C.C. beam of 16 m effective span is 10 kg/cm<sup>2</sup>, the length of the beam having nominal reinforcement, is  
A. 4 cm    B. 6 m    C. 8 m    D. 10 m
41. If the diameter of longitudinal bars of a square column is 16 mm, the diameter of lateral ties should not be less than  
A. 4 mm    B. 5 mm    C. 6 mm    D. 8 mm    E. 10 mm
42. If the depth of actual neutral axis of a doubly reinforced beam  
A. is greater than the depth of critical neutral axis, the concrete attains its maximum stress earlier  
B. is less than the depth of critical neutral axis, the steel in the tensile zone attains its maximum stress earlier  
C. is equal to the depth of critical neutral axis, the concrete and steel attain their maximum stresses simultaneously  
D. all the above.
43. The length of the straight portion of a bar beyond the end of the hook, should be at least  
A. twice the diameter  
B. thrice the diameter  
C. four times the diameter  
D. five times the diameter  
E. seven times the diameter.
44. A simply supported beam, 6 m long and of effective depth 50 cm, carries a uniformly distributed load 2400 kg/m including its self weight.

If the lever arm factor is 0.85 and permissible tensile stress of steel is 1400 kg/cm<sup>2</sup>, the area of steel required, is

- A. 14 cm<sup>2</sup>    B. 15 cm<sup>2</sup>    C. 16 cm<sup>2</sup>    D. 17 cm<sup>2</sup>    E. 18 cm<sup>2</sup>

45. If  $p_1$  is the vertical intensity of pressure at a depth  $h$  on a block of earth weighing  $w$  per unit volume and the angle of repose  $\phi$ , the lateral intensity of pressure  $p_2$  is

- A.  $\frac{wh(1 - \cos \phi)}{(1 + \sin \phi)}$     B.  $\frac{wh(1 - \sin \phi)}{(1 + \sin \phi)}$     C.  $\frac{wh(1 - \tan \phi)}{(1 + \tan \phi)}$     D.  $\frac{w(1 - \sin \phi)}{h(1 + \sin \phi)}$

46. A pile of length  $L$  carrying a uniformly distributed load  $W$  per metre length is suspended at the centre and from other two points  $0.15 L$  from either end ; the maximum hogging moment will be

- A.  $\frac{WL^2}{15}$     B.  $\frac{WL^2}{30}$     C.  $\frac{WL^2}{60}$     D.  $\frac{WL^2}{90}$     E.  $\frac{WL^2}{120}$

47. Distribution of shear intensity over a rectangular section of a beam, follows :

- A. a circular curve  
B. a straight line  
C. a parabolic curve  
D. an elliptical curve  
E. none of these.

48.  $[A + (m - 1)ASC]$  known as equivalent concrete area of R.C.C. is given by

- A. modular ratio method  
B. load factor method  
C. ultimate load method  
D. none of these.

49. Pick up the incorrect statement from the following: Tensile reinforcement bars of a rectangular beam

- A. are curtailed if not required to resist the bending moment  
B. are bent up at suitable places to serve as shear reinforcement  
C. are bent down at suitable places to serve as shear reinforcement  
D. are maintained at bottom to provide at least local bond stress.

50. The maximum diameter of a bar used in a ribbed slab, is

- A. 12 mm    B. 6 mm    C. 20 mm    D. 22 mm    E. 24 mm

	1	2	3	4	5	6	7	8	9	0
0	A	C	B	E	B	C	B	C	A	D
10	E	C	D	A	C	A	E	C	E	D
20	A	B	D	E	C	A	D	C	B	C
30	D	B	B	C	C	D	B	B	D	C
40	B	D	E	C	B	D	C	A	C	D

**Answer Key**

**Explanation**

6.

Taking Moment of area of tension and compression zone for a singly reinforced beam:



### Section 3

- If permissible working stresses in steel and concrete are respectively 1400 kg/cm<sup>2</sup> and 80 kg/cm<sup>2</sup> and modular ratio is 18, in a beam reinforced in tension side and of width 30 cm and having effective depth 46 cm, the lever arms of the section, is  
A. 37 cm    B. 38 cm    C. 39 cm    D. 40 cm
- If the maximum bending moment of a simply supported slab is M Kg.cm, the effective depth of the slab is (where Q is M.R. factor)  
A.  $\frac{M}{100Q}$     B.  $\frac{M}{10\sqrt{Q}}$     C.  $\sqrt{\frac{M}{Q}}$     D.  $\frac{M}{\sqrt{Q}}$     E.  $\sqrt{\frac{M}{100Q}}$
- Though the effective depth of a T-beam is the distance between the top compression edge to the centre of the tensile reinforcement, for heavy loads, it is taken as  
A.  $\frac{1}{8}$  th of span    B.  $\frac{1}{10}$  th of span    C.  $\frac{1}{12}$  th of span    D.  $\frac{1}{16}$  th of span  
E.  $\frac{1}{20}$  th of span
- Design of R.C.C. cantilever beams, is based on the resultant force at  
A. fixed end  
B. free end  
C. mid span  
D. mid span and fixed support.
- If the length of a wall on either side of a lintel opening is at least half of its effective span L, the load W carried by the lintel is equivalent to the weight of brickwork contained in an equilateral triangle, producing a maximum bending moment  
A.  $\frac{WL}{2}$     B.  $\frac{WL}{4}$     C.  $\frac{WL}{6}$     D.  $\frac{WL}{8}$     E.  $\frac{WL}{12}$
- Piles are usually driven by  
A. diesel operated hammer  
B. drop hammer  
C. single acting steam hammer  
D. all the above.
- In favourable circumstances a 15 cm concrete cube after 28 days, attains a maximum crushing strength  
A. 100 kg/cm<sup>2</sup>    B. 200 kg/cm<sup>2</sup>    C. 300 kg/cm<sup>2</sup>    D. 400 kg/cm<sup>2</sup>    E. 500 kg/cm<sup>2</sup>

8. The angle of internal friction of soil mass is the angle whose
  - A. tangent is equal to the rate of the maximum resistance to sliding on any internal inclined plane to the normal pressure acting on the plane
  - B. sine is equal to the ratio of the maximum resistance to sliding on any internal inclined plane to the normal pressure acting on the plane
  - C. cosine is equal to the ratio of the maximum resistance sliding on any internal inclined plane to the normal pressure acting on the plane
  - D. none of these.
9. The anchorage value of a hook is assumed sixteen times the diameter of the bar if the angle of the bend, is
  - A.  $30^\circ$
  - B.  $40^\circ$
  - C.  $45^\circ$
  - D.  $60^\circ$
  - E. all the above.
10. Top bars are extended to the projecting parts of the combined footing of two columns  $L$  distance apart for a distance of
  - A.  $0.1 L$  from the outer edge of column
  - B.  $0.1 L$  from the centre edge of column
  - C. half the distance of projection
  - D. one-fourth the distance of projection.
11. According to the steel beam theory of doubly reinforced beams
  - A. tension is resisted by tension steel
  - B. compression is resisted by compression steel
  - C. stress in tension steel equals the stress in compression steel
  - D. no stress is developed in compression concrete as well as in tension concrete
  - E. all the above.
12. The thickness of the flange of a Tee beam of a ribbed slab is assumed as
  - A. width of the rib
  - B. depth of the rib
  - C. thickness of the concrete topping  $0d$ ) half the thickness of the rib
  - D. twice the width of the rib.
13. In a singly reinforced beam, if the permissible stress in concrete reaches earlier than that in steel, the beam section is called
  - A. under-reinforced section
  - B. over reinforced section
  - C. economic section

- D. critical section.
14. The length of the lap in a compression member is kept greater than bar diameter  $x$  (Permissible stress in bar / Five times the bond stress) or  
 or  
 A. 12 bar diameters  
 B. 18 bar diameters  
 C. 24 bar diameters  
 D. 30 bar diameters  
 E. 36 bar diameters
15. If  $A_t$  is the gross area of steel in tension,  $d$  is the effective depth of the beam and  $y$  is the depth of the centre of gravity of the resultant compression, the moment of resistance  $M$  of the beam, is given by  
 A.  $M = A_t(d - y)$   
 B.  $M = A_t f(d - y)$   
 C.  $M = A_t f(d + y)$   
 D.  $M = \frac{A_t \cdot f}{(d - \bar{y})}$   
 E. none of these.
16. A pre-stressed concrete member  
 A. is made of concrete  
 B. is made of reinforced concrete  
 C. is stressed after casting  
 D. possesses internal stresses.
17. A part of the slab may be considered as the flange of the T-beam if  
 A. flange has adequate reinforcement transverse to beam  
 B. it is built integrally with the beam  
 C. it is effectively bonded together with the beam  
 D. all the above.
18. An R.C.C. roof slab is designed as a two way slab if  
 A. it supports live loads in both directions  
 B. the ratio of spans in two directions is less than 2  
 C. the slab is continuous over two supports  
 D. the slab is discontinuous at edges.
19. If  $C$  is creep coefficient,  $f$  is original prestress in concrete,  $m$  is modular ratio,  $E$  is Young's modulus of steel and  $e$  is shrinkage strain, the combined effect of creep and shrinkage is:  
 A.  $(1 - C)m f - eE$       B.  $(C - 1)m f + eE$       C.  $(C - 1)m f - eE$   
 D.  $(1 - C)m f + eE$

20. In a combined footing for two columns carrying unequal loads, the maximum hogging bending moment occurs at
- less loaded column
  - more loaded column
  - a point equidistant from either column
  - a point of the maximum shear force
  - a point of zero shear force.
21. A raft foundation is provided if its area exceeds the plan area of the building by
- 10%
  - 20%
  - 30%
  - 40%
  - 50%
22. The Total pressure on the vertical face of a retaining wall of height  $h$  exerted by the retained earth weighing  $w$  per unit volume having an angle of surcharge  $\alpha^\circ$ , is :
- $$wh \cos \alpha \frac{\cos \alpha - \sqrt{\cos^2 \alpha - \cos^2 \phi}}{\cos \alpha + \sqrt{\cos^2 \alpha - \cos^2 \phi}}$$
  - $$wh^2 \cos \alpha \frac{\cos \alpha - \sqrt{\cos^2 \alpha - \cos^2 \phi}}{\cos \alpha + \sqrt{\cos^2 \alpha + \cos^2 \phi}}$$
  - $$\frac{wh^2}{2} \cos \alpha \frac{\cos \alpha - \sqrt{\cos^2 \alpha - \cos^2 \phi}}{\cos \alpha + \sqrt{\cos^2 \alpha + \cos^2 \phi}}$$
  - $$\frac{wh^2}{3} \cos \alpha \frac{\cos \alpha - \sqrt{\cos^2 \alpha - \cos^2 \phi}}{\cos \alpha - \sqrt{\cos^2 \alpha - \cos^2 \phi}}$$
23. If  $H$  is the overall height of a retaining wall retaining a surcharge, the width of the base slab usually provided, is
- 0.3  $H$
  - 0.4  $H$
  - 0.5  $H$
  - 0.6  $H$
  - 0.7  $H$
24. The stem of a cantilever retaining wall which retains earth level with top is 6 m. If the angle of repose and weight of the soil per cubic metre are  $30^\circ$  and 2000 kg respectively, the effective width of the stem at the bottom, is
- 51.5
  - 52.5
  - 53.5
  - 54.5
  - 55.5
25. If depth of slab is 10 cm, width of web 30 cm, depth of web 50 cm, centre to centre distance of beams 3 m, effective span of beams 6 m, the effective flange width of the beam, is
- 200 cm
  - 300 cm
  - 150 cm
  - 100 cm
26. In a combined footing if shear stress does not exceed 5 kg/cm<sup>2</sup>, the nominal stirrups provided are
- 6 legged
  - 8 legged
  - 10 legged
  - 12 legged
  - none of these.

27. A flat slab is supported
- on beams
  - on columns
  - on beams and columns
  - on columns monolithically built with slab
  - all the above
28. A singly reinforced beam has breadth  $b$ , effective depth  $d$ , depth of neutral axis  $n$  and critical neutral axis  $n_1$ . If  $f_c$  and  $f_t$  are permissible compressive and tensile stresses, the moment to resistance of the beam, is
- $bn \frac{f_c}{2} \left( d - \frac{n}{3} \right)$
  - $Atf_t \left( d - \frac{n}{3} \right)$
  - $\frac{1}{2} n_1 \left( 1 - \frac{n_1}{3} \right) cbd^2$
  - all the above
29. If diameter of a reinforcement bar is  $d$ , the anchorage value of the hook is
- $4d$
  - $8d$
  - $12d$
  - $16d$
  - none of these.
30. Minimum spacing between horizontal parallel reinforcement of different sizes, should not be less than
- one diameter of thinner bar
  - one diameter of thicker bar
  - sum of the diameters of thinner and thicker bars
  - twice the diameter of thinner bar
  - none of these.
31. If the size of a column is reduced above the floor, the main bars of the columns, are
- continued up
  - bent inward at the floor level
  - stopped just below the floor level and separate lap bars provided
  - all the above.
32. The system in which high tensile alloy steel bars (silica manganese steel) are used as prestressing tendons, is known as
- Freyssinet system
  - Magnel-Blaton system
  - C.C.L. standard system
  - Lee-McCall system.
33. The minimum clear cover for R.C.C. columns shall be
- greater of 40 mm or diameter

- B. smaller of 40 mm or diameter  
 C. greater of 25 mm or diameter  
 D. smaller of 25 mm or diameter
34. If  $j d$  is the lever arm and  $\Sigma O$  is the total perimeter of reinforcement of an R.C.C. beam, the bond stress at the section having  $Q$  shear force, is
- A.  $\frac{Q}{2jd\Sigma O}$     B.  $\frac{Q}{3jd\Sigma O}$     C.  $\frac{Q}{jd\Sigma O}$     D.  $2 \frac{Q}{jd\Sigma O}$
35. If the loading on a prestressed rectangular beam, is uniformly distributed, the tendon to be provided should be .
- A. straight below centroidal axis  
 B. parabolic with convexity downward  
 C. parabolic with convexity upward  
 D. straight above centroidal axis  
 E. none of these.
36. The live load to be considered for an accessible roof, is
- A. Nil    B.  $75 \text{ kg/m}^3$     C.  $150 \text{ kg/m}^2$     D.  $200 \text{ kg/cm}^2$
37. A foundation is called shallow if its depth, is
- A. one-fourth of its width  
 B. half of its width  
 C. three-fourth of its width  
 D. equal to its width  
 E. all the above.
38. A circular slab subjected to external loading, deflects to form a
- A. semi-hemisphere  
 B. ellipsoid  
 C. paraboloid  
 D. none of these.
39. An R.C.C beam of 25 cm width has a clear span of 5 metres and carries a U.D.L. of  $2000 \text{ kg/m}$  inclusive of its self weight. If the lever arm of the section is 45 cm., the beam is
- A. safe in shear  
 B. is safe with stirrups  
 C. is safe with stirrups and inclined members  
 D. needs revision of the section.
40. In a doubly-reinforced beam if  $c$  and  $t$  are stresses in concrete and tension reinforcement,  $d$  is the effective depth and  $n$  is depth of critical neutral axis  $n$ , the following relationship holds good

A.  $\frac{mc}{t} = \frac{n}{d-n}$       B.  $\frac{m+c}{t} = \frac{n}{d+n}$       C.  $\frac{t+c}{m} = \frac{d+n}{n}$       D.  $\frac{mc}{t} = \frac{d-n}{t}$   
 E.  $\frac{m}{t+c} = \frac{n}{d-n}$

41. In testing a pile by load test, pile platform is loaded with one and half times the design load and a maximum settlement is noted. The load is gradually removed and the consequent rebound is measured. For a safe pile, the net settlement (i.e. total settlement minus rebound) per tonne of test load should not exceed  
 A. 10 mm      B. 15 mm      C. 20 mm      D. 25 mm      E. 30 mm

42. If the shear stress in a R.C.C. beam is  
 A. equal or less than 5 kg/cm<sup>2</sup>, no shear reinforcement is provided  
 B. greater than 4 kg/cm<sup>2</sup>, but less than 20 kg/cm<sup>2</sup>, shear reinforcement is provided  
 C. greater than 20 kg/cm<sup>2</sup>, the size of the section is changed  
 D. all the above.

43. If  $S_b$  is the average bond stress on a bar of diameter  $d$  subjected to maximum stress  $t$ , the length of the embedment  $l$  is given by

A.  $l = \frac{dt}{S_b}$       B.  $l = \frac{dt}{2S_b}$       C.  $l = \frac{dt}{3S_b}$       D.  $l = \frac{dt}{4S_b}$       E.  $l = \frac{dt}{5S_b}$

44. On piles, the drop must be at least  
 A. 80 cm      B. 100 cm      C. 120 cm      D. 140 cm      E. 150 cm

45. The maximum shear stress ( $q$ ) in concrete of a reinforced cement concrete beam is

A.  $\frac{\text{Shear force}}{\text{Lever arm} \times \text{Width}}$       B.  $\frac{\text{Lever arm}}{\text{Shear force} \times \text{Width}}$       C.  $\frac{\text{Width}}{\text{Lever arm} \times \text{Shear force}}$   
 D.  $\frac{\text{Shear force} \times \text{Width}}{\text{Lever arm}}$       E.  $\frac{\text{Lever arm} \times \text{Width}}{\text{Shear force}}$

46. An under-reinforced section means

- A. Steel is provided at the under side only  
 B. Steel provided is insufficient  
 C. Steel provided on one face only  
 D. Steel will yield first.

47. The spacing of transverse reinforcement of column is decided by the following consideration.

- A. The least lateral dimension of the column  
 B. Sixteen times the diameter of the smallest longitudinal reinforcing rods in the column  
 C. Forty-eight times the diameter of transverse reinforcement  
 D. All the above.
48. P is the prestressed force applied to the tendon of a rectangular pre-stressed beam whose area of cross section is A and sectional modulus is Z. The maximum stress f in the beam, subjected to a maximum bending moment M, is
- A.  $f = \frac{P}{A} + \frac{Z}{M}$       B.  $f = \frac{A}{P} + \frac{M}{Z}$       C.  $f = \frac{P}{A} + \frac{M}{Z}$       D.  $f = \frac{P}{A} + \frac{M}{6Z}$   
 E.  $f = \frac{P}{A} - \frac{M}{6Z}$
49. If d is the diameter of a bar,  $f_t$  is allowable tensile stress and  $f_b$ , is allowable bond stress, the bond length is given by
- A.  $\frac{f_t \cdot d}{4f_b}$       B.  $\frac{\pi}{4} \cdot \frac{f_t \cdot d}{f_b}$       C.  $\frac{\pi f_t \cdot d^2}{f_b}$       D.  $\frac{\pi}{4} \cdot \frac{f_t \cdot d^3}{f_b}$
50. The diameter of transverse reinforcement of columns should be equal to one-fourth of the diameter of the main steel rods but not less than
- A. 4 mm      B. 5 mm      C. 6 mm      D. 7 mm      E. 8 mm

Answer Key

	1	2	3	4	5	6	7	8	9	0
0	D	E	C	A	C	D	D	A	E	B
10	E	C	B	C	C	D	D	B	B	E
20	E	C	E	C	C	B	D	D	D	B
30	D	D	C	C	B	C	D	C	A	A
40	D	D	D	C	A	D	D	C	A	D



## Section 4

1. After prestressing process is completed, a loss of stress is due to
  - A. shrinkage of concrete
  - B. elastic shortening of concrete
  - C. creep of concrete
  - D. creep of steel
  - E. all the above.
2. The minimum head room over a stair must be
  - A. 200 cm
  - B. 205 cm
  - C. 210 cm
  - D. 200 cm
  - E. 230 cm
3. In case the factor of safety against sliding is less than 1.5, a portion of slab is constructed downwards at the end of the heel slab, which is known as
  - A. a key
  - B. a cut-off wall
  - C. a rib
  - D. all the above.
4. The diameter of the column head support a flat slab, is generally kept
  - A. 0.25 times the span length
  - B. 0.25 times the diameter of the column
  - C. 4.0 cm larger than the diameter of the column
  - D. 5.0 cm larger than the diameter of the column
  - E. none of these.
5. The steel generally used in R.C.C. work, is
  - A. stainless
  - B. mildsteel
  - C. high carbon steel
  - D. high tension steel.
6. Pick up the correct statement from the following:
  - A. Lateral reinforcement in R.C.C. columns is provided to prevent the longitudinal reinforcement from buckling
  - B. Lateral reinforcement prevents the shearing of concrete on diagonal plane
  - C. Lateral reinforcement stops breaking away of concrete cover, due to buckling
  - D. Lateral reinforcement in R.C.C. columns, is kept not less than 5 mm diameter
  - E. All the above.
7. The allowable tensile stress in mild steel stirrups, reinforced cement concrete, is
  - A.  $1400 \text{ kg/cm}^2$

- B.  $190 \text{ kg/cm}^2$   
 C.  $260 \text{ kg/cm}^2$   
 D.  $230 \text{ kg/cm}^2$
8. If longitudinally spanning stairs are casted along with their landings, the maximum bending moment per metre width, is taken as  
 A.  $\frac{wl^2}{4}$     B.  $\frac{wl^2}{8}$     C.  $\frac{wl^2}{10}$     D.  $\frac{wl^2}{12}$     E.  $\frac{wl^2}{16}$
9. If A is the sectional area of a prestressed rectangular beam provided with a tendon prestressed by a force P through its centroidal longitudinal axis, the compressive stress in concrete, is  
 A.  $\frac{P}{A}$     B.  $\frac{A}{P}$     C.  $\frac{P}{2A}$     D.  $\frac{2A}{P}$     E.  $\frac{3A}{P}$
10. According to I.S.: 456, 1978 the thickness of reinforced concrete footing on piles at its edges, is kept less than  
 A. 5 cm    B. 10 cm    C. 15 cm    D. 20 cm    E. 25 cm
11. The self-weight of the footing, is  
 A. not considered for calculating the upward pressure on footing  
 B. also considered for calculating the upward pressure on footing  
 C. not considered for calculating the area of the footing  
 D. both (b) and (c)
12. For normal cases, stiffness of a simply supported beam is satisfied if the ratio of its span to its overall depth does not exceed  
 A. 10    B. 15    C. 20    D. 25    E. 30
13. If the length of an intermediate span of a continuous slab is 5m, the length of the end span is kept  
 A. 4.5 m    B. 4.0 m    C. 3.5 m    D. 3.0 m    E. none of these.
14. If  $M_d$  and  $M_t$  are the maximum bending moments due to dead load and live load respectively and F is the total effective pressure, for a balanced design of a prestressed concrete beam of steel, is  
 A.  $e = \frac{M_d}{F} + \frac{M_t}{2F}$     B.  $e = \frac{M_d}{2F} + \frac{M_t}{F}$     C.  $e = \frac{M_d}{2F} + \frac{M_t}{3F}$     D.  $e = \frac{M_t}{3F} + \frac{M_d}{2F}$
15. The floor slab of a building is supported on reinforced cement floor beams. The ratio of the end and intermediate spans is kept  
 A. 0.7    B. 0.8    C. 0.9    D. 0.6    E. none of these.
16. If  $p_1$  and  $p_2$  are effective lateral loadings at the bottom and top exerted by a level earth subjected to a superload on the vertical face of height h of a retaining wall, the horizontal pressure p per unit length of the

wall, is

- A.  $\frac{\rho_1 - \rho_2}{2} h$       B.  $\frac{\rho_1 + \rho_2}{4} h$       C.  $\frac{\rho_1 + \rho_2}{2} h$       D.  $(\rho_1 - \rho_2) \frac{2}{3} h$

17. Lapped splices in tensile reinforcement are generally not used for bars of size larger than  
 A. 18 mm diameter      B. 24 mm diameter      C. 30 mm diameter  
 D. 36 mm diameter      E. 32 mm diameter
18. An R.C.C. beam of 6 m span is 30 cm wide and has a lever arm of 55 cm. If it carries a U.D.L. of 12 t per m and allowable shear stress is 5 kg/cm<sup>2</sup>, the beam  
 A. is safe in shear  
 B. is safe with stirrups  
 C. is safe with stirrups and inclined bars  
 D. needs revision of section
19. In a slab, the pitch of the main reinforcement should not exceed its effective depth  
 A. three times      B. four times      C. five times      D. two times.
20. The modular ratio  $m$  of a concrete whose permissible compressive stress is  $C$ , may be obtained from the equation.  
 A.  $m = \frac{700}{3C}$       B.  $m = \frac{1400}{3C}$       C.  $m = \frac{2800}{3C}$       D.  $m = \frac{3500}{3C}$   
 E.  $m = \frac{2300}{3C}$
21. In a prestressed member it is advisable to use  
 A. low strength concrete only  
 B. high strength concrete only  
 C. low strength concrete but high tensile steel  
 D. high strength concrete and high tensile steel  
 E. high strength concrete but low tensile steel
22. The ratio of the breadth to effective depth of a beam is kept  
 A. 0.25      B. 0.50      C. 0.70      D. 0.75      E. none of these.
23. Spacing of stirrups in a rectangular beam, is  
 A. kept constant throughout the length  
 B. decreased towards the centre of the beam  
 C. increased at the ends  
 D. increased at the centre of the beam.
24. If the width of the foundation for two equal columns is restricted, the shape of the footing generally adopted, is  
 A. square      B. rectangular      C. trapezoidal      D. triangular.

25. If permissible compressive stress in concrete is 50 kg/cm<sup>2</sup>, tensile stress in steel is 1400 kg/cm<sup>2</sup> and modular ratio is 18, the depth  $d$  of the beam, is

A.  $\sqrt{d = \frac{0.11765 \times \text{B.M}}{\text{breadth}}}$       B.  $\sqrt{d = \frac{0.22765 \times \text{B.M}}{\text{breadth}}}$       C.  $\sqrt{d = \frac{0.33765 \times \text{B.M}}{\text{breadth}}}$

D.  $\sqrt{d = \frac{0.44765 \times \text{B.M}}{\text{breadth}}}$       E.  $\sqrt{d = \frac{0.55765 \times \text{B.M}}{\text{breadth}}}$

26. For a continuous floor slab supported on beams, the ratio of end span length and intermediate span length, is

A. 0.6      B. 0.7      C. 0.8      D. 0.9

27. Steel bars are generally connected together to get greater length than the standard length by providing

- A. straight bar splice  
B. hooked splice  
C. dowel splice  
D. all the above

28. Long and short spans of a two way slab are  $l_y$  and  $l_x$  and load on the slab acting on strips parallel to  $l_x$  and  $l_y$  be  $w_x$  and  $w_y$  respectively. According to Rankine Grashoff theory

A.  $\frac{w_x}{w_y} = \frac{l_y}{l_x}$       B.  $\frac{w_x}{w_y} = \left(\frac{l_y}{l_x}\right)^3$       C.  $\frac{w_x}{w_y} = \left(\frac{l_y}{l_x}\right)^3$       D.  $\frac{w_x}{w_y} = \left(\frac{l_y}{l_x}\right)^4$

E. none of these.

29. If  $p$  is the net upward pressure on a square footing of side  $b$  for a square column of side  $a$ , the maximum bending moment is given by

A.  $\text{B.M} = \frac{pb(c-a)}{4}$       B.  $\text{B.M} = \frac{pb(b-a)^2}{4}$       C.  $\text{B.M} = \frac{pb(b-a)^2}{8}$

D.  $\text{B.M} = \frac{pb(b+a)}{8}$

30. By over-reinforcing a beam, the moment of resistance can be increased not more than

A. 10%      B. 15%      C. 20%      D. 25%

31. The minimum thickness of a flat slab is taken

- A. 13 cm  
B.  $L/32$  for end panels without drops  
C.  $L/36$  for end panels without drops  
D.  $L/36$  for interior panels without drop

- E. all the above.
32. According to I.S. : 456, slabs which span in two directions with corners held down, are assumed to be divided in each direction into middle strips and edge strips such that the width of the middle strip, is
- half of the width of the slab
  - two-third of the width of the slab
  - three-fourth of the width of the slab
  - four-fifth of the width of the slab
  - three-fifth of the width of the slab.
33. Minimum spacing between horizontal parallel reinforcement of the same size should not be less than
- one diameter
  - 2.5 diameters
  - 3 diameters
  - 3.5 diameters
  - 4 diameters
34. Columns may be made of plain concrete if their unsupported lengths do not exceed their least lateral dimension
- two times
  - three times
  - four times
  - five times
  - six times.
35. An R.C.C. column is treated as short column if its slenderness ratio is less than
- 30
  - 35
  - 40
  - 50
  - 60
36. If the tendon is placed at an eccentricity  $e$  below the centroidal axis of the longitudinal axis of a rectangular beam (sectional modulus  $Z$  and stressed load  $P$  in tendon) the stress at the extreme top edge
- is increased by  $\frac{PZ}{e}$
  - is increased by  $\frac{Pe}{Z}$
  - is decreased by  $\frac{Pe}{Z}$
  - remains unchanged.
37. The maximum ratio of span to depth of a slab simply supported and spanning in one direction, is
- 35
  - 25
  - 30
  - 20
  - 15
38. If  $A_c$ ,  $A_{sc}$  and  $A$  are areas of concrete, longitudinal steel and section of a R.C.C. column and  $m$  and  $\sigma_c$  are the modular ratio and maximum stress in the configuration of concrete, the strength of column is
- $\sigma_c A_c + m \sigma_c A_{sc}$
  - $\sigma_c (A - A_{sc}) + m \sigma_c A_{sc}$

- C.  $\sigma c[A + (m - 1)ASC]$   
D. all the above.
39. The load stress of a section can be reduced by  
A. decreasing the lever arm  
B. increasing the total perimeter of bars  
C. replacing larger bars by greater number of small bars  
D. replacing smaller bars by greater number of greater bars  
E. none of these.
40. If W is the load on a circular slab of radius R, the maximum radial moment at the centre of the slab, is  
A.  $\frac{WR^2}{16}$       B.  $\frac{2WR^2}{16}$       C.  $\frac{3WR^2}{16}$       D.  $\frac{5WR^2}{16}$
41. For M 150 grade concrete (1:2:4) the moment of resistance factor is  
A. 0.87      B. 8.50      C. 7.50      D. 5.80      E. none of these.
42. For a ribbed slab  
A. clear spacing between ribs shall not be greater than 4.5 cm  
B. width of the rib shall not be less than 7.5 cm  
C. overall depth of the slab shall not exceed four times the breadth of the rib  
D. all the above.
43. A pile weighing  $W_1$  kg penetrates S metres with its last blow. If  $W_2$  is the weight of the hammer having a drop of H metres, the pile can carry a maximum external load  
A.  $\frac{W_1^2}{W_1+W_2} \cdot \frac{H}{S} + W_1 \text{kg}$       B.  $\frac{W_2^2}{W_1+W_2} \cdot \frac{H}{S} + W_2 \text{kg}$       C.  $\frac{W_1^2}{W_1-W_2} \cdot \frac{H}{S} + W_1 \text{kg}$   
D.  $\frac{W_2^2}{W_1+W_2} \cdot \frac{H}{S} - W_2 \text{kg}$
44. The maximum ratio of span to depth of a slab simply supported and spanning in two directions, is  
A. 25      B. 30      C. 35      D. 40      E. 15
45. The neutral axis of a T-beam exists  
A. within the flange  
B. at the bottom edge of the slab  
C. below the slab  
D. all the above.

46. A pre-stressed concrete member is preferred because
- its dimensions are not decided from the diagonal tensile stress
  - large size of long beams carrying large shear force need not be adopted
  - removal of cracks in the members due to shrinkage
  - all the above.
47. If  $W$  is the uniformly distributed load on a circular slab of radius  $R$  fixed at its ends, the maximum positive radial moment at its centre, is
- $\frac{3WR^2}{16}$
  - $\frac{2WR^2}{16}$
  - $\frac{WR^2}{16}$
  - zero
  - none of these.
48. If  $p_1$  and  $p_2$  are mutually perpendicular principal stresses acting on a soil mass, the normal stress on any plane inclined at angle  $\theta^\circ$  to the principal plane carrying the principal stress  $p_1$ , is :
- $\frac{p_1 - p_2}{2} + \frac{p_1 + p_2}{2} \sin 2\theta$
  - $\frac{p_1 - p_2}{2} + \frac{p_1 + p_2}{2} \cos 2\theta$
  - $\frac{p_1 + p_2}{2} + \frac{p_1 - p_2}{2} \cos 2\theta$
  - $\frac{p_1 + p_2}{2} + \frac{p_1 - p_2}{2} \sin 2\theta$
  - $\frac{p_1 + p_2}{2} + \frac{p_1 - p_2}{2} \tan 2\theta$
49. A very comfortable type of stairs is
- straight
  - dog legged
  - geometrical
  - open newel.
50. If the neutral axis of a T-beam is below the slab, the relationship between the flange width  $B$ , depth of neutral axis  $n$ , thickness of the slab  $ds$ , effective depth of the beam  $d$ , gross area of tensile steel  $At$  and the modular ratio  $m$  may be stated as
- $Bds \left( n - \frac{ds}{2} \right) = mAt(d + n)$
  - $Bds \left( n + \frac{ds}{2} \right) = mAt(d - n)$
  - $Bds \left( n - \frac{ds}{2} \right) = mAt(d - n)$
  - $Bds(n - ds) = mAt(d - n)$

	1	2	3	4	5	6	7	8	9	0
0	E	C	D	A	B	E	A	B	A	C
10	A	C	A	B	C	C	D	D	A	C
20	D	B	D	B	A	D	D	D	C	D
30	E	C	A	C	D	C	C	D	C	C
40	B	D	B	C	D	D	C	C	D	C

**Answer Key**



## Section 5

- A ribbed slab is provided for
  - a plain ceiling
  - thermal insulation
  - acoustic insulation
  - all the above.
- For a number of columns constructed in a rcjw, the type of foundation provided, is
  - footing
  - raft
  - strap
  - strip
  - a combination of the above.
- As the percentage of steel increases
  - depth of neutral axis decreases
  - depth of neutral axis increases
  - lever arm increases
  - lever arm decreases
  - none of these.
- If W is weight of a retaining wall and P is the horizontal earth pressure, the factor of safety against sliding, is
 

A. 1.0    B. 1.25    C. 1.5    D. 2.0    E. 2.5
- If q is the punching shear resistance per unit area a, is the side of a square footing for a column of side b, carrying a weight W including the weight of the footing, the depth (D) of the footing from punching shear consideration, is
 

A.  $D = \frac{W(a - b)}{4a^2bq}$     B.  $D = \frac{W(a^2 - b^2)}{4a^2bq}$     C.  $D = \frac{W(a^2 - b^2)}{8a^2bq}$     D.  $\frac{W(a^2 - b^2)}{4abq}$
- Based on punching shear consideration, the overall depth of a combined footing under a column A, is

$$\frac{\text{Area of the column A} \times \text{Safe punching stress}}{\text{Load on column A}}$$

A.

$$\frac{\text{Perimeter of column A} \times \text{Safe punching stress}}{\text{Load on column A} + \text{Upward pressure} \times \text{Area of column}}$$

B.

$$\frac{\text{Perimeter of column } A \times \text{Safe punching stress}}{\text{Load on column } A \times \text{Upward pressure} \times \text{Area of column}}$$

- C.
- D. None of these.
7. An intermediate T-beam reinforced with two layers of tensile steel with clear cover 13 cm encasted with the floor of a hall 12 metres by 7 metres, is spaced at 3 metres from adjoining beams and if the width of the beam is 20 cm, the breadth of the flange is  
 A. 300 cm    B. 233 cm    C. 176 cm    D. 236 cm    E. 255 cm
8. Pick up the assumption for the design of a prestressed concrete member from the following :  
 A. A transverse plane section remains a plane after bending  
 B. During deformation limits, Hook's law is equally applicable to concrete as well as to steel  
 C. Variation of stress in reinforcement due to changes in external loading is negligible  
 D. All the above.
9. If the diameter of the main reinforcement in a slab is 16 mm, the concrete cover to main bars is  
 A. 12 mm    B. 13 mm    C. 14 mm    D. 15 mm    E. 16 mm
10. Side face reinforcement shall be provided in the beam when depth of the web in a beam exceeds  
 A. 50 cm    B. 75 cm    C. 100 cm    D. 120 cm
11. The stresses developed in concrete and steel in reinforced concrete beam 25 cm width and 70 cm effective depth, are 62.5 kg/cm<sup>2</sup> and 250 kg/cm<sup>2</sup> respectively. If  $m = 15$ , the depth of its neutral axis is  
 A. 20 cm    B. 25 cm    C. 30 cm    D. 35 cm    E. 40 cm
12. If the ratio of long and short spans of a two way slab with corners held down is  $r$ , the actual reduction of B.M. is given by  
 A.  $\frac{5}{6} \frac{r}{1+r^2} M$     B.  $\frac{5}{6} \frac{r^2}{1+r^2} M$     C.  $\frac{5}{6} \frac{r^2}{1+r^3} M$     D.  $\frac{5}{6} \frac{r^2}{1+r^4} M$   
 E. none of these.
13. The angle of repose of a soil is the maximum angle which the outer face of the soil mass makes  
 A. with the horizontal  
 B. with the vertical  
 C. with the perpendicular to. the inclined plane of the soil  
 D. none of these.

14. A column is regarded as long column if the ratio of its effective length and lateral dimension, exceeds  
 A. 10      B. 15      C. 20      D. 25      E. 30
15. Enlarged head of a supporting column of a flat slabs is technically known as  
 A. supporting end of the column  
 B. top of the column  
 C. capital  
 D. drop panel  
 E. none of these.
16. If the length of a combined footing for two columns  $l$  metres apart is  $L$  and the projection on the left side of the exterior column is  $x$ , then the projection  $y$  on the right side of the exterior column, in order to have a uniformly distributed load, is (where  $x$  is the distance of centre of gravity of column loads).  
 A.  $y = L - (l - x)$   
 B.  $y = \frac{L}{2} + (l - \bar{x})$   
 C.  $y = \frac{L}{2} - (l + \bar{x})$   
 D.  $y = \frac{L}{2} - (l - \bar{x})$
17. The section of a reinforced beam where most distant concrete fibre in compression and tension in steel attains permissible stresses simultaneously, is called  
 A. balanced section  
 B. economic section  
 C. critical section  
 D. all the above.
18. The width of the flange of a L-beam, should be less than  
 A. one-sixth of the effective span  
 B. breadth of the rib + four times thickness of the slab  
 C. breadth of the rib + half clear distance between ribs  
 D. least of the above.
19. If the maximum dip of a parabolic tendon carrying tension  $P$  is  $h$  and the effective length of the prestressed beam is  $L$ , the upward uniform

pressure will be

- A.  $\frac{8hP}{l}$       B.  $\frac{8hP}{l^2}$       C.  $\frac{8hl}{P}$       D.  $\frac{8hl}{P^2}$       E.  $\frac{3hl}{P}$

20. A singly reinforced concrete beam of 25 cm width and 70 cm effective depth is provided with 18.75 cm<sup>2</sup> steel. If the modular ratio (m) is 15, the depth of the neutral axis, is  
A. 20 cm      B. 25 cm      C. 30 cm      D. 35 cm      E. 40 cm
21. The weight of reinforced concrete, is generally taken as  
A. 2200 kg/m<sup>3</sup>      B. 2300 kg/m<sup>3</sup>      C. 2400 kg/m<sup>3</sup>      D. 2500 kg/m<sup>3</sup>      E. 2800 kg/m<sup>3</sup>
22. Total pressure on the vertical face of a retaining wall of height h per unit run exerted by the retained earth weighing w per unit volume, is  
A.  $wh \frac{(1 - \sin \phi)}{(1 + \sin \phi)}$       B.  $wh^2 \frac{(1 - \sin \phi)}{(1 + \sin \phi)}$       C.  $\frac{wh^2(1 - \sin \phi)}{2(1 + \sin \phi)}$   
D.  $\frac{wh^2(1 - \sin \phi)}{3(1 + \sin \phi)}$
23. The zone in which transverse bending is likely to occur may be obtained by drawing a line from the faces of the column making an angle  $\theta^\circ$  with horizontal where  $\theta^\circ$  is  
A. 30°      B. 45°      C. 60°      D. none of these.
24. If P kg/m<sup>2</sup> is the upward pressure on the slab of a plain concrete footing whose projection on either side of the wall is a cm, the depth of foundation D is given by  
A.  $D = 0.00775 aP$   
B.  $D = 0.0775 aP$   
C.  $D = 0.07775 aP$   
D.  $D = 0.775 Pa$
25. According to load factor method, the permissible load W on a short column reinforced with longitudinal bars and lateral stirrups, is  
A. Stress in concrete x area of concrete  
B. Stress in steel x area of steel  
C. Stress in concrete x area of concrete + Stress in steel x area of steel  
D. None of these.
26. If A is the area of the foundation of a retaining wall carrying a load W and retaining earth of weight w per unit volume, the minimum depth (h) of the foundation from the free surface of the earth, is

A.  $h = \frac{W}{Aw} \left[ \frac{1 - \sin \phi}{1 + \sin \phi} \right]$       B.  $h = \frac{W}{Aw} \left[ \frac{1 + \sin \phi}{1 + \sin \phi} \right]$       C.  $h = \frac{W}{Aw} \left[ \frac{1 - \sin \phi}{1 + \sin \phi} \right]^2$   
D.  $h = \sqrt{\frac{W}{Aw} \left[ \frac{1 - \sin \phi}{1 + \sin \phi} \right]^2}$

27. In a cantilever retaining wall without a heel slab
- thickness of the stem is kept same throughout
  - base slab is made 10 cm thicker than the stem
  - width of the base slab is kept 0.7 time the total height of the wall
  - all the above.
28. The design of heel slab of a retaining wall, is based on the maximum bending moment due to:
- its own weight
  - weight of the soil above it,
  - load of the surcharge, if any
  - upward soil reaction
  - all the above.
29. If the modular ratio is  $m$ , steel ratio is  $r$  and overall depth of a beam is  $d$ , the depth of the critical neutral axis of the beam, is
- $\frac{m}{m-r} d$
  - $\frac{m}{m+r} d$
  - $\frac{m+r}{m} d$
  - $\frac{r-m}{m} d$
  - $\frac{m}{r} d$
30. As per IS : 1343, total shrinkage for a pretensioned beam, is
- $3.0 \times 10^{-2}$
  - $3.0 \times 10^{-3}$
  - $3.0 \times 10^{-4}$
  - $3.0 \times 10^{-5}$
  - $3.5 \times 10^{-5}$
31. The Young's modulus of elasticity of steel, is
- 150 KN/mm<sup>2</sup>
  - 200 KN/mm<sup>2</sup>
  - 250 KN/mm<sup>2</sup>
  - 275 KN/mm<sup>2</sup>
32. The maximum permissible size of aggregates to be used in casting the ribs of a slab, is
- 5 mm
  - 7.5 mm
  - 10 mm
  - 15 mm
  - 20 mm
33. In a simply supported slab, alternate bars are curtailed at
- 1/4th of the span
  - 1/5th of the span
  - 1/6th of the span
  - 1/7th of the span
  - none of these.
34. The diameter of main bars in R.C.C. columns, shall not be less than
- 6 mm
  - 8 mm
  - 10 mm
  - 12 mm

35. The breadth of a ribbed slab containing two bars must be between  
 A. 6 cm to 7.5 cm    B. 8 cm to 10 cm    C. 10 cm to 12 cm    D. 12 cm to 15 cm    E. none of these.
36. The minimum thickness of the cover at the end of a reinforcing bar should not be less than twice the diameter of the bar subject to a minimum of  
 A. 10 mm    B. 15 mm    C. 20 mm    D. 25 mm    E. 30 mm
37. If  $l_1$  and  $l_2$  are the lengths of long and short spans of a two way slab simply supported on four edges and carrying a load  $w$  per unit area, the ratio of the loads split into  $w_1$  and  $w_2$  acting on strips parallel to  $l_2$  and  $l_1$  is  
 A.  $\frac{w_1}{w_2} = \frac{l_2}{l_1}$     B.  $\frac{w_1}{w_2} = \left(\frac{l_2}{l_1}\right)^2$     C.  $\frac{w_1}{w_2} = \left(\frac{l_2}{l_1}\right)^3$     D.  $\frac{w_1}{w_2} = \left(\frac{l_2}{l_1}\right)^4$
38. If  $L$  is the effective span of a R.C.C. beam which is subjected to maximum shear  $q_{max}$  at the ends, the distance from either end over which stirrups for the shear, are provided, is  
 A.  $\frac{L}{2}\left(1 - \frac{3}{q_{max}}\right)$     B.  $\frac{L}{3}\left(1 - \frac{5}{q_{max}}\right)$     C.  $\frac{L}{2}\left(1 - \frac{5}{q_{max}}\right)$     D.  $\frac{L}{2}\left(1 - \frac{2}{q_{max}}\right)$
39. For the design of a simply supported T-beam the ratio of the effective span to the overall depth of the beam is limited to  
 A. 10    B. 15    C. 20    D. 25    E. 30
40. In the zone of R.C.C. beam where shear stress is less than 5 kg/cm<sup>2</sup>, nominal reinforcement is provided at a pitch of  
 A. one-half lever arm of the section  
 B. one-third lever arm of the section  
 C. lever arm of the section  
 D. one and half lever arm of the section.
41.  $P$  is the prestressed force applied to tendon of a rectangular prestressed beam whose area of cross section is  $A$  and sectional modulus is  $Z$ . The minimum stress  $f$  on the beam subjected to a maximum bending moment  $M$  is  
 A.  $f = \frac{P}{A} - \frac{Z}{M}$     B.  $f = \frac{A}{P} - \frac{M}{Z}$     C.  $f = \frac{P}{A} - \frac{M}{Z}$     D.  $f = \frac{P}{A} - \frac{M}{6Z}$   
 E.  $f = \frac{P}{A} - \frac{M}{3Z}$
42. In a singly reinforced beam  
 A. compression is borne entirely by concrete  
 B. steel possesses initial stresses when em-bedded in concrete

- C. plane sections transverse to the centre line of the beam before bending remain plane after bending
- D. elastic moduli for concrete and steel have different values within the limits of deformation of the beam
- E. none of these.
43. A pre-cast pile generally used, is
- A. circular
- B. square
- C. octagonal
- D. square with corners chamfered.
44. On an absolutely rigid foundation base, the pressure will
- A. be more at the edges of the foundation
- B. be uniform
- C. not be uniform
- D. be zero at the centre of the foundation.
45. As per IS : 456, the reinforcement in a column should not be less than
- A. 0.5% and not more than 5% of cross-sectional area
- B. 0.6% and not more than 6% of cross-sectional area
- C. 0.7% and not more than 7% of cross-sectional area
- D. 0.8% and not more than 8% of cross-sectional area
- E. none of these.
46. If T and R are the tread and rise of a stair which carries a load w per square metre on slope, the corresponding load per square metre of the horizontal area, is
- A.  $\frac{w(R + T)}{T}$       B.  $\frac{w\sqrt{R^2 + T^2}}{T}$       C.  $\frac{w\sqrt{(R + T)}}{T}$       D.  $w \frac{R}{T}$       E.  $w - \frac{T}{R}$
47. If the bearing capacity of soil is 10 tonnes/cm<sup>2</sup> and the projection of plain concrete footing from walls, is a cm, the depth D of footing is
- A.  $D = 0.0775 a$
- B.  $D = 0.775 a$
- C.  $D = 0.775a$
- D.  $D = 0.775 a^2$
48. An R.C.C. lintel is spanning an opening of 2 m span in a brick wall. The height of the roof is 2.9 m above the floor level and that of the opening is 2.1 m above the floor level. The lintel is to be designed for self weight plus
- A. triangular load of the wall
- B. UDL of wall

- C. UDL of wall + load from the roof  
D. triangular load + load from the roof.
49. The pitch of the main bars in a simply supported slab, should not exceed its effective depth by  
A. three times      B. four times      C. five times      D. six times  
E. seven times.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	B	C	B	B	C	D	E	B
10	C	D	A	B	C	D	D	D	B	C
20	C	C	B	A	C	C	D	E	B	E
30	B	C	D	D	B	D	D	C	C	C
40	C	C	D	C	D	B	B	C	D	



## 6 Construction Management

### Section 1

1. Which one of the following represents an activity
  - A. excavation for foundation
  - B. curing of concrete
  - C. setting of question paper
  - D. preparation of breakfast
  - E. all the above.
2. Pick up the incorrect statement from the following:
  - A. An activity of a project is denoted by an arrow on the net work
  - B. The tail of the arrow indicates the start of the activity
  - C. The head of the arrow indicates the end of the activity
  - D. The arrows are drawn to scale from left to right
  - E. Each activity consumes a given time.
3. The technique for establishing and maintaining priorities among the various jobs of a project, is known
  - A. Event flow scheduling technique
  - B. Critical ratio scheduling
  - C. Slotting technique for scheduling
  - D. Short interval scheduling.
4. Mile Stone charts were invented in the year of
  - A. 1910
  - B. 1920
  - C. 1930
  - D. 1940
  - E. 1950
5. Frederick W. Taylor introduced a system of working known as
  - A. line organisation
  - B. line and staff organisation
  - C. functional organisation
  - D. effective organisation.
6. If  $t_o$ ,  $t_p$  and  $t_m$  are the optimistic, pessimistic and most likely time estimates of an activity respectively, the expected time  $t$  of the activity will be

- |                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| $\frac{t_o + 3t_m + t_p}{2}$ A. | $\frac{t_o + 3t_m + t_p}{3}$ B. | $\frac{t_o + 4t_m + t_p}{4}$ C. |
| $\frac{t_o + 4t_m + t_p}{5}$ D. | $\frac{t_o + 4t_m + t_p}{6}$ E. |                                 |

7. In the given figure, the network of a project represents
  - A. activity of an excavation of a footing
  - B. activity of an excavation which starts at event No. 1 and ends at even No. 2
  - C. activity of excavation which takes 8 units of time
  - D. none of these.
8. Pick up the PERT event from the following:
  - A. Digging of foundation started
  - B. Digging of foundation completed
  - C. Laying of concrete started
  - D. Laying of concrete completed
  - E. All the above.
9. If  $D$  is the duration,  $ES$  and  $EF$  are the earliest start and finish,  $LS$  and  $LF$  are latest start and latest finish time, then the following relation holds good
  - A.  $EF = ES + D$
  - B.  $LS = LF - D$
  - C.  $LF = LS + D$
  - D.  $D = EF - ES$
  - E. all the above.
10. Final technical authority of a project lies with
  - A. Assistant Engineer
  - B. Executive Engineer
  - C. Superintending Engineer
  - D. Chief Engineer.
11. The performance of a specific task in CPM, is known
  - A. Dummy
  - B. Event
  - C. Activity
  - D. Contract.
12. Pick up the correct statement from the following:
  - A. The float may be positive, zero or negative
  - B. If the float is positive and the activity is delayed by a period equal to its total float, the completion of project is not delayed
  - C. If the float of an activity is negative, delay in its performance is bound to delay the completion of project
  - D. If the float of an activity is zero, the activity is critical and any delay in its performance will delay the whole project
  - E. All the above.
13. A Milestone chart

- A. shows the interdependencies of various jobs
  - B. depicts the delay of jobs, if any
  - C. points out going ahead of schedule of jobs, if any
  - D. none of these.
14. Completion of an activity on CPM network diagram, is generally known
- A. Event      B. Node      C. Connector      D. All the above.
15. A dummy activity
- A. is artificially introduced
  - B. is represented by a dotted line
  - C. does not consume time
  - D. all the above.
16. Military organisation is known as
- A. line organisation
  - B. line and staff organisation
  - C. functional organisation
  - D. none of these.
17. Pick up the incorrect statement from the following:
- A. The activity is the time consuming part of a project
  - B. The beginning and end of a job, are called events
  - C. The activity which consumes maximum time, is called a node
  - D. Logically and sequentially connected activities and events form a network
  - E. None of these.
18. Various activities of a project, are shown on bar charts by
- A. vertical lines
  - B. horizontal lines
  - C. dots
  - D. crosses.
19. Time and progress chart of a construction, is also known as
- A. Bar chart
  - B. Gantt chart
  - C. Modified Mile stone chart
  - D. Critical path method chart
  - E. All the above.
20. Critical Path Net Work helps an engineer
- A. to concentrate his attention on critical activities

- B. to divert the resources from non-critical advanced activities to critical activities
- C. to be cautious for avoiding any delay in the critical activities to avoid delay of the whole project
- D. all the above.
21. If  $a$  is the optimistic time,  $b$  is the pessimistic time and  $m$  is most likely time of an activity, the expected time of the activity, is
- A.  $\frac{a + m + b}{6}$       B.  $\frac{a + 2m + b}{6}$       C.  $\frac{a + 4m + b}{6}$       D.  $\frac{a + 5m + b}{6}$
22. The time by which activity completion time can be delayed without affecting the start of succeeding activities, is known as
- A. duration
- B. total float
- C. free float
- D. interfering float.
23. The artificial activity which indicates that an activity following it, cannot be started unless the preceding activity is complete, is known as
- A. event      B. free float      C. dummy      D. constant
24. Henry Gantt developed Bar charts for planning and scheduling of projects in
- A. 1880      B. 1900      C. 1920      D. 1940      E. 1950
25. The most popular type of organisation used for Civil Engineering Constructions, is
- A. line organisation
- B. line and staff organisation
- C. functional organisation
- D. effective organisation.
26. The difference between the time avail-to do a job and the time required to do the job, is known as
- A. event      B. float      C. duration      D. constraint.
27. The object of technical planning, is
- A. preparation of specifications
- B. preparation of estimates
- C. initiating the procurement action of resources
- D. taking remedial action for likely bottleneck in the execution
- E. all the above.

28. The salient feature of functional organisation is
- strict adherence to specifications
  - separation of planning and design part
  - each individual maintains functional efficiency
  - work is properly planned and distributed
  - all the above.
29. Critical path method
- is an improvement upon bar chart method
  - provides a realistic approach to daily problems
  - avoids delays which are very common in bar charts
  - was invented by Morgan R. Walker of Dupont and James E. Kalley or Remington U.S.A. in 1957
  - All the above.
30. CPM is
- synthesising in concepts
  - is built of activities oriented programme
  - is based on time estimate
  - is used for repetitive works
  - all the above.
31. Critical path lies along the activities having total float
- positive
  - negative
  - zero
  - same.
32. Construction team means
- an engineer
  - an architect
  - an owner
  - a contractor
  - all the above.
33. Pick up the correct network for the activities of pouring concrete, erection of form work, removal of form work and curing of concrete from the following:
- Pouring of Concrete
    - Erection of form work
    - Curing of concrete
    - Removal of form work
  - Erection of form work
    - Pouring of concrete
    - Curing of concrete
    - Removal of form work
  - Removal of form work
    - Erection of form work

- 3. Pouring of concrete
  - 4. Curing of concrete
- D. 1. Pouring of concrete  
2. Curing of concrete  
3. Erection of form work  
4. Removal of form work
34. A construction schedule is prepared after collecting
- A. number of operations
  - B. output of labour
  - C. output of machinery
  - D. quantity of various items
  - E. all the above.
35. Site order book is used for recording
- A. instructions by the executive engineers
  - B. construction measurements
  - C. issue of store equipments
  - D. names of the casual labour.
36. An Executive Engineer may have powers upto
- A. Rs. 25,000      B. Rs. 50,000      C. Rs. 100,000      D. Rs. 200,000  
E. Rs. 500,000
37. The main principle of an organisation, is
- A. unity of command
  - B. cohegency
  - C. effective control at all levels
  - D. delegation of authority
  - E. all the above.
38. The estimated time required to perform an activity, is known as
- A. event      B. dummy      C. duration      D. float.
39. A CPM family includes
- A. CPA (Critical Path Analysis)
  - B. CPP (Critical Path Plotted)
  - C. MCE (Minimum Cost Expenditure)
  - D. CPS (Critical Path Scheduling)
  - E. All the above.
40. The time which results in the leasi, possible construction cost of an activity, is known
- A. normal time      B. slow time      C. crash time      D. standard time.

41. If the total float and duration of an activity are 5 and 10 days respectively, the particular activity can be
  - A. started 5 days later
  - B. completed 5 days later
  - C. performed at slower rate in 15 days
  - D. all the above.
42. Works costing less than Rs. 20,000 are treated as
  - A. projects
  - B. major projects
  - C. minor projects
  - D. all the above.
43. A critical ratio scheduling
  - A. establishes the relative priorities among various activities on a common basis
  - B. determines the status of each activity
  - C. adjusts automatically changes in activity progress
  - D. is a dynamic system
  - E. none of these.
44. Bar charts are suitable for
  - A. minor works
  - B. major works
  - C. large projects
  - D. all the Above.
45. The first method invented for planning projects, was
  - A. Bar chart method
  - B. Milestone chart
  - C. Critical path method (CPM)
  - D. Programme Evaluation and Review Technique (PERT)
46. If TL is the latest allowable event occurrence time, total activity slack(s), is equal to
  - A.  $LST-EST$
  - B.  $LFT-EFT$
  - C.  $TL-EFT$
  - D. all the above.
47. The Overall in-charge of an organisation at the site responsible for the execution of the works, is
  - A. Executive Engineer
  - B. Engineer
  - C. Junior Engineer
  - D. Sub overseer
  - E. Assistant Engineer.
48. Modular co-ordination of construction means proper
  - A. planning
  - B. designing
  - C. execution
  - D. all the above.
49. Pick up the correct statement from the following:
  - A. CPM analysis is activity oriented

- B. PERT analysis is event oriented
- C. CPM does not make any allowance for the uncertainties in the duration of time
- D. In CPM, the time is related to cost
- E. All the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	E	D	B	D	C	E	C	E	E	D
10	C	E	D	D	D	A	C	B	E	D
20	C	C	C	B	A	B	E	E	E	E
30	C	E	B	E	A	A	E	C	E	B
40	D	C	E	A	A	D	B	D	E	



## Section 2

1. If  $t$  is the duration of an activity,  $t_1$  is the latest finish possible moment of its preceding activity and  $t_2$  is the earliest start possible moment, the independent float of the activity is
  - A.  $(t_1 - t_2) - t$
  - B.  $t - (t_1 - t_2)$
  - C.  $(t_1 + t_2) - t$
  - D.  $t + (t_1 - t_2)$
2. Pick up the correct statement from the following:
  - A. Earliest expected time is denoted by  $TE$
  - B. Latest occurrence time is denoted by  $TL$
  - C. Contractual obligation time is denoted by  $T_s$
  - D. Latest occurrence time is taken as contractual obligation time
  - E. All the above.
3. For the supply of materials for concrete, form work reinforcing and placing of concrete, removal of form work and curing of concrete, number of bar(s) required on bar chart, is
  - A. 1
  - B. 2
  - C. 3
  - D. 4
4. For the execution of a project, a contractor is
  - A. a person
  - B. a firm
  - C. an agency
  - D. all the above.
5. Railway projects are treated as
  - A. light construction
  - B. heavy construction
  - C. industrial construction
  - D. none of these.
6. Pick up the correct statement from the following:
  - A. Optimistic time estimate refers to activities
  - B. Pessimistic time estimate refers to activities
  - C. Most likely time estimate refers to activities
  - D. Expected time estimate refers to activities
  - E. All the above.
7. The critical activity has
  - A. maximum float
  - B. minimum float
  - C. zero float
  - D. none of these.
8. The main disadvantage of line organisation, is
  - A. rigid structure
  - B. extraordinary delay in communications

- C. top level executions over work
  - D. all the above.
9. Pick up the correct statement from the following:
- A. The difference of latest occurrence time and earliest expected time, is called slack
  - B. The activities connecting the events having zero slack, lie on the critical path
  - C. The critical path consumes the maximum time
  - D. All the above.
10. Pre-tender stage requires
- A. acquisition of land
  - B. selection of site
  - C. formalisation of alignment of work
  - D. formalisation of designs and preparation of estimate
  - E. all the above.
11. The final selection of a construction site, is done by
- A. departmental representative or user
  - B. local civil authority representative
  - C. representative of engineer authority
  - D. representative of administration
  - E. all the above.
12. Pick up the correct statement from the following:
- A. The duration between the earliest start time of the preceding event and latest finish time of the succeeding event, is called 'float'
  - B. The duration of time by which an activity can be delayed without affecting the succeeding activity, is called free float
  - C. The float which affects neither the processor nor the successor activities, is called independent float
  - D. The difference between total float and free float, is called interfering float
  - E. All the above.
13. The first stage of a construction, is
- A. preparation of estimate
  - B. survey of the site
  - C. initiation of proposal
  - D. preparation of tender
  - E. allotment of funds.

14. PERT is
- A. an analytic in concept
  - B. limited of event oriented diagrams
  - C. used for research and development projects
  - D. based on three time estimates for activities linking up two events
  - E. all the above.
15. Residential buildings are treated as
- A. light construction
  - B. heavy construction
  - C. industrial construction
  - D. private construction.
16. The main advantage of line organisation, is :
- A. effective command and control
  - B. defined responsibilities at all levels
  - C. rigid discipline in the organisation
  - D. ability of quick decision at all levels
  - E. all the above.
17. PERT analysis is based on
- A. optimistic time
  - B. pessimistic time
  - C. most likely time
  - D. all the above.
18. For completion of a project, the critical path of the network represents
- A. minimum time
  - B. maximum time
  - C. maximum cost
  - D. minimum cost.
19. In CPM analysis,
- A. emphasis is given to activities
  - B. uncertainties are not allowed
  - C. activities are represented by arrows
  - D. beginning and end of an activity, are denoted by nodes
  - E. all the above.
20. A golden rule for the procurement of construction stones, suggests
- A. 100% at the site
  - B. 67% at the site and 33% under procurement
  - C. 50% at the site and 50% under procurement
  - D. 33% at the site and 67% under procurement
  - E. none of these.

21. Power stations are generally treated as
- A. light construction
  - B. heavy construction
  - C. industrial construction
  - D. electrical construction.
22. An event is indicated on the network by a number enclosed in
- A. a circle
  - B. a square
  - C. a triangle
  - D. an ellipse
  - E. all the above.
23. Pick up the incorrect statement from the following:
- A. The difference between the earliest start time and latest finish time of any activity, is the maximum time available for the activity
  - B. The difference between the maximum time available for the job and actual time it consumes, is called total float
  - C. The difference between the latest start time and earliest start time of an activity, is called total float
  - D. The difference between the earliest finish time of an activity and the earliest start time of its successor activity, is called free float of the activity
  - E. None of these.
24. While scheduling a project by C.P.M.
- A. a project is divided into various activities
  - B. required time for each activity is established
  - C. sequence of various activities is made according to their importance
  - D. net work is drawn by connecting the activities and the events
  - E. All the above.
25. Pick up the correct statement from the following with regards to C.P.M. network analysis of projects
- A. Earliest occurrence time of the event from which the activity arrow' originates, is called earliest start time of the activity
  - B. Earliest occurrence time of the event from which the activity arrow originates plus the duration of the activity, is called earliest finish time of the activity
  - C. The latest occurrence time of the node of which the activity arrow terminates minus the duration of the activity, is called latest start time
  - D. The latest occurrence time for the node at which the activity arrow terminates, is called latest finish time

- E. All the above.
26. Pick up the correct statement from the following:
- A. Forward pass is used for calculating earliest expected time
  - B. Backward pass is used for calculating the latest occurrence time
  - C. Maximum value of earliest expected time is used if there are more than one value of any event
  - D. Minimum value of latest occurrence time is used if there are more than one value of any event
  - E. All the above.
27. Which one of the following represents an event ?
- A. concrete cured
  - B. fixing of door
  - C. plastering of walls
  - D. selecting sites
  - E. all the above.
28. Pick up the incorrect statement from the following:
- A. The various functions under each activity, are shown by one bar on Bar Charts
  - B. Bar chart establishes the interdependency of one event on another
  - C. Only approximate percentage of the completed work is reported
  - D. None of these,
29. For the network shown in the given figure, the expected time for the activity
- A. 1-2 is 4      B. 2-3 is 7      C. 3-4 is 8      D. all the above.
30. Frequency distribution curves
- A. having a single lump, are called uninodal curves
  - B. if symmetrical, are called normal curves
  - C. if not symmetrical, are called skew curves
  - D. all the above.
31. Pick up the correct statement from the following:
- A. Programme Evaluation and Review Technique, is event oriented
  - B. Programme Evaluation and Review Technique is not event oriented
  - C. Critical Path Method is event oriented
  - D. Critical Path method is event oriented.
32. The three time estimates for the activities of the network shown in the given figure are shown above their arrows. The earliest expected time for the event 4, is
- A. 19      B. 14      C. 24      D. None of these.

33. Optimistic time, most likely time and pessimistic times for the activities of a network in the given figure are written above their arrows. If the contractual obligation time for the project is 75, the latest occurrence time for the event 2, is  
 A. 20      B. 25      C. 35      D. 15
34. While filling the tender for any work, the contractor considers  
 A. site survey  
 B. availability of construction materials  
 C. availability of labour  
 D. study of specifications  
 E. all the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	E	A	D	B	E	C	D	D	E
10	E	E	C	E	A	E	D	A	E	B
20	C	E	E	E	E	E	A	B	D	D
30	A	A	B	E						

**Explanation**

29.

Expected time = (Pessimistic value + 4\*most likely value + Optimistic value)/6.

1-2 is 4.

2-3 is 7.

3-4 is 8.

## 7 Theory of Structures

### Section 1

1. The assumption in the theory of bending of beams, is :
  - A. material is homogeneous
  - B. material is isotropic
  - C. Young's modulus is same in tension as well as in compression
  - D. each layer is independent to expand or to contract
  - E. all the above.
2. The shape factor of standard rolled beam section varies from
  - A. 1.10 to 1.20
  - B. 1.20 to 1.30
  - C. 1.30 to 1.40
  - D. 1.40 to 1.50
3. Shear strain energy theory for the failure of a material at elastic limit, is due to
  - A. Rankine
  - B. Guest or Tresca
  - C. St. Venant
  - D. Haig
  - E. Von Mises.
4. The point of contraflexure is the point where
  - A. B.M. changes sign
  - B. B.M. is maximum
  - C. B.M. is minimum
  - D. S.F. is zero.
5. The normal component of a force inclined through  $\theta^\circ$  is obtained by multiplying the force by
  - A.  $\sin \theta$
  - B.  $\cos \theta$
  - C.  $\tan \theta$
  - D.  $\sin \theta \cos \theta$
  - E.  $\sin^2 \theta$
6. A material which obeys Hook's law, is subjected to direct stress  $\sigma_0$ . At its elastic limit, the following statement is true,
  - A. Strain is equal to  $\frac{\sigma_0}{E}$
  - B. Maximum shear stress =  $\frac{\sigma_0}{2}$
  - C. Strain energy =  $\frac{\sigma_0^2}{2E} \times \text{volume}$
  - D. Shear strain energy =  $\frac{\sigma_0}{6N} \times \text{volume}$

- E. All the above.
7. In the truss shown in the given figure, the force in member BC is
- 100 t compressive
  - 100 t tensile
  - zero
  - indeterminate
8. A concentrated load P is supported by the free end of a quadrantal ring AB whose end B is fixed. The ratio of the vertical to horizontal deflections of the end A, is
- $\pi$
  - $\frac{\pi}{2}$
  - $\frac{\pi}{3}$
  - $\frac{\pi}{4}$
9. Stress may be defined as
- force per unit length
  - force per unit volume
  - force per unit area
  - none of these.
10. Total strain energy theory for the failure of a material at elastic limit, is known
- Guest's or Tresca's theory
  - St. Venant's theory
  - Rankine's theory
  - Haig's theory
  - Von Mises's theory.
11. Stress may be expressed in Newtons
- per millimetre square ( $\text{N/mm}^2$ )
  - per centimetre square ( $\text{N/cm}^2$ )
  - per metre square ( $\text{N/m}^2$ )
  - All of the above.
12. Principal planes are subjected to
- normal stresses only
  - tangential stresses only
  - normal stresses as well as tangential stresses
  - none of these.
13. In plastic analysis, the shape factor for a circular section, is
- 1.5
  - 1.6
  - 1.7
  - 1.75
14. Keeping the depth d constant, the width of a cantilever of length l of uniform strength loaded with a uniformly distributed load w varies from zero at the free end and



- A.  $\frac{2w}{\sigma d^2} \times l^2$  at the fixed end
- B.  $\frac{3w}{\sigma d} \times l^2$  at the fixed end
- C.  $\frac{3w}{\sigma d^2} \times l^2$  at the fixed end
- D.  $\frac{5w}{\sigma d} \times l^2$  at the fixed end
15. The total strain energy of a beam of length L, having moment of inertia of its section I, when subjected to a bending moment M, is
- A.  $\frac{M^2}{EI} \delta_x$  B.  $\frac{M^2}{2EI} \delta_x$  C.  $\int_0^L \frac{M^2}{2EI} \delta_x$  D.  $\int_0^L \frac{M^2}{EI} \delta_x$
16. A load of 1960 N is raised at the end of a steel wire. The minimum diameter of the wire so that stress in the wire does not exceed 100 N/mm<sup>2</sup> is :
- A. 4.0 mm B. 4.5 mm C. 5.0 mm D. 5.5 mm E. 6.0 mm
17. The force in BF of the truss shown in given figure, is
- A. 4t tension
- B. 4t compression
- C. 4.5t tension
- D. 4.5t compression
- E. zero.
18. The radius of gyration of a section of area A and least moment of inertia I about the centroidal axis, is
- A.  $\frac{A}{I}$  B.  $\frac{I}{A}$  C.  $\sqrt{\frac{I}{A}}$  D.  $\sqrt{\frac{A}{I}}$
19. A simply supported beam carries varying load from zero at one end and w at the other end. If the length of the beam is a, the maximum bending moment will be
- A.  $\frac{wa}{27}$  B.  $\frac{wa^2}{27}$  C.  $\frac{w^2a}{\sqrt{27}}$  D.  $\frac{wa^2}{9\sqrt{3}}$
20. In plastic analysis, the shape factor for rectangular section, is
- A. 1.4 B. 1.5 C. 1.6 D. 1.7

21. In case of a simply supported rectangular beam of span L and loaded with a central load W, the length of elasto-plastic zone of the plastic hinge, is

A.  $\frac{L}{2}$     B.  $\frac{L}{3}$     C.  $\frac{L}{4}$     D.  $\frac{L}{5}$     E.  $\frac{L}{8}$

22. Pick up the correct statement from the following:

A. Hoop strain of the walls of a cylinder due to liquid is  $\frac{pd}{2tE} \left[ 1 - \frac{1}{2m} \right]$   
 B. Longitudinal strain in the walls of a cylinder due to liquid is

$$\frac{pd}{2tE} \left[ \frac{1}{2} - \frac{1}{m} \right]$$

C. Volumetric change in the cylinder due to liquid is  $\frac{pd}{2tE} \left[ \frac{5}{2} - \frac{2}{m} \right]$   
 D. All the above.

23. A material may fail if

A. maximum principal stress exceeds the direct stress  $\sigma_0$

B. maximum strain exceeds  $\frac{\sigma_0}{E}$

C. maximum shear stress exceeds  $\frac{\sigma_0}{2}$

D. total strain energy exceeds  $\frac{\sigma_0^2}{2E} \times \text{volume}$

E. all the above.

24. A truss containing j joints and m members, will be a simple truss if

A.  $m = 2j - 3$

B.  $j = 2m - 3$

C.  $m = 3j - 2$

D.  $j = 3m - 2$

25. The stiffness of the close coil helical spring is

A.  $\frac{d^4N}{8D^3n}$     B.  $\frac{d^4N}{4D^3n}$     C.  $\frac{4D^3N}{d^4n}$     D.  $\frac{8D^3N}{d^4n}$

26. If E, N, K and 1/m are modulus of elasticity, modulus of rigidity, Bulk modulus and Poisson ratio of the material, the following relationship holds good

- A.  $E = 3 K \left( 1 - \frac{2}{m} \right)$       B.  $E = 2 N \left( 1 + \frac{1}{m} \right)$       C.  $\frac{3}{2} K (1 - 2/m) = N \left( 1 + \frac{1}{m} \right)$   
 D. all the above.

27. The ratio of maximum shear stress to average shear stress of a circular beam, is

- A.  $\frac{2}{3}$       B.  $\frac{3}{2}$       C.  $\frac{3}{4}$       D.  $\frac{4}{3}$

28. A rolled steel joist is simply supported at its ends and carries a uniformly distributed load which causes a maximum deflection of 10 mm and slope at the ends of 0.002 radian. The length of the joist will be,

- A. 10 m      B. 12 m      C. 14 m      D. 16 m      E. 18 m

29. A steel rod 1 metre long having square cross section is pulled under a tensile load of 8 tonnes. The extension in the rod was 1 mm only. If  $E_{\text{steel}} = 2 \times 10^6 \text{ kg/cm}^2$ , the side of the rod, is

- A. 1 cm      B. 1.5 cm      C. 2 cm      D. 2.5 cm

30. The maximum deflection due to a uniformly distributed load  $w$ /unit length over entire span of a cantilever of length  $l$  and of flexural rigidity  $EI$ , is

- A.  $\frac{wl^3}{3EI}$       B.  $\frac{wl^4}{3EI}$       C.  $\frac{wl^4}{8EI}$       D.  $\frac{wl^4}{12EI}$

31. A material is said to be perfectly elastic if

- A. it regains its original shape on removal of the load  
 B. It regains its original shape partially on removal of the load  
 C. it does not regain its original shape at all  
 D. none of these.

32. For calculating the allowable stress of long columns. The empirical formula, is known as

- A. Straight line formula  
 B. Parabolic formula  
 C. Perry's formula  
 D. Rankine's formula.

33. Beams composed of more than one material, rigidly connected together so as to behave as one piece, are known as

- A. Compound beams  
 B. Indeterminate beams  
 C. Determinate beams  
 D. Composite beams.

34. Pick up the correct statement from the following:
- In a loaded beam, the moment at which the first yield occurs is called yield moment
  - In a loaded beam, the moment at which the entire section of the beam becomes fully plastic, is called plastic moment
  - In a fully plastic stage of the beam, the neutral axis divides the section in two sections of equal area
  - The ratio of plastic moment to the yield moment, is called shape factor
  - All the above.
35. The maximum magnitude of shear stress due to shear force  $F$  on a rectangular section of area  $A$  at the neutral axis, is
- $\frac{F}{A}$
  - $\frac{F}{2A}$
  - $\frac{3F}{2A}$
  - $\frac{2F}{3A}$
36. Two bars, one of steel and the other of copper having areas of cross-sections  $A_s$  and  $A_c$ , coefficient of expansion  $\alpha_s$  and  $\alpha_c$  and Young's Moduli  $E_s$  and  $E_c$  are rigidly connected together at the ends and subjected to temperature change of  $t^\circ$ . If the length of the bars initially is  $L$ , the final extension  $\delta$  of the two bars at  $t^\circ$  temperature is given by
- $$\delta = Lt \times \frac{(\sigma_c E_c A_c + \sigma_s E_s A_s)}{E_c A_c + E_s A_s}$$
  - $$\delta = Lt \times \frac{(\sigma_c E_c A_c - \sigma_s E_s A_s)}{E_c A_c + E_s A_s}$$
  - $$\delta = Lt \times \frac{(\sigma_c E_c A_c - \sigma_s E_s A_s)}{E_c A_c - E_s A_s}$$
  - $$\delta = Lt \times \frac{(\sigma_c E_c A_c + \sigma_s E_s A_s)}{E_c A_c - E_s A_s}$$
37. The tangential component of stress on a plane inclined  $\theta^\circ$  to the direction of the force, may be obtained by multiplying the normal stress by
- $\sin \theta$
  - $\cos \theta$
  - $\tan \theta$
  - $\sin \theta \cos \theta$
  - $\sin^2 2\theta$
38. The force in AD of the truss shown in given figure, is
- 4.0t compression
  - 3.0t compression
  - 0.5t compression
  - 0.5t tension
  - zero.
39. There are two hinged semicircular arches A, B and C of radii 5 m, 7.5 m and 10 m respectively and each carries a concentrated load  $W$  at their crowns. The horizontal thrust at their supports will be in the ratio of
- 1 : 1 1/2 : 2
  - 2 : 1 1/2 : 1
  - 1 : 1 : 2
  - none of these.

40. A spring of mean radius 40 mm contains 8 active coils of steel ( $N = 80000 \text{ N/mm}^2$ ), 4 mm in diameter. The clearance between the coils being 1 mm when unloaded, the minimum compressive load to remove the clearance, is  
 A. 25 N    B. 30 N    C. 35 N    D. 40 N
41. A shaft is subjected to bending moment  $M$  and a torque  $T$  simultaneously. The ratio of the maximum bending stress to maximum shear stress developed in the shaft, is  
 A.  $\frac{M}{T}$     B.  $\frac{T}{M}$     C.  $\frac{2M}{T}$     D.  $\frac{2T}{M}$
42. The ratio of the deflections of the free end of a cantilever due to an isolated load at  $1/3$ rd and  $2/3$ rd of the span, is  
 A.  $\frac{1}{7}$     B.  $\frac{2}{7}$     C.  $\frac{3}{7}$     D.  $\frac{2}{5}$
43. If  $Q$  is load factor,  $S$  is shape factor and  $F$  is factor of safety in elastic design, the following:  
 A.  $Q = S + F$     B.  $Q = S - F$     C.  $Q = F - S$     D.  $Q = S \times F$   
 E.  $Q = \frac{S}{F}$
44. In plastic analysis, the shape factor for a triangular section, is  
 A. 1.5    B. 1.34    C. 2.34    D. 2.5
45. Pick up the correct statement from the following:  
 A. The point of intersection of the bending axis with the cross section of the beam, is called shear centre  
 B. For I sections, the shear centre coincides with the centroid of the cross section of the beam  
 C. For channels, the shear centre does not coincide its centroid  
 D. Bending loads should pass through the shear centre to avoid twisting  
 E. All the above.
46. Pick up the correct statement from the following:  
 A. The bending moment which when acting alone would produce the maximum stress equal to the major principal stress caused by combined bending and torsion, is called equivalent bending moment  
 B.  $M_{eq} = (M^2 + T^2)^{1/2}$  where letters carry their usual meanings  
 C.  $T_{eq} = m^2 + T^2$  where letters carry their usual meanings  
 D. The torque which when acting alone would produce maximum shear stress equal to the maximum shear stress caused by the combined bending and torsion, is called equivalent torque

- E. All the above.
47. If  $\Sigma H$  and  $\Sigma V$  are the algebraic sums of the forces resolved horizontally and vertically respectively, and  $\Sigma M$  is the algebraic sum of the moments of forces about any point, for the equilibrium of the body acted upon  
 A.  $\Sigma H = 0$     B.  $\Sigma V = 0$     C.  $\Sigma M = 0$     D. all the above.
48. For determining the support reactions at A and B of a three hinged arch, points B and C are joined and produced to intersect the load line at D and a line parallel to the load line through A at D'. Distances AD, DD' and AD' when measured were 4 cm, 3 cm and 5 cm respectively. The angle between the reactions at A and B is  
 A.  $30^\circ$     B.  $45^\circ$     C.  $60^\circ$     D.  $90^\circ$
49. Pick up the incorrect statement from the following : The torsional resistance of a shaft is directly proportional to  
 A. modulus of rigidity  
 B. angle of twist  
 C. reciprocal of the length of the shaft  
 D. moment of inertia of the shaft section.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	E	A	E	A	D	E	C	B	C	D
10	D	A	C	C	C	C	D	C	D	B
20	B	D	E	A	A	D	D	D	C	C
30	A	A	D	E	C	A	E	C	C	C
40	C	B	D	C	E	E	D	D	D	

## Section 2

- By applying the static equations i.e.  $\Sigma H = 0$ ,  $\Sigma V = 0$  and  $\Sigma M = 0$ , to a determinate structure, we may determine
  - supporting reactions only
  - shear forces only
  - bending moments only
  - internal forces only
  - all the above.
- The general expression for the B.M. of a beam of length  $l$  is the beam carries
  - a uniformly distributed load  $w$ /unit length
  - a load varying linearly from zero at one end to  $w$  at the other end
  - an isolated load at mid span
  - none of these.
- The ratio of the length and diameter of a simply supported uniform circular beam which experiences maximum bending stress equal to tensile stress due to same load at its mid span, is
  - $\frac{1}{8}$
  - $\frac{1}{4}$
  - $\frac{1}{2}$
  - $\frac{1}{3}$
  - 1.0
- If a solid shaft (diameter 20 cm, length 400 cm,  $N = 0.8 \times 10^5$  N/mm<sup>2</sup>) when subjected to a twisting moment, produces maximum shear stress of 50 N/mm<sup>2</sup>, the angle of twist in radians, is
  - 0.001
  - 0.002
  - 0.0025
  - 0.003
  - 0.005
- The maximum B.M. due to an isolated load in a three hinged parabolic arch, (span  $l$ , rise  $h$ ) having one of its hinges at the crown, occurs on either side of the crown at a distance
  - $\frac{l}{4}$
  - $\frac{h}{4}$
  - $\frac{l}{2\sqrt{3}}$
  - $\frac{l}{3\sqrt{2}}$
- The vertical reaction for the arch is
  - $\frac{Wa}{2l}$
  - $\frac{Wl}{a}$
  - $\frac{Wa}{l}$
  - $\frac{Wa^2}{2l}$
- A bar of square section of area  $a^2$  is held such that its one of its diagonals is vertical. The maximum shear stress will develop at a depth  $h$  where  $h$  is
  - $\frac{2\sqrt{3}}{4}$
  - $\frac{3\sqrt{2}}{4}$
  - $\frac{2}{\sqrt{3}}$
  - $\frac{\sqrt{3}}{4}$

8. The equivalent length of a column of length  $L$ , having both the ends hinged, is
- A.  $2L$     B.  $L$     C.  $\frac{L}{2}$     D.  $\frac{L}{\sqrt{2}}$
9. A steel rod of sectional area 250 sq. mm connects two parallel walls 5 m apart. The nuts at the ends were tightened when the rod was heated to  $100^\circ\text{C}$ . If  $\alpha_{\text{steel}} = 0.000012/\text{C}^\circ$ ,  $E_{\text{steel}} = 0.2 \text{ MN/mm}^2$ , the tensile force developed at a temperature of  $50^\circ\text{C}$ , is
- A.  $80 \text{ N/mm}^2$     B.  $100 \text{ N/mm}^2$     C.  $120 \text{ N/mm}^2$     D.  $150 \text{ N/mm}^2$
10. The ratio of circumferential stress to the longitudinal stress in the walls of a cylindrical shell, due to flowing liquid, is
- A.  $\frac{1}{2}$     B. 1    C.  $1\frac{1}{2}$     D. 2
11. The strain energy stored in a spring when subjected to greatest load without being permanently distorted, is called
- A. stiffness  
B. proof resilience  
C. proof stress  
D. proof load.
12. If a three hinged parabolic arch, (span  $l$ , rise  $h$ ) is carrying a uniformly distributed load  $w$ /unit length over the entire span,
- A. horizontal thrust is  $wl^2/8h$   
B. S.F. will be zero throughout  
C. B.M. will be zero throughout  
D. all the above.
13. Co-efficient of wind resistance of a circular surface, is
- A.  $\frac{1}{2}$     B.  $\frac{1}{3}$     C.  $\frac{2}{3}$     D.  $\frac{3}{2}$
14. Pick up the correct statement from the following:
- A. For a uniformly distributed load, the shear force varies linearly  
B. For a uniformly distributed load, B.M. curve is a parabola  
C. For a load varying linearly, the shear force curve is a parabola  
D. For a load varying linearly, the B.M. curve is a cubic parabola  
E. All the above.
15. The ratio of moments of inertia of a triangular section about its base and about a centroidal axis parallel to its base, is
- A. 1.0    B. 1.5    C. 2.0    D. 2.5    E. 3.0



16. The ratio of shear stress and shear strain of an elastic material, is
- Modulus of Rigidity
  - Shear Modulus
  - Young's Modulus
  - Modulus of Elasticity
  - both (a) and (b).
17. The ratio of the maximum deflections of a simply supported beam with a central load W and of a cantilever of same length and with a load W at its free end, is
- $\frac{1}{8}$
  - $\frac{1}{10}$
  - $\frac{1}{12}$
  - $\frac{1}{14}$
  - $\frac{1}{16}$
18. The greatest load which a spring can carry without getting permanently distorted, is called
- stiffness
  - proof resilience
  - proof stress
  - proof load.
19. The horizontal deflection of a parabolic curved beam of span 10 m and rise 3 m when loaded with a uniformly distributed load 1 t per horizontal length, is (where  $I_c$  is the M.I. at the crown, which varies as the slope of the arch).
- $\frac{50}{EI_c}$
  - $\frac{100}{EI_c}$
  - $\frac{150}{EI_c}$
  - $\frac{200}{EI_c}$
  - $\frac{250}{EI_c}$
20. A three hinged arch is generally hinged at its supports and
- at one quarter span
  - at the crown
  - any where in the rib
  - none of these.
21. For permissible shear stress  $f_s$ , the torque transmitted by a thin tube of mean diameter D and wall thickness t, is
- $\frac{\pi D^2}{2} t f_s$
  - $\frac{\pi D}{2} t f_s$
  - $\pi D 2t f_s$
  - $\frac{\pi D^2 t^2}{4} f_s$
22. A compound bar consists of two bars of equal length. Steel bar cross-section is 3500 mm<sup>2</sup> and that of brass bar is 3000 mm<sup>2</sup>. These are subjected to a compressive load 100,000 N. If  $E_b = 0.2$  MN/mm<sup>2</sup> and  $E_s = 0.1$  MN/mm<sup>2</sup>, the stresses developed are:
- $\sigma_b = 10$  N/mm<sup>2</sup>,  $\sigma_s = 20$  N/mm<sup>2</sup>

- B.  $\sigma_b = 8 \text{ N/mm}^2$ ,  $\sigma_s = 16 \text{ N/mm}^2$   
 C.  $\sigma_b = 6 \text{ N/mm}^2$ ,  $\sigma_s = 12 \text{ N/mm}^2$   
 D.  $\sigma_b = 5 \text{ N/mm}^2$ ,  $\sigma_s = 10 \text{ N/mm}^2$
23. is the equation for Euler's crippling load if  
 A. both the ends are fixed  
 B. both the ends are hinged  
 C. one end is fixed and other end is free  
 D. one end is fixed and other end is hinged.
24. Flat spiral springs  
 A. consist of uniform thin strips  
 B. are supported at outer end  
 C. are wound by applying a torque  
 D. are used in clock-work mechanism  
 E. all the above.
25. A simply supported uniform rectangular bar breadth  $b$ , depth  $d$  and length  $L$ , carries an isolated load  $W$  at its mid-span. The same bar experiences an extension  $e$  under same tensile load. The ratio of the maximum deflection to the elongation, is  
 A.  $\frac{L}{d}$     B.  $\frac{d}{2d}$     C.  $\left(\frac{L}{2d}\right)^2$     D.  $\left(\frac{L}{3d}\right)^2$
26. A cantilever of length 2 cm and depth 10 cm tapers in plan from a width 24 cm to zero at its free end. If the modulus of elasticity of the material is  $0.2 \times 10^6 \text{ N/mm}^2$ , the deflection of the free end, is  
 A. 2 mm    B. 3 mm    C. 4 mm    D. 5 mm    E. 6 mm
27. Pick up the correct statement from the following:  
 A. The bending stress in a section is zero at its neutral axis and maximum at the outer fibres  
 B. The shear stress is zero at the outer fibres and maximum at the neutral axis  
 C. The bending stress at the outer fibres, is known as principal stress  
 D. The planes of principal stresses are inclined at  $45^\circ$  to the neutral plane  
 E. All the above.
28. A simply supported rolled steel joist 8 m long carries a uniformly distributed load over its span so that the maximum bending stress is  $75 \text{ N/mm}^2$ . If the slope at the ends is 0.005 radian and the value of  $E = 0.2 \times 10^6 \text{ N/mm}^2$ , the depth of the joist, is  
 A. 200 mm    B. 250 mm    C. 300 mm    D. 350 mm    E. 400 mm

29. A square column carries a load  $P$  at the centroid of one of the quarters of the square. If  $a$  is the side of the main square, the combined bending stress will be
- A.  $\frac{P}{a^2}$     B.  $\frac{2P}{a^2}$     C.  $\frac{3P}{a^2}$     D.  $\frac{4P}{a^2}$
30. The degree of indeterminacy of the frame in the given figure, is
- A. 1    B. 2    C. 3    D. zero
31. The forces in the members of simple trusses, may be analysed by
- A. graphical method  
B. method of joints  
C. method of sections  
D. all the above.
32. A bar  $l$  metre long and having its area of cross-section  $A$ , is subjected to a gradually applied tensile load  $W$ . The strain energy stored in the bar is
- A.  $\frac{WL}{2AE}$     B.  $\frac{WL}{AE}$     C.  $\frac{W^2L}{AE}$     D.  $\frac{W^2L}{2AE}$
33. A rectangular column shown in the given figure carries a load  $P$  having eccentricities  $e_x$  and  $e_y$  along  $X$  and  $Y$  axes. The stress at any point  $(x, y)$  is
- A.  $\frac{P}{bd} \left[ 1 + \frac{12e_y \cdot y}{d^2} + \frac{12e_x \cdot x}{d^2} \right]$     B.  $P \left[ 1 + \frac{6e_y \cdot y}{b} + \frac{6e_x \cdot x}{b} \right]$     C.  $\frac{P}{bd} \left[ 1 + \frac{6e_y \cdot y}{d} + \frac{6e_x \cdot x}{d} \right]$
- D.  $\frac{P}{bd} \left[ 1 + \frac{e_y \cdot y}{d} + \frac{e_x \cdot x}{d} \right]$
34. A simply supported beam which carries a uniformly distributed load has two equal overhangs. To have maximum B.M. produced in the beam least possible, the ratio of the length of the overhang to the total length of the beam, is
- A. 0.207    B. 0.307    C. 0.407    D. 0.508
35. is the equation of Euler's crippling load, if
- A. both the ends are fixed  
B. both the ends are hinged  
C. one end is fixed and other end is free  
D. one end is fixed and other end is hinged.
36. At yield point of a test piece, the material
- A. obeys Hooke's law

- B. behaves in an elastic manner  
 C. regains its original shape on removal of the load  
 D. undergoes plastic deformation.
37. For the close coil helical spring of the maximum deflection is
- A.  $\frac{WD^3n}{d^4N}$       B.  $\frac{2WD^3n}{d^4N}$       C.  $\frac{4W^2D^3n}{d^4N}$       D.  $\frac{6WD^2n}{d^4N}$       E.  $\frac{8WD^3n}{d^4N}$
38. In the truss, the force in the member AC is
- A. 6.25 t compressive  
 B. 8.75 t tensile  
 C.  $\frac{8.75}{\sqrt{3}}$  t tensile  
 D.  $\frac{8.75}{\sqrt{3}}$  t compressive.
39. The moment of inertia of a triangular section (height h, base b) about its base, is
- A.  $\frac{bh^2}{12}$       B.  $\frac{b^2h}{12}$       C.  $\frac{bh^3}{12}$       D.  $\frac{b^3h}{12}$
40. A steel bar 5 m x 50 mm is loaded with 250, 000 N. If the modulus of elasticity of the material is 0.2 MN/mm<sup>2</sup> and Poisson's ratio is 0.25, the change in the volume of the bar is :
- A. 1.125 cm<sup>3</sup>      B. 2.125 cm<sup>3</sup>      C. 3.125 cm<sup>3</sup>      D. 4.125 cm<sup>3</sup>
41. A rod of uniform cross-section A and length L is deformed by  $\delta$ , when subjected to a normal force P. The Young's Modulus E of the material, is
- A.  $E = \frac{P \cdot \delta}{A \cdot L}$       B.  $E = \frac{A \cdot \delta}{P \cdot L}$       C.  $E = \frac{P \cdot L}{A \cdot \delta}$       D.  $E = \frac{P \cdot A}{L \cdot \delta}$   
 E.  $E = \frac{A \cdot L}{P \cdot \delta}$
42. The S.F. diagram of a loaded beam shown in the given figure is that of
- A. a simply supported beam with isolated central load  
 B. a simply supported beam with uniformly distributed load  
 C. a cantilever with an isolated load at the free end  
 D. a cantilever with a uniformly distributed load.
43. An isolated load W is acting at a distance a from the left hand support, of a three hinged arch of span 2l and rise h hinged at the crown, the

horizontal reaction at the support, is

- A.  $\frac{Wa}{h}$       B.  $\frac{Wa}{2h}$       C.  $\frac{2W}{ha}$       D.  $\frac{2h}{Wa}$

44. The ratio of lateral strain to axial strain of a homogeneous material, is known

- A. Yield ratio  
B. Hooke's ratio  
C. Poisson's ratio  
D. Plastic ratio.

45. For beams of uniform strength, if depth is constant,

- A. width  $b \propto M$   
B. width  $b \propto M$   
C. width  $b \propto 3 M$   
D. width  $b \propto \frac{1}{M}$

46. The area of the core of a column of cross sectional area A, is

- A.  $\frac{1}{3} A$       B.  $\frac{1}{6} A$       C.  $\frac{1}{12} A$       D.  $\frac{1}{18} A$

47. A simply supported beam carries a varying load from zero at one end and w at the other end. If the length of the beam is a, the shear force will be zero at a distance x from least loaded point where x is

- A.  $\frac{a}{2}$       B.  $\frac{a}{3}$       C.  $\frac{a}{\sqrt{3}}$       D.  $\frac{a\sqrt{3}}{2}$

48. The locus of reaction of a two hinged semi-circular arch, is

- A. straight line      B. parabola      C. circle      D. hyperbola.

49. The ratio of the area of cross-section of a circular section to the area of its core, is

- A. 4      B. 8      C. 12      D. 16

50. The yield moment of a cross section is defined as the moment that will just produce the yield stress in

- A. the outer most fibre of the section  
B. the inner most fibre of the section  
C. the neutral fibre of the section  
D. the fibre everywhere

	1	2	3	4	5	6	7	8	9	0
0	E	A	C	C	C	A	B	B	C	D
10	B	D	C	E	E	E	E	D	D	C
20	A	A	B	E	C	D	E	E	C	C
30	D	D	A	A	C	D	E	D	C	C
40	C	D	B	C	A	D	C	A	D	A

**Answer Key**

### Section 3

1. If a concrete column 200 x 200 mm in cross-section is reinforced with four steel bars of 1200 mm<sup>2</sup> total cross-sectional area. Calculate the safe load for the column if permissible stress in concrete is 5 N/mm<sup>2</sup> and  $E_s$  is 15  $E_c$   
 A. 264 MN      B. 274 MN      C. 284 MN      D. 294 MN      E. None of these.
2. If normal stresses due to longitudinal and transverse loads on a bar are  $\sigma_1$  and  $\sigma_2$  respectively, the normal component of the stress on an inclined plane  $\theta^\circ$  to the longitudinal load, is  
 A.  $\sigma_1 \sin \theta + \sigma_2 \cos \theta$   
 B.  $\sigma_1 \sin^2 \theta + \sigma_2 \cos^2 \theta$   
 C.  $(\sigma_1 - \sigma_2) \frac{\sin 2\theta}{2}$   
 D.  $(\sigma_1 + \sigma_2) \frac{\sin 2\theta}{2}$
3. A shaft subjected to a bending moment  $M$  and a torque  $T$ , experiences  
 A. maximum bending stress =  $\frac{32 M}{\pi d^3}$   
 B. maximum shear stress =  $\frac{16 T}{\pi d^3}$   
 C. both (a) and (b)  
 D. neither (a) nor (b)
4. In the truss shown in given figure the force in member DC is  
 A. 100 t compressive  
 B. 100 t tensile  
 C. zero  
 D. indeterminate
5. If  $M$ ,  $I$ ,  $R$ ,  $E$ ,  $F$ , and  $Y$  are the bending moment, moment of inertia, radius of curvature, modulus of elasticity stress and the depth of the neutral axis at section, then  
 A.  $\frac{M}{I} = \frac{R}{E} = \frac{F}{Y}$       B.  $\frac{I}{M} = \frac{R}{E} = \frac{F}{Y}$       C.  $\frac{M}{I} = \frac{E}{R} = \frac{E}{Y}$       D.  $\frac{M}{I} = \frac{E}{R} = \frac{Y}{F}$
6. The eccentricity ( $e$ ) of a hollow circular column, external diameter 25 cm, internal diameter 15 cm for an eccentric load 100 t for non-development of tension, is

- A. 2.75 cm      B. 3.00 cm      C. 3.50 cm      D. 4.25 cm      E. 5.0 cm
7. If  $I_x$  and  $I_y$  are the moments of inertia of a section about X and Y axes, the polar moment of inertia of the section, is
- A.  $\frac{I_x + I_y}{2}$
- B.  $\frac{I_x - I_y}{2}$
- C.  $I_x + I_y$
- D.  $\frac{I_x}{I_y}$
8. Maximum shear stress theory for the failure of a material at the elastic limit, is known
- A. Guest's or Tresca's theory
- B. St. Venant's theory
- C. Rankine's theory
- D. Haig's theory
- E. Von Mises's theory.
9. The force in AC of the truss shown in the given figure, is
- A.  $5t$  tension
- B.  $4t$  tension
- C.  $4t$  compression
- D.  $5t$  compression
- E. None of these.
10. For determining the force in the member AB of the truss shown in the given figure by method of sections, the section is made to pass through AB, AD and ED and the moments are taken about
- A. joint C      B. joint B      C. joint D      D. joint A
11. A composite beam is composed of two equal strips one of brass and other of steel. If the temperature is raised
- A. steel experiences tensile force
- B. brass experiences compressive force
- C. composite beam gets subjected to a couple
- D. composite beam bends
- E. All the above.



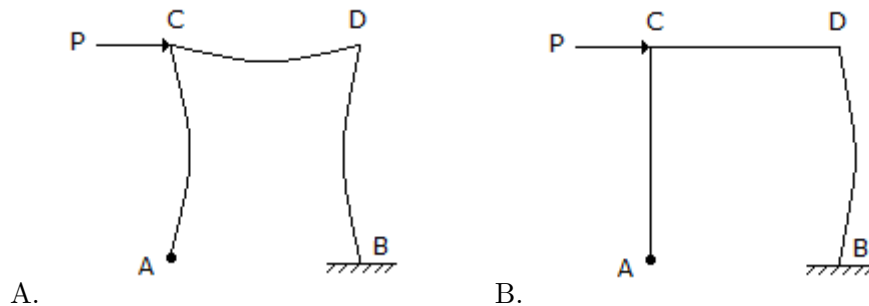
12. A two hinged parabolic arch of span  $l$  and rise  $h$  carries a load varying from zero at the left end to  $\omega$  per unit run at the right end. The horizontal thrust is
- A.  $\frac{\omega l^2}{4h}$     B.  $\frac{\omega l^2}{8h}$     C.  $\frac{\omega l^2}{12h}$     D.  $\frac{\omega l^2}{16h}$
13. The force in EC of the truss shown in the given figure, is
- A. zero  
B.  $5t$  tension  
C.  $5t$  compression  
D.  $4t$  tension  
E. None of these.
14. Shear centre of a half circular section of radius  $r$  and of constant thickness, lies at a distance of  $x$  from the centre where  $x$  is
- A.  $\frac{r}{\pi}$     B.  $2 \frac{r}{\pi}$     C.  $3 \frac{r}{\pi}$     D.  $4 \frac{r}{\pi}$
15. Pick up the correct statement from the following:
- A. The moment of inertia is calculated about the axis about which bending takes place  
B. If tensile stress is less than axial stress, the section experiences compressive stress  
C. If tensile stress is equal to axial stress, the section experiences compressive stress  
D. If tensile stress is more than axial stress, some portion of the section experiences a tensile stress  
E. All the above.
16. The forces acting on the bar as shown in the given figure introduce
- A. compressive stress  
B. tensile stress  
C. shear stress  
D. none of these.
17. The equation of a parabolic arch of span  $l$  and rise  $h$ , is given by
- A.  $y = \frac{h}{l^2} x (1 - x)$     B.  $y = \frac{2h}{l^2} x (1 - x)$     C.  $y = \frac{3h}{l^2} x (1 - x)$   
D.  $y = \frac{4h}{l^2} x (1 - x)$
18. Pick up the correct statement from the following:
- A. A wire wound in spiral form, is called a helical spring

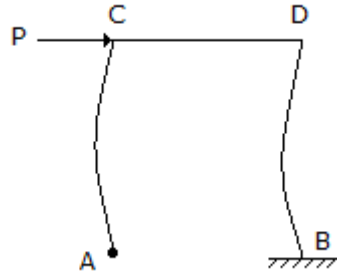
- B. The pitch of a close coil spring, is very small
- C. The angle made by the coil with horizontal, is called the angle of helix
- D. In the open coil helical spring, the angle of helix is comparatively large
- E. All the above.
19. The horizontal thrust on the ends of a two hinged semicircular arch of radius R carrying
- A. a uniformly distributed load  $\omega$  per unit run over its right half span, is  $\frac{2}{3} \frac{\omega R}{\pi}$
- B. a uniformly distributed load  $\omega$  per unit run over its entire span is  $\frac{4}{3} \frac{\omega R}{\pi}$
- C. a distributed load varying from zero at the left end to  $\omega$  per unit horizontal run at the right end, is  $\frac{2}{3} \frac{\omega R}{\pi}$
- D. all the above.
20. Maximum principal stress theory for the failure of a material at elastic point, is known
- A. Guest's or Tresca's theory
- B. St. Venant's theory
- C. Rankine's theory
- D. Haig's theory
- E. Von Mises's theory.
21. The equivalent length is of a column of length L having both the ends fixed, is
- A.  $2L$     B.  $L$     C.  $\frac{L}{2}$     D.  $\frac{L}{\sqrt{2}}$
22. The moment of inertia of a rectangular section of width B and depth D about an axis passing through C.G. and parallel to its width is
- A.  $\frac{BD^2}{6}$     B.  $\frac{BD^3}{6}$     C.  $\frac{BD^3}{12}$     D.  $\frac{B^2D}{6}$     E.  $\frac{DB^2}{12}$
23. A masonry dam (density = 20, 000 N/m<sup>3</sup>) 6 m high, one metre wide at the top and 4 m wide at the base, has vertical water face. The minimum stress at the base of the dam when the reservoir is full, will be
- A. 75 N/m<sup>2</sup>    B. 750 N/m<sup>2</sup>    C. 7500 N/m<sup>2</sup>    D. 75000 N/m<sup>2</sup>

24. The ratio of tangential and normal components of a stress on an inclined plane through  $\theta^\circ$  to the direction of the force, is :  
 A.  $\sin \theta$     B.  $\cos \theta$     C.  $\tan \theta$     D.  $\cos \theta$     E.  $\sec \theta$
25. For calculating the allowable stress of long columns is the empirical formula, known as  
 A. Straight line formula  
 B. Parabolic formula  
 C. Perry's formula  
 D. Rankine's formula.
26. A steel plate  $d \times b$  is sandwiched rigidly between two timber joists each  $D \times B/2$  in section. The moment of resistance of the beam for the same maximum permissible stress  $\sigma$  in timber and steel will be (where Young's modulus of steel is  $m$  times that of the timber).  
 A.  $\sigma \left( \frac{BD^2 + mbd^2}{6D} \right)$     B.  $\sigma \left( \frac{BD^3 + mbd^3}{6D} \right)$     C.  $\sigma \left( \frac{BD^2 + mbd^3}{4D} \right)$   
 D.  $\sigma \left( \frac{BD^2 + mbd^2}{4D} \right)$
27. The ratio of crippling loads of a column having both the ends fixed to the column having both the ends hinged, is  
 A. 1    B. 2    C. 3    D. 4
28. Maximum strain theory for the failure of a material at the elastic limit, is known as  
 A. Guest's or Trecas' theory  
 B. St. Venant's theory  
 C. Rankine's theory  
 D. Haig's theory  
 E. Von Mises's theory.
29. A cantilever of length  $L$  is subjected to a bending moment  $M$  at its free end. If  $EI$  is the flexural rigidity of the section, the deflection of the free end, is  
 A.  $\frac{ML}{EI}$     B.  $\frac{ML}{2EI}$     C.  $\frac{ML^2}{2EI}$     D.  $\frac{ML^2}{3EI}$
30. The maximum bending moment for a simply supported beam with a uniformly distributed load  $w$ /unit length, is  
 A.  $\frac{wI}{2}$     B.  $\frac{wI^2}{4}$     C.  $\frac{wI^2}{8}$     D.  $\frac{wL^2}{12}$
31. Pick up the correct statement from the following:

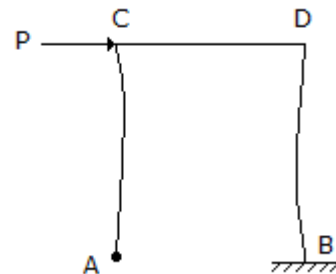
- A. The structural member subjected to compression and whose dimensions are small as compared to its length, is called a stmt
- B. The vertical compression members, are generally known as columns or stanchions
- C. Deflection in lateral direction of a long column, is generally known as buckling
- D. All the above.
32. A short column (30 cm x 20 cm) carries a load P1 at 4 cm on one side and another load P2 at 8 cm on the other side along a principal section parallel to longer dimension. If the extreme intensity on either side is same, the ratio of P1 to P2 will be
- A.  $\frac{2}{3}$       B.  $\frac{3}{2}$       C.  $\frac{8}{5}$       D.  $\frac{5}{8}$
33. Gradually applied static loads do not change with time their
- A. magnitude
- B. direction
- C. point of application
- D. all the above.
34. Slenderness ratio of a long column, is
- A. area of cross-section divided by radius of gyration
- B. area of cross-section divided by least radius of gyration
- C. radius of gyration divided by area of cross-section
- D. length of column divided by least radius of gyration.
35. is the equation of Euler's crippling load if
- A. both at the ends are fixed
- B. both the ends are hinged
- C. one end is fixed and other end is free
- D. one end is fixed and other end is hinged.
36. In the cable shown in the given figure, the minimum tension occurs at
- A. A
- B. B
- C. C
- D. between A and C
- E. between B and C
37. A shaft rotating N.R.M. under a torque T, transmits a power
- A.  $\frac{T\pi N}{30}$  Newton metres/sec

- B.  $\frac{T\pi N}{30}$  Newton metres/min
- C.  $\frac{T\pi N}{60}$  Newton metres/min
- D.  $\frac{T\pi N}{60}$  Newton metres/sec
38. In the truss shown in given figure, the force in member BD is
- A. 100 t compressive
- B. 100 t tensile
- C. zero
- D. indeterminate
39. The normal and tangential components of stress on an inclined plane through  $\theta^\circ$  to the direction of the force, will be equal if  $\theta$  is
- A.  $45^\circ$     B.  $30^\circ$     C.  $60^\circ$     D.  $90^\circ$
40. If D and d are external and internal diameters of a circular shaft respectively, its polar moment of inertia, is
- A.  $\frac{\pi}{2} (D^4 - d^4)$     B.  $\frac{\pi}{4} (D^4 - d^4)$     C.  $\frac{\pi}{64} (D^4 - d^4)$     D.  $\frac{\pi}{32} (D^4 - d^4)$
41. A steel bar 20 mm in diameter simply-supported at its ends over a total span of 40 cm carries a load at its centre. If the maximum stress induced in the bar is limited to N/mm<sup>2</sup>, the bending strain energy stored in the bar, is
- A. 411 N mm    B. 511 N mm    C. 611 Nmm    D. 711 N mm
42. The deflection curve for the portal frame shown in the given figure is





C.



D.

43. A close coil helical spring when subjected to a moment  $M$  having its axis along the axis of the helix
- it is subjected to pure bending
  - its mean diameter will decrease
  - its number of coils will increase
  - all the above.
44. For beams breadth is constant,
- depth  $d \propto M$
  - depth  $d \propto M$
  - depth  $d \propto 3 M$
  - depth  $d \propto \frac{1}{M}$
45. A body is said to be in equilibrium if
- it moves horizontally
  - it moves vertically
  - it rotates about its C.G.
  - none of these.
46. Keeping breadth constant, depth of a cantilever of length  $l$  of uniform strength loaded with uniformly distributed load  $w$  varies from zero at the free end and

A.  $\frac{2w}{\sigma b} \times l$  at the fixed end

B.  $\sqrt{\frac{3w}{\sigma b} \times l}$  at the fixed end

C.  $\sqrt{\frac{2w}{\sigma b} \times l}$  at the fixed end

D.  $\frac{3w}{\sigma d} \times l$  at the fixed end

47. The force in CD of the truss shown in given figure, is
- $3t$  compression
  - $3t$  tension
  - zero
  - $1.5t$  compression
  - $1.5t$  tension
48. The deflection of a uniform circular bar of diameter  $d$  and length  $l$ , which extends by an amount  $e$  under a tensile pull  $W$ , when it carries the same load at its mid-span, is
- $\frac{el}{2d}$
  - $\frac{e^2l}{3d^2}$
  - $\frac{el^2}{3d^2}$
  - $\frac{e^{1/2}}{3d^2}$
49. The ratio of the stresses produced by a suddenly applied load and by a gradually applied load on a bar, is
- $\frac{1}{4}$
  - $\frac{1}{2}$
  - 1
  - 2
  - 3
50. The forces acting normally on the cross section of a bar shown in the given figure introduce
- compressive stress
  - tensile stress
  - shear stress
  - none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	B	C	C	C	D	C	A	B	C
10	E	D	C	D	E	C	D	E	D	C
20	C	C	C	C	B	B	D	B	D	C
30	D	C	D	D	A	C	A	A	A	D
40	C	D	A	B	D	B	C	C	D	A

## Section 4

- In case of principal axes of a section
  - sum of moment of inertia is zero
  - difference of moment inertia is zero
  - product of moment of inertia is zero
  - none of these.
- The forces acting normally on the cross section of a bar shown in the given figure introduce
  - compressive stress
  - tensile stress
  - shear stress
  - none of these.
- The maximum deflection due to a load  $W$  at the free end of a cantilever of length  $L$  and having flexural rigidity  $EI$ , is
  - $\frac{WL^2}{2EI}$
  - $\frac{WL^2}{3EI}$
  - $\frac{WL^3}{2EI}$
  - $\frac{WL^3}{3EI}$
- If the normal stresses due to longitudinal and transverse loads on a bar are  $\sigma_1$  and  $\sigma_2$  respectively, the tangential component of the stress on an inclined plane through  $\theta^\circ$ , the longitudinal load is
  - $\sigma_1 \sin \theta + \sigma_2 \cos \theta$
  - $\sigma_1 \sin^2 \theta + \sigma_2 \cos^2 \theta$
  - $(\sigma_1 - \sigma_2) \frac{\sin 2\theta}{2}$
  - $(\sigma_1 + \sigma_2) \frac{\sin 2\theta}{2}$
- The ratio of the section modulus of a square section of side  $B$  and that of a circular section of diameter  $D$ , is
  - $\frac{2\pi}{15}$
  - $\frac{3\pi}{16}$
  - $\frac{3\pi}{8}$
  - $\frac{\pi}{16}$
- The force in  $BC$  of the truss shown in the given figure, is
  - $3.0t$  compression
  - $3.0t$  tension
  - $\frac{3\sqrt{3}}{2} t$  tension



$$\frac{3\sqrt{3}}{2}$$

- D.  $\frac{3\sqrt{3}}{2} t$  compression  
 E. None of these.
7. The equivalent length of a column of length  $L$ , having one end fixed and other end hinged, is
- A.  $2L$     B.  $L$     C.  $\frac{L}{2}$     D.  $\frac{L}{\sqrt{2}}$
8. At any point of a beam, the section modulus may be obtained by dividing the moment of inertia of the section by
- A. depth of the section  
 B. depth of the neutral axis  
 C. maximum tensile stress at the section  
 D. maximum compressive stress at the section  
 E. none of these.
9. For calculating the permissible stress is the empirical formula, known as
- A. Straight line formula  
 B. Parabolic formula  
 C. Perry's formula  
 D. Rankine's formula.
10. The maximum height of a masonry dam of a triangular section whose base width is  $b$  and specific gravity  $s$ , is
- A.  $bs$     B.  $b.s$     C.  $bs$     D.  $s b$     E.  $\frac{b}{\sqrt{s}}$
11. The load on a spring per unit deflection, is called
- A. stiffness  
 B. proof resilience  
 C. proof stress  
 D. proof load.
12. In a shaft, the shear stress is not directly proportional to
- A. radius of the shaft  
 B. angle of twist  
 C. length of the shaft  
 D. modulus of rigidity.

13.  $A_b$  and  $A_c$  are the cross sections of bronze and copper bars of equal length,  $\sigma_b$ ,  $\sigma_c$  are their respective stresses due to load  $P$ . If  $P_b$  and  $P_c$  are the loads shared by them, (where  $E_b$  and  $E_c$  are their moduli).

$$\frac{\sigma_b}{\sigma_c} = \frac{E_b}{E_c}$$

- A.  $\frac{\sigma_b}{\sigma_c} = \frac{E_b}{E_c}$   
 B.  $P = P_b + P_c$   
 C.  $P = A_b \sigma_b + A_c \sigma_c$   
 D. all the above
14. A compound truss may be formed by connecting two simple rigid frames, by  
 A. two bars  
 B. three bars  
 C. three parallel bars  
 D. three bars intersecting at a point.
15. The locus of the end point of the resultant of the normal and tangential components of the stress on an inclined plane, is  
 A. circle    B. parabola    C. ellipse    D. straight line.
16. The degree of indeterminacy of the frame in the given figure, is  
 A. zero    B. 1    C. 2    D. 3
17. The equivalent length of a column of length  $L$  having one end fixed and the other end free, is  
 A.  $2L$     B.  $L$     C.  $\frac{L}{2}$     D.  $\frac{L}{\sqrt{2}}$
18. To determine the force in  $BD$  of the truss shown in the given figure a section is passed through  $BD$ ,  $CD$  and  $CE$ , and the moments are taken about  
 A.  $A$  joint    B.  $B$  joint    C.  $C$  joint    D.  $D$  joint.
19. The ratio of the length and depth of a simply supported rectangular beam which experiences maximum bending stress equal to tensile stress, due to same load at its mid span, is  
 A.  $\frac{1}{2}$     B.  $\frac{2}{3}$     C.  $\frac{1}{4}$     D.  $\frac{1}{3}$
20. The radius of gyration of a rectangular section (depth  $D$ , width  $B$ ) from a centroidal axis parallel to the width is  
 A.  $\frac{D}{2}$     B.  $\frac{D}{\sqrt{3}}$     C.  $\frac{D}{2\sqrt{3}}$     D.  $\frac{D}{4\sqrt{3}}$

21. For a strongest rectangular beam cut from a circular log, the ratio of the width and depth, is  
 A. 0.303    B. 0.404    C. 0.505    D. 0.606    E. 0.707
22. The moment of inertia of a circular section about any diameter D, is  
 A.  $\frac{\pi D^2}{64}$     B.  $\frac{\pi D^4}{32}$     C.  $\frac{\pi D^3}{64}$     D.  $\frac{\pi D^4}{64}$
23. The ratio of maximum and average shear stresses on a rectangular section, is  
 A. 1    B. 1.25    C. 1.5    D. 2.0    E. 2.5
24. The locus of the moment of inertia about inclined axes to the principal axis, is  
 A. straight line    B. parabola    C. circle    D. ellipse.
25. A lift of weight W is lifted by a rope with an acceleration f. If the area of cross-section of the rope is A, the stress in the rope is  
 A.  $\frac{W}{A} \left( 1 + \frac{f}{g} \right)$     B.  $\frac{W}{A} \left( 1 - \frac{g}{f} \right)$     C.  $\frac{W}{A} \left( 2 + \frac{f}{g} \right)$   
 D.  $\frac{W}{A} \left( 2 + \frac{g}{f} \right)$
26. A close coil helical spring of mean diameter D consists of n coils of diameter d. If it carries an axial load W, the energy stored in the spring, is  
 A.  $\frac{4WD^2n}{d^4N}$     B.  $\frac{4W^2Dn}{d^4N}$     C.  $\frac{4W^2D^3n}{d^4N}$     D.  $\frac{4W^2D^3n^2}{d^4N}$
27. A simply supported beam A carries a point load at its midspan. An other identical beam B carries the same load but uniformly distributed over the entire span. The ratio of the maximum deflections of the beams A and B, will be  
 A.  $\frac{2}{3}$     B.  $\frac{3}{2}$     C.  $\frac{5}{8}$     D.  $\frac{8}{5}$
28. The maximum deflection of a simply supported beam of span L, carrying an isolated load at the centre of the span ; flexural rigidity being EI, is  
 A.  $\frac{WL^3}{3EI}$     B.  $\frac{EL^3}{8EI}$     C.  $\frac{WL^3}{24EI}$     D.  $\frac{WL^3}{48EI}$
29. The strain energy due to volumetric strain  
 A. is directly proportional to the volume

- B. is directly proportional to the square of exerted pressure  
 C. is inversely proportional to Bulk modulus  
 D. all the above.
30. If the strain energy stored per unit volume in a hollow shaft subjected to a pure torque when  $t$  attains maximum shear stress is the ratio of inner diameter to outer diameter, is
- A.  $\frac{1}{2}$     B.  $\frac{1}{3}$     C.  $\frac{1}{4}$     D.  $\frac{1}{5}$
31.  $m_1$  and  $m_2$  are the members of two individual simple trusses of a compound truss. The compound truss will be rigid and determinate if
- A.  $m = m_1 + m_2$   
 B.  $m = m_1 + m_2 + 1$   
 C.  $m = m_1 + m_2 + 2$   
 D.  $m = m_1 + m_2 + 3$
32. In case of a simply supported I-section beam of span  $L$  and loaded with a central load  $W$ , the length of elasto-plastic zone of the plastic hinge, is
- A.  $\frac{L}{2}$     B.  $\frac{L}{3}$     C.  $\frac{L}{4}$     D.  $\frac{L}{5}$     E. none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	B	D	C	B	C	D	B	D	A
10	A	C	D	B	C	B	A	C	B	C
20	E	D	C	D	A	C	D	D	D	C
30	D	D								

## 8 Estimating and Costing

### Section 1

1. Pick up the excavation where measurements are made in square metres for payment.
  - A. Ordinary cuttings up to 1 m
  - B. surface dressing up to 15 cm depths
  - C. Surface excavation up to 30 cm depths
  - D. Both (b) and (c)
  - E. Both (a) and (b)
2. The expected out turn of 2.5 cm cement concrete floor per mason per day
  - A. 2.5 sqm
  - B. 5.0 sqm
  - C. 7.5 sqm
  - D. 10 sqm
3. A portion of an embankment having a uniform up-gradient 1 in 500 is circular with radius 1000 m of the centre line. It subtends  $180^\circ$  at the centre. If the height of the bank is 1 m at the lower end, and side slopes 2:1, the earth work involved.
  - A. 26, 000 m<sup>3</sup>
  - B. 26, 500 m<sup>3</sup>
  - C. 27, 000 m<sup>3</sup>
  - D. 27, 500 m<sup>3</sup>
4. The correct prismoidal formula for volume is
  - A.  $D$  [first area + last area +  $\sum$  Even area + 2  $\sum$  odd areas]
  - B.  $\frac{D}{3}$  [first area + last area + 4  $\sum$  Even area + 2  $\sum$  odd areas]
  - C.  $\frac{D}{3}$  [first area + last area + 2  $\sum$  Even area + 4  $\sum$  odd areas]
  - D.  $\frac{D}{6}$  [first area + last area + 2  $\sum$  Even area + 4  $\sum$  odd areas].
5. The order of booking dimensions is
  - A. Length, breadth, height
  - B. Breadth, length, height
  - C. Height, breadth, length
  - D. None of these.
6. As per Indian Standard Specifications, the peak discharge for domestic purposes per capita per minute, is taken
  - A. 1.80 litres for 5 to 10 users
  - B. 1.20 litres for 15 users
  - C. 1.35 for 20 users

- D. All the above.
- 7. Pick up the item of work not included in the plinth area estimate
  - A. Wall thickness
  - B. Room area
  - C. Verandah area
  - D. W.C. area
  - E. Courtyard area.
- 8. Pick up the correct statement from the following:
  - A. The bent up bars at a support resist the negative bending moment
  - B. The bent up bars at a support resist the sharing force
  - C. The bending of bars near supports is generally at  $45^\circ$
  - D. All the above.
- 9. The brick work is measured in sq metre, in case of
  - A. Honey comb brick work
  - B. Brick flat soling
  - C. Half brick walls or the partition
  - D. All the above.
- 10. Brick walls are measured in sq. m if the thickness of the wall is
  - A. 10 cm      B. 15 cm      C. 20 cm      D. None of these.
- 11. Pick up the correct statement in case of water supply.
  - A. Pipes laid in trenches and pipes fixed to walls are measured separately
  - B. Cutting through walls and floors are included with the item
  - C. Pipes are classified according to their sizes and quality
  - D. In laying pipes, the method of jointing and fixing is specifically specified
  - E. All the above.
- 12. In case of laying gullies, siphons, intercepting traps, the cost includes
  - A. Setting and laying
  - B. Bed concreting
  - C. Connection to drains
  - D. All of these.
- 13. In long and short wall method of estimation, the length of long wall is the centre to centre distance between the walls and
  - A. breadth of the wall
  - B. half breadth of wall on each side
  - C. one fourth breadth of wall on each side

- D. None of these.
14. The height of the sink of wash basin above floor level is kept  
A. 60 cm      B. 70 cm      C. 75 cm to 80 cm      D. 80 cm
15. While preparing a detailed estimate  
A. Dimension should be measured correct to 0.01 m  
B. Area should be measured correct to 0.01 sqm  
C. Volume should be measured correct to 0.01 cum  
D. All the above.
16. Pick up the incorrect statement regarding a master trap from the following :  
A. It is provided in between the lower end of the house drain and the street sewer  
B. It is provided a cleaning eye at the top of the trap  
C. The height of fresh air inlet pipe fixed vertically with wall is 3 m  
D. The mica flap valve which opens inwards only, is fitted at the top of the inlet pipe  
E. The water seal is less than that of ordinary traps.
17. The concrete work for the following part of the building of specified thickness is measured in square metres  
A. Root slabs      B. Floors      C. D.P.C.      D. Wall panels      E. All the above.
18. Pick up the correct statement from the following:  
A. The estimated value of the work excluding the amount for contingencies, work charged establishment, tool and plants, is called work value  
B. The actual expenditure involved to complete a work including incidental, establishment and travelling charges, is called actual cost  
C. The formal acceptance by the administrative department for incurring an expenditure on the work, is called administrative approval  
D. The order of a competent authority sanctioning a properly detailed estimate of the cost of a work of construction or repair is called technical sanction  
E. All the above.
19. The expected out turn of cement concrete 1 : 2 : 4 per mason per day is  
A.  $1.5 \text{ m}^3$       B.  $2.5 \text{ m}^3$       C.  $3.5 \text{ m}^3$       D.  $5.0 \text{ m}^3$

20. The area of the cross-section of a road fully in banking shown in the given figure, is
- A.  $\frac{sb^2 + r^2 (2bd + Sd)^2}{r^2 - S^2}$       B.  $\frac{Sb^2 + r^2 (2bd + Sd)^2}{r^2 - S^5}$       C.  $\frac{Sb^2 + r^2 (2bd + Sd)^2}{r - S}$   
D. None of these
21. The plinth area of a building not includes
- A. area of the walls at the floor level  
B. area of stair cover  
C. internal shaft for sanitary installations up to 2 sq m. in area  
D. lift and wall including landing  
E. area of cantilevered porch.
22. For 12 mm thick cement plastering 1 : 6 on 100 sq.m new brick work, the quantity of cement required, is
- A. 0.200 m<sup>3</sup>      B. 0.247 m<sup>3</sup>      C. 0.274 m<sup>3</sup>      D. 0.295 m<sup>3</sup>
23. The minimum width of a septic tank is taken
- A. 70 cm      B. 75 cm      C. 80 cm      D. 90 cm
24. The item of the brick structure measured in sq.m, is
- A. Reinforced brick work  
B. Broken glass coping  
C. Brick edging  
D. Brick work in arches.
25. The inspection pit or chamber is a manhole provided in a base drainage system
- A. at every change of direction  
B. at every change of gradient  
C. at every 30 m intervals  
D. at the point where vertical soil pipe joins the house drain  
E. All the above.
26. In the mid-section formula
- A. The mean depth is the average of depths of two consecutive sections  
B. The area of mid-sections is calculated by using mean depth  
C. The volume of the earth work is calculated by multiplying the mid-section area by the distance between the two sections  
D. The volume of the earth work is calculated by multiplying the mid-section area by the distance between the two original sections  
E. (a), (b) and (c) of the above.



27. The item of steel work which is measured in sq.m, is
- Collapsible gates
  - Rolling shutters
  - Steel doors
  - Ventilators and glazing.
  - All the above.
28. The value of 'C' of Indian type W.C. shown in the given figure is :
- 400 mm
  - 450 mm
  - 500 mm
  - 550 mm
29. The area of a sloping surface of a protective embankment of mean height  $d$ , side slopes  $S : 1$  and length  $L$  is
- $d \times d \times s$
  - $d^2 \times (ds)^2$
  - $L \cdot D \cdot 1 + s^2$
  - $2 \cdot LD \cdot 1 + s^2$
30. If the formation level of a highway has a uniform gradient for a particular length, and the ground is also having a longitudinal slope, the earthwork may be calculated by
- Mid-section formula
  - Trapezoidal formula
  - Prismoidal formula
  - All the above.
31. The most reliable estimate is
- Detailed estimate
  - Preliminary estimate
  - Plinth area estimate
  - Cube rate estimate
  - None of these.
32. The expected out turn of 12 mm plastering with cement mortar is
- 2.5 sq m
  - 4.0 sq m
  - 6.0 sq m
  - 8.0 sq m
  - 10 sq m
33. The main factor to be considered while preparing a detailed estimate, is
- Quantity of the materials
  - Availability of materials
  - Transportation of materials
  - Location of site and local labour charges
  - All the above.

34. The damp proof course (D.P.C.) is measured in  
A. Cub.m    B. Sq m    C. Metres    D. None of these
35. The reduced levels of points, 30 metres apart along the longitudinal section of a road portion between chainages 5 and 9 are shown in the given figure. If there is a uniform up-gradient of the road 120 in 1, the chainage of the point with no filling or cutting is  
A. (6 + 15) chains  
B. (6 + 12) chains  
C. (6 + 18) chains  
D. None of these.
36. The area is measured correct to the nearest  
A. 0.01 sqm    B. 0.02 sqm    C. 0.03 sqm    D. 0.04 sqm    E. 0.05 sqm
37. Cost of fittings and their fixing is specified for the following sanitary fittings  
A. Water closets  
B. Flushing pipes  
C. Lavatory basins  
D. Sinks  
E. All the above.
38. The volume is measured correct to the nearest  
A. 0.01 cum    B. 0.02 cum    C. 0.03 cum    D. 0.04 cum    E. 0.05 sum
39. Pick up the correct statement from the following:  
A. The earth work of cutting in trenches or borrow pits in fairly uniform ground is measured with the help of average depths of the dead men  
B. The earth work in trenches or borrow pits in irregular ground is measured by taking the difference in levels before and after completion of work  
C. The earth work in trenches or borrow pits, where neither a nor b is feasible, are measured from the fillings after deduction of voids  
D. All the above.
40. Pick up the item whose weight is added to the weight of respective item, is  
A. Cleats  
B. Brackets  
C. Bolts  
D. Distance separators

- E. All the above.
41. The total length of a cranked bar through a distance (d) at  $45^\circ$  in case of a beam of effective length L, is
- $L + 0.42 d$
  - $L + 2 \times 0.42 d$
  - $L - 0.42 d$
  - $L - 2 \times 0.4 d$
42. While estimating a reinforced cement structure, the omitted cover of concrete is assumed
- at the end of reinforcing bar, not less than 25 mm or twice the diameter of the bar
  - in thin slabs, 12 mm minimum or diameter of the bar whichever is more
  - for reinforcing longitudinal bar in a beam 25 mm minimum or diameter of the largest bar which is more
  - All the above.
43. The excavation exceeding 1.5 m in width and 10 sq.m in plan area with a depth not exceeding 30 cm, is termed as
- Excavation
  - Surface dressing
  - Cutting
  - Surface excavation.
44. Pick up the incorrect statement from the following:
- Dimensions are measured to the nearest 0.01 m
  - Areas are measured to the nearest 0.01 sq.m
  - Cubic contents are measured to the nearest 0.1 cm m
  - Weights are measured to the nearest 0.001 tonnes
45. If tensile stress of a steel rod of diameter D is  $1400 \text{ kg/cm}^2$  and bond stress is  $6 \text{ kg/cm}^2$ , the required bond length of the rod is
- $30 D$
  - $40 D$
  - $50 D$
  - $53 D$
  - $59 D$
46. The measurement is not made in square metres in case of
- D.P.C. (Damp proof course)
  - Form works
  - Concrete Jaffries
  - R.C. Chhajja.
47. According to ISI method of measurement, the order of the sequence is
- Length, breadth, height

- B. Breadth, length, height  
 C. Height, length, breadth  
 D. None of these.
48. The assumption on which the trapezoidal formula for volumes is based, is
- A. The end sections are parallel planes  
 B. The mid-area of a pyramid is half the average area of the ends  
 C. The volume of the prismoidal is over-estimated and hence a prismoidal correction is applied  
 D. All the above.
49. The cross-sections for a highway is taken at
- A. right angle to the centre line  
 B. 30 metres apart  
 C. intermediate points having abrupt change in gradient  
 D. the starting end points of the curves  
 E. All the above.
50. The detention period in a septic tank is assumed
- A. 20 minutes      B. 25 minutes      C. 30 minutes      D. 40 minutes

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	C	D	B	A	D	E	D	D	A
10	E	D	B	C	D	E	E	E	D	A
20	E	C	B	B	E	E	E	C	C	D
30	A	D	E	B	B	A	E	A	D	E
40	B	D	D	C	E	D	A	D	E	C

## Section 2

1. For 100 sq. m cement concrete (1 : 2: 4) 4 cm thick floor, the quantity of cement required, is  
A.  $0.90 \text{ m}^3$     B.  $0.94 \text{ m}^3$     C.  $0.98 \text{ m}^3$     D.  $1.00 \text{ m}^3$
2. For the construction of buildings, the subheads of the estimate are  
A. Earthwork, Concrete work, Brick work  
B. Brickwork, Stone work, Roofing  
C. Brickwork Flooring, Wood work, Steel work  
D. Plastering or pointing, finishing, water supply and sanitary work  
E. All the above.
3. The measurement is made for stone work in square metre in case of  
A. Wall facing  
B. Columns, lintels, copings  
C. Building work  
D. Dressed stones in Chajjas  
E. (a) and (d) of the above.
4. The 'centre line method' is specially adopted for estimating  
A. Circular buildings  
B. Hexagonal buildings  
C. Octagonal buildings  
D. Other geometrical shaped buildings  
E. All the above.
5. The value of 'A' of Indian type W.C. shown in the given figure is :  
A. 25 cm    B. 30 cm    C. 40 cm    D. 45 cm
6. Referring of given figure, pick up the correct statement from the following:  
A. The total length of centre line of four walls is 20 m  
B. Length of long wall out-to-out is 6.80 m  
C. Length of short walls in-to-in is 3.20 m  
D. All the above.
7. Size, capacity and materials need be specified for  
A. Bib-cocks    B. Stop-cocks    C. Ferrules    D. Ball valves    E. All the above.
8. A cement concrete road is 1000 m long, 8 m wide and 15 cm thick over the sub-base of 10 cm thick gravel. The box cutting in road crust is  
A.  $500 \text{ m}^3$     B.  $1000 \text{ m}^3$     C.  $1500 \text{ m}^3$     D.  $2000 \text{ m}^3$
9. The expected out turn for earth work in excavation in ordinary soil per mazdoor per day is

- A. 1.00 cubic meter
  - B. 2.00 cubic meter
  - C. 3.00 cubic meter
  - D. 4.00 cubic meter
10. Anti-siphonage pipe is connected to
- A. Main soil pipe
  - B. Bottom of P trap W.C.
  - C. Top of P trap W.C.
  - D. Side of water closet.
11. Pick up the incorrect statement from the following:
- A. The built up covered area at the floor level of any storey of a building is called plinth area
  - B. The usable covered area of the rooms of any storey of a building is called carpet area
  - C. The carpet area of a building along with area of its kitchen, pantry, store, lavatory, bath room and glazed verandah, is called floor area
  - D. None of these.
12. Carpet area does not include the area of
- A. the walls along with doors and other openings
  - B. verandah, corridor and passage
  - C. bath room and lavatory
  - D. kitchen and pantry
  - E. All the above.
13. The trap which is provided to disconnect the house drain from the street sewer is called
- A. Master trap
  - B. Intercepting trap
  - C. Interception manhole
  - D. Interceptorchamber
  - E. All the above.
14. Pick up the incorrect statement from the following:
- A. Lead is the average horizontal straight distance between the borrow pit and the place of spreading soil
  - B. The lead is calculated for each block of the excavated area
  - C. The unit of lead is 50 m for a distance upto 500 m
  - D. The unit of lead is 1 km where the lead exceeds 2 km.

15. Pick up the correct statement regarding the centre line method of estimating a building
- Product of the centre line of the walls and area of cross-section of any item, gives total quantity of the item
  - The centre line is worked out separately for different sections of walls of a building
  - The centre line length is reduced by half the layer of main wall joining the partition wall
  - All the above.
16. Pick up the correct statement from the following:
- Pointing is measured in sq.m
  - Plastering is measured in sq.m
  - Glazing is measured in sq.m
  - Striking is measured in sq.m
  - All the above.
17. The expected out turn of half brick partition wall per mason per day is
- $1.5 \text{ m}^3$
  - $2.0 \text{ m}^3$
  - $4.0 \text{ m}^2$
  - $5.0 \text{ m}^2$
18. If B is the width of formation, d is the height of the embankment, side slope S : 1, for a highway with no transverse slope, the area of cross-section is
- $B + d + Sd$
  - $Bd + Sd^2$
  - $B \times d - Sd^2/2$
  - $\frac{1}{2} (Bd + Sd^2)$
19. The floor area includes the area of the balcony up to
- 100%
  - 75%
  - 50%
  - 25%
20. The cross-section of a road partly in banking and partly in cutting is shown in the given figure. The area of the shaded portion is
- $\frac{1}{3} \times \frac{(b - rd)^2}{r - s}$
  - $\frac{1}{3} \times \frac{(b - rd)^2}{r + s}$
  - $\frac{1}{2} \times \frac{(b + rd)^2}{r - s}$
  - $\frac{1}{3} \times \frac{(b - rd)^2}{r - s}$
21. According to Indian Standards Institute, the actual size of modular bricks is
- 23 cm x 11.5 cm x 7.5 cm
  - 25 cm x 13 cm x 7.5 cm
  - 19 cm x 9 cm x 9 cm

- D. 20 cm x 10 cm x 10 cm
22. While estimating the quantities for the construction of a building, the correct metric unit is
- Metre for length
  - Cubic metre for area
  - Square metres for volume
  - Kilogram for weight
  - Litre for capacity
23. The slope of the outlet of 'P trap' below the horizontal is kept
- 8°
  - 10°
  - 12°
  - 14°
24. Pick up the correct statement from the following:
- In a gully trap, a water seal of 6 to 7.5 cm is provided
  - The gully trap collects waste water from the kitchen, sink, wash basins, etc.
  - The gully trap disconnects the sullage drain from the main drainage system
  - The grating provided over gully traps is 23 cm square.
25. The unit of measurement is per quintal for the following:
- Collapsible gates with rails
  - Rolling shutters
  - Expanded metal wire netting
  - M.S. reinforcement of R.C.C. works.
26. Due to change in price level, a revised estimate is prepared if the sanctioned estimate exceeds
- 2.0%
  - 2.5%
  - 4.0%
  - 5.0%
27. Pick up the correct statement from the following:
- The incidental expenses of a miscellaneous character which could not be predicted during preparation of the estimate, is called contingencies
  - Additional supervising staff engaged at work site, is called work charged establishment
  - Detailed specifications specify qualities, quantities and the proportions of materials to be used for a particular item
  - The cost per unit at which the article can be procured, from the open market at a given time, is called 'market rate'
  - All the above.
28. The expected out turn of brick work in cement mortar in foundation and plinth per mason per day, is
- 1.00 m<sup>3</sup>
  - 1.25 m<sup>3</sup>
  - 1.50 m<sup>3</sup>
  - 1.75 m<sup>3</sup>



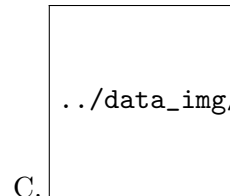
29. Pick up the correct statement from the following:
- If the bed level is above N.S.L. the canal is called fully in banking and the berms are designed as  $3d$  where  $d$  is full supply depth of water (F.S.D.)
  - Area of canal in cutting  $= BD + Sd^2$  where  $B$  = bed width,  $d$  = depth of cutting and  $S$  is the side slope
  - Area of the bank of canal  $= B_1d_1 + Sd_1^2$  where  $B_1$ ,  $d_1$  and  $S$  are the width of bank, height of the bank above N.S.L. and side slope respectively
  - If F.S.L. is above N.S.L the canal is called partly in cutting and partly in filling and berms are designed as  $2d$  where  $d$  is full supply depth
  - All the above.
30. The following item of earth work is not measured separately.
- Setting out of works
  - Site clearance
  - dead men
  - Steps in deep excavation
  - All the above.
31. Pick up the correct statement from the following:
- In order to check up the average depth of excavation, 'Dead mans' are left at the mid-widths of borrow pits
  - The earthwork calculation in excavation is made from the difference in levels obtained with a level
  - The earth work in excavation to form the road embankment includes the formation of correct profile and depositing the soil in layers
  - All the above.
32. The ground surface slopes 1 in 50 along a proposed railway embankment 150 m in length. The height of the embankment at zero chainage is 0.5 m, the width is 11 m and side slopes 2:1. If the falling gradient of the embankment is 1 in 150, the quantity of the earthwork calculated by prismoidal formula, is
- A.  $3250 \text{ m}^3$       B.  $3225 \text{ m}^3$       C.  $3275 \text{ m}^3$       D.  $3300 \text{ m}^3$
33. The diameter of a domestic sewer pipe laid at gradient 1 in 100 is recommended
- A. 100 mm      B. 150 mm      C. 200 mm      D. 175 mm
34. Pick up the correct statement from the following:
- Bricks are paid per thousand

- B. Cement is paid per 50 kg bag
  - C. Lime is paid per quintal
  - D. Brick aggregates is paid per cum
  - E. All the above.
35. The weight of an item is measured correct to nearest  
 A. 0.25 kg    B. 0.50 kg    C. 0.75 kg    D. 1.00 kg    E. 5 kg
36. The rate of payment is made for 100 cu m (per % cu m) in case of  
 A. Earth work in excavation  
 B. Rock cutting  
 C. Excavation in trenches for foundation  
 D. Earth work in filling the plinth  
 E. all the above.
37. The cost of the earthwork in excavation for the surface drain of cross-section shown in the given figure for a total length of 5 metres @ Rs. 450% cum, is  
 A. Rs. 400    B. Rs. 425    C. Rs. 450    D. Rs. 500
38. Pick up the incorrect statement from the following:  
 A. No deduction is made for the volume occupied by reinforcement  
 B. No deduction is made for the openings upto 0.1 sq.m  
 C. No deduction is made for volumes occupied by pipes, not exceeding 100 sq.cm in cross-section  
 D. No deductions are made for the ends of dissimilar structures up to 500 sq.cm cross-sectional area  
 E. None of these.
39. The measurement is made in square metre in case of  
 A. Cement concrete in foundation  
 B. R.C.C. structure  
 C. Hollow concrete block wall  
 D. Concrete fencing posts  
 E. None of these.
40. Berms are provided in canals if these are  
 A. fully in excavation  
 B. partly in excavation and partly in embankment  
 C. fully in embankment  
 D. All the above.
41. The brick work is not measured in cu m in case of  
 A. One or more than one brick wall

- B. Brick work in arches  
 C. Reinforced brick work  
 D. Half brick wall.
42. The cross-sectional area of the embankment of a canal fully in embankment in the given figure is

A.  $\frac{1}{2} (b_1 + b_2)h$

B.  $(b_1 + b_2)h + Sb^2$



D.  $2[(b_1 + b_2) (b + Sh^2)]$

43. The value of 'B' of Indian type W.C. shown in the given figure is :  
 A. 45 cm      B. 50 cm      C. 30 cm      D. 25 cm

44. The rate of an item of work depends on

- A. Specifications of works  
 B. Specifications of materials  
 C. Proportion of mortar  
 D. Method of construction  
 E. All the above.

45. Pick up the correct statement from the following:

- A. All pipes and fittings are classified according to their diameters  
 B. The diameter of the pipes is the nominal diameter of internal bore  
 C. All pipes are measured along the centre line of the pipes in metres  
 D. Lead caulked joints are enumerated separately  
 E. All the above.

Answer Key

	1	2	3	4	5	6	7	8	9	0
0	B	E	E	E	B	D	E	C	C	C
10	D	E	E	D	D	E	B	B	C	A
20	C	E	D	B	D	D	E	B	E	E
30	D	B	B	E	D	E	C	E	E	B
40	D	C	A	E	E					

## 9 UPSC Civil Service Exam Questions

### Section 1

1. Which type of light energy is effectively absorbed by CO<sub>2</sub> in the lower boundary of the troposphere ?  
A. X - rays      B. UV - rays      C. Visible light      D. Infra-red rays
2. The following steps are involved in laying a sewer in a trench :1. Transferring the center line of the sewer to the bottom trench.2. Setting sight rails over the trench.3. Driving pegs to the level of the invert line of the sewer.4. Placing the sewer of these steps is The correct sequence of these steps is  
A. 1, 2, 3, 4      B. 2, 3, 4, 1      C. 4, 2, 3, 1      D. 2, 3, 1, 4
3. A horizontal rod AB carries three loads of 3.0 kg, 7.0 kg and 10.0 kg at distances of 2.0 cm, 9.0 cm and 15 cm respectively from A where it is hinged. Neglecting the weight of the rod, which is the point at which the rod will be balance ?  
A. 10.95 cm from A  
B. 11.25 cm from A  
C. 12.55 cm from A  
D. 13.25 cm from A
4. Distemper is used to coat  
A. external concrete surfaces  
B. interior surfaces not exposed to weather  
C. woodwork  
D. compound walls
5. Two simply supported beams B1 and B2 have spans  $l$  and  $2l$  respectively. Beam B1 has a cross-section of  $1 \times 1$  units and beam B2 has a cross-section of  $2 \times 2$  units. These beams are subjected to concentrated loads  $W$  each at the centre of their spans. The ratio of the maximum flexural stress in these beams is  
A. 4      B. 2      C.  $\frac{1}{2}$       D.  $\frac{1}{4}$
6. A soil has a liquid limit of 45% and lies above the A-line when plotted on a plasticity chart. The group, symbol of the soil as per Soil Classification is  
A. CH      B. CI      C. CL      D. MI
7. A short column of external diameter  $D$  and internal diameter  $d$ , is subjected to a load  $W$ , with an eccentricity 'e', causing zero stress at

an extreme fibre. Then the value of 'e' must be

- A.  $\frac{D^2 + d^2}{8\pi D}$       B.  $\frac{D^2 - d^2}{8\pi D}$       C.  $\frac{D^2 + d^2}{8D}$       D.  $\frac{D^2 - d^2}{8D}$

8. A high efficiency pump is required for low discharge, high head and low maintenance cost. Delivery of water need not be continuous. The pump need not run at high speed. Which one of the following is the correct choice ?
  - A. Centrifugal pump
  - B. Reciprocating pump
  - C. Air lift pump
  - D. Hydraulic ram
9. For total reaction time of 2.5 seconds, coefficient of friction 0.35, design speed 80 km/h, what is the stopping sight distance on a highway ?
  - A. 127 m      B. 132 m      C. 76 m      D. 56 m
10. What is the use of a station pointer ?
  - A. For making soundings in water bodies
  - B. For plotting of soundings in harbour area
  - C. For marking sunken shipping hazards
  - D. For making tidal observations
11. The plastic modulus of a section is  $5 \times 10^{-4} \text{ m}^3$ . Its shape factor is 1.2 and the plastic moment capacity is 120 kNm. What is the value of the yield stress of the material ?
  - A. 100 N/mm<sup>2</sup>      B. 200 N/mm<sup>2</sup>      C. 240 N/mm<sup>2</sup>      D. 288 N/mm<sup>2</sup>
12. According to ICAO recommendations, what is the rate of elevation correction for the runway above MSL ?
  - A. 1 % for every 100 m of elevation above MSL
  - B. 7 % for every 300 m of elevation above MSL
  - C. 2 % for every 500 m of elevation above MSL
  - D. 2 % for every 300 m of elevation above MSL
13. The absolute maximum Bending Moment in a simply supported beam of span 20 m due to moving udl of 4 t/m spanning over 5 m is
  - A. 87.5 t-m at the support
  - B. 87.5 t-m near the midpoint
  - C. 3.5 t-m at the midpoint
  - D. 87.5 t-m at the midpoint
14. The following steps are involved in making a spigot and socket joint of cast iron pipes used in water supply systems :1. Tarred gasket or hemp

yarn in wrapped around the spigot.2. The sipgot end is centered into the socket end of the preceding pipe.3. A joining ring end is placed around the barrel and against the face of the socket.4. The gasket or hemp yarn in caulked slightly.5. Molten pig lead is poured and then caulked.The correct sequence of these steps is

A. 2, 1, 4, 3, 5      B. 2, 1, 3, 4, 5      C. 1, 2, 4, 5, 3      D. 1, 2, 3, 5, 4

15. Consider the following statements :A : In masonry, bricks are joined together by cement mortar.B : Cement mortar adheres more effectively to brick surface than any other material.
  - A. both  $A$  and  $R$  are true and  $R$  is the correct explanation of  $A$
  - B. both  $A$  and  $R$  are true but  $R$  is not the correct explanation of  $A$
  - C.  $A$  is true but  $R$  is false
  - D.  $A$  is false but  $R$  is true
16. In the force system shown in the figure, the force CA should be
  - A.  $5\ t$       B.  $-5\ t$       C.  $4\ t$       D.  $-4\ t$
17. A cylindrical shell made of mild steel plate of 100 cm diameter is to be subjected to an internal pressure of 10 kg/cm<sup>2</sup>. If the material yields at 2000 kg/cm<sup>2</sup>, assuming factor of safety as four and using maximum principal stress theory, thickness of the plate will be
  - A. 5 mm      B. 10 mm      C. 15 mm      D. 20 mm
18. A plot of land 60°m x 20 m is measure steel tape. If the standard error of length width measurements is taken as  $\pm 1\ \text{cm}$ , the standard error of the area of the plot be
  - A.  $\pm 0.1414\ \text{m}^2$
  - B.  $\pm 0.566\ \text{m}^2$
  - C.  $\pm 0.632\ \text{m}^2$
  - D.  $\pm 0.8484\ \text{m}^2$
19. The graphical condition for equilibrium of concurrent forces is that
  - A. both the force polygon and the funicular polygon must be closed figures
  - B. funicular polygon should be a closed figure
  - C. force polygon need not be a closed figure
  - D. force polygon should be a closed figure
20. In a tilted aerial photograph, if the swing is 230°, then the rotation angle is equal to
  - A. 140°      B. 130°      C. 50°      D. 25°
21. A cold drawn seamless steel tubing subject to internal pressure, has a diameter of 6 cm and wall thickness of 0.2 cm. The ultimate strength

- of steel is  $3600 \text{ kg/cm}^2$ . The bursting pressure (in  $\text{kg/cm}^2$ ) is  
 A. 120      B. 240      C. 480      D. 960
22. Which of the following factors are associated with the behaviour of sand mass during earthquake to cause liquefaction ?  
 1. Number of stress cycles  
 2. The frequency, and amplitude of vibration of waves generated by an earthquake  
 3. Characteristics of sand  
 4. Relative density  
 Select the correct answer using the codes given below :  
 A. 1, 2 and 3      B. 1, 2, 3 and 4      C. 2 and 4      D. 3 and 4
23. The ratio of total elongation of a bar of uniform cross-section produced under its own weight to the elongation produced by an external load equal to the weight of the bar is  
 A. 2      B. 1      C.  $1/2$       D.  $1/4$
24. The figure refers to a channel section of uniform thickness of 1 cm used as a beam with the cross-sectional dimensions shown in cm units. If the Moment of Inertia of channel  $I_{xx}$  be equal to  $246 \text{ cm}^4$  and C be the shear centre, then the value of  $e$  in cm is equal to  
 A. 1.5      B. 2.5      C. 2.25      D. 1.67
25. The shear force diagram of a beam is shown in the given figure. The absolute maximum bending moment in the beam is  
 A.  $(2P \times a)$   
 B.  $(5P \times a)$   
 C.  $(4P \times a)$   
 D.  $(7P \times a)$
26. A locomotive has four pairs of driving wheels carrying an axle load of  $24 \times 10^4 \text{ N}$ . The maximum load that can be pulled if the coefficient of friction is  $1/6$ , is  
 A.  $32 \times 10^4 \text{ N}$   
 B.  $16 \times 10^4 \text{ N}$   
 C.  $8 \times 10^4 \text{ N}$   
 D.  $4 \times 10^4 \text{ N}$
27. A bar of circular cross-section of diameter  $D$  is subjected to a torque  $T$  at B as shown in the figure given. What is the angle of twist at A?  
 A. Same as that at B  
 B. Zero  
 C. Twice as that at B  
 D. Half as that at B
28. Consider the following statements regarding Plane Table surveying :  
 1. It is less accurate than chain surveying.  
 2. It is not necessary to do accurate centering of plane table for small scale survey.  
 3. Compass rule

may be made use for adjusting the plane table transverse.4. From the instrument station, resectors are drawn to plot the position of object in the field. Of these statements :

- A. 1, 2 and 4 are correct
  - B. 2, 3 and 4 are correct
  - C. 1, 2 and 3 are correct
  - D. 1, 3 and 4 are correct
29. A pin-jointed tower truss is loaded as shown in the given figure. The force induced in the member DF is
- A. 1.5 kN (tension)
  - B. 4.5 kN (tension)
  - C. 1.5 kN (compression)
  - D. 4.5 kN (compression)
30. In a PERT network, the activity durations are given as to (optimistic), tp (pessimistic) and tm (most likely time). What is the variance of is activity ?
- A.  $\frac{t_o + 4t_m + t_p}{6}$
  - B.  $\left( \frac{t_p - t_o}{6} \right)$
  - C.  $\left( \frac{t_p - t_o}{6} \right)^2$
  - D. None of the above
31. A particle of mass 3 kg moving in a straight line decelerates uniformly from a speed of 40 m/s to 20 m/s in a distance of 300 m. Before it comes to rest, it will travel a further distance pf
- A. 10 m
  - B. 20 m
  - C. 50 m
  - D. 100 m
32. For designing end bearing piles of square cross-section in clays having average unconfined compressive strength of 6 t/m<sup>2</sup>, the net ultimate bearing capacity may be taken as
- A. 15 t/m<sup>2</sup>
  - B. 18 t/m<sup>2</sup>
  - C. 20 t/m<sup>2</sup>
  - D. 27 t/m<sup>2</sup>
33. The side AD of the square block ABCD as shown in the given figure is fixed at the base and it is under a state of simple shear causing shear stress  $\tau$  and shear strain  $\pi$ , where The distorted shape is AB'C'D. The diagonal strain (linear) will be
- A.  $\frac{\phi}{2}$
  - B.  $\frac{\phi}{\sqrt{2}}$
  - C.  $\phi^2$
  - D.  $\phi$



34. Consider the following statements : Collision diagram is used to  
 1. study accident pattern  
 2. eliminate accidents  
 3. determine remedial measures  
 4. make statistical analysis of accidents  
 Of these statements :
- A. 1 and 2 are correct  
 B. 1 and 3 are correct  
 C. 3 and 4 are correct  
 D. 2 and 4 are correct
35. Consider the following statements :  
 1. An ascending gradient of 1 in 100 meets an ascending gradient of 1 in 120 to form a Valley curve.  
 2. A falling gradient of 1 in 25 meets a falling gradient of 1 in 50 to form a summit curve.  
 3. The length of summit curve is determined on the basis of head light sight distance.  
 Which one of the statements given above is/are correct ?
- A. 1 and 2      B. 2 and 3      C. 1 and 3      D. 2 only
36. The rectangular block shown in the given figure is subjected to pure shear to intensity 'q'. If BE represents the i principal plane and the principal stresses are  $\sigma_1, \sigma_2$  ; then the values of  $\theta, \sigma_1$  and  $\sigma_2$  will be respectively.
- A.  $\theta^\circ, 90^\circ; +q$  and  $-q$   
 B.  $30^\circ, 120^\circ; +q$  and  $-q$   
 C.  $45^\circ, 135^\circ; +$  and  $-\frac{q}{2}$   
 D.  $45^\circ, 135^\circ; +q$  and  $-q$
37. The maximum energy stored at elastic limit of a material is called
- A. resilience  
 B. proof resilience  
 C. modulus of resilience  
 D. bulk resilience
38. If the pressure carried by a CBR specimen at 2.5 mm penetration is 3.5 N/mm<sup>2</sup>, the CBR of the soil is
- A. 10%      B. 35%      C. 50%      D. 70%
39. A close-coiled helical spring with n coils, mean radius R and diameter d is subjected to an axial load W. What is the compression in the spring ?
- A.  $\frac{64 WR^3 n}{Cd^3}$       B.  $\frac{64 WR^3 n}{Cd^4}$       C.  $\frac{32 WR^3 n}{Cd^3}$       D.  $\frac{32 WR^3 n}{Cd^4}$
40. Activated sludge is the
- A. resultant sludge removable from the aeration unit  
 B. sludge settled in the humus tank

- C. sludge in the secondary tank post-aeration rich in microbial mass  
 D. sludge in the secondary tank post aeration, rich in nutrients.
41. Which are the critical activities of the bar chart shown above ?  
 A. Activities *B* and *E*  
 B. Activities *A*, *D* and *F*  
 C. Activities *A*, *C* and *E*  
 D. Activities *A* and *F*
42. What is the effective height of a free-standing masonry wall for the purpose of computing slenderness ratio ?  
 A. 0.5 L      B. 1.0 L      C. 2.0 L      D. 2.5 L
43. To generate 10, 000 hp under a head of 81 m while working at a speed of 500 rpm, the turbine of choice would be  
 A. Pelton      B. Kaplan      C. Bulb      D. Francis
44. Consider the following statements : Sand in mortar is needed for  
 1. decreasing the quantity of cement.  
 2. reducing shrinkage.  
 3. decreasing the surface area of the binding material.  
 4. increasing the strength.  
 Of these statements :  
 A. 2, 3 and 4 are correct  
 B. 1, 2 and 3 are correct  
 C. 1, 3 and 4 are correct  
 D. 1, 2 and 4 are correct
45. The given figure shows gradually varied flow in an open channel with a break in bed slope. Types of water surface profiles occurring from left to right are  
 A.  $H_2$ ,  $S_3$       B.  $H_2$ ,  $S_2$       C.  $H_2$ ,  $M_2$       D.  $H_3$ ,  $M_2$
46. Consider the following strengths of concrete :  
 1. Cube strength  
 2. Cylinder strength  
 3. Split-tensile strength  
 4. Modulus of rupture  
 The correct sequence in decreasing order of these strengths is  
 A. 3, 4, 2, 1      B. 3, 4, 1, 2      C. 4, 3, 2, 1      D. 4, 3, 1, 2
47. A reinforced concrete slab is 75 mm thick. The maximum size of reinforcement bar that can be used is  
 A. 12 mm diameter      B. 10 mm diameter      C. 8 mm diameter  
 D. 6 mm diameter
48. Consider the following methods of preservation of timber :  
 1. Dipping  
 2. Brushing or spraying  
 3. Pressure impregnation  
 The correct sequence in decreasing order of the effectiveness of these methods of preservation is  
 A. 1, 2, 3      B. 2, 1, 3      C. 3, 1, 2      D. 3, 2, 1

49. Purlins are provided, in industrial buildings, over roof trusses to carry dead loads, live loads and wind loads. As per IS code, what are they assumed to be ?
- Simply supported
  - Cantilever
  - Continuous
  - Fixed
50. Ratio of bearing capacity of double Under Reamed (U.R.) pile to that of single U.R. pile is nearly
- A. 2      B. 1.5      C. 1.2      D. 1.7

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	A	B	A	B	C	B	A	B
10	C	B	D	C	D	A	B	C	A	B
20	B	B	C	A	B	B	A	A	A	C
30	D	B	A	D	B	D	B	C	B	C
40	A	C	A	D	B	D	C	C	C	B

## Section 2

1. A soil has a bulk density of  $1.80 \text{ g/cm}^3$  at water content of 5%. If the void ratio remains constant, then its bulk density for a water content of 10% will be  
A.  $1.88 \text{ g/cm}^3$     B.  $1.80 \text{ g/cm}^3$     C.  $1.98 \text{ g/cm}^3$     D.  $1.70 \text{ g/cm}^3$
2. The base width of a soil gravity dam is 25 m. The material of the dam has a specific gravity of 2.56 and the dam is designed as an elementary profile ignoring uplift. What is the approximate allowable height of the dam ?  
A. 64 m    B. 40 m    C. 164 m    D. 80 m
3. In a gusseted base, when the end of the column is machined smooth for complete bearing, the axial load is transferred to base slab :  
A. Fully through fastening  
B. Fully by direct bearing  
C. 50 % by direct bearing and 50% through fastening  
D. 60 % by direct bearing and 40% through fastening
4. Which of the following assumptions are made in the analysis of jet impinging normally on a moving plate?  
1. Friction between jet and plate is neglected  
2. Flow is steady  
3. Momentum of jet is unchanged  
4. Plate moves at a constant velocity  
Choose the correct answer using the codes given below :  
A. 1, 2 and 4    B. 1, 2 and 3    C. 2, 3 and 4    D. 1, 3 and 4
5. A 3000 m long line lying at an elevation of 450 m measures 10 cm on a vertical photograph. The focal length of the camera is 21 cm. The scale of the photograph for the area having an elevation of 1000 m will be  
A. 1 : 27381    B. 1 : 25008    C. 1 : 20606    D. 1 : 30421
6. While driving a large number of piles in loose sand :  
A. It is advantageous to follow a sequence of pile driving such that the inner piles are driven first and then proceed outwards  
B. It is advantageous to follow a sequence of pile driving such that the piles near the periphery are driven first and inner piles are driven later  
C. It is advantageous to follow a sequence of pile driving such that alternately inner and outer piles are driven  
D. Driving of piles can be done in any random order
7. Surface tension of water when in contact with air is  $0.0737 \text{ N/m}$ . The difference of pressure between the inside and outside of a droplet of rain water 1 mm in diameter is nearly equal to

- A.  $0.15 \text{ kN/m}^2$     B.  $0.20 \text{ kN/m}^2$     C.  $0.25 \text{ kN/m}^2$     D.  $0.30 \text{ kN/m}^2$
8. The upstream slope of an earth dam under steady seepage condition is
- equipotential line
  - phreaticline
  - flow-line
  - seepage line
9. What are the magnitudes of horizontal and vertical support reactions, respectively at support. A of the frame shown in figure below ?
- 16 kN, 18 kN
  - 16 kN, 6 kN
  - 6 kN, 16 kN
  - 8 kN, 6 kN
10. Consider the following statements :Shrinkage of concrete depends upon the
- relative humidity of the atmosphere.
  - passage of time.
  - applied stress.
- Which of these statements is/are correct ?
- 1 and 2
  - 2 and 3
  - 1 alone
  - 1, 2 and 3
11. Consider the following statements :Wind rose diagram is used for the purpose of
- runway orientation.
  - estimating the runway capacity.
  - geometric design of holding apron.
- Of these statements :
- 1 and 2 are correct
  - 2 and 3 are correct
  - 1 and 3 are correct
  - 1 alone is correct
12. The discharge per metre width at the foot of a spillway is  $10 \text{ m}^3/\text{s}$  at a velocity of  $20 \text{ m/s}$ . A perfect free hydraulic jump will occur at the foot of the spillway when the tail water depth is approximately equal to
- 4.50 m
  - 5.00 m
  - 5.50 m
  - 6.50 m
13. Which one of the following is the appropriate triaxial test to assess the immediate stability of an unloading problem, such as an excavation of a clay slope ?
- UU test
  - CU test
  - CD test
  - Unconsolidated drained test
14. A mild steel flat subjected to a tensile force of 84 tonnes is connected to a gusset plate using rivets. If the forces required to shear a single rivet, to crush the rivet and to tear the plate per pitch length are 5000 kg, 8000 kg and 6000 kg respectively, then the number of rivets

required is

A. 12      B. 14      C. 16      D. 17

15. What does the confining pressure used in triaxial compression tests on an undisturbed soil sample represent ?
- A. The in-situ total normal stress  
B. The in-situ total lateral stress  
C. The in-situ effective average principal stress  
D. The in-situ shear stress
16. The distance between two bench marks is 1000 m. If during levelling, the total error due to collimation, curvature and refraction is found to be + 0.120 m, then the magnitude of the collimation error is
- A. 0.00527 m      B. 0.0527 m      C. 0.527 m      D. 0.673 m
17. Mercury (density = 13600 kg/m<sup>3</sup>,  $\sigma = 0.49\text{N/mm}$  internal diameter open-ended capillary tube is inserted in the middle of the beaker into the mercury. The meniscus in the tube will be below the external mercury surface by how much distance?
- A. 4.2 mm      B. 5.7 mm      C. 6.8 mm      D. 7.3 mm
18. Which one of the following is considered to be an advantage of the heading and benching method of tunnels construction ?
- A. It is suitable for construction in unstable rocks  
B. In this method, it is easy to install timber support  
C. Tunnelling can be continuous and the work can be expedited  
D. In case of excessive water, it is easy to take corrective steps
19. In a close-coiled helical spring subjected to an axial load, other quantities remaining the same, if the wire diameter is doubled, then the stiffness of the spring when compared to the original one, will become
- A. twice      B. four times      C. eight times      D. sixteen times
20. The plastic section modulus of a rectangular section of width 100 mm and depth 12 mm is
- A. 1000 mm<sup>3</sup>      B. 1800 mm<sup>3</sup>      C. 2400 mm<sup>3</sup>      D. 3600 mm<sup>3</sup>
21. Consider the following factors pertaining to flow through soil:1. Hydraulic gradient2. Grain size3. Void ratio4. Cross-sectional area of the sample.Of these, the factors affecting permeability include
- A. 1 and 4      B. 2 and 3      C. 1, 2 and 3      D. 2, 3 and 4
22. In drawing AOA networks and making time computations, the following processes are involved :1. Activity listing2. Work breakdown structure3. Activity time allotment4. Consideration of available resources for each activity5. Activity dependencies6. Float computations7. Backward path computation8. Project duration9. Forward

path computation What is the correct sequence of the processes given above ?

- A. 1, 2, 4, 3, 9, 7, 5, 6, 8
  - B. 2, 1, 4, 3, 5, 9, 8, 7, 6
  - C. 4, 1, 3, 2, 9, 5, 7, 8, 6
  - D. Any sequence can be followed but 6 and 7 will be the last two ones
23. Timber can be made more fire resistant by
- A. dipping and steeping process
  - B. hot and cold open tank treatment
  - C. charring
  - D. Sir Abel's process
24. Which one of the following is correct in respect of the influence line for the bending moment at one-fourths of the span from left support of a prismatic beam simply supported at ends ?
- A. It is composed of straight lines only
  - B. It is composed of curved lines only
  - C. It is composed of straight and curved line
  - D. It is parabolic
25. Consider the following statements :In a uni-dimensional stress system, the principal plane is defined as one on which the 1. shear stress is zero. 2. normal stress is zero.3. shear stress is maximum. 4. normal stress is maximum. Of these statements :
- A. 1 and 2 are correct
  - B. 2 and 3 are correct
  - C. 1 and 4 are correct
  - D. 3 and 4 are correct
26. Which one of the following pairs relating to flumes carrying open channel flow is correctly matched ?
- A. N-modular flume....Flow is unaffected by drowning
  - B. Venturi flume....Standing wave forms at the throat
  - C. Venturi flume....Flow at the throat is at less than critical velocity
  - D. Standing wave flume....Hump is not provided at the throat
27. A cylindrical vessel with a constant plane area of 1 m<sup>2</sup> is rotated about its vertical axis such that the liquid inside the vessel is about to spill. If the height of the vessel is 2 m and the height of the paraboloid at 1 m, then the volume (in m<sup>3</sup>) of the liquid in the vessel will be
- A. 2
  - B. 1.5
  - C. 1.0
  - D. 0.5

28. Critical hydraulic gradient is given by (where,  $G$  = specific gravity of solids  $e$  = void ratio)
- A.  $\frac{G+1}{1-e}$       B.  $\frac{G-1}{1+e}$       C.  $\frac{G+1}{1+e}$       D.  $\frac{G-1}{1-e}$
29. Consider the following statements with reference to oxidation ponds :  
 1. They require high initial investments  
 2. They have low operational cost  
 3. They are also called stabilization ponds.  
 Which of the statements given above are correct ?  
 A. 1 and 2      B. 2 and 3      C. 1 and 3      D. 1, 2 and 3
30. The length, coefficient of thermal expansion and Young's modulus of bar 'A' are twice that of bar 'B'. If the temperature of both bars is increased by the same amount while preventing any expansion, then the ratio of stress developed in bar A to that in bar B will be  
 A. 2      B. 4      C. 8      D. 16
31. A constant angle arch dam when compared to a constant radius arch dam utilizes concrete quantity of about  
 A. 33%      B. 43%      C. 73%      D. 143%
32. A bar of elastic material is subjected to a direct compressive stress  $\sigma_1$  in the longitudinal direction. Suitable lateral compressive stress  $\sigma_2$  is applied along each of the other two lateral directions to limit the net strain in each of the lateral directions to half the magnitude of what it could be under  $\sigma_1$  acting alone. If  $\mu$  is the Poisson's ratio of the material, then the magnitude of  $\sigma_2$  is  
 A.  $\frac{2(1-\mu)}{\mu} \sigma_1$       B.  $\frac{1}{2} \frac{(1-\mu)}{\mu} \sigma_1$       C.  $\frac{1}{2} \frac{\mu}{(1-\mu)} \sigma_1$       D.  $\frac{1}{2} \frac{\mu}{(1-\mu^2)} \sigma_1$
33. In a simply supported wooden beam under uniformly distributed load, a hole has to be made in the breadthwise direction at mid-span to provide a pipeline. From structural strength point of view, it would be advisable to have the hole made at  
 A. the bottom  
 B. the top  
 C. mid-depth  
 D. 1/4 depth either from the top or the bottom
34. The water supply to a house begins with the connection of the service pipe with the municipal water mains. The connections comprises :  
 1. Stopcock 2. Goose neck 3. Ferrule 4. Water meter  
 The correct statement of these connections is :  
 A. 1, 2, 3, 4      B. 3, 1, 2, 4      C. 3, 2, 1, 4      D. 1, 2, 4, 3
35. A point load applied at shear centre induces :



- A. Zero shear force
  - B. Zero bending
  - C. Pure twisting
  - D. Pure bending
36. Cross sections of two beams A (600mm x 200mm) and B (800mm x 60mm) are shown in the given figure. Both the beams have the same material. By how many times is the beam A stronger than the beam B in resisting bending ?  
 A. 80      B. 60      C. 50      D. 25
37. Viewing watershed as a system, which one of the following assumptions is made in the unit graph theory ?  
 A. Non-linearity  
 B. Both linearity and time variance  
 C. Both time invariance and non-linearity  
 D. Both linearity and time invariance
38. Following statements certain to the position of Sun when it lies over the First Point of Aries :1. It's hour angle is zero. 2. It's right ascension is zero.3. It's declination is zero.Of these statements :  
 A. 1 and 3 are correct  
 B. 2 and 3 are correct  
 C. 1 and 2 are correct  
 D. 1, 2 and 3 are correct
39. The bearing capacity factors  $N_c$ ,  $N_q$  and  $N_r$  are functions of:  
 A. width and depth of footing  
 B. density of soil  
 C. cohesion of soil  
 D. angle of internal friction of soil
40. Budgeting with Bar chart is a tool to find  
 A. total cost of project  
 B. total time along with cost of project  
 C. indirect cost of project  
 D. direct cost of project
41. The slenderness ratio of lacing bars should not exceed :  
 A. 100      B. 200      C. 145      D. 180
42. A three-hinged semicircular arch of radius  $R$  carries a uniformly distributed load  $W$  per unit run over the whole span. The horizontal thrust is  
 A.  $WR$       B.  $WR/2$       C.  $4/3\pi WR$       D.  $\frac{2}{3\pi} WR$

43. The acceleration components of a fluid particle are denoted as 1. local tangential acceleration. 2. convective tangential acceleration. 3. local normal acceleration. 4. convective normal acceleration. In a curved nozzle fitted to the end of straight pipeline carrying water under variable head, the acceleration component that are present would include  
 A. 1 and 2      B. 3 and 4      C. 1, 2 and 4      D. 1, 2, 3 and 4
44. In the truss shown in the given figure, the forces in the members AB and BC will be respectively (plus denotes tension)  
 A. zero and zero  
 B.  $-W/\cos 60^\circ$  and  $+W \tan 60^\circ$   
 C.  $-W/\cos 60^\circ$  and zero  
 D. zero and  $+W \tan 60^\circ$
45. Consider the following statements : In the beam shown in the given figure, for all positions of load  $W$  (except  $x = 0$ )  
 1. bending moment is maximum at B  
 2. bending moment is maximum under load  
 3. deflection is zero at A  
 4. deflection is zero at B  
 Of these statements :  
 A. 1 and 3 are correct  
 B. 2 and 4 are correct  
 C. 1 and 4 are correct  
 D. 1, 3 and 4 are correct
46. In a three-layered soil, water flows parallel to stratification. The thickness of the middle layer is twice that of top and bottom layer. The coefficient of permeability of middle layer ( $2K$ ) is twice that of top and bottom layer ( $K$ ). What is the average coefficient of permeability for this flow ?  
 A.  $K$       B.  $1.33 K$       C.  $1.5 K$       D.  $0.66 K$
47. Which type of brick masonry bond is provided for heavy loads on masonry ?  
 A. English bond  
 B. Zigzag bond  
 C. Single Flemish bond  
 D. Double Flemish bond
48. In the set up shown in the above figure, assuming the specific weight of water as  $10,000 \text{ N/m}^3$ , the pressure difference between the points A and B will be  
 A.  $10 \text{ N/m}^2$       B.  $-10 \text{ N/m}^2$       C.  $20 \text{ N/m}^2$       D.  $-20 \text{ N/m}^2$
49. The ratio of the "standard error of a single observation of unit weight" to the standard error of the arithmetic mean of ' $n$ ' observation all of unit weight, will be  
 A.  $(1/n)$       B.  $n^2$       C.  $3n$       D.  $n$

50. If the azimuths of the two tangents to a circular curve of radius 100 m are due north and due east, then the area bounded by the two tangents and the circular curve will be
- A. 7857 sq. m      B. 5000 sq. m      C. 3143 sq. m      D. 2143 sq. m

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	B	B	C	A	A	D	A	B	A
10	D	D	B	D	B	B	D	C	D	D
20	B	A	D	A	C	C	B	B	B	B
30	B	C	C	C	D	D	D	A	D	B
40	C	B	C	A	D	C	A	B	D	D

### Section 3

1. What is the type of soil structure having arrangement of soil particles with a 'face to face' or parallel orientation generally recognized as
  - A. Honeycomb structure
  - B. Single-grained structure
  - C. Flocculent structure
  - D. Dispersed structure
2. In the case of a three-pinned parabolic arch carrying a uniformly distributed load on the entire span, then bending moment will be
  - A. equal to that of a simply supported beam loaded in the same manner
  - B. maximum at quarter span
  - C. zero only at the centre
  - D. zero throughout the span
3. To make certain that the backfill material is more pervious than the soil to be drained, the relationship used in
  - A.  $(D_{15})_{Filter} \leq 5 (D_{85})_{Protected\ soil}$
  - B.  $(D_{15})_{Filter} \geq 5 (D_{85})_{Protected\ soil}$
  - C.  $(D_{15})_{Filter} \geq 5 (D_{15})_{Protected\ soil}$
  - D.  $(D_{15})_{Filter} \leq 5 (D_{15})_{Protected\ soil}$
4. A perfect plane frame having n number of members and j number of joints should satisfy the relation
  - A.  $n \leq (2j - 3)$
  - B.  $n = (2j - 3)$
  - C.  $n \geq (2j - 3)$
  - D.  $n = (3 - 2j)$
5. Which of the following determination are NOT necessary for raw water from a lake for use as source of supply of water for boiler-feed ?1. Turbidity2. Bacterial count3. Iron4. Hardness.Select the correct answer using the codes given below :
 

A. 1, 2 and 3      B. 1, 2 and 4      C. 1, 3 and 4      D. 2, 3 and 4
6. A beam of square section of side 'a' is plane in the following way :Case I: with two sides horizontalCase II: with a diagonal horizontalThe ratio of the section modulus of Case I that of Case II is
 

A. 2      B. 2      C.  $\frac{1}{\sqrt{2}}$       D.  $\frac{1}{2}$
7. Consider the following statements :1. Tests on cement paste to determine initial and final setting times are done at normal consistency

- condition.2. Low heat cement has a high percentage to tricalcium aluminate.3. High early strength portland cement contains a larger percentage of tricalcium silicate and a lower percentage of dicalcium silicate. Which of these statements are correct ?  
 A. 1 and 2    B. 1 and 3    C. 2 and 3    D. 1, 2 and 3
8. What is the vertical deflection of joint C of the frame shown in figure ?  
 A.  $PL/AE$     B.  $2PL/AE$     C.  $PL/2AE$     D.  $3PL/AE$
9. Which of the following pairs is not correctly matched ?  
 A. B.O.D. - Strength of sewage  
 B. Methane - Product of anerobic decomposition  
 C. C.O.D. - Biodegradability of waste-water  
 D. Nitrate - Methemoglobinemia
10. In consolidation testing, curve fitting method is used to determine  
 A. compression index  
 B. swelling index  
 C. coefficient of consolidation  
 D. time factor
11. Consider the following types of soil tests :1. California bearing ratio2. Consolidation3. Unconfined compressionThe soil tests required to be done in the case of undisturbed samples include  
 A. 1, 2 and 3    B. 1 and 2    C. 1 and 3    D. 2 and 3
12. A cantilever beam AB, fixed at A and carrying a load W at the free end B, is found to deflect by  $\delta$  at the mid-point of AB. The deflection of B due to a load  $W/2$  at the mid-point will be  
 A.  $2\delta$     B.  $\delta$     C.  $\delta/2$     D.  $\delta/4$
13. A plan of an area drawn with the original scale of 1 cm = 10 m, has shrunk such that a line, originally 15 cm long on the plan, measures now 14.5 cm. The shrunk scale is given by 1 cm equal to  
 A. 0.97 m    B. 9.70 m    C. 10.34 m    D. 10.97 m
14. In a tree, the cambium layer is situated between :  
 A. the outer bark and inner bark  
 B. the inner bark and sap wood  
 C. the sap wood and heart wood  
 D. the pith and heart wood
15. Two closed thin vessels, one cylindrical and the other spherical with equal internal diameter and wall thickness are subjected to equal internal fluid pressure. The ratio of hoop stresses in the cylindrical to that of spherical vessels is  
 A. 4.0    B. 2.0    C. 1.0    D. 0.5

16. Total elongation of a prismatic bar of length  $L$ , weight  $W$ , cross-sectional area  $A$  and modulus of elasticity  $E$ , under its own weight, while hanging vertically, is
- A.  $\frac{WL}{AE}$     B.  $\frac{2WL}{AE}$     C.  $\frac{WL}{2AE}$     D.  $\frac{WL}{3AE}$
17. For a partially saturated soil,  $\Delta u$  the increase in pore water pressure, when no drainage is permitted, is expressed as (where  $A$  and  $B$  are Skempton's pore pressure parameters and  $\Delta\sigma_1$  and  $\Delta\sigma_3$  are major and minor principal stress increments)
- A.  $\Delta u = B[\Delta\sigma_3 + A(\Delta\sigma_1 - \Delta\sigma_3)]$   
 B.  $\Delta u = A[\Delta\sigma_3 + B(\Delta\sigma_1 - \Delta\sigma_3)]$   
 C.  $\Delta u = \Delta\sigma_3 + A(\Delta\sigma_1 - \Delta\sigma_3)$   
 D.  $\Delta u = \Delta\sigma_3 + B(\Delta\sigma_1 - \Delta\sigma_3)$
18. The shear force diagram for a simple supported beam of span 'l' is given in the figure. The maximum bending moment is
- A.  $\frac{WI}{2}$   
 B.  $W\left(\frac{l}{2} - l_1\right)$   
 C.  $Wl - 1$   
 D.  $W(l - 2l_1)$
19. A compound bar consisting of material A and B is tightly secured at the ends. The coefficients of thermal expansion of A is more than that of B. When the temperature is increased the stresses induced will be
- A. tensile in both the materials  
 B. tensile in material A and compressive in material B  
 C. compressive in material A and tensile in material B  
 D. compressive in both the materials
20. Couple  $M$  is applied at C on a simply supported beam AB. What is the maximum shear force for the beam ?
- A. Zero    B.  $M$     C.  $2M/3$     D.  $M/3$
21. At a certain point in a structural member, there are perpendicular stresses  $80 \text{ N/mm}^2$  and  $20 \text{ N/mm}^2$ , both tensile. What is the equivalent stress in simple tension, according to the maximum principal strain theory ? (Poisson's ratio = 0.25)
- A. zero    B.  $20 \text{ N/mm}^2$     C.  $60 \text{ N/mm}^2$     D.  $75 \text{ N/mm}^2$
22. Duration along the critical path defines which of the following ?
1. Shortest duration needed  
 2. Shortest duration permissible  
 3. Longest

duration needed.4. Longest duration permissible. Select the correct answer using the code given below :

A. 1 and 2 only      B. 1 and 4 only      C. 2 and 3 only      D. 3 and 4 only

23. A cantilever of constant depth carries a uniformly distributed load on the whole span. To make the maximum stress at all sections the same, the breadth of the section at a distance  $x$  from the free end should be proportional to  
A.  $x$       B.  $x$       C.  $x^2$       D.  $x^3$
24. Consider the following parameters related to a rotary intersection :1. Width of the weaving section.2. Length of the weaving section.3. Proportion of weaving traffic.4. Weaving angle.5. Width of the carriageway at entry.Capacity is generally expressed in terms of  
A. 1, 2, 3 and 4      B. 1, 2, 3 and 5      C. 1, 2 and 3      D. 4 and 5
25. Consider the following statements :I. The intersection of the first and last ray in funicular diagram is on the line of action of the resultant.II. Intersection of first and last ray in polar diagram gives the magnitude of the resultant. Of these statements :  
A. both I and II are true  
B. I is false but II is true  
C. I is true but II is false  
D. both I and II are false
26. What is value of stress at the base CC for the bar shown in the given figure ?  
A.  $16.67 \text{ N / mm}^2$   
B.  $13.33 \text{ N / mm}^2$   
C.  $26.67 \text{ N / mm}^2$   
D.  $30 \text{ N / mm}^2$
27. The frame shown in the given figure has  
A. one unknown reaction component  
B. two unknown reaction components  
C. three unknown reaction components  
D. six unknown reaction components
28. Following data are given for two soil samples A and B : Sample A : Void ratio = 1, total volume =  $1 \text{ m}^3$  Sample B : Void ratio = 2, total volume =  $1 \text{ m}^3$ . The two samples are mixed and compacted in a mould to a volume of  $1 \text{ m}^3$ . Which one of the following figures correctly indicates the porosity of the compacted soil ?  
A. 17%      B. 54%      C. 60%      D. 83%

29. The laboratory tests on a sample yielded the following results :Plasticity index : 32 %Liquidity index : - 0.15, Activity number: 1.58.Which of the following inferences can be drawn ?1. The soil is very stiff.2. The soil is medium soft.3. The soil is highly plastic.4. The soil is medium plastic.5. The soil is active.Select the correct answer using the codes given below :  
A. 1, 3 and 5      B. 1, 3 and 4      C. 2, 3 and 5      D. 1, 2 and 4
30. The compacting factor test of cement concrete determines its  
A. strength  
B. porosity  
C. degree of compaction under loads  
D. workability
31. The depreciation charges for a machine are thirty paise per working hour. The machine has a scrap value of Rs 2, 000 and a working hour average life of 24000 hours. What is the purchase price of the machine ?  
A. Rs. 1, 800      B. Rs. 7, 200      C. Rs. 9, 200      D. Rs. 14, 275
32. Dench's groyne is a special type of groyne which is :  
A. Pointing upstream  
B. Pointing downstream  
C. Hockey type  
D. T - headed
33. As a natural material, timber is which one of the following ?  
A. Isotropic      B. Anisotropic      C. Homogeneous      D. Heterogeneous
34. Consider the implicit details between, before and after successive steps in/within the order while doing time computations on a CPM network. (FP = Forward Pass; BP = Backward Pass; LET = Late Event Time; EET = Early Event Time; TF = Total Float; PD = Project Duration; AD = Activity Duration)The correct sequence of computation would be  
A. EET, PD, LET, TF  
B. EET, PD, LET, AD  
C. AD, EET, BP, PD  
D. FP, EET, TF, PD
35. A retaining wall 8 m high with a smooth vertical back retains a clay back fill with  $C' = 15 \text{ kN/m}^2$ ,  $\phi = 15^\circ$  and  $\gamma = 18 \text{ kN/m}^3$ . (Given  $\sin 15^\circ \cong 0.25$ ). The pressure at the top will, nearly, be equal to  
A.  $35.2 \text{ kN/m}^2$       B.  $23.0 \text{ kN/m}^2$       C.  $27.6 \text{ kN/m}^2$       D.  $11.5 \text{ kN/m}^2$



36. In a compression member, plate element may buckle locally before the entire member fails. To avoid this, which of the following recommendations are made ?  
 1. Thickness of members is taken in terms of lengths of compression members  
 2. Length of element is increased  
 3. Length of member is increased  
 4. Outstand is decreased  
 Select the correct answer using the codes given below:  
 A. 1, 2 and 3      B. 1, 3 and 4      C. 2 and 3      D. 1 and 4
37. The deflection at the free end of a cantilever of rectangular cross-section due to certain loading of 0.8 cm. If the depth of the section is doubled keeping the width the same, then the deflection at the free end due to the same loading will be  
 A. 0.1 cm      B. 0.4 cm      C. 0.8 cm      D. 1.6 cm
38. Self-purification of running streams may be due to  
 A. sedimentation, oxidation and coagulation  
 B. dilution, sedimentation and oxidation  
 C. dilution, sedimentation and coagulation  
 D. dilution, oxidation and coagulation
39. At a point in a strained material, if two mutually perpendicular tensile stresses of 2000 kg/cm<sup>2</sup> and 1000 kg/cm<sup>2</sup> are acting, then the intensity of tangential stress on a plane inclined at 15° to the axis of the minor stress will be :  
 A. 125 kg/cm<sup>2</sup>  
 B. 250 kg/cm<sup>2</sup>  
 C. 500 kg/cm<sup>2</sup>  
 D. 1000 kg/cm<sup>2</sup>
40. A particle is moving on a plane curve with velocity  $v$ . 's' is the arc length of the particle from a fixed point on the curve and  $(r, \theta)$  its position coordinates at time 't'. The transverse component of the acceleration of the particle is given by  
 A.  $\frac{d^2 r}{dt^2} - r^2 \frac{d\theta}{dt}$       B.  $r \frac{d^2 \theta}{dt^2} + 2 \frac{dr}{dt} \frac{d\theta}{dt}$       C.  $\frac{d\bar{v}}{dt}$       D.  $\frac{\bar{v}^2}{r} \frac{d\theta}{ds}$
41. A propped cantilever is acted upon by a moment  $M_0$  at the propped end, what is the prop reaction ?  
 A.  $0.5 M_0$       B.  $\frac{M_0}{L}$       C.  $\frac{1.5 M_0}{L}$       D.  $\frac{2.0 M_0}{L}$
42. How are concrete mixers specified ?  
 A. By the number of cement bags used in a batch  
 B. By the nominal volume of concrete that can be mixed in a batch  
 C. By the volume of water used

- D. By the volume of aggregate used
43. In photogrammetric surveying, the image of the top of the hill is 90 mm, from the principal point of the photograph. If the elevation of the top of the hill is 500 m and the flying height is 5000 m above datum, then the relief displacement is  
A. 0.9 mm      B. 9 mm      C. 90 mm      D. 900 mm
44. The phenomenon of decreased resistance of a material due to reversal of stress is called  
A. resilience      B. elasticity      C. creep      D. fatigue
45. A mild steel bar is in three parts, each 20 cm long. The diameters of parts AB, BC and CD are 2 cm, 1 cm and 3 cm respectively. The bar is subjected to an axial pull of 4t as shown in the given figure. If  $E = 2 \times 10^6 \text{ kg/cm}^2$  and the elongations in the three parts of the bar are  $\Delta_1$ ,  $\Delta_2$  and  $\Delta_3$  respectively, then the ratio of the greatest to the least of these elongations will be  
A. 9      B. 4      C. 3      D. 2
46. At the same mean velocity, what is the ratio of head loss per unit length for a sewer pipe flowing full to that for the same pipe flowing half full ?  
A. 2.0      B. 1.7      C. 1.0      D. 0.6
47. A heavy elastic ball drops from the ceiling of a room, and after rebounding once from the floor, reaches a height equal to three-fourth of that of the ceiling. The coefficient of restitution will be  
A.  $\sqrt{\frac{2}{3}}$       B.  $\frac{\sqrt{3}}{2}$       C.  $\frac{\sqrt{2}}{3}$       D.  $\frac{1}{3}$
48. A beam of rectangular section having simply supported span L, is subject to a concentrated load at its mid-span. What is the length of elasto-plastic zone of the plastic hinge ?  
A.  $\frac{L}{3}$       B.  $\frac{L}{4}$       C.  $\frac{L}{5}$       D.  $\frac{L}{7}$
49. Consider the following statement: High early strength of cement is obtained as a result of 1. fine grinding. 2. decreasing the lime content 3. burning at higher temperatures 4. increasing the quantity of gypsum. Of these statements :  
A. 1 and 2 are correct  
B. 1 and 3 are correct  
C. 2, 3 and 4 are correct  
D. 1, 3 and 4 are correct
50. A prismatic beam is shown in the figure. Consider the following statements :1. The structure is unstable. 2. The bending moment is zero

at supports and internal hinge.3. It is mechanism.4. It is statically indeterminate.Which of the statements given above is/are correct ?  
A. 1, 2, 3 and 4      B. 1, 2 and 3      C. 1 and 2      D. 3 and 4

Answer Key

	1	2	3	4	5	6	7	8	9	0
0	D	D	D	B	A	B	B	B	A	C
10	C	D	C	B	B	C	A	C	C	D
20	D	B	C	D	C	D	D	A	A	D
30	C	D	B	C	D	D	A	B	B	B
40	B	B	B	D	C	A	B	A	B	B

## Section 4

- The moment of inertia of a given rectangular area is minimum about
  - its longer centroidal axis
  - its polar axis
  - its axis along the diagonal
  - its shorter centroidal axis
- If the efficiencies of BOD removal of first-stage and second-stage trickling filters are each 65.0%, then what is the overall BOD removal efficiency of these filters ?
 

A. 65%      B. 77.25%      C. 87.75%      D. 92.6%
- Which one of the following tests can be carried out at the construction site to determine the dynamic elastic properties of soil ?
  - Block vibration test
  - Dutch cone penetration test
  - Standard penetration test
  - Vane shear test
- A particle moves with simple harmonic motion. If its acceleration at distance 'D' from the equilibrium position is 'A' then the period of the motion is given by
 

A.  $2\pi AD$       B.  $\frac{2\pi}{\sqrt{AD}}$       C.  $2\pi\sqrt{\frac{A}{D}}$       D.  $2\pi\sqrt{\frac{D}{A}}$
- Consider the following statements :A high lime content in a composite cement-lime mortar results in1. slow hardening.2. quick setting.3. weaker mortar.Of these statements :
  - 2 and 3 are correct
  - 1 and 2 are correct
  - 1 and 3 are correct
  - 1, 2 and 3 are correct
- Seasoning of timber is required to
  - soften the timber
  - harden the timber
  - straighten the timber
  - remove sap from the timber
- Four vertical columns of the same material, height and weight have the same end condition. The buckling load will be the largest for a column having the cross-section of a/an
  - solid square
  - thin hollow circle

- C. solid circle  
D.  $I$
8. A beam has a solid circular cross-section having diameter  $d$ . If a section of the beam is subjected to a shear force  $F$  the maximum shear stress in the cross-section is given by
- A.  $\frac{4}{3} \frac{F}{\pi d^2}$       B.  $\frac{16}{3} \frac{F}{\pi d^2}$       C.  $\frac{8}{3} \frac{F}{\pi d^2}$       D.  $\frac{3}{16} \frac{F}{\pi d^2}$
9. A cantilever beam of span 4 m and cross-sectional are 0.3 m wide and 0.4 m deep is subjected to a concentrated load of 10 kN at the free end. Neglecting self-weight, the maximum bending stress at a section 2 m from the free end will be
- A. 20 kN/m<sup>2</sup>      B. 2500 kN/m<sup>2</sup>      C. 4000 kN/m<sup>2</sup>      D. 5000 kN/m<sup>2</sup>
10. A simply supported beam AB of span 'l' has a form cross-section throughout. It carries a central concentrated load  $W$  and another load which is uniformly distributed over the entire span, its total magnitude being  $W$ . The minimum deflection in the beam is
- A.  $\frac{9}{384} \frac{WL^3}{EI}$       B.  $\frac{13}{384} \frac{WL^3}{EI}$       C.  $\frac{10}{384} \frac{WL^3}{EI}$       D.  $\frac{15}{384} \frac{WL^3}{EI}$
11. Consider the following statements about concrete sleepers :1. They improve the track modulus.2. They have good scrap value.3. They render transportation easy4. They maintain the gauge quite satisfactorily.Of these statements :
- A. 1 and 2 are correct  
B. 2 and 3 are correct  
C. 3 and 4 are correct  
D. 1 and 4 are correct
12. When are dropman holes provided in a sewerage system ?
- A. There is a change from gravity system to pressure system  
B. There is a change in the elevation of the ground level  
C. There is change in the diameter of the sewer  
D. There is change in the direction of the sewer line
13. Consider the following statements :For the manufacture of good quality bricks it is essential to1. use a reverberatory kiln.2. blend the soil with clay or sand as deemed appropriate.3. knead the soil in a ghani.4. temper the soil in a pug mill.Of these statements;
- A. 1 and 3 are correct  
B. 2 and 4 are correct

- C. 1, 3 and 4 are correct  
D. 2, 3 and 4 are correct
14. For the propped cantilever beam shown in the figure given above, the plastic moment capacity is  $M_p$ . What is the value of its collapse load ?  
A.  $\frac{4 M_p}{L}$       B.  $\frac{6 M_p}{L}$       C.  $\frac{8 M_p}{L}$       D.  $\frac{11.7 M_p}{L}$
15. Consider the following statements in case of impulse turbine :1. The pressure and velocity both change as the water flows through the turbine.2. Pressure throughout remains atmospheric and the velocity alone changes.3. All the available energy is converted into kinetic energy.4. Water is admitted over the entire circumference of the runner.5. Water is admitted only through the nozzle.Which of these statements are correct ?  
A. 2, 3 and 5      B. 2 and 3      C. 1, 4 and 5      D. 1 and 4
16. Non-disposal of solid waste may cause the spread of  
A. malaria  
B. rodents related plague  
C. typhoid  
D. dysentery
17. What is the steepest gradient permissible on a  $2^\circ$  curve for B.G. line having using gradient of 1 in 200 ?  
A. 1 in 250      B. 1 in 238      C. 1 in 209      D. 1 in 198
18. A cantilever beam of uniform EI has span equal to 'L'. An upward force W acts at the mid-point of the beam and a downward force P acts at the free end. In order that the deflection at the free end is zero, the relation between P and W should be  
A.  $W = 3P/2$   
B.  $W = 2P$   
C.  $W = 16P/5$   
D.  $W = 5P$
19. In what context is the slump test performed ?  
A. Strength of concrete  
B. Workability of concrete  
C. Water-cement ratio  
D. Durability of concrete
20. In trigonometric levelling, if the horizontal distance between the instrument and the object is 3088 m, the coefficient of refraction is 0.07

and  $R \sin 1'' = 30.88 \text{ m}$ , then the refraction correction in angular measure would be

- A.  $0.07''$       B.  $0.70''$       C.  $7.0''$       D.  $1'10''$

21. Given figure shows a retaining wall of base width  $B_1$  and height  $H_1$ . The sp. gravity of the material of construction is  $S$ . Further  $AB = BC = CD$ . When the depth of storage increases from 0 to  $H_1$ , the resultant force will move from  
A.  $A$  to  $B$       B.  $B$  to  $C$       C.  $C$  to  $D$       D.  $B$  to  $D$
22. A machine costs Rs. 16,000. By constant rate of declining balance method of depreciation, its salvage value after an expected life of 3 years is Rs. 2,000. The rate of depreciation is  
A. 0.25      B. 0.30      C. 0.40      D. 0.50
23. Consider the following statements regarding the longitude of a place. It is determined by : 1. wireless time signals 2. transportation of chronometers 3. electric telegraph. Of these statements :  
A. 1, 2 and 3 are correct  
B. 1 and 2 are correct  
C. 1 and 3 are correct  
D. 2 and 3 are correct
24. The outstand of the flange of built-up beams from the line of connection should not extend beyond: (where  $T$  is the thickness of flange and  $t_w$  is the thickness of web)  
A.  $10 T$       B.  $85 T$       C.  $\frac{256 T}{\sqrt{f_y}}$       D.  $180 t_w$
25. Consider the following statements : In subsoil exploration programme the term "significant depth of exploration" is upto 1. the width of foundation 2. twice the width of foundation 3. the depth where the additional stress intensity is less than 20% of overburden pressure 4. the depth where the additional stress intensity is less than 10% of the overburden pressure 5. hard rock level. Of these statements :  
A. 1, 3 and 5 are correct  
B. 2, 3 and 5 are correct  
C. 1 and 4 are correct  
D. 2 and 4 are correct
26. Which one of the following statements is correct ? Compared to IFR conditions, the runway capacity of a runway operating under VFR conditions  
A. is higher  
B. is lower  
C. is the same

- D. cannot be generalised
27. In an otherwise symmetrical portal frame with one end fixed and the other end hinged, the large support sinks by an amount  $\Delta$ . The fixed end bending moment induced at each end of the horizontal member of the frame due to the sinking of the support will be (given that 'L' is the length of the member and 'E' is the flexural stiffness)
- A.  $\frac{3EI\Delta}{L^2}$       B.  $\frac{4EI\Delta}{L^2}$       C.  $\frac{2EI\Delta}{L^2}$       D.  $\frac{6EI\Delta}{L^2}$
28. The total observed runoff volume during a 4 hour storm with a uniform intensity of 2.8 cm/hr is  $25.2 \times 10^6 \text{ m}^3$  from a basin of  $280 \text{ km}^2$  area. What is the average infiltration rate for the basin ?
- A. 3.6 mm/hr      B. 4.8 mm/hr      C. 5.2 mm/hr      D. 5.5 mm/hr
29. A car accelerates from rest to a speed of 10 m/s and the energy spent in doing this is E. If the car is further accelerated from 10 m/s to 20m/s, what is the amount of energy to be spent further ?
- A. E      B. 2E      C. 3E      D. 4E
30. The losses in prestress in pre-tensioning system are due to :1. elastic deformation of concrete when wires are tensioned successively2. friction3. shrinkage and creep of concreteSelect the correct answer using the codes given below:
- A. 1, 2 and 3      B. 2 and 3      C. 1 alone      D. 3 alone
31. Consider the following statements in relation to the given sketch :1. Soil is partially saturated at degree of saturation = 60%2. Void ratio = 40%3. Water content = 30%4. Saturated unit weight =  $1.5 \text{ g/cc}$ Of these statements :
- A. 1, 2 and 3 are correct  
B. 1, 3 and 4 are correct  
C. 2, 3 and 4 are correct  
D. 1, 2 and 4 are correct
32. A journey from work to home made by walking to the bus, travelling by bus to the station and completing the journey by train is regarded as
- A. 4 trips      B. 3 trips      C. 2 trips      D. 1 trip
33. If P is the direct load, L is the length of the member, A is the uniform area of cross-section and E is the Young's modulus; then strain energy due to direct stress caused by a gradually applied load is
- A.  $\frac{P^2L}{2AE}$       B.  $\frac{P^2L}{2A^2E}$       C.  $\frac{PL}{2AE}$       D.  $\frac{PL}{AE}$
34. A T-section is used as a simply supported beam with uniform loading. The maximum bending stress for a given load will occur at the



- A. top of the section
  - B. C.G. of the section
  - C. mid-point of the depth of section
  - D. bottom of the section
35. If the width of a carriageway is 5.5 m, then what is it called ?
- A. Single lane
  - B. two lanes
  - C. intermediate lane
  - D. Multi-lane
36. The performance of a well is measured by its
- A. Specific capacity
  - B. Specific yield
  - C. Storage coefficient
  - D. Permeability coefficient
37. What is the prime objective of providing a point lock ?
- A. To ensure that each switch is correctly set.
  - B. To ensure that the point may not be operated while the train is on it.
  - C. To detect any obstruction between stock rail and tongue rail.
  - D. To limit the riding of the conical exterior circumference of the wheels.
38. The velocity vector for a steady three-dimensional flow field is described as :At point (1, 2, 3) what is the approximate value of the magnitude of the velocity?
- A. 21      B. 18      C. 10      D. 4
39. As per the maximum principal stress theory, when a shaft is subjected to a bending moment  $M$  and torque  $T$ , and if  $\sigma$  is the allowable stress in axial tension, then the diameter 'd' of the shaft is given by
- A.  $d^3 = \frac{16}{\pi \sigma} [M + \sqrt{M^2 + T^2}]$       B.  $d^3 = \frac{4}{\pi \sigma} [M + \sqrt{M^2 + T^2}]$       C.  $d^3 = \frac{32}{\pi \sigma} [M + \sqrt{M^2 + T^2}]$
- D.  $d^3 = \frac{8}{\pi \sigma} [M + \sqrt{M^2 + T^2}]$
40. In a closed traverse, the sum of south latitudes exceeds the sum of north latitudes and the sum of east departures exceeds the sum of west departures. The closing line will lie in the
- A.  $N-W$  quadrant
  - B.  $N-E$  quadrant
  - C.  $S-E$  quadrant

- D. *S-W* quadrant
41. Creep of a material is a property indicated by
- a time-dependent strain of the material
  - elongation of the material due to changes in the material properties
  - shortening caused by shrinkage of the member
  - the decrease in the volume of the material affected by the weather conditions
42. The most accurate measurement of the lengths of long survey lines is made by using ?
- steel band
  - invar tape
  - electronic distance measuring equipment
  - autoredution tachometer
43. A saturated clay layer with single drainage face takes 4 years to attain 50% degree of consolidation. If the clay layer had double drainage, then the time required to attain 50% degree of consolidation is
- 8 years
  - 4 years
  - 2 years
  - 1 year
44. Consider the following statements :Among the more common varieties of timber, namely, sal, mango and deodar, 1. sal is the strongest. 2. mango is the least durable.3. deodar is the lightest.Of these statements :
- 1, 2 and 3 are correct
  - 1 and 2 are correct
  - 1 and 3 are correct
  - 2 and 3 are correct
45. Which one of the following tools is required to bend the rails for track maintenance ?
- Rail tong
  - Jim crow
  - Crowbar
  - Wire claw
46. On which one of the following concepts is the basic principle of structural design based ?
- Weak column strong beam
  - Strong column and weak beam
  - Equally strong column-beam
  - Partial weak column-beam
47. Consider the following statements : If two planes at right angles carry only shear stress of magnitude ' $q$ ', then the1. diameter of Mohr's circle would equal  $2q$ 2. centre of the Mohr's circle would lie at the origin3. principal stresses are unlike and have magnitude ' $q$ '4. angle between

the principal plane and the plane of maximum shear would be equal to  $45^\circ$  Of these statements :

- A. 1 and 2 are correct
  - B. 2 and 4 are correct
  - C. 3 and 4 are correct
  - D. 1, 2, 3 and 4 are correct
48. Two bodies of masses  $m_1$  and  $m_2$  are communicated by a light inextensible string passing over a small smooth fixed pulley;  $m_1 > m_2$ . What is the acceleration of the system ?
- A.  $g (m_1 + m_2)/(m_1 - m_2)$
  - B.  $g (2m_1 + m_2)/(m_1 - 2m_2)$
  - C.  $g (m_1 + 2m_2)/(2m_1 - m_2)$
  - D.  $g (m_1 - m_2)/(m_1 + m_2)$
49. Consider the following statements :1. Butterfly valve is used for throttling and controlling flow rate.2. Check valve is used in the discharge piping of a pump.3. Air-relief valve is placed in the pipeline at the valleys to automatically vent the accumulated air in the system4. Altitude valve is provided in user overhead tank.Which of the statements given above are correct ?
- A. 1, 2 and 4 only
  - B. 1, 2 and 3 only
  - C. 1 and 2 only
  - D. 3 and 4 only
50. A beam of rectangular section 100 mm x 300 mm carries certain loads such that the Bending Moment at a section A is  $M$  and at another section B it is  $(M + C)$ .The distance between the sections A and B is 0.5 m and there are no external loads acting between the two sections. If the value of  $C$  is 10, 000 Nm, then the maximum shear stress is
- A.  $1.5 \text{ MN/m}^2$
  - B.  $1.0 \text{ MN/m}^2$
  - C.  $0.5 \text{ MN/m}^2$
  - D.  $0.25 \text{ MN/m}^2$

#### Answer Key

	1	2	3	4	5	6	7	8	9	0
0	D	C	D	D	B	D	A	B	B	B
10	D	B	B	B	A	B	B	C	B	C
20	B	D	B	C	B	A	D	D	D	A
30	A	D	A	D	C	A	B	A	A	C
40	A	C	D	A	B	B	D	D	C	B

#### Explanation

46. In tall buildings, it is important to control lateral displacements within the serviceability limit state. A structural system may be classified as follows:

- (i) Buildings frame system
- (ii) Moment resisting frame system
- (iii) Dual frame system
- (iv) Tube system

In a moment resistant frame, the relative stiffness of beam and column is very important. A frame may be designed using weak column-strong beam proportions or strong column – weak beam proportions. A frame with weak beam - strong column is more stable and therefore highly desirable.

## Section 5

1. Consider the following statements :If a simply supported beam of uniform cross-section is subjected to a clockwise moment at the left support and an equal anticlockwise moment at the right support, then the1. B.M.D. will be in the shape of a rectangle.2. S.F.D. will be a straight line coinciding with the base.3. deflection curve will be in the shape of a circular arc.Of these statements :
  - A. 1, 2 and 3 are correct
  - B. 1 and 2 are correct
  - C. 1 and 3 are correct
  - D. 2 and 3 are correct
2. Which one of the following related to domestic potable water quality is correct?
  - A. Turbidity (on Silica scale) is 15-20 ppm or mg/lit.
  - B. Colour (on Cobalt scale) is 15-25 ppm or mg/lit.
  - C. Hardness (expressed as  $CaCO_3$  equivalent) is 75-115 ppm or mg/lit
  - D. BOD is 20 ppm or mg/lit
3. Which one of the following pairs in not correctly matched ?
  - A. Lame's constant : Thick cylinder
  - B. Macaulay's method : Deflection of beams
  - C. Euler's method : Theory of columns
  - D. Eddy's theorem : Torsion of shafts.
4. BOD is preferred to COD as an index of sewage concentration because
  - A. BOD represents both carbonaceous and nitrogenous organic matter while COD may indicate carbonaceous matter only
  - B. BOD test is easier to perform and gives more reliable result
  - C. BOD relates specifically to putrescible organic matter which is the most objectionable sewage constituent
  - D. COD relates to the impurities which can only removed by chemical treatment which is expensive
5. Consider the following systems :1. Trusses and purlins2. Suspension system3. Flat grid roof 4. ShellsWhen these are used in single deck industrial structures, the correct sequence in increasing order of spans will be
  - A. 3, 1, 2, 4
  - B. 1, 3, 2, 4
  - C. 3, 1, 4, 2
  - D. 2, 4, 1, 3
6. A clay layer 3 m deep is sandwiched by a pervious material. The soil reaches 90% consolidation in 3 years. At another site, the same clay layer is bounded by impervious boundary at the bottom and sand at

- the top. What is the time taken by this layer to reach 90% settlement ?
- A. 9 years      B. 12 years      C. 15 years      D. 21 years
7. What is the distance through which the tongue rail moves laterally at the toe of the switch for movement of trains called ?
- A. Flangeway clearance  
B. Heel divergence  
C. Throw of the switch  
D. None of the above
8. Presence of which one of the following in water is the major cause of depression paralysis, blindness and/or birth defects ?
- A. cadmium      B. Chromium      C. Manganese      D. Mercury
9. Consider a close-coiled helical spring of radius  $R$ , subjected to a load  $P$ . The spring consists of  $n$  turns of wire with wire radius  $r$ . The stiffness of the spring is
- A.  $\frac{PR^3}{GI_z}$       B.  $\frac{Gr^4}{4nR^3}$       C.  $\frac{GI_z nr^4}{2nR^3}$       D.  $\frac{PR^4 2n\pi}{GI_z}$
10. Force of buoyancy on a floating body equals
- A. total pressure on the vertical projection of the body  
B. total pressure on the horizontal projection of the body  
C. weight of the liquid equal to the volume of the body  
D. weight of the liquid equal to the immersed volume of the body
11. Which one of the following statements is correct ? Lug angles:
- A. are necessarily unequal angles  
B. are always equal angles  
C. increase the shear resistance of joint  
D. reduce the length of joint
12. Consider the following statements : A : The collapse load found in the plastic analysis of a continuous beam is affected by sinking of supports. B : Large elastic stresses are caused at the supports due to sinking of supports. Of these statements :
- A. Both  $A$  and  $B$  are true  
B.  $A$  is true but  $B$  is false  
C. Both  $A$  and  $B$  are false  
D.  $A$  is false but  $B$  is true
13. When a particular discharge is flowing in a horizontal pipe, a mercury-water U-tube manometer connected to the entrance and throat of a venturimeter fitted in the pipe recorded a deflection of 25 cm. If the

same discharge flowed through the same pipe kept at an inclination of  $45^\circ$  to the horizontal, then the corresponding deflection recorded by the U-tube manometer will be

- A. 25 cm
  - B.  $25/2$  cm
  - C.  $25/2$  cm
  - D. 25 cm
14. Velocity in the z direction is given by
- A.  $\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}\right)$
  - B.  $\left(\frac{\partial u}{\partial x} - \frac{\partial v}{\partial y}\right)$
  - C.  $\left(\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y}\right)$
  - D.  $\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right)$
15. A grinding wheel rotates 3000 rpm. When power supply is cut off, the wheel stops completely in 10 seconds. What is the number of revolutions made by the wheel before coming to rest ?
- A. 3000
  - B. 1000
  - C. 500
  - D. 250
16. When is a masonry wall known as a shear wall ?
- A. If the earthquake load is out-of-plane
  - B. If the earthquake load is in-plane
  - C. If it is under reinforced
  - D. If it is placed as infill to the frame
17. A parabolic arch, symmetrical, with hinges at centre and ends, carries a point load P at distance x from left support. The arch has a span of 20 m and rise of 5 m. What is the value of x if the left hinge reaction is inclined with a slope of two vertical on one horizontal ?
- A. 8 m
  - B. 5 m
  - C. 4 m
  - D. 2.5 m
18. Which of the following equations will be satisfied by irrotational flow of an incompressible fluid?
- A.  $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$
  - B.  $\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} = \frac{\partial u}{\partial z} + \frac{\partial w}{\partial x} = \frac{\partial w}{\partial y} + \frac{\partial v}{\partial z} = 0$
  - C.  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 w}{\partial z^2} = 0$
  - D.  $\frac{\partial v}{\partial x} = \frac{\partial u}{\partial y}, \frac{\partial u}{\partial z} = \frac{\partial w}{\partial x}, \frac{\partial v}{\partial z} = \frac{\partial w}{\partial y}$
19. Consider the following statements for the column with a bracket as shown in the figure :1. Shear force is constant throughout.2. Maximum moment in the column is P.e.3. The compressive axial force in the

column is 0.4. p. Which of the statements given above is/are correct ?

- A. 1, 2 and 3      B. 1 only      C. 1 and 3      D. 2 only

20. Increase in fineness of cement

- A. reduces the rate of strength development and leads to higher shrinkage
- B. increases the rate of strength development and reduces the rate of deterioration
- C. decreases the rate of strength development and increases the bleeding of cement
- D. increases the rate of strength development and leads to higher shrinkage

21. Two springs of stiffnesses  $K_A$  and  $K_B$  are placed one inside the other so as to be compressed by the same amount under an applied axial load. The combined stiffness of the two springs will be

- A.  $\frac{1}{K_A} + \frac{1}{K_B}$
- B.  $K_A K_B / (K_A + K_B)$
- C.  $(K_A + K_B) / 2$
- D.  $K_A + K_B$

22. If the Young's modulus 'E' is equal to bulk modulus 'K', then what is the value of the Poisson's ratio ?

- A.  $\frac{1}{4}$       B.  $\frac{1}{2}$       C.  $\frac{1}{3}$       D.  $\frac{3}{4}$

23. At the time of initial tensioning the maximum tensile stress in tendon immediately behind the anchorage shall Not exceed

- A. 50% of the ultimate tensile strength of the wire or bar strength
- B. 80% of the ultimate tensile strength of the wire or bar strength
- C. 40% of the ultimate tensile strength of the wire or bar strength
- D. 60% of the ultimate tensile strength of the wire strength

24. The following statements relate to a laminar flow : 1. Laminar flow is rotational. 2. In laminar flow the loss of head is proportional to the square of the velocity. 3. In laminar flow the loss of head is proportional to the first power of viscosity. 4. In laminar flow the velocity is constant over the cross-section. 5. Other quantities remaining the same, increase in diameter will increase the Reynolds number in laminar flow. Of these statements :

- A. 1, 2 and 4 are correct
- B. 1, 3 and 4 are correct



- C. 1, 3 and 5 are correct
  - D. 2, 3 and 5 are correct
25. Plate load test is useful to estimate
- A. Bearing capacity of foundation
  - B. Settlement of foundation
  - C. Both bearing capacity and settlement of foundation
  - D. Depth of foundation
26. In the figure shows two blocks of equal weights designated as W1 and W2 connected together by a rod and resting on an inclined plane whose angle  $\alpha$  can be varied. The coefficients of friction between the blocks and the surface of the plane are  $\mu_1 = 0.2$  and  $\mu_2 = 0.3$ . The value of angle  $\alpha$  at which the slipping will commence is given by
- A.  $\tan \alpha = 0.1$       B.  $\tan \alpha = 0.2$       C.  $\tan \alpha = 0.25$       D.  $\tan \alpha = 0.8$
27. The most suitable type of equipment for compaction of cohesive soils is
- A. Smooth-wheeled rollers
  - B. Vibratory rollers
  - C. Sheep foot rollers
  - D. Tampers
28. Ringelmann's scale is used to
- A. measure CO
  - B. measure SO<sub>2</sub>
  - C. grade density of smoke
  - D. grade automobile exhaust gas
29. Consider the following statements :1. Obtaining reliable properties of soil is very important in geotechnical engineering. Chunksamples obtained from the field are the best for this purpose.2. Chunk samples may easily be obtained at all depths below ground level and for all types of soils.3. Undisturbed soil samples are enclosed in rugged containers. As such, they do not get disturbed easily during transportation and handling.Which of the statements given above is/are correct ?
- A. 1, 2 and 3      B. 1 only      C. 2 and 3      D. 1 and 3
30. In a V-notch, an error of 1% in the measurement of head would constitute in the discharge measurement, an error of
- A. 1.0%      B. 1.5%      C. 2.0%      D. 2.5%
31. In a diamond riveting, for a plate of width  $l$  and rivet diameter 'd' the efficiency of the joint is given by

- A.  $(b - d)/b$
  - B.  $(b / 2d)/b$
  - C.  $(b - d)/d$
  - D.  $(b - 2d)/d$
32. Shear strength of timber depends on which one of the following ?
- A. Lignin with fibres
  - B. Medullary rays
  - C. Heartwood
  - D. Sapwood
33. The number of independent conditions required to be satisfied for the adjustment of a braced quadrilateral in triangulation survey is
- A. 2      B. 4      C. 6      D. 8
34. In case of well foundation, grip length is defined as the
- A. length below the top of the well cap to the cutting edge
  - B. length between the bottom of the well cap to the cutting edge
  - C. depth of the bottom of the well below the minimum scour level
  - D. depth of the bottom of the well below the maximum scour level
35. The coefficient of linear expansion of granite is in the range of that of
- A. glass
  - B. mild steel
  - C. high carbon steel
  - D. bamboo
36. The optimistic, most likely and pessimistic time estimates of an activity are 5, 10 and 21 days respectively. What are the expected time and standard deviation respectively ?
- A. 12, 3      B. 11, 4      C. 11, 2.67      D. 10, 16
37. A fixed beam made of steel is shown in the figure. At collapse, the value of load P will be equal to :
- A.  $10 Mp/L$       B.  $12 Mp/L$       C.  $16 Mp/L$       D.  $20 Mp/L$
38. Consider the following statements :The use of relatively weak mortar1. will accommodate movements due to loads, cracking if any and will be distributed as thin hair cracks which are less noticeable or harmful.2. will result in reduction of stresses due to differential expansion of masonry units.Of these statements :
- A. 1 alone is correct
  - B. 2 alone is correct
  - C. both 1 and 2 are correct
  - D. neither 1 nor 1 is correct

39. A stone dropped from the top of a tower is found to travel  $(5/9)$  of the height of the tower during the last second of its fall. What is the total time of fall ?  
 A. 2 s      B. 3 s      C. 6 s      D. 4 s
40. Field vane shear is the appropriate field test for obtaining the shear strength of which one of the following ?  
 A. Stiff clay      B. Weathered rock      C. Sand      D. Soft clay
41. A hydro-electric reservoir can supply water continuously at a rate of 100 m<sup>3</sup>/s. The head is 75 m. The theoretical power that can be developed is  
 A. 10000 mhp      B. 100000 mhp      C. 7500 mhp      D. 7500 kW
42. The structure shown in the given figure is stable if  
 A.  $x = 2y$   
 B.  $2x = y$   
 C.  $2x = y$   
 D.  $x = 2y$
43. Flow happens at a critical depth of 0.5 m in a rectangular channel of 4 m width. What is the value of discharge ?  
 A. 5.4 m<sup>3</sup>/s  
 B. 5.1 m<sup>3</sup>/s  
 C. 4.9 m<sup>3</sup>/s  
 D. 4.4 m<sup>3</sup>/s
44. Which one of the following statements is NOT correct ?  
 A. In combined sewerage system, one set of sewers is laid for both sanitary sewage and storm water.  
 B. In separate system, the design of sewage system is economical  
 C. In separate system, self cleaning velocities are not available and occasional flushing is required.  
 D. As the sewage is diluted by storm water in combined sewage system, cost of treatment is low.
45. A mild steel bar of square cross-section 40 mm x 40 mm is 400 mm long. It is subjected to a longitudinal tensile stress of 440 N/mm<sup>2</sup> and lateral compressive stress is 200 N/mm<sup>2</sup> in perpendicular directions.  $E = 2 \times 10^5$  N/mm<sup>2</sup>,  $\mu = 0.3$ . What is the approximate elongation of the bar in the longitudinal direction ?  
 A. 0.44 mm      B. 0.88 mm      C. 0.22 mm      D. 1 mm
46. What are the values of tolerable CO concentration in residential area, for continuous exposure durations of 1 hour and 8 hours, respectively ?

- A. 4 and 2 mg / m<sup>3</sup>  
 B. 1 and 2 mg / m<sup>3</sup>  
 C. 4 and 6 mg / m<sup>3</sup>  
 D. 5 and 1 mg / m<sup>3</sup>
47. If the proportion of soil passing 75 micron sieve is 50% and the liquid limit and plastic limit are 40% and 20% respectively, then the group index of the soil is  
 A. 3.8      B. 6.5      C. 38      D. 65
48. Which one of the following instruments can be used as a clinometer ?  
 A. Prism square      B. Line ranger      C. Abney level      D. Optical square
49. Consider the following statements :For the N-girder shown in the given figure, ILD for force in the member, L0U1 is obtained by1. multiplying the ordinate of ILD for shear in the panel L0L1, by sec  $\theta$ .2. dividing the ordinate of ILD for moment at L1 by cos  $\theta$  x L0L13. dividing the ordinate of ILD for moment at L1 by L1 U1Of these statements :  
 A. only 3 is correct  
 B. 1 and 3 are correct  
 C. 1 and 2 are correct  
 D. 1, 2 and 3 are correct
50. Consider the following statements :1. In a fluid under motion, the pressure at a point is always perpendicular to the surface.2. Pascal's law states that the pressure at a point is same in all directions.3. Magnitude of pressure of a fluid at a point is obtained from hydrostatic law.4. Pascal's law is applicable in the operation of a hydraulic press.Which of these statements are correct ?  
 A. 1, 2 and 3      B. 1, 3 and 4      C. 1, 2 and 4      D. 2, 3 and 4

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	C	D	B	A	B	C	D	B	D
10	D	A	D	D	D	B	C	A	C	D
20	D	C	B	D	C	C	C	C	B	D
30	A	A	D	D	A	C	A	A	B	D
40	B	D	D	C	D	A	B	C	A	D

## Section 6

- The process of determining the location of the station (on the map) occupied by the plane table is called as
  - Intersection
  - Three-point problem
  - Traversing
  - Resection
- Which one of the following correctly expresses the split tensile strength of a circular cylinder of length  $L$  and diameter  $D$ , subject to a maximum load of  $P$  ?
  - $\frac{P}{\pi DL}$
  - $\frac{P}{2\pi DL}$
  - $\frac{2P}{\pi DL}$
  - $\frac{P}{4\pi DL}$
- If 'A' is the angle formed by two gauge faces, the crossing number will be
  - $\tan A$
  - $\cot A$
  - $\sec A$
  - $A \text{ rad}$
- What is the curve resistance for a 50 tonnes train on a BG track on a  $4^\circ$  curve?
  - 0.05 tonne
  - 0.06 tonne
  - 0.08 tonne
  - 0.01 tonne
- What does high COD to BOD ratio of an organic pollutant represent ?
  - High biodegradability of the pollutant
  - Low biodegradability of the pollutant
  - Presence of free oxygen for aerobic decomposition
  - Presence of toxic material in the pollutants
- Consider the following limitations :1. Can be performed only on purely cohesionless soils2. Plane of failure is predetermined3. There is virtually no control on drainage4. Non-uniform distribution of stresses5. Principal stresses in the sample cannot be determined The limitations inherent in direct shear test include
  - 1, 2 and 3
  - 2, 3 and 4
  - 3, 4 and 5
  - 1, 2 and 5
- Given that  $g$  = acceleration due to gravity and  $R$  = hydraulic mean depth, the Darcy Weisbach friction factor is related to Manning's roughosity coefficient 'n' as
  - $\frac{8 g n^2}{R^{1/3}}$
  - $\frac{g n^2}{8 R^{1/3}}$
  - $\frac{64 n g}{R^{1/3}}$
  - $\frac{R^{1/3}}{8 g n^2}$
- A symmetrical circular arch of span 25 m with a central rise of 5 is hinged at crown and springings. It carries a point load on the arch in the span between the left hinge and central hinge. If the inclination of

the thrust at the right hinge is  $\theta$  measured from horizontal, then what is the value of  $\tan \theta$  ?

- A. 2.5
  - B. 1.0
  - C. 0.4
  - D. Not possible to calculate with given data
9. The combined motion of rotation and translation may be assumed to be a motion of pure rotation about some centre which goes on changing from time to time. The centre in question is known as
- A. Shear centre
  - B. Meta centre
  - C. Instantaneous centre
  - D. Gravitational centre
10. A train is hauled by 2-8-2 locomotive with 22.5 tonnes load on each driving axle. Assuming the coefficient of rail-wheel friction to be 0.25, what would be the hauling capacity of the locomotive ?
- A. 15.0 tonnes    B. 22.5 tonnes    C. 45.0 tonnes    D. 90.0 tonnes
11. Which is the best sewer material to resist hydrogen sulphide corrosion ?
- A. Glazed stone ware
  - B. Glazed earthen ware
  - C. R.C.C.
  - D. Brick masonry
12. A steel bar of 2 m length is fixed at both ends at  $20^{\circ}\text{C}$ . The coefficient of thermal expansion is  $11 \times 10^{-6}/^{\circ}\text{C}$  and the modulus of the elasticity is  $2 \times 10^6 \text{ kg/cm}^2$ . If the temperature is changed to  $18^{\circ}\text{C}$ , then the bar will be experience a stress of
- A.  $22 \text{ kg/cm}^2$  (tensile)
  - B.  $22 \text{ kg/cm}^2$  (compressive)
  - C.  $44 \text{ kg/cm}^2$  (compressive)
  - D.  $44 \text{ kg/cm}^2$  (tensile)
13. Which one of the following is not biodegradable organic matter ?
- A. Carbohydrates    B. Fats    C. Alcohols    D. Petrol
14. A column base is subjected to moment. If the intensity of bearing pressure due to axial load is equal to stress due to the moment, then the bearing pressure between the base and the concrete is
- A. uniform compression throughout
  - B. zero at one end and compression at the other end

- C. tension at one end and compression at the other end
  - D. uniform tension throughout
15. The bending moment diagram for an overhanging beam is shown in the given figure :The points of contraflexure would include
- A.  $A$  and  $F$
  - B.  $B$  and  $E$
  - C.  $C$  and  $D$
  - D.  $A$  and  $D$
16. A symmetric parabolic arch of span 12m and rise 4 m has hinges at springings and at the crown. What is the influence line ordinate at the location 3m from one lower hinge ?
- A. 2.25 units      B. 1.25 units      C. 1.125 units      D. 1.0 unit
17. Bottom-dump wagons are suitable for handling which of the following ?
- A. Wet sticky clay
  - B. Sand and gravel
  - C. Quarry rocks
  - D. Any type of material
18. In a BG railway track, the specified ruling gradient is 1 in 250. The horizontal curve of  $3^\circ$  on a gradient of 1 in 250 will have the permissible compensated gradient of
- A. 1 in 257      B. 1 in 357      C. 1 in 457      D. 1 in 512
19. The daily cover of MSW landfills consists of which one of the following ?
- A. Compacted soil      B. Geomembrane      C. Geotextile      D. Geo-composite
20. Which one of the following structures can be classified in a system of coplanar forces ?
- A. A grid
  - B. A plane pin-jointed truss
  - C. A shaft
  - D. A stab
21. If the stream function  $\psi = 3x^2 - y^3$ , what is the magnitude of velocity at point (2, 2) ?
- A. 9      B. 13      C. 15      D. 17
22. In each of the following examples certain quantity of work 'W' is done.1. The point of application of a force of  $(50\mathbf{i} + 60\mathbf{j} + 80\mathbf{k})$  in kN units moves through a distance given by  $(6\mathbf{i} + 5\mathbf{j} + 2.5\mathbf{k})$  in metres.2. A pump raises 2m<sup>3</sup> of water through a height of 20 m (Take

- $g = 10 \text{ m/s}^2$ ).3. A shaft delivering a torque = 200 kNm makes 0.75 revolution.4. A couple  $(30\mathbf{i} - 20\mathbf{j} + 100\mathbf{k})$  in kNm units acting on a body rotates it through an angular displacement of  $(2\mathbf{i} + 3\mathbf{j} + 6\mathbf{k})$  radians. The correct sequence of these quantities of work 'W' arranged in order of their increasing magnitude is  
A. 1, 4, 2, 3    B. 2, 4, 1, 3    C. 3, 2, 1, 4    D. 2, 3, 4, 1
23. Which one of the following characteristics of ballast makes it unsuitable for use ?  
A. High resilience  
B. High stability  
C. High water absorption  
D. High modulus
24. In the propped cantilever shown in the figure below, what are the values of the bending moment and shear force at the support A ?  
A.  $2 Pa, P/3$   
B.  $Pa, P$   
C.  $Pa, P/3$   
D.  $2 Pa, 4 P/3$
25. Which one of the following methods of O-D traffic surveys is conducted for comprehensive analysis of traffic and transportation data ?  
A. Home interview  
B. Roadside interview  
C. Registration number method  
D. Postcard method
26. Consider the following statements :Soft varieties of pig iron are also known as1. foundry pig 2. grey pig3. forge pig4. mottled pig.Of these statements :  
A. 1, 2, 3 and 4 are correct  
B. 1 alone is correct  
C. 1 and 2 are correct  
D. 3 and 4 are correct
27. A turn-table on railways is used for  
A. preventing the lateral movement of wheels  
B. reversing the direction of the engine  
C. reducing the damage to the rails  
D. reducing the accidents
28. Consider the following statements regarding use of mechanical vibrator :1. It can be used for small as well as large volumes of concrete.2.



The mix can have high value of slump. 3. Density of concrete can be high. The advantages of a mechanical vibrator include :

A. 2 and 3      B. 1 and 3      C. 1, 2 and 3      D. 1 and 2

29. Which one of the following specifications for length of base line refers to Third Order Triangulation system ?

A. 0.5 to 3 km      B. 1.5 to 4 km      C. 5 to 15 km      D. 10 to 20 km

30. Two long columns C1 and C2 are made of the same materials. Column C1 has both the ends hinged while column C2 has one end hinged and other end fixed. What is the ratio of the critical load for C1 to that of C2 according to the Euler's formula ?

A. 2      B.  $\frac{1}{2}$       C. 4      D.  $\frac{1}{4}$

31. The bending moments at point A, B, and C of the beam shown in the given figure will be:

A. 10 kNm, 10 kNm and 10 kNm  
B. 10 kNm, 10 kNm and - 10 kNm  
C. 20 kNm, 10 kNm and - 10 kNm  
D. 10 kNm, - 10 kNm and 20 kNm

32.  $x_1x_1$  and  $x_2x_2$  are parallel axes of which  $XX$  is the centroidal axis. If moment of inertia of the figure about  $x_1x_1$  axis is  $10m^4$ , what is the moment of inertia of the figure about  $x_2x_2$  axis?

A.  $10m^4$       B.  $11m^4$       C.  $14m^4$       D.  $15m^4$

33. As per Lacey's regime equation, what is the flow velocity proportional to ?

A.  $(Qf^2)^{1/3}$   
B.  $(Qf^2)^{1/6}$   
C.  $Q/f^2$   
D.  $(Q/f)^{1/6}$

34. Which of the following types of pumps can be used for concreting ? 1. Piston operated. 2. Pneumatically operated. 3. Centrifugal operated, with straight blades. 4. Screw type.

A. 1 and 3      B. 1 and 2      C. 1, 3 and 4      D. 2 and 4

35. For medium silt where average grain size is 0.16 mm, Lackey's silt factor is likely to be

A. 0.30      B. 0.45      C. 0.70      D. 1.32

36. Guide banks are provided to

A. train the flow of a river along a specified course  
B. reduce the peak flood discharge

- C. confine the width of river  
D. increase the water way
37. A soil fails under an axial vertical stress of 100 kN/m<sup>2</sup> in unconfined compression test. The failure plane makes an angle of 50° with the horizontal. The shear parameters  $c$  and  $\phi$  respectively will be  
A. 41.9 kN/m<sup>2</sup>, 0  
B. 50.0 kN/m<sup>2</sup>, 0  
C. 41.9 kN/m<sup>2</sup>, 10°  
D. 50.0 kN/m<sup>2</sup>, 10°
38. The fix of a plane table from three known points is good if  
A. the middle station is the nearest  
B. the middle station is farther than the other two stations  
C. either of the extreme stations is the nearest  
D. the middle station is close to the great circle
39. A hollow steel shaft of external diameter 100 mm and internal diameter 50 mm is to be replaced by a solid alloy shaft. Assuming the same value of polar modulus for both, the diameter of the solid alloy shaft will be  
A. 10 x <sup>3</sup>√9375 mm  
B. 10 x <sup>3</sup>√9375 x 10 mm  
C.  $10 \times \sqrt[3]{\frac{9375}{10}}$  mm  
D. <sup>3</sup>√9375 mm
40. For a circular curve of radius 200 m, the coefficient of lateral friction of 0.15 and the design speed is 40 kmph. The equilibrium superelevation (for equal pressure on inner and outer wheel) would be  
A. 21.3    B. 7    C. 6.3    D. 4.6
41. A ball of mass 1 kg moving with a velocity 2 m/s collides directly with a stationary ball of mass 2 kg. If the first ball comes to rest after the impact, what is the velocity of the second ball after impact ?  
A. 1.0 m/s    B. zero    C. 2 m/s    D. 0.5 m/s
42. What is number of categories into which masonry buildings are divided on the basis of earthquake resistance features ?  
A. Five    B. Four    C. Three    D. Two
43. A mild steel bar is 40 cm long. The lengths of parts AB and BC of the bar are 20 cm each. It is loaded as shown in the given figure. The ratio of the stresses,  $\sigma_1$  in part AB to  $\sigma_2$  in part BC is  
A. 2    B. 1/2    C. 4    D. 1/4
44. Zero hardness of water is achieved by :

- A. using lime soda process
  - B. excess lime treatment
  - C. ion exchange method
  - D. using excess alum dosage
45. The normal duration and normal cost of an activity are 10 days and Rs 350/- respectively. The cost slope is Rs 75/- per day. If the crash duration is 8 days, then what is the crash cost of the activity ?  
 A. Rs 400/-      B. Rs 500/-      C. Rs 600/-      D. None of these
46. Laboratory vane shear test can also be used to determine
- A. Shear parameters of silty sand
  - B. Shear parameters of sandy clay
  - C. Liquid limit of silty clay
  - D. Plastic limit of clayey silt
47. Consider the following statements regarding base-line measurements :  
 :1. Very precise measurement can be done only on densely cloudy days or at nights.  
 :2. Error due to application of non-standardised pull on the tape can be either cumulative or compensating type.  
 :3. Intermediate obstructions in the measurement of base-lines can be cleared by erecting towers.  
 Of these statements :
- A. 1, 2 and 3 are correct
  - B. 1 and 2 are correct
  - C. 1 and 3 are correct
  - D. 2 and 3 are correct
48. In a hydraulic jump occurring in a horizontal rectangular channel, the sequent depths are 0.3 m and 1.2 m. What is the approximate value of energy loss in the jump ?  
 A. 1.5 m      B. 0.9 m      C. 0.5 m      D. 0.35 m
49. Acidic soils are reclaimed by
- A. leaching of the soil
  - B. using limestone as a soil amendment
  - C. using gypsum as a soil amendment
  - D. provision of drainage
50. The function of coping is to serve as a :
- A. Covering to the wall to throw off water
  - B. ornamental course between lintel level and roof level
  - C. Projection from a wall to support a structural member
  - D. shade against solar radiation

<b>Answer Key</b>		1	2	3	4	5	6	7	8	9	0
	0	D	C	B	C	A	D	A	C	C	B
	10	A	C	D	B	B	A	B	B	A	B
	20	D	B	C	B	A	A	B	B	A	B
	30	B	D	B	B	C	A	C	B	C	C
	40	A	A	B	C	B	D	C	C	B	A

## Section 7

1. Which one of the following statements is correct ? The function of an air vessel in a reciprocating pump is to obtain :
  - A. reduction of suction head
  - B. rise in delivery head
  - C. continuous supply of water at uniform rate
  - D. increase in supply of water
2. Dolphin is a type of which one of the following ?
  - A. Pile foundation
  - B. Isolated footing
  - C. Raft foundation
  - D. Caisson
3. A steel rod, 100 mm long is held between two rigid supports. It is heated by  $20^{\circ}\text{C}$ . If the coefficient of thermal expansion of the material of the rod is  $15 \times 10^{-6} / ^{\circ}\text{C}$  and modulus of elasticity is  $200 \times 10^3 \text{ MN/m}^2$ , what is the stress in the rod ?  
A.  $20 \text{ MN/m}^2$     B.  $40 \text{ MN/m}^2$     C.  $60 \text{ MN/m}^2$     D.  $80 \text{ MN/m}^2$
4. Consider for following statements :In an under-reinforced concrete beam,
  1. actual depth of neutral axis is less than the critical depth of neutral axis.
  2. concrete reaches ultimate stress prior to steel reaching the ultimate stress.
  3. moment of resistance is less than that of balanced sections.
  4. lever arm of resisting couple is less than that of balanced sections.Which of the statements given above are correct ?  
A. 1 and 2    B. 1 and 3    C. 2, 3 and 4    D. 1 and 4
5. What is the appropriate field test to determine the in-situ undrained shear strength of a soft clay ?
  - A. static cone penetration test
  - B. standard penetration test
  - C. Plate load test
  - D. Vane shear test
6. A continuous beam ABC of two equal spans AB and BC carries a load P at Z, the centre of BC. Then the magnitude of collapse load P is equal to  
A.  $\frac{2M_p}{l}$     B.  $\frac{4M_p}{l}$     C.  $\frac{6M_p}{l}$     D.  $\frac{8M_p}{l}$
7. What is the maximum number of passenger cars that can pass a given point on a lane or roadway during one hour under ideal roadway and traffic conditions, known as ?

- A. Practical capacity
  - B. Possible capacity
  - C. Basic capacity
  - D. Road capacity
8. In PERT, the actual time duration along the critical path for the project completion time is probabilistic. It is usually presumed to follow which one of the following ?
- A. Beta distribution
  - B. Poisson distribution
  - C. Normal distribution
  - D. Log-normal distribution.
9. Why are moorings provided ?
- A. For anchoring of ships
  - B. For towing the ships to the sea
  - C. For repair of ships
  - D. For washing of ships and ship boards
10. Allowable disposable rate of application of sludge on land is determined by
- A. carbon content of sludge
  - B. nitrogen content of sludge
  - C. phosphorus content of sludge
  - D. potassium content of sludge
11. Which of the following treatments reduce salinity of water?
1. Flash mixing and sedimentation
  2. Electrodialysis
  3. Reverse osmosis
  4. Freezing
  5. Filtration
- Select the correct answer using the codes given below:
- A. 1, 2, 3, 4 and 5
  - B. 2, 3 and 4
  - C. 1, 3 and 5
  - D. 1, 2 and 4
12. Why is lime added to cement slurry for the topcoat of plastering ?
- A. To improve the strength of plaster
  - B. To stiffen the plaster
  - C. To smoothen the plaster for ease of spread
  - D. To make the plaster non-shrinkable
13. A concentrated load  $W$  moves on the span of a three-hinged arch. The horizontal thrust at the supports is maximum when the load is at which one of the following ?

- A. The springing
  - B. One-sixth of the span from one end
  - C. Quarter span
  - D. The crown
14. A 30 m steel tape was standardised at 20°C measurements of distances were taken as 15°C. If the coefficient of linear expansion of the material of the tape were 0.00, 00112 degree centigrade, then the error, due to temperature, per tape length would be
- A. - 0.00, 00560 m
  - B. + 0.00, 00560 m
  - C. + 0.00, 16800 m
  - D. - 0.00, 16800 m
15. The slenderness ratio of a compression member in the context of Rankine's formula is defined as
- A.  $\frac{\text{length}}{\text{least lateral dimension}}$
  - B.  $\frac{\text{effective length}}{\text{least radius of gyration}}$
  - C.  $\frac{\text{effective length}}{\text{least lateral dimension}}$
  - D.  $\frac{\text{length}}{\text{least radius of gyration}}$
16. Which one of the following is not related to theories of creep of rails ?
- A. Wave theory
  - B. Percussion theory
  - C. Drag theory
  - D. Reversal theory
17. Preliminary project report for a road project must contain
- A. the detailed estimated cost based on detailed design
  - B. the several alternatives of the project that have been considered
  - C. the soil survey, traffic survey, concept design and approximate cost
  - D. these contract documents for inviting tenders
18. The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from as-cast level of supports of floors, roofs and all other horizontal members should NOT exceed
- A. span/350
  - B. span/300
  - C. span/250
  - D. span/200
19. Why are bricks soaked in water before using in brick masonry ?
- A. For removing dust
  - B. For reducing air voids
  - C. For preventing depletion of moisture from mortar
  - D. For reducing efflorescence

20. A bed of sand consists of three horizontal layers of equal thickness. The value of Darcy's  $k$  for the upper and lower layers is  $1 \times 10^{-2}$  cm/sec and that for the middle layer is  $1 \times 10^{-1}$  cm/sec. The ratio of the permeability of the bed in the horizontal direction to that in the vertical direction is  
 A. 10.0 to 1      B. 2.8 to 1      C. 2.0 to 1      D. 1 to 10
21. Consider the following statements relating to hydraulic gradient line and energy gradient line. 1. In the case of a fluid flowing in a pipeline, hydraulic gradient line and energy gradient line may coincide. 2. The line joining the points representing piezometric heads is known as hydraulic gradient line. 3. In the case of ideal fluid, energy gradient line is always horizontal. 4. Hydraulic gradient line has a downward slope in the case of flow through pipes. Of these statements :  
 A. 1, 2 and 3 are correct  
 B. 1, 3 and 4 are correct  
 C. 2, 3 and 4 are correct  
 D. 1, 2 and 4 are correct
22. An open cylindrical vessel with axis vertical and filled with a liquid is falling freely with an acceleration. What will be the absolute pressure at the base of the vessel ?  
 A. Equal to liquid column  
 B. Below atmospheric pressure  
 C. Above atmosphere pressure  
 D. Equal to atmosphere pressure
23. Dechlorination of water is achieved by adding  
 A. sodium thiosulphate  
 B. sodium sulphate  
 C. sodium hexametaphosphate  
 D. sodium bisulphate
24. On which of the following is the working principle of concrete hammer for non-destructive test based ?  
 A. Rebound deflections  
 B. Radioactive waves  
 C. Ultrasonic pulse  
 D. Creep-recovery
25. Given for a soil sample : Degree of saturation = 90% Specific gravity of soil grains = 2.70 Void ratio = 0.30 The water content of the sample is  
 A. 10%      B. 13.5%      C. 22.5%      D. 35%



26. An equilateral triangular plate is immersed in water as shown in the above figure. The centre of pressure below the water surface is at a depth of
- A.  $\frac{3h}{4}$       B.  $\frac{h}{3}$       C.  $\frac{2h}{3}$       D.  $\frac{h}{2}$
27. Consider the following factors :1. Air traffic control measures2. Aircraft traffic composition3. VFR/IFR operation4. Runway configurationWhich of these factors affect the capacity of a runway ?
- A. 1, 2 and 3      B. 2 and 3      C. 1 and 4      D. 1, 2, 3 and 4
28. A city supply of 15000 cubic metres of water per day is treated with a chlorine dosage of 0.5 ppm. For this purpose, the requirement of 25% bleaching powder per day would be
- A. 300 kg      B. 75 kg      C. 30 kg      D. 7.5 kg
29. The ratio between the stress produced in a bar by a sudden application of load (impact loading) as compared to the stress produced by the gradual application of same load is
- A. 1.5      B. 2.0      C. 2.5      D. 3.0
30. The shear stress distribution over a rectangular cross-section of a beam follows
- A. a straight line path  
B. a circular path  
C. a parabolic path  
D. an elliptical path
31. Which among the following brings about the Hazardous Waste Management and Handling Rules in India?
- A. Central Pollution Control Board  
B. Ministry of Environment and Forests  
C. Ministry of Urban Development  
D. Ministry of Rural Development
32. Consider the following statements :A : Single scaffolding consists of a single framework of standards, ledgers and potlogs constructed parallel to the wall.R : Potlogs are placed at both ends on frames when it is difficult to provide holes in the wall. Of these statments :
- A. both  $A$  and  $R$  are true and  $R$  is the correct explanation of  $A$   
B. both  $A$  and  $R$  are true but  $R$  is not a correct explanation of  $A$   
C.  $A$  is true but  $R$  is false  
D.  $A$  is false but  $R$  is true
33. A beam of circular cross-section of diameter  $d$  is subjected to a direct compressive axial load and an eccentric compressive load with eccentricity 'e'. In order that the tensile stress induced is zero the limiting

region of application of the load should be shaded concentric circle of diameter

- A.  $\frac{d}{3}$       B.  $\frac{d}{4}$       C.  $\frac{d}{6}$       D.  $\frac{d}{8}$

34. The issue rate of an item stocked in stores is
- Permanently fixed
  - fixed at the beginning of each year
  - a rate less than the market rate
  - the rate revised during the year when there is an appreciable variation in the rates of the items
35. For the truss shown in the figure, which one of the following members has zero force induced in it ?
- A. BC      B. AD      C. DE      D. BD
36. A VOR radio transmitter which emits beam in a vertical plane and gives an indication to the pilot whether he is to the left or right of the correct alignment for approach to the runway is known as
- Outer marker
  - Localiser antenna
  - Glide slope antenna
  - Marker beacon
37. Gantt charts indicate
- comparison of actual progress with the scheduled progress
  - balance of work to be done
  - Progressive costs of project
  - inventory costs
38. A cantilever has rectangular cross-section and supports concentrated load at its free end initially. If depth and width of the beam sections are doubled, the deflection, at free end of the cantilever will reduce to what percentage of the initial deflection ?
- A. 20%      B. 15.72%      C. 9.37%      D. 6.25%
39. The optimistic, most likely, and pessimistic estimates of time for an activity are 4 days, 11 days and 12 days respectively. The expected completion time of this activity is
- A. 8 days      B. 9 days      C. 10 days      D. 11 days
40. When a single point load  $W$  travels over a simply supported beam, what is shape of the graph for maximum positive or negative shear force ?
- A triangle with maximum ordinate  $W$  at centre and zero at two simple supports

- B. A triangle with maximum ordinate  $W$  at a support
  - C. A rectangle with ordinate  $W$
  - D. A parabola with maximum ordinate  $W$  at centre of span and zero at supports
41. A beam of uniform strength refers which one of the following ?
- A. A beam in which extreme fibre stresses are same at all cross-sections along the length of the beam.
  - B. A beam in which the moment of inertia about the axis of bending is constant at all cross-sections of the beam.
  - C. A beam in which the distribution of bending stress across the depth of cross-section is uniform of all cross-sections of the beam.
  - D. A beam in which the bending stress is uniform at the maximum bending moment cross-section.
42. A sample of ground water at a pH of 7.0 contains 122 mg/l of bicarbonates. What is the alkalinity of this water (in terms of  $\text{CaCO}_3$ ) ?
- A. 120 mg/l    B. 60 mg/l    C. 100 mg/l    D. 200 mg/l
43. The effective depth of a singly reinforced rectangular beam is 30 cm. The section is over-reinforced and the neutral axis is 12 cm below the top. If the maximum stress attained by concrete is 50 kg/cm<sup>2</sup> and the modular ratio is 18, then the stress developed in steel would be
- A. 1800 kg/cm<sup>2</sup>
  - B. 1600 kg/cm<sup>2</sup>
  - C. 1350 kg/cm<sup>2</sup>
  - D. 1300 kg/cm<sup>2</sup>
44. Soil at a site consists of two layers. The top layer has permeability  $k$  units and bottom layer has permeability  $5k$  units. If the thickness of both the layers is equal, then what is the average permeability in the vertical direction ?
- A.  $3k$  units    B.  $(5/3)k$  units    C.  $(6/5)k$  units    D.  $(5/6)k$  units
45. A part of the Newmark's influence chart with four concentric circles is shown in the above figure. If the hatched areas 1 and 2 are loaded separately with the same intensity of loading, then the intensity of pressure yielded
- A. By 1 will be more than that yielded by 2
  - B. By 2 will be more than that yielded by 1
  - C. By 1 and 2 will be equal
  - D. at the centre will be in inverse proportion to the radii of the two, circles
46. The loss of prestress due to shrinkage of concrete is the product of

- A. modular ratio and percentage of steel  
 B. modulus of elasticity of concrete and shrinkage of concrete  
 C. modulus of elasticity of steel and shrinkage of concrete  
 D. modular ratio and modulus of elasticity of steel
47. Which one of the following pressure units represents the LEAST pressure ?  
 A. Millibar      B. mm of mercury      C.  $\text{N/mm}^2$       D.  $\text{kgf/cm}^2$
48. A cantilever is loaded as shown in the given figure. The bending moment along the length is  
 A. uniform  
 B. uniformly varying  
 C. zero  
 D. concentrated at the free end
49. Consider the following statements in regard to aerobic and anaerobic treatment processes :1. Biomass production in the aerobic treatment process is more as compared to the anaerobic treatment process.2. Start-up period is more in the aerobic treatment process as compared to the anaerobic treatment process.3. Energy consumption and production is more in the aerobic treatment process as compared to the anaerobic treatment process.Which of the statements given above is/are correct ?  
 A. 1 and 2      B. 2 and 3      C. only 2      D. only 1
50. Earth pressure and resultant possibilities of wall movement are shown in the given diagram. The point marked 'x' in the diagram denotes  
 A. earth pressure.at rest  
 B. active earth pressure  
 C. arching active pressure  
 D. passive earth pressure

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	A	C	B	D	C	C	A	A	B
10	B	A	D	D	B	D	C	C	C	B
20	C	A	A	A	A	D	C	C	B	C
30	B	C	B	A	A	D	A	C	C	A
40	A	C	D	B	C	C	A	A	D	D

## Section 8

- Which one of the following pairs is correctly matched ?
  - Sandstone....Igneous rock
  - Limestone....Sedimentary rock
  - Basalt....Metamorphic rock
  - Granite....Argillaceous rock
- A line of true length 500 m when measured by a 20 m tape is reported to be 502 m long. The correct length of the tape is  
 A. 19.92 m      B. 20.08 m      C. 20.80 m      D. 21 m
- Where should splices in the columns be provided ?
  - At the floor levels
  - At the mid height of columns
  - At the beam-column joints
  - At one-fourth height of columns
- In a rectangular channel, the depths of flow before and after the hydraulic jump are respectively 0.2 m and 1.2 m. What is the energy loss in the jump ?  
 A. 1.042 m      B. 2.084 m      C. 3.126 m      D. 4.168 m
- A three-hinged circular arch ACB is formed by two quadrants of circles AC and BC of radii  $2R$  and  $R$  respectively with C as crown, as shown in the figure at side. Consider the following in respect of the reactive forces developed at support A and B due to concentrated load  $W$  at the Crown.
  - Line of action RA at A is inclined as  $45^\circ$  to the horizontal.
  - $VA = VB = W/2$
  - $HB = 2 HA$
  - $HA = HB = W/2$
 Which of the above is/are correct ?  
 A. 1 and 3      B. 2 and 3      C. 1, 2 and 4      D. 4 only
- When two moving bodies collide with each other, their velocity of separation bears a constant ratio to their velocity of approach. This ratio is termed as coefficient of  
 A. collidity      B. friction      C. restitution      D. permeability
- A thin cylindrical shell of internal diameter ' $D$ ' and thickness ' $t$ ' is subjected to internal pressure ' $p$ '. The change in diameter is given by :  
 A.  $\frac{pD^2}{4tE} (2 - \mu)$       B.  $\frac{pD^2}{4tE} (1 - 2\mu)$       C.  $\frac{pd^2}{2tE} (1 - 2\mu)$       D.  $\frac{pd^2}{2tE} (2 - \mu)$
- Consider the following statements in the context of aeolian soils :1. The soil has low density and low compressibility2. The soil is deposited by wind3. The soil has large permeability.Of these statements :  
 A. 1, 2 and 3 are correct

- B. 2 and 3 are correct  
 C. 1 and 3 are correct  
 D. 1 and 2 are correct
9. Which of the following pairs are correctly matched ?  
 1. Standard penetration test....Relative density  
 2. Vane shear....Cohesion  
 3. Consolidation test....Bearing capacity  
 Select the correct answer using the codes given below :  
 A. 1, 2 and 3      B. 1 alone      C. 1 and 2      D. 2 and 3
10. Neglecting self weight, which of the following beams will have points of contraflexure ?  
 A. A simply supported beam with uniformly distributed load over part of the structure  
 B. An overhanging beam with loading only over supported span and not on overhangs  
 C. Fixed beam subjected to concentrated load  
 D. Cantilever beam subjected to uniformly varying load with zero load at free end
11. Which one of the following is not essential to derive the formula used in constructing a synthetic unit hydrograph ?  
 A. Time to peak      B. peakflow      C. Inter flow      D. Time base
12. In an aerial photogrammetric survey, if the exposure interval is 20 seconds to cover ground distance of 1000 m between exposures, what would be the ground speed of the aircraft ?  
 A. 90 km/hour      B. 120 km/hour      C. 150 km/hour      D. 180 km/hour
13. The head over a  $90^\circ$  V-notch weir increases from 0.15 m to 0.3 m. The ratio of new discharge to the original discharge is, nearly equal to  
 A. 5.65      B. 1.42      C. 4.0      D. 2.62
14. Consider the following statements with regard to crack formation and its control:  
 1. The surface width of the crack should not, in general, exceed 0.30 mm for structures not subjected to aggressive environment.  
 2. When depth of web in a beam exceeds 750 mm, side face reinforcement @ 0.1 percent of web area should be provided on each face.  
 3. The nominal spacing of main bars in a slab should not exceed three times the effective depth of a solid slab or 300 mm, whichever is smaller.  
 Which of the statements given above is/are correct ?  
 A. 1 only      B. 1 and 2      C. 1 and 3      D. 2 and 3
15. A rigid bar is supported by a spring as shown in the given figure. The deflection of the point B will be  
 A. 10 mm upward

- B. 20 mm downward  
C. 5 mm upward  
D. 40 mm downward.
16. Undrained strength of a clay soil can be obtained by conducting which of the following tests ?  
1. UC test  
2. Vane shear test  
3. Cyclic triaxial test  
4. Slow direct shear test  
Select the correct answer using the code given below :  
A. 1 and 2 only      B. 2 only      C. 1 and 4      D. 1, 2 and 3
17. Which one of the following is the nominal size of standard modular brick ?  
A. 25cm x 13cm x 8cm  
B. 25cm x 10cm x 8cm  
C. 20cm x 10cm x 10cm  
D. 20cm x 15cm x 10cm
18. What is the ratio of rate of back-washing to that of filtration in a typical rapid sand filter ?  
A. 2      B. 4      C. 6      D. 10
19. A point in an element is stressed as shown in the given figure. What is the value of normal stress on the oblique plane BE ?  
A. 200 N / mm<sup>2</sup>  
B. 175 N / mm<sup>2</sup>  
C. 150 N / mm<sup>2</sup>  
D. 100 N / mm<sup>2</sup>
20. What is the maximum bending moment at mid-span of the beam given below ?  
A.  $\frac{wl^2}{2}$       B.  $\frac{wl^2}{6}$       C.  $\frac{wl^2}{12}$       D.  $\frac{wl^2}{6}\sqrt{2}$
21. A circular sewer of diameter 1 m carries storm water to a depth of 0.75 m. The hydraulic radius is approximately  
A. 0.3 m      B. 0.4 m      C. 0.5 m      D. 0.6 m
22. If the staff intercept on a staff located at 100 m from the level for five division deviation of the bubble is 0.050 m and if the length of one division of the bubble is 2 mm, then the radius of curvature of the bubble is 0.050 m and if the length of one division of the bubble is 2 mm, then the radius of curvature of the bubble tube is  
A. 2.02 m      B. 2.20 m      C. 20.00 m      D. 20.20 m
23. If the magnitude of the resultant of two forces F and 2F acting at a point O is 50 N, and the included angle between F and 2F is 90°, then what is the magnitude of F ?

- A.  $F = 10 \text{ N}$
  - B.  $F = 502 \text{ N}$
  - C.  $F = 252 \text{ N}$
  - D.  $F = 105 \text{ N}$
24. Consider the following assumptions in the analysis of a plane truss 1. The individual members are straight. 2. The individual members are connected by frictionless hinges. 3. The loads and reactions act only at the joints. Of these assumptions :
- A. 1 and 2 are valid
  - B. 1 and 3 are valid
  - C. 2 and 3 are valid
  - D. 1, 2 and 3 are valid
25. In a shear test on cohesionless soils, if the initial void ratio is less than the critical void ratio, the sample will :
- A. increase in volume
  - B. initially increase in volume and then remain constant
  - C. decrease in volume
  - D. initially decrease and then increase in volume
26. Active earth pressure per metre length on the retaining wall with a smooth vertical back as shown in the given figure will be
- A.  $81 \text{ t}$     B.  $27 \text{ t}$     C.  $2 \text{ t}$     D.  $1 \text{ t}$
27. Which of the following rules are used in choosing the repeating variables in dimensional analysis : 1. Repeating variables should include the dependent variables 2. Repeating variables should contain all primary units used in describing the variables in the problem 3. Repeating variables should combine among themselves. 4. Repeating variables should not contain the dependent variables. Select the correct answer using the codes given below :
- A. 1 and 2    B. 2 and 3    C. 2 and 4    D. 3 and 4
28. The proportion of second moment of area about the centroidal axis to second moment of area about the base of a rectangle will be
- A.  $1/4$     B.  $1/2$     C. 2    D. 3
29. Mean precipitation over an area is best obtained from gauged amounts by
- A. arithmetic mean method
  - B. Thiessen method
  - C. linearly interpolated isohyetal method
  - D. orographically weighted isohyetal method
30. Loess deposits are formed by



- A. physical disintegration of rock  
 B. constant blowing of wind from the same direction  
 C. vertical deposition of glacial till  
 D. chemical weathering of residual deposits.
31. If the time required for 60% consolidation of a remoulded soil sample of clay with single drainage is  $t$ , then what is the time required to consolidate the same sample of clay with the same degree of consolidation but with double drainage ?  
 A.  $4t$     B.  $2t$     C.  $t/2$     D.  $t/4$
32. Which one of the following is the correct expression for the versine ( $h$ ) of a curve ? (Where  $l$  = length of rail on the curve portion and  $r$  = radius of curvature)  
 A.  $h = \frac{l^2}{r}$     B.  $h = \frac{l^2}{2r}$     C.  $h = \frac{l^2}{8r}$     D.  $h = \frac{l^2}{4r}$
33. The principle of virtual work states that the virtual work is zero for  
 A. a body moving with constant linear velocity  
 B. a body rotating with constant angular velocity  
 C. a body in equilibrium  
 D. a body moving with constant linear acceleration
34. A uniform beam of span  $l$  carries a uniformly distributed load  $W$  per unit length as shown in the figure. The supports are at a distance of  $x$  from either end. What is the condition for the maximum bending moment in the beam to be as small as possible?  
 A.  $x = 0.107l$   
 B.  $x = 0.207l$   
 C.  $x = 0.237l$   
 D.  $x = 0.25l$
35. The distance of the centroid of a semi-circle of radius  $r$  from its base is  
 A.  $\frac{4r}{3\pi}$     B.  $\frac{3r}{4\pi}$     C.  $\frac{4r}{3\pi}$     D.  $\frac{3r}{4\pi}$
36. A steel frame is shown in the given figure. If joint O of the frame is rigid, the rotational stiffness of the frame at point O is given by  
 A.  $\frac{11EI}{l}$     B.  $\frac{10EI}{l}$     C.  $\frac{8EI}{l}$     D.  $\frac{6EI}{l}$
37. A circle of radius 7 m has a standard error of 0.02 m on the radius. The standard error of its area is  
 A.  $0.04 \text{ m}^2$     B.  $0.14 \text{ m}^2$     C.  $0.28 \text{ m}^2$     D.  $0.88 \text{ m}^2$

38. A circular shaft is subjected to a twisting moment  $T$  and bending moment  $M$ . The ratio of maximum bending stress to maximum shear stress is given by
- A.  $\frac{2M}{T}$       B.  $\frac{M}{T}$       C.  $\frac{2T}{M}$       D.  $\frac{M}{2T}$
39. By using sieve analysis, the particle size distribution curve has been plotted for a particular soil. The coefficient of curvature  $C_c$  is given by
- A.  $\frac{D_{30}}{D_{60} \times D_{10}}$       B.  $\frac{\sqrt{D_{30}}}{D_{60} \times D_{10}}$       C.  $\frac{D_{30}}{\sqrt{D_{60} \times D_{10}}}$       D.  $\frac{D_{30}^2}{D_{60} \times D_{10}}$
40. Consider the following properties :1. The sum of the three sides is always greater than the circumference of the great circle.2. The sum of the three angles is less than six right angles and greater than two right angles.3. The sum of the sides is greater than the third side.4. The smaller angle is opposite the smaller side and vice versa.The properties of spherical triangles would include
- A. 1, 2 and 3      B. 2, 3 and 4      C. 1, 2 and 4      D. 1, 3 and 4
41. On which one of the following factors, does strength of concrete depend primarily ?
- A. Quality of coarse aggregate  
B. Quality of fine aggregate  
C. Fineness of cement  
D. Water-cement ratio
42. When a load crosses a through type Pratt truss in the direction left to right, the nature of force in any diagonal member in the left half of the span would :
- A. change from compression to tension  
B. change from tension to compression  
C. always be compression  
D. always be tension
43. The double-line field book is most commonly used for recording
- A. precise work  
B. ordinary chain survey work  
C. large-scale plotting work  
D. small-scale plotting work
44. The wood preservative "Creosote" is derived from
- A. wood or coal  
B. acidic cupric chromate

- C. chromated zinc chloride
  - D. pentachlorophenol
45. To determine the length of a bridge proposed to be built across a wide river, the surveying method of choice would be
- A. tacheometry
  - B. chain surveying
  - C. hydrographic surveying
  - D. triangulation
46. Which one of the following statements is correct ?Maximum service volume of a road is defined as the total number of vehicles that
- A. can pass a given point in a specified period of time
  - B. can be accommodated on a unit length of road
  - C. can pass a given point in unit time
  - D. None of the above three
47. The pressure gradient in the direction of flow is equal to the :
- A. Shear gradient parallel to the direction of flow
  - B. Shear gradient normal to the direction of flow
  - C. Velocity gradient parallel to the direction of flow
  - D. Velocity gradient normal to the direction of flow
48. When the strain in a material increases with time under sustained constant stress, the phenomenon is known as
- A. Strain hardening
  - B. Hysteresis
  - C. Creep
  - D. Visco-elastici
49. An upward hydraulic gradient  $i$  of a certain magnitude will initiate the phenomenon of boiling in granular soils. The magnitude of this gradient is
- A.  $0 \leq i \leq 0.5$       B.  $0.5 < i < 1.0$       C.  $i \cong 1.0$       D.  $1 < i \leq 2$
50. Well-graded dense saturated sands have high shear strength because :
- A. Such sands have a better grade (superior type) of sand grains resulting in higher strength
  - B. Such sands have lower water content, which increases shear strength
  - C. Such sands have better interlocking of grains, higher inter-particle contacts and higher inter-particle frictional resistance resulting in higher strength.
  - D. Presence of water in such sands induces capillary pressure generating higher inter-granular stresses, which generate apparent cohesion and hence higher shear strength.

	1	2	3	4	5	6	7	8	9	0
0	B	B	D	A	A	C	B	B	C	C
10	C	D	A	C	D	D	D	C	A	C
20	A	C	D	B	B	B	C	A	C	B
30	D	C	C	B	C	A	C	A	D	B
40	D	A	B	A	D	C	B	C	C	C

**Answer Key**

**Explanation**

15.

The Force in spring  $F = (500 \times 2L)/L = 1000\text{N}$ .

Deflection in the spring  $\delta = F/k = 1000/50 = 20\text{mm}$ .

Deflection at the point B =  $2\delta = 40\text{mm}$  downward.

## Section 9

1. Consider the following statements :A critical activity in a CPM network has1. The longest duration of all activities2. zero total float3. zero for float4. The shortest duration of all activitieswhich one of the statements given above are correct ?  
A. 1 and 2      B. 1 and 3      C. 2 and 3      D. 3 and 4
2. Which one of the following is the correct statement ? A heterotroph is an organism that obtains  
A. its cell carbon from an inorganic source.  
B. its energy from the oxidation of simple inorganic compounds.  
C. its cell carbon as well as its energy from organic matter.  
D. its energy from a natural ecosystem.
3. Which one of the following sections performs better on the ductility criterion ?  
A. Balanced section  
B. Over-reinforced section  
C. Under-reinforced section  
D. Non-prismatic section
4. Westergaard's formula for vertical stress gives greater value of stress than that by the Boussinesq's formula, when  $r/z$  exceeds :  
A. 1.5      B. 2.5      C. 3.5      D. 4.0
5. A round steel bar of overall length 40 cm consists of two equal portions of 20 cm each having diameters of 10 cm and 8 cm respectively. If the rod is subjected to a tensile load of 10 tonnes, the elongation will be given by :( $E = 2 \times 10^6 \text{ kg/cm}^2$ )  
A.  $\frac{1}{10}\pi (1/25 + 1/16) \text{ cm}$   
B.  $\frac{2}{10}\pi (1/25 + 1/16) \text{ cm}$   
C.  $\frac{3}{10}\pi (1/25 + 1/16) \text{ cm}$   
D.  $\frac{4}{10}\pi (1/25 + 1/16) \text{ cm}$
6. In the cantilever beam shown in the figure, what is the percentage of bending moment at  $l/2$  with respect to the maximum bending moment at the fixed support ?  
A. 15%      B. 20%      C. 25%      D. 30%
7. Which one of the following is the correct statement ? The strength of timber :  
A. is maximum in a direction parallel to the grain  
B. is maximum in a direction perpendicular to the grain  
C. is maximum in a direction  $45^\circ$  to the grain

- D. remains same in all directions
8. A and B are two traverse stations free from local attraction errors. If the true bearing of a line AB is  $89^\circ$ , and the magnetic declination at point A is  $1^\circ$  West, then the magnetic bearing of the line BA would be  
A.  $88^\circ$       B.  $90^\circ$       C.  $268^\circ$       D.  $270^\circ$
  9. For a fully saturated clay Skempton's pore pressure parameter B is  
A. zero  
B. between zero and 1  
C. 1  
D. more than 1
  10. What is the correct sequence of the following metals in the decreasing order of their Poisson's ratio ? (a) Aluminium (b) Cast iron (c) Steel  
Select the correct answer using the code given below :  
A. 1 - 2 - 3      B. 2 - 1 - 3      C. 1 - 3 - 2      D. 3 - 1 - 2
  11. A symmetrical channel section is made of a material which is equally strong in tension and compression. It is used as a simply supported beam with its web horizontal to carry vertical loads. It will  
A. be strongest if the web is used as top face  
B. be strongest if the web is used as bottom face  
C. be equally strong in (a) and (b) above  
D. not be possible to state which of the above statements is correct
  12. A machine costing Rs. 8,500 will have a scrap value of Rs. 300. Machines of this class have a working hour average life of 25,000 hours. What will be the depreciation charge at the end of the first year, if the machine is operated for a total of 1500 hours ? (use straight line method of depreciation)  
A. Rs. 492.00      B. Rs. 542.00      C. Rs. 548.50      D. Rs. 692.00
  13. The limits of percentage p of the longitudinal reinforcement in a column is  
A. 0.15% to 2%      B. 0.8% to 4%      C. 0.8% to 6%      D. 0.8% to 8%
  14. Figure shows the forces acting on a body. Each square is 3 cm x 3 cm. If  $F_1 = 30$  N,  $F_2 = 15$  N,  $F_3 = 25$  N and  $F_4 = 20$  N, the resultant force and the moment about point O, respectively, are  
A. 0 N, 0 Ncm      B. 90 N, 80 Ncm      C. 60 N, 60 Ncm      D. 30 N, 30 Ncm
  15. A simply supported beam of span (l) carries a point load W at midspan. The breadth 'b' of the beam along the entire span is constant. Given,  $f$  = permissible stress in bending, for a beam of uniform strength, the

- depth of the beam at any cross-section, at a distance  $x$  from the support would be :
- A.  $6Wx/fb$       B.  $6Wx/fb$       C.  $3Wx/fb$       D.  $3Wx/fb$
16. In the truss shown in the given figure which one of the following members has no force induced in it ?  
A. CD      B. CE      C. CF      D. DF
17. Consider the following statements :A : An isotropic material is always homogeneous. R : An isotropic material is one in which all the properties are the same in all the directions at every point. Of these statements :  
A. Both A and R are true and R is the correct explanation of A  
B. Both A and R are true but R is not a correct explanation of A  
C. A is true but R is false  
D. A is false but R is true
18. The ratio of pressures between two points A and B located respectively at depths 0.5 m, and 2 m below a constant level of water in a tank is  
A. 1 : 2      B. 1 : 2      C. 1 : 4      D. 1 : 16
19. The acceleration of a particle starting from rest varies with time according to the relation  $a = -s\omega^2 \sin \omega t$  What is the displacement of this particle at a time  $t$  ?  
A.  $s \sin \omega t$   
B.  $s\omega \cos \omega t$   
C.  $s\omega \sin \omega t$   
D.  $-1/2 (s\omega^2 \sin \omega t)t^2$
20. For which one of the following purposes is the double mass curve used ?  
A. Checking on the consistency of precipitation records  
B. Prediction of annual precipitation  
C. Defining which periods of storm should be analyzed to obtain the maximum useful information from storm rainfall records  
D. For estimating the capacity of a reservoir.
21. If  $s$  is the shear strength,  $c$  and  $\Phi$  are shear strength parameters, and  $\sigma_n$  is the normal stress at failure, then Coulomb's equation for shear strength of the soil can be represented by  
A.  $c = s + \sigma_n \tan \Phi$   
B.  $c = s - \sigma_n \tan \Phi$   
C.  $s = \sigma_n + c \tan \Phi$   
D.  $s = c - \sigma_n \tan \Phi$

22. The beam shown in the figure given above is subjected to concentrated load and clockwise couple. What is the vertical reaction at A ?  
 A. 10 kN    B. 40 kN    C. 50 kN    D. 30 kN
23. What is the vertical displacement at the point C of the structure shown in the figure ?  
 A.  $\frac{9 Pa^3}{2 EI}$     B.  $\frac{27 Pa^3}{2 EI}$     C.  $\frac{27 Pa^3}{8 EI}$     D.  $\frac{3 Pa^3}{8 EI}$
24. If all the dimensions of a prismatic bar of square cross-section suspended freely from the ceiling of a roof are doubled then the total elongation produced by its own weight will increase  
 A. eight times    B. four times    C. three times    D. two times
25. Which of the following statements are true for the pile shown in the figure ?  
 1. Frictional resistance acts upwards through the length of the pile.  
 2. Negative skin friction acts over the length AB  
 3. Frictional resistance acts upwards over the length BC  
 4. There is point resistance at level C  
 Select the correct answer using the codes given below :  
 A. 1, 3 and 4    B. 2, 3 and 4    C. 1 and 2    D. 2 and 3
26. If the standard meridian is  $82^\circ 30'$  E and the standard time at longitude  $90^\circ$  E is known to be 8 hr 30 m, the corresponding local mean time at the place will be  
 A. 7 hr 00 m    B. 8 hr 00 m    C. 8 hr 30 m    D. 9 hr 00 m
27. For a masonry dam of base width  $b$ , at which location w.r.t. the central line, should the resultant loading intersect the section to avoid tension in any horizontal section ?  
 A. Outside of  $b/6$   
 B. Within  $b/6$   
 C. Within  $b/8$   
 D. At the central line
28. Consider the following statements :  
 Excessive camber is not provided on the roads because  
 1. Transverse tilt causes discomfort  
 2. Of formation of cross ruts  
 3. Of likely toppling over of highly laden bullock carts  
 4. Of higher costs involved  
 Which of the statements given above are correct ?  
 A. 2, 3 and 4 only  
 B. 1, 3 and 4 only  
 C. 1, 2 and 4 only  
 D. 1, 2 and 3 only
29. Consider the following statements :  
 1. A project has a mission.  
 2. A project has to terminate at some time or the other.  
 3. Projects vary in terms of technology, equipment and materials, machinery and people,



work ethics and organisational culture. Amongst the above, the characteristic features for a project are

- A. 1 and 2      B. 2 and 3      C. 1 and 3      D. 1, 2 and 3
30. Which one of the following gives the correct distance between the lighthouse and a ship, when the lighthouse whose height is 100 m is visible just above the horizon from the ship ?  
A. 30.68 km      B. 36.50 km      C. 38.54 km      D. 40.54 km
31. Consider the following statements : Bearing stiffness, in plate girders, are : 1. provided at supports. 2. provided under concentrated loads. 3. provided alternately on the web. Which of the statements given above is/are correct ?  
A. 1 only      B. 2 only      C. 1 and 2      D. 1, 2 and 3
32. Which one of the following statements is correct ? As the depth of immersion of a vertical plane surface increases, the location of centre of pressure.  
A. comes closer to the centre of the area  
B. moves apart from the centre of gravity of the area  
C. ultimately coincides with the centre of gravity of the area  
D. remains unaffected
33. A highly sensitive undisturbed clay sample was brought to the laboratory and UU test was performed. The curve of deviator stress versus strain % plot will be (among the four curves shown in the given figure) the one labelled  
A. A      B. B      C. C      D. D
34. The sequent depth ratio in a hydraulic jump formed in a horizontal rectangular channel is 16.48. The flow is supercritical. What is the value of the Froude number of flow ?  
A. 4.0      B. 8.0      C. 12.0      D. 120.0
35. Consider the following operations in a spire test : 1. Depress telescope and sight a point on the ground nearer to the instrument 2. Clamp horizontal plates 3. Sight a well defined high point on a high building 4. Change face and repeat the procedure. The correct sequence of these operations is  
A. 1, 2, 3, 4      B. 3, 1, 2, 4      C. 3, 2, 1, 4      D. 2, 1, 3, 4
36. Probability of a 10-year flood to occur at least once in the next 4 years is  
A. 25%      B. 35%      C. 50%      D. 65%
37. Weigh-batching proceeds on  
A. the assumption of the declared weight in each bag of cement  
B. weighing the contents of each bag

- C. accurately estimating the weight of each material to be used in each batch
  - D. the assumption of correct dry weight of each size range of each material and the weight of water.
38. A cantilever beam of span  $l$  carries a uniformly varying load of zero intensity at the free end and  $w$  per metre length at the fixed end. What does the integration of the ordinate of the load diagram between the limits of free and fixed ends of the beam give ?
- A. Bending moment at the fixed end
  - B. Shear force at the fixed end
  - C. Bending moment at the free end
  - D. Shear force at the free end
39. A shaft PQRS is subjected to torques at P, Q, R, S as shown in the given figure. The maximum torque for the shaft section occurs between
- A.  $P$  and  $Q$
  - B.  $P$  and  $R$
  - C.  $Q$  and  $R$
  - D.  $R$  and  $S$
40. When the recirculation ratio in a high rate trickling filter is unity, then what is the value of the recirculation factor ?
- A. 1    B.  $\frac{1}{2}$     C.  $\frac{1}{3}$     D. Zero
41. In a direct shear test the shear stress and normal stress on a dry sand sample at failure are  $0.6 \text{ kg/cm}^2$  and  $1 \text{ kg/cm}^2$  respectively. The angle of internal friction of the sand will be nearly
- A.  $25^\circ$     B.  $31^\circ$     C.  $37^\circ$     D.  $43^\circ$
42. In the network given in figure, the maximum number of shovels and dumpers required are
- A. 6 shovels and 14 dumpers on days 9 and 10
  - B. 24 shovels and 10 dumpers on days 3 and 4
  - C. 30 shovels and 90 dumpers on all days
  - D. 10 shovels and 24 dumpers on days 3 and 4
43. Consider the following statements : A good soil for making bricks should contain 1. about 30% alumina 2. about 10% lime nodules 3. a small quantity of iron oxides 4. about 15% magnesia. Of these statements :
- A. 1 and 2 are correct
  - B. 1 and 3 are correct
  - C. 1, 3 and 4 are correct
  - D. 2, 3 and 4 are correct

44. Service connection consists of
- ferrule, stopcock and gooseneck
  - ferrule, check valve and gooseneck
  - stopcock, meter and sluice valve
  - sluice valve, check valve and meter
45. In the phase diagrams given, the change due to initial state changing into final state is shown due to consolidation. Depth of soil layer undergoing consolidation is  $H$  ;  $e_0$  is initial void ratio;  $e_f$  is final void ratio ;  $\Delta e$  is change in void ratio. Indicate which of the following expressions gives settlement of the layer :
- A.  $H \cdot \log_{10} \left( \frac{\Delta e}{1 + e_0} \right)$       B.  $\log_{10} \left( H \cdot \frac{\Delta e}{1 + e_0} \right)$       C.  $\frac{\Delta e}{1 + e_0}$       D.  $H \cdot \frac{\Delta e}{1 + e_0}$
46. What does super-saturation of water body with DO cause ?
- Eutrophication
  - Gas bubble disease in fish
  - Methamoglobinemia
  - Endemic goitre
47. In a third order traverse, if the standard error of  $\pm 3''$  is assigned to each of the four source of errors, namely :(i) reading the vernier(ii) non-adjustment of transit(iii) sighting and(iv) setting over the station, then the total standard error of the work would be
- A.  $\pm 3''$       B.  $\pm 6''$       C.  $\pm 6.92''$       D.  $\pm 12''$
48. Which one of the following statements is correct ?
- The axis of plate level should be parallel to the vertical axis.
  - The axis of striding level must be parallel to the horizontal axis.
  - The axis of the altitude level must be perpendicular to the plate level axis.
  - The line of collimation must be perpendicular to the plate level axis.
49. Consider the following statements regarding settlement of foundations :1. Differential settlement of foundation leads to structural damage to the superstructure.2. In non-cohesive soils, the major component of settlement is due to consolidation.3. Lowering of ground water table contributes of settlement of foundations.Of these statements :
- 1 and 2 are correct
  - 1 and 3 are correct
  - 2 and 3 are correct
  - 1, 2 and 3 are correct

50. A solid circular shaft is subjected to a bending moment  $M$  and torque  $T$ . The ratio of maximum bending stress to the maximum shear stress is given by
- A.  $MT/2$
  - B.  $2M/T$
  - C.  $M/2T$
  - D.  $M/T$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	C	C	A	A	C	A	B	C	C
10	A	A	C	A	D	C	B	C	A	A
20	B	A	A	B	A	D	B	D	D	C
30	C	A	C	C	C	B	C	A	C	B
40	B	D	B	A	D	A	B	B	D	B

## Section 10

- Which one of the following closely represents the shape of the earth?
  - Spheroid
  - Ellipsoid
  - Oblate spheroid
  - Prolate spheroid
- In an old map, line PQ was drawn to a magnetic bearing of  $6^{\circ}32'$ , the magnetic declination at that time being  $1^{\circ}$  East. The present magnetic declination is  $9^{\circ}42'$  East. The magnetic bearing to which the line is set at present is
  - $357^{\circ} 50'$
  - $356^{\circ} 50'$
  - $3^{\circ} 10'$
  - $2^{\circ} 10'$
- Based on the Gaussian law of distribution of random errors, the number of errors that are expected to exceed the limit of  $\pm a$ , where 0 represents the standard deviation, out of 1000 observations is
  - 317
  - 46
  - 30
  - 3
- In a trigonometric levelling, the height of the signal used is 4.62 m and the instrument height is 1.25 m. If the horizontal distance of the target from the instrument is 5780 m, then the axis-signal correction is
  - $\frac{206265 \times 3.37}{5780}$  seconds
  - $\frac{5780 \times 5.87}{206265}$  seconds
  - $\frac{5780 \times 206265}{5.87}$  seconds
  - $\frac{206265 \times 5780}{3.37}$  seconds
- The rotation of a rigid body is governed by What is its angular velocity at  $t - 2s$  ?
  - $18 \text{ rad/s}$
  - $\pi/4 \text{ rad /s}$
  - $\pi/8 \text{ rad /s}$
  - zero.
- The figure shows a rigid frame fixed at A and hinged at C.If a pure moment of 20 kNm is applied at B in the plane of the figure, then what is the moment at the fixed end A?
  - 10 kNm
  - 7.5 kNm
  - 5 kNm
  - 2.5 kNm
- The effective throat thickness in mm of a 6 mm size fillet weld with an angle of  $75^{\circ}$  between the fusion faces is
  - 3.6
  - 4.0
  - 4.2
  - 4.5

8. Which one of the following is the correct statement ? A streamlined body is one for which the
  - A. skin friction is zero.
  - B. thickness of the body is less than  $1/100$  of its length
  - C. corners are rounded off.
  - D. separation occurs, if at all, at the farthest downstream part of the body.
9. The correct sequence of plasticity of minerals in soil in an increasing order is
  - A. Silica, Kaolinite, Illite, Montmorillonite
  - B. Kaolinite, Silica, Illite, Montmorillonite
  - C. Silica, Kaolinite, Montmorillonite, Illite
  - D. Kaolinite, Silica, Montmorillonite, Illite
10. Why is a proportional flow weir provided in a grit chamber ?
  - A. To reduce the suspended solids entering into the grit chamber
  - B. To maintain the constant flow depth in the grit chamber
  - C. To take care of maintaining constant flow velocity in the grit chamber over a certain depth range
  - D. To allow the sewage afresh into the grit chamber
11. The "Back sight" reading on a vertically held staff at a point A on the floor along the centre line of a railway tunnel is 3.465 m, and the "Fore sight" on the inverted staff held at the roof of the tunnel just vertically above A is 1.115 m. The height of the tunnel along the centre line at floor point A is
 

A. 2.310 m      B. 3.465 m      C. 4.620 m      D. 6.930 m
12. The tipping load of a crane refers to
  - A. lifted weight together with all attached handling tackle and hoist rope, with grounded attached outriggers
  - B. lifted weight together with all attached handling tackle but excluding hoist rope, with specifying the radius horizontally, with grounded outriggers
  - C. lifted weight alone, with specifying the radius for the lifted weight and also for the counter weight without grounding the outriggers
  - D. lifted weight alone, at specified horizontal radius without grounding the outriggers.
13. According to the theory of filtration in water treatment, which of the following mechanisms come into play when water is filtered through a filter bed ? 1. Mechanical straining 2. Capillary action 3. Centrifugal force 4. Electro kinetic phenomenon 5. Osmotic force 6. Bacteriological

actionSelect the correct answer using the code given below :

A. 1, 2, 4 and 6      B. 2, 3 and 5      C. 3, 4, 5 and 6      D. 1, 3, 4 and 6

14. A ball of mass 1 kg moving with a velocity of 2 m/s collides directly with a stationary ball of mass 2 kg and comes to rest after the impact. The velocity of the second ball after impact will be  
A. 0      B. 1 m/s      C. 2 m/s      D. 4 m/s
15. Consider the following statements :In the critical path method of construction planning free float can be 1. greater than total float 2. greater than independent float3. equal to total float 4. less than independent float. Of these statements :  
A. 1 and 4 are correct  
B. 2 and 3 are correct  
C. 3 and 4 are correct  
D. 1 and 2 are correct
16. In a cantilever beam, the bending moment at any section of the beam is equal to the  
A. area of the shear force diagram between the free end of the beam and that section  
B. area of the bending force moment diagram between the free end of the beam and that section  
C. the area of shear force diagram between the fixed end of the beam and that section  
D. the vertical ordinate at that section in the shear force diagram
17. Which one of the following is the correct sound intensity expression with usual notations ?  
A.  $dB = 10 \log_{10} (I/I_0)^2$   
B.  $dB = 10 \log_{10} (I/I_0)$   
C.  $dB = 10 \log_{10} (I - I_0)^2$   
D.  $dB = 10 \log_{10} (I - I_0)$
18. A three-hinged parabolic arch rib with hinges at abutments and at crown is under the action of uniformly distributed load 'W' per unit length over its entire span 'l' through its crown. The bending moment at quarter span is  
A. zero      B.  $Wl^2/8$       C.  $Wl^2/12$       D.  $Wl^2/24$
19. A bulldozer operates on a 30 m stretch and moves at 2.4 kmph when pushing the earth, and returns empty at 6 kmph. The time lost in loading and shifting gears per trip is 18 seconds. Its operating factor is nearly 50 min/hour. What is the number of trips made per hour ?  
A. 31      B. 33      C. 35      D. 37

20. In the case of panel wall subjected to horizontal loads at right angles to the plane of the wall, with the mortar not leaner than M1 type, tensile stress in bending in the vertical direction may be allowed to the extent of  
 A.  $0.4 \text{ kg/cm}^2$     B.  $0.7 \text{ kg/cm}^2$     C.  $1.0 \text{ kg/cm}^2$     D.  $1.2 \text{ kg/cm}^2$
21. The 'Euler' load for a column is 1000 kN and crushing load is 1500 kN. The 'Rankine' load is equal to  
 A. 600 kN    B. 1000 kN    C. 1500 kN    D. 2500 kN
22. In "full face" method of constructing tunnel, the first operation relates to  
 A. removal to bottom portion  
 B. excavation of one drift in the centre  
 C. removal of top portion  
 D. excavation being done along the perimeter
23. Which one of the following statements best defines a 'level surface'?  
 A. A horizontal surface every element of which is normal to plumb line  
 B. A curved surface every element of which is perpendicular to the spheroidal shape of the earth  
 C. A plane surface which is perpendicular at all points to the direction of gravity  
 D. A curved surface which is perpendicular to the direction of gravity at every point
24. In a shape test of aggregate, which one of the following gives the correct slot for flakiness index of a material passing 50 mm sieve and retained on 40 mm sieve ?  
 A. 25 mm    B. 27 mm    C. 81 mm    D. 30 mm
25. Ruling gradient on highways as per IRC in plane terrain is  
 A. 1 in 30    B. 1 in 60    C. 1 in 100    D. 1 in 200
26. For a symmetrical continuous beam as shown in the figure given above, which one of the following is correct in respect of distribution factors at B ?  
 A.  $\delta_{BA} : \delta_{BC} = 3:4$   
 B.  $\delta_{BA} : \delta_{BC} = 1:2$   
 C.  $\delta_{BA} : \delta_{BC} = 3:2$   
 D.  $\delta_{BA} : \delta_{BC} = 3:8$
27. For the retaining wall shown in the given figure, if the stress at the heel is zero, then the maximum storage 'H' will be specific gravity of



the material of the wall = 2.25

A. 7.5 m      B. 5 m      C. 4 m      D. 3 m

28. A short column of external diameter  $D_1$  and internal diameter  $D_2$  carries an external load  $W$ . For no-tension condition, the eccentricity will be :
- A.  $(D_1^2 - D_2^2)/8D_2$   
B.  $(D_1^2 - D_2^2)/8D_1$   
C.  $(D_1^2 - D_2^2)/8D_2$   
D.  $(D_1 - D_2)^2/8D_1$
29. The following four hydrological features have to be estimated or taken as inputs before one can compute the flood hydrograph at any catchment outlet: 1. Unit hydrograph 2. Rainfall hydrograph 3. Infiltration index 4. Base flow. The correct order in which they have to be employed in the computations is
- A. 1, 2, 3, 4      B. 2, 1, 4, 3      C. 2, 3, 1, 4      D. 4, 1, 3, 2
30. Which one of the following statements is correct? A forebay in a hydel system is provided at the junction of :
- A. the power channel and the tail race channel  
B. the tail race channel and the penstock  
C. the penstock and the turbine  
D. the power channel and the penstock
31. Consider the following statements: Higher water-cement ratio in concrete results in 1. stronger mix. 2. better workable mix. 3. a weak mix. 4. less bleeding.
- A. 1 and 2 are correct  
B. 2 and 3 are correct  
C. 3 and 4 are correct  
D. 1 and 4 are correct
32. Which one of the following is not the reason for coning of wheels?
- A. To reduce the wear and tear of wheel flanges and rails  
B. To provide the possibility of lateral movement of axle  
C. To reduce the unit weight of wheels  
D. To prevent wheels from slipping to some extent
33. For a vertical stiffened web of a plate girder, the lesser clear dimension of the panel should not exceed : (Where  $t$  is the thickness of the web)
- A.  $85t$       B.  $180t$       C.  $200t$       D.  $250t$
34. Deck bridges have the main disadvantage that
- A. their compression flanges have no lateral support

- B. the traffic is exposed to winds
  - C. it is not possible to provide portal bracings
  - D. the road level has to be very high
35. Electrostatic precipitator is a device to control
- A. SO<sub>2</sub> emission
  - B. Particulate emission
  - C. Both SO<sub>2</sub> and particulate emission
  - D. Precipitation of Al(OH)<sub>3</sub> in water coagulation.
36. For carrying out bituminous patch work during the rainy season, the most suitable binder is
- A. road tar
  - B. hot bitumen
  - C. cutback bitumen
  - D. bituminous emulsion
37. The vertices of an astronomical triangle would include
- A. zenith, pole and heavenly body
  - B. azimuth, zenith and pole
  - C. azimuth, pole and heavenly body
  - D. azimuth, zenith and heavenly body
38. In a restrained rectangular slab subjected to uniformly distributed load, the yield lines form first
- A. along the shorter span on the loaded face of slab
  - B. along the longer span on the loaded face of slab
  - C. at the intersection of shorter and longer side
  - D. along the centre line of the unloaded face of slab
39. The channel section can be designed on the basis of Lacey's Theory. The steps are mentioned below :1. Finding out the perimeter2. Finding out the velocity3. Calculation of the silt factor4. Finding out the areaWhat is the correct sequence of the steps ?
- A. 4 - 2 - 3 - 1      B. 3 - 1 - 4 - 2      C. 4 - 1 - 3 - 2      D. 3 - 2 - 4 - 1
40. The radius of curvature of an ideal transition curve should be
- A. inversely proportional to its length from the beginning
  - B. directly proportional to its length from the beginning
  - C. proportional to the speed of the vehicle
  - D. proportional to the superelevation
41. A dry soil has a mass specific gravity of 1.35. If the specific gravity of solids is 2.7, then the void ratio will be
- A. 0.5      B. 1.0      C. 1.5      D. 2.0

42. The change in the vertical stress in the soil mass estimated by Boussinesq's equation when Poisson's ratio of soil changes from 0.3 to 0.5 will be
- reduction by 30%
  - increase by 50%
  - reduction by 20%
  - no change
43. Which one of the following is NOT as excavating the moving type of equipment ?
- Bulldozer
  - Clam shell
  - Scraper
  - Dump truck
44. When was the water (Prevention and Control of Pollution). Act enacted by the Indian Parliament ?
- 1970
  - 1974
  - 1980
  - 1985
45. In Lacey's regime theory, the velocity of flow is proportional to :
- $Qf^2$
  - $Q/f^2$
  - $(Qf^2)^{1/6}$
  - $(Q/f^2)^{1/6}$
46. The kern of a circular cross-section of radius R is a concentric circular area with a radius of
- $\frac{R}{3}$
  - $\frac{R}{4}$
  - $\frac{R}{6}$
  - $\frac{R}{8}$
47. On which of the following do the numerical values of Terzaghi's bearing capacity factors depend ?
- Angle of internal friction of soil and depth of foundation
  - Angle of internal friction of soil only
  - Coefficient of curvature of soil and bulk density of soil
  - Uniformity coefficient of soil and dry density of soil
48. A cantilever AB is loaded as shown in the figure. What is the shape of the bending moment diagram for portion AC?
- Parabolic
  - Linearly varying with maximum value of the bending moment at C
  - Linear with constant bending moment value from C to A
  - Linearly varying with maximum value at A
49. In the network given above, the critical path of activities is in the given figure
- A-C-H
  - B-E-F-H
  - A-D-E-F-H
  - A-D-E-G

50. In highway geometric design, once the cumulative speed distribution is drawn, the design adequacy is checked at which percentile ?

- A. 85<sup>th</sup> percentile
- B. 95<sup>th</sup> percentile
- C. 98<sup>th</sup> percentile
- D. 99<sup>th</sup> percentile

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	A	A	D	B	C	C	D	A	C
10	C	B	A	B	C	A	B	A	D	C
20	A	C	D	B	A	A	A	C	C	D
30	B	C	C	B	B	D	A	D	D	A
40	B	D	D	B	C	B	B	D	C	C

## Section 11

1. The initial and final void ratios of a clay sample in a consolidation test are 1 and 0.5, respectively. If the initial thickness of the sample is 2.4 cm, then its final thickness will be  
A. 1.3 cm    B. 1.8 cm    C. 1.9 cm    D. 2.2 cm
2. Cohesion is 15 kN/m<sup>2</sup>, the unit weight of soil is 20 kN/m<sup>3</sup>, the factor of safety is 1.5 and stability number is 0.05; the safe maximum height of the slope is  
A. 5.0 m    B. 8.0 m    C. 10.0 m    D. 12.0 m
3. The nail diameter should not be more than ( $t$  = least thickness of the wooden member to be connected)  
A.  $\frac{t}{6}$     B.  $\frac{t}{8}$     C.  $\frac{t}{10}$     D.  $\frac{t}{12}$
4. As per practice of Indian Railways, the grade compensation provided for B.G. on curves is  
A. 0.5% degree    B. 0.2% degree    C. 0.4% degree    D. 0.15% degree
5. In cement concrete pavements, tie bars are installed in  
A. expansion joints  
B. contraction joints  
C. warping joints  
D. longitudinal joints
6. A cantilever beam of T cross-section carries uniformly distributed load. Where does the maximum magnitude of the bending stress occur ?  
A. At the top of cross-section  
B. At the junction of flange and web  
C. At the mid-depth point  
D. At the bottom of the section
7. Which of the following are claimed as advantageous in respect of aerobic sludge digestion as compared to anaerobic sludge digestion ?  
1. Lower BOD concentration in supernatant liquor.  
2. Production of a sludge with excellent dewatering propensity.  
3. Greater production of methane.  
4. Lesser operating cost.  
5. Lesser capital cost.  
Select the correct answer using the codes given below :  
A. 1, 2 and 4    B. 2, 3, 4 and 5    C. 3, 4 and 5    D. 1, 2 and 5
8. Which one of the following statements is not correct ?  
A control section in an open channel is the site  
A. where the flow quantity can be controlled

- B. at which flow is known to be critical  
 C. where the discharge can be measured  
 D. where the specific energy is determined
9. For a given storm, other factors remaining same :
- A. Basins with large drainage densities give smaller flood peaks.  
 B. Low drainage density basins give shorter time bases of hydrographs.  
 C. The flood peak is independent of the drainage density.  
 D. Basins having low drainage density give smaller peaks in flood hydrographs.
10. Two small orifices A and B of diameters 1 cm and 2 cm, respectively, are placed on the sides of a tank at depths of  $h_1$  and  $h_2$  below the open liquid surface. If the discharges through A and B are equal, then the ratio of  $h_1$  and  $h_2$  (assuming equal Cd values) will be  
 A. 16 : 1    B. 8 : 1    C. 4 : 1    D. 2 : 1
11. The moment of inertia of a square cross-section of side 'b' about its diagonal is  
 A.  $b^4/3$     B.  $b^4/6$     C.  $b^4/8$     D.  $b^4/12$
12. A particle of mass M is attached to a light horizontal wire which is stretched tightly between two fixed ends with a tension T. If a and b are the distances of the particle from the two ends, then the period of a small transverse oscillation of the particle is given by  
 A.  $2\pi \left( \frac{Mab}{T(a+b)} \right)^{1/2}$     B.  $2\pi \left( \frac{Tab}{M(a+b)} \right)^{1/2}$     C.  $2\pi \left( \frac{M(a+b)}{Tab} \right)^{1/2}$   
 D.  $\frac{2\pi T}{M} \left( \frac{ab}{a+b} \right)^{1/2}$
13. What is the ratio of the permissible bearing stress in power driven shop rivets relative to the yield stress of mild steel ?  
 A. 1.0    B. 0.8    C. 0.6    D. 0.4
14. If the methyl orange alkalinity of water equals or exceeds total hardness, all of the hardness is  
 A. non-carbonate hardness  
 B. carbonate hardness  
 C. pseudo hardness  
 D. negative non-carbonate hardness
15. Which one of the following statements is correct ? The number of unknowns to be determined in the stiffness method is equal to :  
 A. the static indeterminacy

- B. the kinematic indeterminacy  
 C. the sum of kinematic indeterminacy and static indeterminacy  
 D. two times the number of supports
16. If the diameter of a shaft subjected to torque alone, is doubled, then the horse power  $P$  can be increased to  
 A.  $16 P$     B.  $8 P$     C.  $4 P$     D.  $2 P$
17. Which one of the following represents the basic capacity of a single lane road?(where  $V$  = speed in kmph,  $s$  = Average centre to centre spacing of vehicle in m,  $h$  = Average time headway between two vehicles in seconds.)  
 A.  $\frac{1000 s}{V}$     B.  $\frac{1000 V}{s}$     C.  $\frac{1000 h}{V}$     D.  $\frac{1000 V}{h}$
18. Consider the following factors :1. Mass of ships to be berthed2. Overall transit time3. Speed of berthing4. Environmental conditions of the portWhich of these factors are taken into account while selecting the type of fender system ?  
 A. 1, 2 and 3    B. 2, 3 and 4    C. 1, 3 and 4    D. 1 and 4
19. Which one of the following statements is correct with respect to rigid pavements ?  
 A. Vertical stresses are transmitted to the lower layer through the points of contact in granular structure.  
 B. Vertical compressive stress is maximum on the pavement surface directly under the wheel load.  
 C. Lower layers have to take lesser magnitudes of stress  
 D. Stresses on rigid pavements are transmitted to a wider area of sub grade.
20. Consider the following statements :Selection of the type and grade of the bituminous binder is made on the basis of1. cost of the binder material.2. climatic conditions of the area and the construction technique.3. degree of importance of the road.4. thickness of pavement layer to be constructed.Which of these statements is/are correct ?  
 A. 1 only    B. 2 only    C. 1, 2 and 4    D. 1, 2 and 3
21. Consider the following statements :1. Welded structures are usually lighter than riveted structures.2. Welding allows the arrangement of structural components in such a manner that the joint provides maximum efficiency.3. During welding, the members do not get distorted.Of these statements :  
 A. 1, 2 and 3 correct  
 B. 1 and 2 are correct  
 C. 2 and 3 are correct

- D. 1 and 3 are correct
22. Which is the major pollutant present in photochemical smog ?  
A. PAN    B.  $\text{SO}_2$     C. HC    D.  $\text{NO}_2$
23. What are the bending moments at the ends A and B of a uniform beam AB fixed in direction and position at A and B when acted upon by two concentrated loads at  $\frac{1}{3}$ rd span as shown in the figure ?  
A.  $\frac{2}{9} WL$     B.  $\frac{4}{9} WL$     C.  $\frac{6}{9} WL$     D.  $\frac{8}{9} WL$
24. Due to rise in temperature, the viscosity and unit weight of percolating fluid are reduced to 70% and 90% respectively. Other things being constant, the change in coefficient of permeability will be  
A. 20.0%    B. 28.6%    C. 63.0%    D. 77.8%
25. The correct sequence of the sludge digestion steps is  
A. Acid formation, hydrolysis, methane formation  
B. Methane formation, acid formation, hydrolysis  
C. Hydrolysis, methane formation, acid formation  
D. Hydrolysis, acid formation, methane formation
26. Consider the following statements : Kiln seasoning of timber results is :1. reduced density.2. reduced life.3. dimensional stability. Which of the following given above is/are correct ?  
A. 1, 2 and 3    B. 1 only    C. 2 and 3    D. 1 and 3
27. The approximate ratio of strength of 15 cm x 30 cm concrete cylinder to that of 15 cm cube of the same concrete is  
A. 1.25    B. 1.00    C. 0.85    D. 0.50
28. Consider the following characteristic of soil layer :1. Poisson's ratio 2. Young's modulus 3. Finite nature of soil layer 4. Effect of water table 5. Rigidity of footing Westergaard's analysis for pressure distribution in soils utilises  
A. 1, 3, 4 and 5    B. 2, 3, 4 and 5    C. 3, 4 and 5    D. 1 and 2
29. Consider the following statements associated with the laws of weights in the theory of errors :1. If an equation is multiplied by its own weight, then the weight of the resulting equation is equal to the reciprocal of the weight of the equation. 2. The weight of the algebraic sum of two or more quantities is equal to the reciprocal of the sum of the individual weights. 3. If the quantity of a given weight is multiplied by a factor, then the weight of the result is obtained by dividing its given weight by the square root of that factor. 4. If the quantity of a given weight is divided by a factor, then the weight of the result is obtained by multiplying its given weight by the square of that factor. Of these statements :  
A. 1 and 4 are correct



- B. 2 and 3 are correct  
 C. 3 and 4 are correct  
 D. 1 and 3 are correct
30. The given diagrams show the details of two simply supported beams B1 and B2. EI is constant throughout the length and same for both the beams. The beams have the same area of cross-section and the same depth. What is the ratio of maximum bending stress in B2 to that in B1 ?
- A. 4      B. 1      C. 2      D.  $\frac{1}{2}$
31. The Chezy's coefficient C is related to Darcy-Weisbach friction factor f as
- A.  $C = (g/8f)$   
 B.  $C = (6g/f)$   
 C.  $C = (8g/f)$   
 D.  $C = (f/8g)$
32. What is the maximum permissible longitudinal pitch in staggered riveted compression joints ?
- A. 500 mm      B. 400 mm      C. 300 mm      D. 100 mm
33. For determining the forces in the members of a truss by graphic statics, the method of substitution will be required in the case of
- A. Fink truss  
 B. Howe truss  
 C. King post truss  
 D. Warren truss
34. A Rankine (oval) half-body PP is subjected to a two-dimensional flow (x, y coordinate directions from origin O) with uniform velocity V, resulting in typical streamlines as shown in the figure by dotted lines. The point A on the body surface is
- A. separation point  
 B. stall point  
 C. stagnation point  
 D. point of maximum velocity
35. A projectile is fired horizontally with a velocity of 6 m/s from a point of height h m above and 12 m away from an object. What is the value of h required so that projectile hits the object ?
- A. 4.9 m      B. 9.8 m      C. 6 m      D. 19.6 m
36. For a simple circular curve which one of the following gives the correct relation between the radius R and degree of curve D, for 20 m arc

length ?

A.  $R = \frac{5729.6}{D}$       B.  $R = \frac{1718.9}{D}$       C.  $R = \frac{1145.9}{D}$       D.  $R = \frac{572.9}{D}$

37. A car negotiates a curve on a slippery road at a constant speed of 10 m/s. If the coefficient of friction is 0.5, what is the minimum radius of the arc in which the car can turn ?  
A. 20 m      B. 10 m      C. 5 m      D. 4 m
38. Grid lines on a mapsheet can be plotted mechanically by means of a  
A. rotometer  
B. pantograph  
C. coordinatograph  
D. stereometer
39. A municipal sewage has BOD<sub>5</sub> of 200 mg/l. It is proposed to treat it and dispose off into a marine environment. For what minimum efficiency should the sewage treatment plant be designed ?  
A. 85%      B. 60%      C. 50%      D. 33.67%
40. As the state of strain of an element of dense sand changes from plain strain to trivial condition, the effective angle of internal friction :  
A. increases  
B. decreases  
C. remains constant  
D. first increases and then remains constant
41. The force in member 1 of the truss shown in the given figure is  
A.  $4T$  compressive  
B.  $36T$  tensile  
C.  $16T$  tensile  
D.  $20T$  tensile
42. High alumina cement is produced by fusing together a mixture of  
A. limestone and bauxite  
B. limestone, bauxite and gypsum  
C. limestone, gypsum and clay  
D. limestone, gypsum, bauxite, clay and chalk
43. The declination of a star is  $21^\circ 15'$  N at a latitude of  $43^\circ 30'$  N. The zenith distance at the upper culmination is  
A.  $22^\circ 15'$       B.  $21^\circ 15'$       C.  $64^\circ 45'$       D.  $43^\circ 30'$
44. Consider the following statements :Ventilation of sewer lines is necessary to1. avoid building up to sewer gases.2. ensure atmospheric

pressure in the waste water surface.3. ensure the safety of sewer maintenance people.4. provide oxidation facility to sewage. Which of these statements are correct ?

A. 1, 2 and 4      B. 1, 3 and 4      C. 2, 3 and 4      D. 1, 2 and 3

45. For fish habitat in a river, the minimum dissolved oxygen required is  
A. 2 mg/l      B. 4 mg/l      C. 8 mg/l      D. 10 mg/l
46. A clay soil specimen when tested in unconfined condition gave an unconfined compressive strength of 100 kN/m<sup>2</sup>. A specimen of the same clay with the same initial condition is subjected to a UU triaxial test under a cell pressure of 100 kN/m<sup>2</sup>. The axial stress (in kN/m<sup>2</sup>) at failure would be  
A. 150      B. 200      C. 250      D. 300
47. A propped cantilever of span 4 m is fixed at A and propped at B. The beam carries a u.d.l. of 1 t/m over the entire span. The reaction at B is  
A. 5/2 t      B. 2 t      C. 1 t      D. 3/2 t
48. The spacing of tile drains to relieve water-logged land is directly proportional to the  
A. depth of drain below the ground surface  
B. depth of impervious strata from the drain  
C. depth of drain below the water level  
D. coefficient of permeability of the soil to be drained
49. Four bolts share the load P as shown in the figure. The shear strength of bolt is 30 kN and tension strength of bolt is 40 kN. Which one of the following is the value of P ?  
A. 96 kN      B. 105 kN      C. 117 kN      D. 134 kN
50. The object of chain and cross-staff survey is to  
1. locate the boundaries of an area.  
2. plot the figure to a scale.  
3. find the area of the plot.  
4. find the reduced levels of the plot.  
Which of the above statements is/are correct ?  
A. 1, 2, 3 and 4      B. 1, 2 and 3      C. 1 and 2      D. 4 alone

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	C	A	C	D	D	D	B	D	A
10	D	B	B	B	C	B	B	C	B	B
20	A	A	A	B	D	D	C	D	D	D
30	C	C	A	C	D	C	A	C	A	B
40	C	A	A	D	B	B	D	D	D	B

## Section 12

1. A pipeline of 5 cm diameter is reduced abruptly to 2.5 cm diameter at a section to enable measurement of the water flowing through it. The loss of head at the contraction is 0.5 m. Given that, in metric units,  $2g = 4.43$  and  $g = 3.132$ , the mean velocity in the reduced section will be  
A. 0.5 m/sec    B. 1.1075 m/sec    C. 1.566 m/sec    D. 4.43 m/sec
2. A clay layer, 5 m thick undergoes 50% consolidation in 5 years when subjected to an average pressure increase of 50 kN/m<sup>2</sup>. If the clay layer were 10 m thick, in what period would it undergo 50% consolidation for the same pressure ?  
A. 10 years    B. 2.5 years    C. 25 years    D. 20 years
3. Which one of the following is the most preferred wood for high quality and durable furniture ?  
A. Sandalwood    B. Deodar wood    C. Teakwood    D. Shisham wood
4. For ornamental work, which type(s) of bricks is/ are preferred ?  
1. Silica bricks  
2. Silica lime bricks  
3. Bricks produced in autoclaves  
Select the correct answer using the code given below :  
A. 1 and 3 only    B. 2 and 3 only    C. 1 only    D. 2 only
5. In case of footing on the surface of shallow depth is very dense sand, which one of the following types of failure is likely to occur?  
A. Punching shear failure  
B. Local shear failure  
C. General shear failure  
D. Any of the above three
6. For one cubic metre of brick masonry, the number of modular bricks needed is  
A. 400 or less    B. 400 to 450    C. 500 to 550    D. 600 to 650
7. To produce low heat cements, it is necessary to reduce the compound  
A.  $C_3S$     B.  $C_2S$     C.  $C_3A$     D.  $C_4AF$
8. The probability that the load on a scaffolding will exceed the design load of 3 tonnes is 0.15. At the same time, the probability that the strength of the scaffolding will be more than 3 tonnes is 0.85. The probability that the scaffolding will fail is  
A. 0.2775    B. 0.1275    C. 0.0225    D. 0.0020
9. The dry density of a soil is 1.5 g/cc. If the saturation water content were 50%, then its saturated density and submerged density would, respectively, be  
A. 1.5 g/cc and 1.0 g/cc

- B. 2.0 g/cc and 1.0 g/cc  
 C. 2.25 g/cc and 1.25 g/cc  
 D. 2.0 g/cc and 1.50 g/cc
10. Consider the following soil parameters and conditions :1. Drainage conditions2. Thickness of layer3. Initial void ratio4. Over-burden pressureThe magnitude of settlement is influenced by,  
 A. 1, 2 and 3     B. 2, 3 and 4     C. 1, 3 and 4     D. 1, 3 and 4
11. A concentrated load acting on the surface of a soil produces a stress of 19.1 kPa at a depth of 1 m below it. Using Boussinesq's expression, the stress at 2 m depth is  
 A. 9.55 kPa     B. 6.37 kPa     C. 4.775 kPa     D. 4.37 kPa
12. Consider the following statements : Seasoning of timber results is  
 1. increased strength 2. increased durability.3. reduced resilience.Of these statements :  
 A. 1, 2 and 3 are correct  
 B. 1 and 3 are correct  
 C. 1 and 2 are correct  
 D. 2 and 3 are correct
13. Gypsum is added to Portland cement during its manufacture so that it may  
 A. accelerate the setting time  
 B. retard the setting time  
 C. decrease the burning temperature  
 D. facilitate grinding
14. If the velocity potential  $\phi = 4xy$ , what are the x and y components of velocity at the point(1, 4) ?  
 A.  $u = -16, v = -4$   
 B.  $u = -4, v = -16$   
 C.  $u = 16, v = -4$   
 D.  $u = 16, v = 16$
15. Unit cost of any item of work can be found by using  
 A. specifications  
 B. value analysis  
 C. economic analysis  
 D. rate analysis
16. Which one of the following different types of submerged soils is susceptible to liquefaction under earthquake shocks ?  
 A. Dense sand     B. Soft clay     C. Loose silt     D. Fissured clay

17. In the given figure,  $\sigma_1$  and the  $\sigma_2$  and maximum and minimum principal stresses. In order that the resultant stress on the plane AB is the value of  $\theta$  should be  
 A.  $30^\circ$     B.  $45^\circ$     C.  $60^\circ$     D.  $75^\circ$
18. Eutrophication of water bodies is caused by the  
 A. discharge of toxic substances  
 B. excessive discharge of nutrients  
 C. excessive discharge of suspended solids  
 D. excessive discharge of chlorides
19. For laminar flow through a circular tube, the average velocity at a section is  
 A. the same as that at the centre of tube  
 B. two-thirds the velocity at the centre of the tube  
 C. half the velocity at the centre of the tube  
 D. dependent on the pressure at the section
20. In the figure shows, the effective pressure at C is given by (symbols have the usual meanings)  
 A.  $(h + z) \gamma_w$   
 B.  $\gamma_w z$   
 C.  $\gamma_{sat} z$   
 D.  $\gamma_w h + \gamma_{sat} z$
21. Consider the following assumptions :1. Failure occurs on a plane surface.2. Wall is smooth but not necessarily vertical.3. Failure wedge is a rigid body.Coulomb's theory of earth pressure is based on assumptions  
 A. 1, 2 and 3    B. 1 and 3    C. 1 and 2    D. 2 and 3
22. A 2-metre diameter water pipe is required to withstand a 200 meter head of water. Assuming the limiting tensile stress for the pipe material to be  $200 \text{ kg/cm}^2$ , the minimum thickness of the material of the pipe to be used will have to be  
 A. 5 cm    B. 10 cm    C. 15 cm    D. 20 cm
23. In the preliminary treatment of wastewater, skimming tanks are often included in the treatment scheme. Various features of skimming tanks are that these :1. can remove general floating matter.2. can remove oily and greasy matter.3. have detention time of 30 min.4. employ compressed air blown through diffusers.Which of these statements are correct ?  
 A. 1 and 3    B. 2 and 4    C. 2 and 3    D. 1 and 2

24. Consider the following statements :1. A dummy activity is artificially introduced in a network when necessary.2. A dummy activity consumes some time.3. A dummy activity is represented by a dotted arrow.4. A dummy activity must necessarily be introduced in every network. Which of the above statements are correct ?  
A. 1, 2 and 3    B. 1 and 3    C. 2, 3 and 4    D. 1 and 2
25. Consider the following stages in the manufacturing of bricks :1. Weathering2. Moulding3. TemperingThe correct sequence of these stages in the manufacturing of the bricks, is  
A. 1, 2, 3    B. 2, 3, 1    C. 1, 3, 2    D. 3, 2, 1
26. What is the predominating coagulation mechanism for raw water having high turbidity and high alkalinity?  
A. Ionic layer compression  
B. Adsorption and charge neutralization  
C. Sweep coagulation  
D. Inter particle bridging
27. The momentum correction factor ( $\beta$ ) is used to account for  
A. change in the direction of flow  
B. change in total energy  
C. change in mass rate of flow  
D. non-uniform distribution of velocities
28. Where is d'Alembert's principle employed ?  
A. In the design of long columns  
B. To determine stresses induced in thick cylinders  
C. To reduce a problem of kinetics to an equivalent problem of statics  
D. In the analysis of many geotechnical problems
29. The hoop stress in a dome subjected to uniformly distributed load  
A. is always compressive  
B. is tensile at sections whose radius vectors are at angles less than  $51^{\circ}51'$  with the vertical  
C. is tensile at sections whose radius vectors are at angles greater than  $51^{\circ}51'$  with the vertical  
D. is always tensile
30. A commonly used handpump is the  
A. centrifugal pump  
B. reciprocating pump  
C. rotary pump  
D. axial flow pump

31. What is the ratio of the forces in the members AB, BE and AE of the pin-jointed truss shown in the figure?
- A. 5 : 4 : 3  
 B. 4 : 3 : 5  
 C.  $\left(\frac{1}{4}\right) : \left(\frac{1}{3}\right) : \left(\frac{1}{5}\right)$   
 D. None of the above
32. A sewer, 1000 mm in diameter is laid at a slope to obtain a velocity of 0.8 m/s when running full. Assuming Manning's n as constant, what is the velocity in this sewer if it is running half full.  
 A. 0.2 m/s    B. 0.4 m/s    C. 0.6 m/s    D. 0.8 m/s
33. For the network shown in the above figure (the number on each arrow denotes the time duration of activity in days), the earliest start time, in days for activity 5-6 is  
 A. 8    B. 7    C. 9    D. 11
34. A clay layer 5 m thick in field takes 300 days to attain 50% consolidation with condition of double drainage. If the same clay layer is underlain by hard rock then the time taken to attain 50% consolidation will be  
 A. 300 days    B. 600 days    C. 900 days    D. 1200 days
35. Two forces  $P = 6$  N and  $Q = 10$  N act on a particle and their lines of action are inclined to each other at an angle of  $60^\circ$ . What is the magnitude of the third force R which will keep the particle in equilibrium?  
 A. 13.30 N    B. 13.89 N    C. 14.00 N    D. 14.02 N
36. The three-hinged arch shown in the given figure will have value of H as  
 A. 20 kN    B. 30 kN    C. 40 kN    D. 50 kN
37. What is 5 days  $20^\circ\text{C}$  BOD equal to ?  
 A. 3 days  $27^\circ\text{C}$  BOD  
 B. 4 days  $30^\circ\text{C}$  BOD  
 C. 6 days  $32^\circ\text{C}$  BOD  
 D. 7 days  $35^\circ\text{C}$  BOD
38. Consider the following statements :In solid waste management1. density separation of solid wastes can be accomplished by air classifiers.2. iron recovery from solid wastes can be done by magnetic separators.3. aluminium separation from solid wastes can be accomplished by eddy current separators. Which of the statements given above are correct ?  
 A. 1 and 2    B. 2 and 3    C. 1 and 3    D. 1, 2 and 3



39. Consider the following statements : 1. Book value is the unamortized cost of the asset as it still appears on the accounting books of the business. 2. Termination of economic life implies disposal of the equipment. Which of the statements given above is/are correct ?
- 1 only
  - 2 only
  - Both 1 and 2
  - Neither 1 nor 2
40. A person of height 1.65 m standing on a cliff of height 20 m above the water level on sea-shore can sight a ship at a distance of about
- 10 km
  - 18 km
  - 30 km
  - 40 km
41. Which of the following characteristic features may be used while plotting a contour plan ? 1. Two contour lines having the same elevation cannot unite the continue as one line. 2. Contour lines closed together indicate a gentle slope. 3. Contour lines cross a valley line at right angles. Select the correct answer using the codes given below:
- 1, 2 and 3
  - 1 and 2
  - 2 and 3
  - 1 and 3
42. The radial moment at the boundary of a simply supported circular slab of radius  $R$ , subjected to a uniformly distributed load of  $w$  will be
- $wR^2/8$
  - $wR^2/12$
  - $3wR^2/16$
  - zero
43. Soundness test of cement is done to determine its
- durability in sea water
  - free-lime content
  - iron oxide content
  - alumina content
44. For a non-concurrent force system to be in equilibrium
- closure of the force polygon alone is sufficient
  - closure of the funicular polygon alone is sufficient
  - both force and funicular polygon must close
  - the conditions mentioned at (a), (b) and (c) are not relevant
45. The displacement method is also referred to as which one of the following ?
- Minimum strain energy method
  - Maxwell-Mohor method

- C. Consistent deformation method  
D. Slope-deflection method
46. If the CBR value obtained at 5 mm penetration is higher than that at 2.5 mm, then the test is repeated for checking ; and if the check test reveals a similar trend, then the CBR value is to be reported as the
- A. Mean of the values for 5 mm and 2.5 mm penetrations  
B. Higher value minus the lower value  
C. Lower value corresponding to 2.5 mm penetration  
D. Higher value obtained at 5 mm penetration
47. If a descending gradient of 1 in 25 meets an ascending gradient of 1 in 40, then the length of valley curve required for a headlight sight distance of 100 m will be
- A. 30 m      B. 130 m      C. 310 m      D. 630 m
48. In rock masses reduction in strength occurs due to the presence of relatively large quantities of
- A. silica      B. iron oxides      C. orthoclase      D. hornblende
49. What is the zone where fish life might tend to progressively dwindle when waste water, is discharged into a river, called ?
- A. zone of degradation  
B. zone of active decomposition  
C. zone of mixing  
D. zone of recovery
50. Which one of the following states of field compaction of sand deposit truly represents the corrected standard penetration test value :  $N_{(corrected)} = 27$  ?
- A. Loose      B. Medium dense      C. Dense      D. Very dense

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	C	B	C	C	C	C	C	B
10	C	A	B	A	D	C	B	B	C	C
20	B	B	B	B	C	C	D	C	B	B
30	B	D	A	D	C	C	A	A	C	B
40	D	C	B	C	D	D	B	D	B	B

### Section 13

1. A river is the source of water for water supply to a town. Its water is very turbid and polluted. The correct sequence of steps for treating the river water would be :
  - A. Presedimentation -> prechlorination -> coagulation -> sedimentation -> filtration -> post chlorination
  - B. coagulation -> sedimentation -> post-chlorination
  - C. coagulation -> filtration -> sedimentation -> post-chlorination
  - D. sedimentation -> post-chlorination
2. What is the probable maximum precipitation (PMP) ?
  - A. Projected precipitation for a 100-yr return period
  - B. Maximum precipitation for all past recorded storms
  - C. Upper limit of rainfall, which is justified climatologically
  - D. Effective precipitable water
3. Westergaard's analysis for stress distribution beneath loaded area is applicable to
  - A. sandy soils
  - B. clayey soils
  - C. stratified soils
  - D. silty soils
4. Which of the following variations of magnetic declination are correctly matched ?
  1. Diurnal variation.....Variation whose time period varies from 100-350 years
  2. Annual variation.....Annual rate of change of secular variation
  3. Secular variation.....Variation of declination periodic in character
  4. Irregular variation.....Caused due to magnetic storms in earth's magnetic fieldSelect the correct answer using the codes given below :  
A. 1, 3 and 4    B. 2 and 3    C. 1 and 4    D. 3 and 4
5. In order to find the resultant of a system of coplanar parallel system of forces, the correct sequence of the graphical procedure to be followed is
  - A. force diagram, space diagram, funicular polygon and polar diagram
  - B. funicular polygon, force diagram, space diagram and polar diagram
  - C. space diagram, force diagram, polar diagram and funicular polygon
  - D. space diagram, funicular polygon, force diagram and polar diagram.

6. Given that,  $t$  = thickness of the plates,  $b$  = width of the plates,  $d$  = diameter of the rivets,  $n$  = number of rivets in a line,  $\sigma t$  = permissible tensile stress. The tearing strength of the joint is given by
- $t(b - nd)\sigma t$
  - $t(b + nd)\sigma t$
  - $(bt - nd/t)\sigma t$
  - $(bt - nd/t)\sigma t$
7. Consider the following statements pertaining to a pile group and a single pile at failure :1. In loose and medium dense sands, the failure load per pile in a group will generally be greater than the failure load for a single pile.2. In cohesive soils, the failure load per pile in a group will be greater than failure load for a single pile.3. For piles driven in dense sands, the failure load per pile in a group is greater than the failure load for a single pile.4. When the pile spacing is greater than 10 times the pile diameter, the failure loads per pile in a group and for single pile are the same in both sands and clays. Of these statements :
- 1 and 4 are correct
  - 2 and 4 are correct
  - 1, 2, 3 and 4 are correct
  - 2, 3 and 4 are correct
8. A surge tank is provided in a hydropower scheme to
- provide additional storage close to the penstock
  - take care of change of slope, alignment or size of the water conductor system
  - reduce the pressures under transient conditions
  - provide convenient overflows
9. If the settlement of a single pile in sand is denoted by  $S$  and that of a group of  $N$  identical piles (each pile carrying the same load) by  $S_g$ , then the ratio  $S_g/S$  will
- be equal to 1 irrespective of width of the group
  - be equal to  $N$  irrespective of width of the group
  - decrease as the width of the group increases
  - increase as the width of the group increases
10. For the analysis of flow in a water distribution network, the site engineers prefer the following head loss equation :
- Darcy-Weisbach equation
  - Chezy's equation
  - Hazen-William's equation
  - Manning's equation

11. Consider the following factors :1. Period of construction, winter/summer2. Degree of foundation roughness3. Slab thickness4. Reinforced/unreinforcedWhich of these factors are considered as per IRC for obtaining the maximum expansion joint spacing in rigid pavements ?  
A. 1, 2 and 3    B. 2, 3 and 4    C. 2 and 3    D. 1 and 4
12. The concentration of hardness producing cations may be estimated using which one of the following ?  
A. Conductivity meter  
B. pH meter  
C. Spectrophotometer  
D. Flame photometer
13. A vehicle is moving up on an inclined plane. The vehicle has rear-wheel drive. Force of friction on the rear wheels will be in a direction  
A. along the plane but backward  
B. backward at an angle  $\phi$  with the plane, where  $\phi$  is the friction angle  
C. along the plane but forward  
D. forward at an angle  $\phi$  with the plane, where  $\phi$  is the friction angle
14. Consider the following statements :In the case of close coiled spring carrying an axial loading the spring is subjected to : 1. torsion 2. axial force3. bending moment the effect of which can be neglected.Of these statements :  
A. 1, 2 and 3 are correct  
B. 1 and 2 are correct  
C. 1 and 3 are correct  
D. 2 and 3 are correct
15. The given figure shows a frame to be analysed by moment distribution method. The distribution factors for members GF, GH and GD will be respectively  
A.  $\frac{1}{4}$ ,  $\frac{1}{4}$  and  $\frac{1}{2}$     B.  $\frac{1}{3}$ ,  $\frac{1}{3}$  and  $\frac{1}{3}$     C.  $\frac{1}{2}$ ,  $\frac{1}{4}$  and  $\frac{1}{4}$     D.  $\frac{2}{3}$ , 0 and  $\frac{1}{3}$
16. Which one of the following equations correctly gives the relationship between the specific gravity of soil grains (G) and the hydraulic gradient (i) to initiate 'quick' condition in a sand having a void ratio of 0.5 ?  
A.  $G = 0.5 i + 1$   
B.  $G = i + 0.5$   
C.  $G = 1.5 i + 1$   
D.  $G = 1.5 i - 1$

17. What is the bending moment at A for the bent column shown in the D figure ?  
 A. 40 kNm      B. 20 kNm      C. 10 kNm      D. Zero C
18. Consider the following statements :The principle of superpositions is applied to :1. Linear elastic bodies2. Bodies subjected to small deformations. Of these statements :  
 A. 1 alone is correct  
 B. 1 and 2 are correct  
 C. 2 alone is correct  
 D. neither 1 nor 2 is correct
19. In which type of lakes, does a perfect ecological equilibrium among the producers, decomposers and consumer groups of organisms exist ?  
 A. Senescent lakes  
 B. Mesotrophic lakes  
 C. Oligotrophic lakes  
 D. Eutrophic lakes
20. A soil deposit has three layers having same thickness each but the permeabilities of the layers are in the ratio of 1 : 2 : 4 from top to bottom. What is the ratio of average permeability in the horizontal direction to that in the vertical direction ?  
 A. 7 : 2      B. 14 : 6      C. 28 : 24      D. 49 : 36
21. The three-point problem in hydrographic surveying considers the data on the location of three shore signals A, B and C and the angles  $\alpha$  and  $\beta$  subtended by AP, BP and CP at the boat P; and then proceeds to plot the position of P. The problem may become indeterminate in special cases when  
 A. B and P are on opposite sides of the line AC  
 B. both B and P are on the same side of the line AC  
 C. P is within the triangle ABC  
 D. P is very close to the extension of one of the edges of the triangle ABC
22. Horizontal stiffeners are needed in plate girders if the thickness of web is (where d = distance between the flanges and L = span)  
 A.  $\geq 6$  mm  
 B.  $\geq d/200$   
 C.  $\geq L/500$   
 D. nearly equal to flange thickness
23. What is the full width of the land acquired before finalizing highway alignment, known as ?

- A. width of formation  
B. right of way  
C. Carriage way  
D. Roadway
24. What is the superelevation for a horizontal highway curve of radius 500 m and speed 100 kmph in mixed traffic condition ?  
A. 8.9%    B. 6.2%    C. 0%    D. 1%
25. Which one of the following is a compression member ?  
A. Purlin    B. Boom    C. Girt    D. Tie
26. In the riveted connection shown in the given figure, the rivets subjected to maximum stress would include  
A. *A, B, C* and *D*  
B. *C, D, E* and *F*  
C. *E, F, G* and *H*  
D. *A, B, G* and *H*
27. An elementary structural frame ABC consists of a vertical member BC and a cantilever beam AB which carries a load P at the free end A, as shown in the given figure. The bending moment diagram consists of  
A. triangle for both *AB* and *BC*  
B. rectangle for both *AB* and *BC*  
C. triangle for *AB* and rectangle for *BC*  
D. rectangle for *AB* and triangle for *BC*
28. Approximate ratio of the permeabilities of two clean soils having  $D_{10} = 0.6$  mm and  $D_{10} = 0.3$  mm is  
A. 4.0    B. 3.75    C. 4.25    D. 3.5
29. The ratio of the torsional moments of resistance of a solid circular shaft of diameter D, and a hollow circular shaft having external diameter D and internal diameter d is given by  
A.  $\frac{D^4}{D^4 - d^4}$     B.  $\frac{D^4 - d^4}{D^4}$     C.  $\frac{D^3 - d^3}{D^3}$     D.  $\frac{D^3}{D^3 - d^3}$
30. The force in member AB is in the given figure  
A. 5 kN compression  
B. 2 kN compression  
C. zero  
D. 7 kN compression
31. Which one of the following systems of pre-stressing is suitable for pre-tensioned members ?  
A. Freyssinet system

- B. Magnel-Blaton system  
C. Hoyer system  
D. Gifford-Udall system
32. Consider the following statements :Liquefaction is a phenomenon1. observed in fine sands2. associated with development of positive pore pressure.Which of the statements given above is/are correct ?  
A. 1 only  
B. 2 only  
C. Both 1 and 2  
D. Neither 1 nor 2
33. Which of the following pairs is/are correctly matched ?1. Eutrophication.... Nutrient accumulation leading to ecosystem change occurring in impounded water.2. Autotrophism.... Utilization, rearrangement and decomposition of complex materials predominate.3. Heterotrophism....Predominance of fixation of light energy, use of simple inorganic substances and built-up complex substances.Select the correct answer from the codes given below :  
A. 1, 2 and 3     B. 1 alone     C. 2 and 3     D. 1 and 3
34. Consider the following statements :A grillage base is checked for1. bending2. shear3. compression4. web cripplingWhich of these statements are correct ?  
A. 1 and 4     B. 1 and 3     C. 2, 3 and 4     D. 1, 2 and 4
35. In the pin-jointed plane truss shown above, what is the magnitude and nature of force in member BC?  
A. Zero  
B. 50 kN (tensile)  
C. 50 kN (compressive)  
D.  $\frac{50\sqrt{2}}{2}$  kN(tensile)
36. A footing is resting on a fully saturated clayey strata. For checking the initial stability, shear parameters are used from which one of the following ?  
A. Consolidated non-drained test  
B. Unconsolidated drained test  
C. Unconsolidated non-drained test  
D. Unconsolidated non-drained test with pore pressure measurement
37. Consider the following factors :1. Reaction time 2. Speed3. Coefficient of longitudinal friction 4. Gradient Which of these factors are taken into account for computing braking distance ?  
A. 1 and 3     B. 1, 2 and 4     C. 2, 3 and 4     D. 2 and 3



38. For the purpose of designing a well point system for lowering ground water table in a sandy silt deposit, the coefficient of permeability of the soil is to be determined. Which one of the following methods would be most suitable ?
- Constant Head Permeameter Test
  - Variable Head Permeameter Test
  - Pumping out Test in the field
  - Pumping in Test in the field
39. Which of the following are associated with alum coagulation ? 1. A decrease of alkalinity in treated water 2. Formation of hydroxide flocs of aluminium 3. A slight decrease of pH in treated water 4. An increase of permanent hardness Select the correct answer using the codes given below :
- 1, 2 and 3
  - 1, 3 and 4
  - 1, 2, 3 and 4
  - 2 and 4
40. Consider the following statements : For an over-reinforced (singly reinforced) rectangular RC section. 1. the lever arm will be less than that for a balanced section. 2. the maximum stress developed by steel would equal the allowable stress in steel. 3. the maximum stress developed by concrete would equal allowable stress in concrete. Of these statements :
- 1 and 2 are correct
  - 1 and 3 are correct
  - 2 and 3 are correct
  - 1, 2 and 3 are correct
41. ABC is rigid bar. It is hinged at A and suspended at B and C by two wires BD and CE made of copper and steel respectively, as shown in the given figure. The bar carries load of 1t at F, mid-way between B and C. Given  $A_c = 4 \text{ cm}^2$ ,  $A_s = 2 \text{ cm}^2$ ,  $E_c = 1 \times 10^6 \text{ kg/cm}^2$ ,  $E_s = 2 \times 10^6 \text{ kg/cm}^2$ .  $P_s$  is the force in the steel wire and  $P_c$  is the force in the copper wire, the ratio  $P_c/P_s$  will be
- 0.5
  - 4
  - 0.25
  - 2
42. A hydraulic model of a spillway is constructed with a scale 1 : 16. If the prototype discharge is 2048 cumec, then the corresponding discharge for which the model should be tested is
- 1 cumec
  - 2 cumec
  - 4 cumec
  - 8 cumec
43. A beam has the same section throughout its length with  $I = 1 \times 10^8 \text{ mm}^4$ , It is subjected to a uniform B.M. = 40 kNm.  $E = 2 \times 10^5 \text{ N/mm}^2$ , What is the radius of curvature of the circle into which the beam will bend in the form of an arc of a circle ?
- 1000 m
  - 500 m
  - 400 m
  - 350 m

44. Consider the following statements in respect of plate girders :1. A large number of cover plates are provided over flange angles so that curtailed flanges match the bending moment diagram exactly.2. At least one cover plate should extend over the entire span so that rain water may not enter and corrode the connections.3. A minimum of one-third of flange area should be provided in flange angles and balance in flange cover plates for stability.Which of the statements given above are correct ?  
 A. 1 and 2      B. 2 and 3      C. 1 and 3      D. 1, 2 and 3
45. A rigid cantilever frame ABC is fixed at C. It carries a load P at A, as shown in the given figure. Neglecting axial deformation, the vertical deflection of the point A is given by (EI constant throughout the frame).  
 A.  $PIh^2/2EI$   
 B.  $PI^2h/3EI$   
 C.  $PI^2(3h + I)/3EI$   
 D.  $PI^2(2h + I)/2EI$
46. If R is the radius of the main curve,  $\theta$  the angle of deflection S the shift and L the length of the transition curve, then the total tangent length of the curve is given by  
 A.  $(R - S) \tan \theta/2 - L/2$   
 B.  $(R + S) \tan \theta/2 - L/2$   
 C.  $(R + S) \tan \theta/2 + L/2$   
 D.  $(R - S) \tan \theta/2 + L/2$
47. Which one of the following, gives the correct decreasing order of the densities of a soil sample?  
 A. Saturated, submerged, wet, dry  
 B. Saturated, wet, submerged, dry  
 C. Saturated, wet, dry, submerged  
 D. Wet, saturated, submerged, dry
48. What does the critical path in PERT represent ?1. The shortest path for the earliest completion of the project.2. The longest path of the network from the initial to final event,  
 A. 1 only  
 B. 2 only  
 C. Both 1 and 2  
 D. Neither 1 nor 2
49. A simply supported beam of constant width and varying depth and uniform strength is subjected to a central concentrated load. The

depth of the beam  $dx$  at a distance  $x$  from one of the supports is proportional to

- A.  $x^{1/2}$       B.  $x^{1/3}$       C.  $x$       D.  $x^2$

50. In the given figure, the maximum bending moment at the fixed end of the cantilever caused by the UDL is  $M$ . The bending moment at section  $1/5$  from the free end is

- A. 4% of  $M$       B. 5% of  $M$       C. 10% of  $M$       D. 20% of  $M$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	C	C	D	C	A	A	C	D	C
10	A	C	C	C	B	C	D	A	C	D
20	D	B	B	D	B	D	C	A	A	C
30	C	C	B	D	A	C	C	C	C	A
40	D	B	B	D	C	C	C	B	A	A

## Section 14

1. Bricks are burnt at a temperature range of
  - A.  $500^{\circ}$  to  $700^{\circ}\text{C}$
  - B.  $700^{\circ}$  to  $900^{\circ}\text{C}$
  - C.  $900^{\circ}$  to  $1200^{\circ}\text{C}$
  - D.  $1200^{\circ}$  to  $1500^{\circ}\text{C}$
2. Drop panel is a structural component in :
  - A. grid floor
  - B. flat plate
  - C. flat slab
  - D. slab-beam system of floor
3. A ship is berthed in a chamber and lifted by principles of buoyancy. Such a chamber is called
  - A. Dry dock
  - B. Web dock
  - C. Floating dock
  - D. Refuge dock
4. Which one of the following pairs is not correctly matched ?
  - A. Check valve - To check water flow in all directions
  - B. Sluice valve - To control flow of water through pipe lines
  - C. Air valve - To release the accumulated air
  - D. Scour valve - To remove silt in a pipe line
5. The following refer to the stability analysis of an earth dam under different conditions :1. Stability of D/S slope during steady seepage.2. Stability of U/S slope during sudden drawdown.3. Stability of U/S and D/S slopes during construction.Of these statements :
  - A. 1 and 2 are correct
  - B. 1 and 3 are correct
  - C. 2 and 3 are correct
  - D. 1, 2 and 3 are correct
6. A bar AB, 4 cm is diameter and 4 m long is rigidly fixed at its ends. A torque of 12000 kg/cm is applied at a section of the bar, one metre from end A. The fixing coupled TA and TB (in kg. cm) at the supports A and B will be respectively
  - A. 9000, 6000
  - B. 3000, 9000
  - C. 6000, 9000
  - D. 9000, 3000
7. Consider the following assumptions of Bowditch method :1. Angular measurements are more precise than linear measurements.2. Linear measurements are more precise than angular measurements.3. Errors in linear measurements are proportional to L.4. Correction to latitude or departure of any side = Total error in L (or D) x Length of that side / Perimeter of traverse.Which of these statements are correct ?
  - A. 1 and 4
  - B. 1, 2 and 3
  - C. 2, 3 and 4
  - D. 3 and 4

8. For the beam shown in the given figure, the collapse load  $P$  is given by
- A.  $\frac{16M_p}{L}$       B.  $\frac{14M_p}{L}$       C.  $\frac{12M_p}{L}$       D.  $\frac{10M_p}{L}$
9. For a laminated spring,  $l$  = length,  $n$  = number of plates, width of each plate =  $b$ , thickness of each plate =  $t$ , central point load =  $W$ , what is the expression for the maximum bending stores ?
- A.  $f = \frac{3Wl}{4nbt^2} * 2$       B.  $f = \frac{5Wl}{2nbt^2}$       C.  $f = \frac{2Wl}{3nbt^2}$       D.  $f = \frac{3Wl}{4nbt^2}$
10. Two particles of masses 21 gm and 28 gm are connected by a light inextensible string which passes over a fixed smooth pulley. The tension in the string in the ensuing motion will be
- A. 7 gm. wt      B. 10 gm. wt      C. 12 gm. wt      D. 24 gm. wt
11. Which of the following measures are resorted to for strengthening masonry walls ? 1. Provide cross walls. 2. Pre-stressing. 3. Provide gunite slab on the surface(s) of walls. 4. Provide buttresses. Select the correct answer using the code given below :
- A. 1, 3 and 4      B. 1 and 2      C. 2 and 3      D. 1, 2, 3 and 4
12. Which one of the following surveys is employed for collecting sufficient data in connection with sewage disposal and water supply works ?
- A. Topographic survey  
B. Cadastral survey  
C. Geodetic survey  
D. Cross-sectioning and profile levelling
13. Cost-benefit studies are essential to
- A. assess the total cost of the work  
B. ascertain the relevant escalation in prices  
C. monitor the expenditure  
D. evaluate the viability and worthwhileness of taking up the project
14. What is the value of flexural strength of M 25 concrete ?
- A. 4.0 MPa      B. 3.5 MPa      C. 3.0 MPa      D. 1.75 MPa
15. The correct sequence of the increasing order of the disturbance to soil samples obtained from chunk, piston, split spoon and remolded sampler is
- A. piston sampler, chunk sampler, split spoon sampler, remolded sampler  
B. chunk sampler, piston sampler, split spoon sampler, remolded sampler

- C. piston sampler, chunk sampler, remolded sampler, split spoon sampler  
 D. chunk sampler, piston sampler, remolded sampler, split spoon sampler
16. In an external focusing tachometer, the fixed interval between static hairs is 5 mm, the focal length of the objective is 25 cm, and the distance of the vertical axis of the instrument from the optical centre of the objective is 15 cm. Which one of the following is the set of constant of the tachometer ?  
 A. 30, 0.15      B. 30, 0.40      C. 50, 0.25      D. 50, 0.40
17. Which one of the following treatments is economically effective in the control of guinea worm disease ?  
 A. Chlorination      B. Filtration      C. Ozonation      D. Sedimentation
18. Which of the following data would be required for the design of progressive type computerised traffic signal system in a series of intersection on a busy street ?  
 1. Volume of fast moving traffic  
 2. Volume of pedestrian traffic  
 3. Volume of slow traffic  
 4. Approach speed of fast moving traffic  
 Select the correct answer using the codes given below :  
 A. 1, 2, 4 and 5      B. 1, 2, 3 and 4      C. 2, 3, and 5      D. 1, 3, 4 and 5
19. A sailor, standing on the deck of a ship, just sees the light beam from a lighthouse on the shore. If the height of the sailor's eye and of the light beam at the lighthouse, above the sea level, are 9 m and 25 m respectively, what is the distance between the sailor and the lighthouse ?  
 A. 29.8 km      B. 31.1 km      C. 31.9 km      D. 33.2 km
20. The displacement of a particle undergoing rectilinear motion along the x-axis is given by  $x = 2t^3 - 21t^2 + 60t + 6$  (m). The acceleration of the particle when its velocity is zero, is  
 A.  $36 \text{ m/s}^2$       B.  $\pm 18 \text{ m/s}^2$       C.  $9 \text{ m/s}^2$       D.  $-9 \text{ m/s}^2$
21. In a circular sewer of diameter  $D$ , if the depth of flow is  $D/4$ , what is the wetted perimeter equal to ?  
 A.  $\pi D/4$       B.  $\pi D/2$       C.  $\pi D/3$       D.  $2\pi D/3$
22. The standard time meridian in India is  $82^\circ 30' \text{E}$ . If the standard time at any instant is 20 hours 10 minutes, the local mean time for the place at a longitude of  $20^\circ \text{E}$  would be  
 A. 4h PM  
 B. 4h 10m PM  
 C. 1h 20m PM  
 D. 0h 20m AM

23. With a vertical point load on the surface when considering the vertical plane passing through the load, the stress gets reduced by 52.3% at a depth of
- 0.25 of unit length
  - 0.5 of unit length
  - 0.75 of unit length
  - 1 of unit length
24. Consider the following statementsThe main reinforcement in the counterfort in a counterfort retaining wall of R.C.C is provided on the :1. inclined face in front of counterfort.2. bottom face in. back counterfort.3. inclined face in back counterfort.4. bottom face in front counterfort.Select the correct answer using the codes given below :
- 1 and 2
  - 2 and 3
  - 3 and 4
  - 2 and 4
25. In a free vortex, velocity
- decreases with radius
  - increases with radius
  - is constant
  - varies inversely as the square of the radius
26. In the schematic flownet shown in the given figure the hydraulic potential at point A is
- 5 m of water
  - 12 m of water
  - 15 m of water
  - 25 m of water
27. A 4-hour rainfall in a catchment of 250 km<sup>2</sup> produces rainfall depths of 6.2 cm and 5.0 cm in successive 2-hour unit periods. Assuming the  $\phi$  index of the soil to be 1.2 cm/hour, the run-off volume in ha-m will be
- 16
  - 22
  - 1600
  - 2200
28. Consider the following statements :The critical path in a network plan of a project1. helps in planning efficient time schedule2. indicates the shortest path in time3. helps in crashing the project judiciously4. helps in encouraging discipline in execution.Of these statements :
- 1, 3 and 4 are correct
  - 1, 2, 3 and 4 are correct
  - 1 and 4 are correct
  - 2 and 3 are correct
29. Which of the following pairs are correctly matched ?1. Alpha iron....non magnetic2. Beta iron....strongly magnetic3. Gamma iron....non-magnetic and capable of dissolving carbon.4. Delta iron....non-magnetic and absorbs very little carbon.Select the correct answer using the codes given

below :

A. 3 and 4      B. 1 and 2      C. 1, 3 and 4      D. 2 and 4

30. The height of a hydraulic jump in a stilling pool was found to be 10 cm in a model with  $l_p/l_m = 36$ . The prototype jump height would be
- A. 0.6 m  
B. 3.6 m  
C. 21.6m  
D. indeterminable for want of adequate data
31. If the stress on the cross-section of a circular short column of diameter  $D$  is to be wholly compressive, the load should be applied within a concentric circle of diameter
- A.  $D/2$       B.  $D/8$       C.  $D/4$       D.  $D/6$
32. What does higher standard deviation imply in cost analysis ?
- A. Higher uncertainty  
B. Lower uncertainty  
C. Nothing to do with uncertainty  
D. Extra costs are likely
33. Consider the following statements :The disease of dry rot in timber is caused by :1. complete submergence in water.2. alternate wet and dry condition.3. lack of ventilation.Which of the statements given above is/are correct ?
- A. 1 only      B. 3 only      C. 2 only      D. 2 and 3
34. A section of a flitched beam is shown in the given figure. The main role of the steel plate placed between the two timber sections is to
- A. increase the axial resistance of the section  
B. increase density  
C. increase shear and bending resistance of the section  
D. avoid development of shear stress in the two timber sections
35. A velocity field with no components in the  $y$  and  $z$  directions is given by  $V = 6 + 2xy + t^2$ The acceleration along the  $x$ -direction at a point  $(3, 1, 2)$ , at time 2, is
- A. 8 units      B. 16 units      C. 28 units      D. 36 units
36. For stream function  $\psi = 3x^2 - y^3$ , the magnitude of velocity at the point  $(2, 1)$  is
- A. 12.37      B. 12      C. 13      D. 13.5
37. Consider the following statements about provision of sag rods :1. Sag rods reduce span length of purlin in the weak direction.2. Sag rods are installed in the plane of the roof.3. Ridge purlin is subject to vertical components of sag rods on either side of slope.Which of the statements



given above are correct ?

- A. 1, 2 and 3      B. 2 and 3      C. 1 and 2      D. 1 and 3

38. The smallest scale adopted for topographical surveys is

- A. 1 : 25, 000      B. 1 : 50, 000      C. 1 : 2, 50, 000      D. 1 : 5, 00, 000

39. A shot of mass  $m$  penetrates a thickness  $t$  of a fixed plate of mass  $M$ . If the plate were free to move and the resistance supposed to be uniform, which one of the following is the thickness penetrated ?

- A.  $\frac{Mt}{M+m}$       B.  $\frac{mt}{M+m}$       C.  $\frac{t}{M+m}$       D.  $\frac{t}{M+2m}$

40. Which one of the following gives the number of gate position in an airport ?

- A.  $\frac{\text{Capacity of runway}}{2} \times \text{average gate occupancy time}$   
 B.  $\frac{\text{Capacity of apron}}{60 \times 2} \times \text{number of aircraft movements}$   
 C.  $\frac{\text{Capacity of taxiway}}{60 \times 2} \times \text{average gate occupancy time}$   
 D.  $\frac{\text{Capacity of holding apron}}{2} \times \text{average gate occupancy time}$

41. During the measurement of a line by chain or tape in slopes, if the length of the line is 'l' and the height difference between the ends of the line is 'h', then the correction to the measured length is more than by

- A. zero      B.  $+\frac{h^4}{8l^3}$       C.  $+\frac{h^3}{4l^2}$       D.  $-\frac{h^3}{2l^2}$

42. Which one of the following represents the correct relationship between seepage pressure ( $ps$ ), unit weight of water ( $\gamma_w$ ) and hydraulic gradient ( $i$ ), inside an earth dam ?

- A.  $ps = i/\gamma_w$   
 B.  $ps = i \cdot \gamma_w$   
 C.  $ps = i^2 \cdot \gamma_w$   
 D.  $ps = \gamma_w/i$

43. Consider the following factors :1. Large number of loading cycles 2. Large variations in stress 3. Large stress concentration. Those associated with fatigue would include

- A. 1 and 2      B. 1 and 3      C. 2 and 3      D. 1, 2 and 3

44. As per I.S. 1904-1986 the permissible angular distortion with respect to steel structures in isolated foundations resting on plastic clay is
- A.  $\frac{2}{3000}$     B.  $\frac{1}{3000}$     C.  $\frac{1}{3000}$     D.  $\frac{2}{200}$
45. Which one of the following statements about photogrammetric surveying is correct ? The relief displacement
- A. decreases with increase in flying height  
 B. is negative for a point above datum  
 C. decreases as the distance of the object from the principal point increases  
 D. of the point is not affected by the tilt of the photograph.
46. A soil has liquid limit of 60%, plastic limit of 35% and shrinkage limit of 20% and it has a natural moisture content of 50%. The liquidity index of soil is
- A. 1.5    B. 1.25    C. 0.6    D. 0.4
47. Which of the following statements about design period are true ? 1. It is concerned with economy of investment. 2. It takes into account aspects like life of durability and ease or difficulty of capacity increase of installations. 3. It considers the frequency of occurrence of extremes of river flow. 4. It is concerned with estimating future requirements. Select the correct answer using the codes given below :
- A. 1, 2, 3 and 4    B. 2 and 3    C. 1, 2 and 4    D. 1, 3 and 4
48. Gypsum is used as an admixture in cement grouts for
- A. accelerating the setting time  
 B. retarding the setting time  
 C. increasing the plasticity  
 D. reducing the grout shrinkage
49. A sand deposit has a porosity of 0.375 and a specific gravity of 2.6, the critical hydraulic gradient for the sand deposit is
- A. 2.975    B. 2.225    C. 1    D. 0.75
50. If the actual observed value of standard penetration resistance, N is greater than 15 in a fine sand layer below water table, then the equivalent penetration resistance will be
- A.  $15 + \frac{(N + 15)}{2}$     B.  $15 - \frac{(N + 15)}{2}$     C.  $15 + \frac{(N - 15)}{2}$     D.  $15 + \frac{(N - 15)}{2}$

Answer Key

	1	2	3	4	5	6	7	8	9	0
0	C	C	C	A	C	D	A	D	D	D
10	A	D	D	B	A	D	B	B	B	B
20	C	A	C	C	A	B	C	A	A	B
30	C	D	B	C	D	A	A	A	A	A
40	B	B	A	C	A	C	C	B	C	C

## Section 15

1. Tensile strength of concrete is measured by
  - A. direct tension test in the universal testing machine
  - B. applying compressive load along the diameter of the cylinder
  - C. applying third point loading on a prism
  - D. applying tensile load along the diameter of the cylinder
2. What is the moment (approximate) of the force acting on a railway sign post shown in the figure about the point ?  
 A. 1135 Nm    B. 1205 Nm    C. 980 Nm    D. 1300 Nm
3. A flash mixer of 2.0 m<sup>3</sup>, with a velocity gradient of mixing mechanisms equal to 660/s, and fluid absolute viscosity of  $1.0 \times 10^{-3}$  Ns/m<sup>2</sup> is continuously operated. What is the power input per unit volume ?  
 A. 360 W    B. 720 W    C. 1440 W    D. 300 W
4. What is the discharge corresponding to a critical depth of 1.20 m in a 3.0 m wide rectangular channel:
  - A. 4.12 m<sup>3</sup>/s
  - B. 4.94 m<sup>3</sup>/s
  - C. 8.24 m<sup>3</sup>/s
  - D. 12.35 m<sup>3</sup>/s
5. A lemniscate curve between the tangents is transitional throughout, if the polar deflection angle of its apex is equal to ( $\phi$  in the deflection angle between the initial and final tangents)  
 A.  $\phi/2$     B.  $\phi/4$     C.  $\phi/6$     D.  $\phi$
6. Consider the following statements :Total float is :1. the time span by which the starting (or finishing) of an activity can be delayed without delaying the completion of the project.2. difference between maximum time available and the actual time required to perform the activity.3. difference between its earliest finish time and the earliest start time of its successor activity.Which among the following is/are correct ?  
 A. 2 and 3    B. 1, 2 and 3    C. 1 only    D. 1 and 2
7. In a linear reservoir, the
  - A. volume varies linearly with elevation
  - B. outflow rate varies linearly with storage
  - C. storage varies linearly with time
  - D. storage varies linearly with inflow rate
8. The given figure shows the relation between void ratio and shear strain for a sand under two density conditions. The void ratio corresponding to the dashed line is called
  - A. optimum void ratio

- B. critical void ratio
  - C. residual void ratio
  - D. undisturbed void ratio
9. The separation of boundary layer takes place when the pressure gradient is
- A. negative      B. positive      C. zero      D. constant
10. A free vortex formed from originally still water, say, as when draining still water in a flat-bottomed basin by suddenly pulling the stopper at the bottom on the drain hole, will be
- A. clockwise in the northern as well as the southern hemispheres
  - B. anticlockwise in the northern as well as the southern hemispheres
  - C. anticlockwise in the northern hemisphere and clockwise in the southern hemisphere
  - D. clockwise in the northern hemisphere and anticlockwise in the southern hemisphere
11. Which of the following are the fundamental lines of a theodolite ?  
 1. The vertical and horizontal axes  
 2. The diagonally opposite screw lines  
 3. The line of collimation and axes of the plate levels  
 4. The bubble line of the altitude level.  
 Select the correct answer using the codes given below:
- A. 1, 2 and 3      B. 1, 2 and 4      C. 2 and 3      D. 1, 3 and 4
12. Heliograph is a type of
- A. instrument used for recording the movement of sun
  - B. instrument used for contouring an area
  - C. electronic distance measuring device
  - D. sun signal used in triangulation work
13. The amount of gradient is required to be reduced, whenever a horizontal curve and gradient have to be provided together. What is this process known as ?
- A. Momentum gradient
  - B. Pusher gradient
  - C. Grade compensation
  - D. Grade resistance
14. As per Terzaghi's equation, the bearing capacity of strip footing resting on cohesive soil ( $c = 10 \text{ kN/m}^2$ ) for unit depth and unit width (assume  $N_c$  as 5.7 ) is
- A.  $47 \text{ kN/m}^2$       B.  $57 \text{ kN/m}^2$       C.  $67 \text{ kN/m}^2$       D.  $77 \text{ kN/m}^2$
15. A and B are Skempton's pore pressure coefficients. For saturated normally consolidated soils,

- A.  $A < 1$  and  $B < 1$   
 B.  $A < 1$  and  $B > 1$   
 C.  $A > 1$  and  $B < 1$   
 D.  $A > 1$  and  $B = 1$
16. If the mean temperature of Sun's surface 6000 K and  $\lambda_m$  of its radiation is 0.5 what is the mean temperature of earth surface for which  $\lambda_m$  is 10.0  $\mu\text{m}$ , according to Wien's Displacement Law in Remote Sensor Concept ?  
 A. 25 °C      B. 28 °C      C. 27 °C      D. 30 °C
17. The deflection at the free end of a cantilever subjected to a couple M at its free end and having a uniform flexural rigidity EI throughout its length 'L' is equal to  
 A.  $\frac{ML^2}{2EI}$       B.  $\frac{ML^2}{4EI}$       C.  $\frac{ML^2}{6EI}$       D.  $\frac{ML^2}{8EI}$
18. A compression member has a centre to centre length of 4.0 m. It is fixed at one end and hinged at the other end. The effective length of the column is  
 A. 4.0 m      B. 3.2 m      C. 2.8 m      D. 2.6 m
19. An image of the top of the hill is 96 mm from the principal point of the photograph. The elevation of the top of the hill is 500 m and flying height is 4000 m above the datum. The relief displacement will be  
 A. 768 mm      B. 88 mm      C. 12 M      D. 8 mm
20. If the curve lead of a broad gauge railway turnout is 16.76 metres, the angle of crossing of the turnout will be given by  
 A.  $\tan^{-1} 10$   
 B.  $\tan^{-1} 5$   
 C.  $\tan^{-1} 1/10$   
 D.  $\tan^{-1} 1/5$
21. Which one of the following is the correct statement? In beam to column connections in steel construction, if torsion is permitted at the ends of simply supported beams by not providing the cleats, the  
 A. effective length of the beam increases by 20 %  
 B. effective length remains same as the actual length  
 C. Permissible bending stresses are increased by around 10 %  
 D. joint has to be designed for torsion
22. Consider the following statements : In the bar chart planning  
 1. Interdependence of the operations cannot be portrayed  
 2. Progress of work can be measured  
 3. Spare time of the activities can be determined  
 4. Schedule cannot be updated  
 Of these statements :

- A. 1, 2 and 3 are correct
  - B. 1 and 4 are correct
  - C. 2, 3 and 4 are correct
  - D. 1, 2 and 4 are correct
23. Which one of the following flood routing methods involves the concepts of wedge and prism storages ?
- A. Coefficient method
  - B. Muskingum method
  - C. Pul's method
  - D. Lag method
24. Groynes are adopted for river bank protection works. When it is placed inclined downstream in the direction of flow in the river, it is designated as which one of the following ?
- A. Repelling groyne
  - B. Attracting groyne
  - C. Neither repelling nor attracting groyne
  - D. Fixed groyne
25. If the magnetic bearing of a line is  $48^{\circ}24'$  and magnetic declination is  $5^{\circ}38'$  East, then the true bearing is
- A.  $42^{\circ} 02'$       B.  $42^{\circ} 46'$       C.  $54^{\circ} 02'$       D.  $54^{\circ} 46'$
26. The true bearing of a line is  $34^{\circ} 20' 40''$  and the magnetic declination at the place of observation is  $2^{\circ} 00' 20''$  W on the date of observation. The magnetic bearing of the line is
- A.  $36^{\circ} 21' 00''$       B.  $34^{\circ} 20' 20''$       C.  $32^{\circ} 20' 20''$       D.  $32^{\circ} 00' 20''$
27. What is the inclination of resultant reactions at A with the vertical for the frame shown in the given figure ?
- A.  $60^{\circ}$       B.  $40^{\circ}$       C.  $30^{\circ}$       D.  $50^{\circ}$
28. Which one of the following, measures the stiffness of a track ?
- A. Tractive effort
  - B. Tractive resistance
  - C. Track modulus
  - D. Load capacity
29. Consider the following statements :1. About 25% of alumina in brick earth imparts the plasticity necessary for moulding bricks into required shape.2. Iron pyrite present in brick earth preserves the form of the bricks at high temperatures.3. Presence of weeds in brick earth makes the bricks unsound.Which of these statements are correct ?
- A. 1 and 2      B. 1 and 3      C. 2 and 3      D. 1, 2 and 3

30. In the cross-section of a rectangular beam, what is the ratio of the average shear stress to the maximum shear stress ?  
 A.  $3/2$     B.  $2/3$     C.  $4/3$     D.  $3/4$
31. Which type of plume may occur during winter nights ?  
 A. Looping    B. Inversion    C. Coning    D. Lofting
32. In a compaction test on a soil sample, if the compaction energy is decreased ( $\gamma_d$  = maximum dry density, OMC = optimum moisture content)  
 A.  $\gamma_d$  will increase with increase in OMC  
 B.  $\gamma_d$  will decrease with increase in OMC  
 C.  $\gamma_d$  will decrease with decrease in OMC  
 D.  $\gamma_d$  will increase with decrease in OMC.
33. A three-hinged symmetric parabolic arch is hinged at the springing and at the crown. The span and rise are 40 m and 10 m respectively. The left half of the arch is loaded with U.D.L. of 3 t/m. The horizontal thrust at the springings will be  
 A. 15 t    B. 20 t    C. 30 t    D. 40 t
34. At a hydraulic jump, the depths at the two sides are 0.4 m and 1.4 m. The head loss in the jump is nearly  
 A. 1.0 m    B. 0.9 m    C. 0.7 m    D. 0.45 m
35. A 12 kg mass rests on a surface for which the coefficient of friction is  $\mu = 0.15$ . What is the smallest force that can give the mass acceleration of 3 m/s<sup>2</sup> ? (Take  $g = 10$  m/s<sup>2</sup>).  
 A. 120 N    B. 100 N    C. 65 N    D. 54 N
36. Which one of the following expresses the degree of disturbance of undisturbed clay sample due to remoulding ?  
 A. Thixotropy    B. Dilatancy    C. Sensivity    D. Plasticity
37. For strengthening a 50 m long and 5 m high straight compound wall built in brick work, which one of the following would be most suitable ?  
 A. Providing buttresses at certain intervals  
 B. Providing a deeper foundation  
 C. Using a richer mortar  
 D. Using stronger bricks
38. Why are tie plates provided in laced columns ?  
 A. To check the buckling of column as whole  
 B. To check the buckling of the lacing flats  
 C. To check the buckling of the component columns  
 D. To check the distortion of the end cross sections

39. Which of the following treatments reduce salinity of water ? 1. Flocculation and sedimentation 2. Filtration 3. Reverse osmosis 4. Electrodialysis Select the correct answer using the codes given below :  
 A. 1 and 2      B. 3 and 4      C. 2 and 3      D. 1 and 4
40. A deposit of fine sand has a porosity 'n' and specific gravity of soil solids is G. The hydraulic gradient of the deposit to develop boiling condition of sand is given by  
 A.  $i_c = (G - 1)(1 - n)$   
 B.  $i_c = (G - 1)(1 + n)$   
 C.  $i_c = \frac{G - 1}{1 - n}$   
 D.  $i_c = \frac{G - 1}{1 + n}$
41. A vertical photograph of a chimney was taken from an elevation of 500 m above M.S.L, The elevation of the base of the chimney was 250 m. If the relief displacement of the chimney was 51.4 mm and the radial distance of the image of the top of the chimney was 110 mm, the height of the chimney is  
 A. 233.64 m      B. 133.2 m      C. 116.82 m      D. 58.41m
42. A beam of rectangular cross-section (b x d) is subjected to a torque T. What is the maximum torsional stress induced in the beam ? (Where b is d, and  $\alpha$  is a constant)  
 A.  $\frac{T}{\alpha b^2 d}$       B.  $\frac{T}{\alpha b d^2}$       C.  $\frac{T}{\alpha b d^2}$       D.  $\frac{T}{b d}$
43. A simply supported beam is subjected to an eccentric concentrated load. Where does the maximum deflection of the beam due to the applied load occur ?  
 A. Directly under the load  
 B. At the centre of the beam  
 C. Between the load point and the nearest end support  
 D. Between the load point and centre of the beam.
44. Which of the following factors are taken into account for estimating the runway length required for aircraft landing 1. Normal maximum temperature. 2. Air port elevation. 3. Maximum landing weight. 4. Effective runway gradient. Select the correct answer using the codes given below:  
 A. 1, 2, 3 and 4      B. 1, 3 and 4      C. 2 and 3      D. 1, 2 and 4
45. Two geometrically similar pumps are running at the same speed of 1000 r.p.m. and lifting water against the heads of 25 m and 16 m



respectively. First pump is having an impeller diameter of 300 mm. The impeller diameter of second pump shall be

A. 192 mm      B. 240 mm      C. 300 mm      D. 469 mm

46. If the flange angle is  $\beta$ , coefficient of friction between flange and rail is  $\mu$ , the derailment coefficient according to Nadal's formula should not exceed

A.  $\frac{\tan \beta - \mu}{1 - \mu \sqrt{\cot \beta}}$       B.  $\frac{\sqrt{\tan \beta} - \mu}{1 - \mu \sqrt{\cot \beta}}$       C.  $\frac{\tan^2 \beta - \mu}{1 + \mu \cot \beta}$       D.  $\frac{\tan \beta - \mu}{1 + \mu \tan \beta}$

47. Consider the following field tests :1. Vertical pile load test2. Cyclic pile load test3. Lateral pile load test4. Instrumented test pile While estimating the load carrying capacity of a pile, the tests that can be used for separating the skin resistance from point resistance, would include

A. 1 and 3      B. 1 and 4      C. 2 and 3      D. 2 and 4

48. Consider the following statements :In water supply distribution network, 1. the grid-iron system requires more length of pipe lines and larger number of cut-off valves.2. the design of the grid-iron system is difficult but economical.3. employing a grid-iron system, the dead ends are completely eliminated.4. employing a grid-iron system permits more water to be diverted towards the affected point from various directions. Which of the statements given above are correct ?

A. 1, 2 and 4      B. 1, 3 and 4      C. 2, 3 and 4      D. 1, 2 and 3

49. The entry of foul smelling gases into the house coming from the sewers can be prevented by

A. providing water seals for all the fixtures  
B. providing water seals for all the fixtures and a vent pipe in the plumbing system  
C. providing sufficient vent pipes in the plumbing system  
D. exhaust fans

50. In the alignment of an irrigation channel wherefrom offtakes have to be provided at regular intervals, changes in the given channel parameters are made use of. The correct sequence of the decreasing order of preference of these parameters is

A. Width, slope, depth  
B. Width, depth, slope  
C. Depth, slope, width  
D. Depth, width, slope

<b>Answer Key</b>		1	2	3	4	5	6	7	8	9	0
	0	A	A	B	D	C	B	B	B	B	B
	10	D	D	C	B	D	C	A	C	C	C
	20	A	B	B	B	C	A	C	C	B	B
	30	D	B	C	D	B	C	A	C	B	A
	40	C	A	D	D	B	C	C	B	B	B

## Section 16

- Water is to be pumped at the rate of  $0.025 \text{ m}^3/\text{s}$  from a 4 m deep ground level tank to an overhead tank. The difference in levels of the full tank levels of these tanks is 16 m. What is the approximate power required for operating a 65% efficient centrifugal pump ?  
A. 7.5 kW    B. 6.0 kW    C. 3.9 kW    D. 3.2 kW
- If in a concrete mix the fineness modulus of coarse aggregate is 7.6, the fineness modulus of fine aggregate is 2.8 and the economical value of the fineness modulus of combined aggregate is 6.4, then the proportion of fine aggregate is  
A. 25%    B.  $33 \frac{1}{3} \%$     C. 50%    D.  $66 \frac{2}{3} \%$
- A rectangular footing  $1 \text{ m} \times 2 \text{ m}$  is placed at a depth of 2 m in a saturated clay having an unconfined compressive strength of  $100 \text{ kN/m}^2$ . According to Skempton, the net ultimate bearing capacity is  
A.  $420 \text{ kN/m}^2$   
B.  $412.5 \text{ kN/m}^2$   
C.  $385 \text{ kN/m}^2$   
D.  $350 \text{ kN/m}^2$
- A floating body is in stable equilibrium  
A. when its metacentric height is zero  
B. when the centre of gravity of the body is below the centre of buoyancy  
C. when its metacentre is above the centre of gravity of body  
D. in none of the above situations
- For three-dimensional movement of a weight, which one of the following is most suitable ?  
A. Chain hoist    B. Winch    C. Crane    D. Jack
- The following data pertain to a sewage sample :Initial D.O = 10 mg/l Final D.O. = 10 mg/l Dilution to 1% The BOD of the given sewage sample is  
A. 8 mg/l    B. 10 mg/l    C. 100 mg/l    D. 2 mg/l
- In a simply supported beam of span 'l', each end is restrained against torsion, compression flange being unrestrained. According to IS : 800, the effective length of the compression flange will be equal to  
A.  $0.65l$     B.  $0.85l$     C.  $0.75l$     D.  $0.70l$
- Which one of the following is the correct statement ? Penetration to know bitumen grade is measured in  
A. one-hundredth of mm

- B. one-tenth of mm  
C. one-tenth of an inch  
D. one micron
9. Which one of these methods of Tunnel Construction is not suitable in rocks ?  
A. Full face method  
B. Compressed air method  
C. Heading and benching method  
D. Drift method
10. Consider the following statements regarding uniform flow in an open channel :1. Energy grade line, water surface and bed slope are parallel to each other.2. Froude number does not vary from section to section.3. Velocity of water is the same at all points of the cross-section.Of these statements :  
A. 1, 2 and 3 are correct  
B. 1 and 2 are correct  
C. 1 and 3 are correct  
D. 2 and 3 are correct
11. For the continuous beam (EI constant) loaded as shown in the figure given, the moment at 'B' is  
A. 0.75 times free moment at mid-span of AB  
B. same as the free moment at mid-span of AB  
C. 1.50 times free moment at mid-span of AB  
D. 2.00 time free moment at mid-span of AB
12. The representative fraction means that the scale is 1 cm equal to  
A. 0.25 m    B. 2.5 m    C. 25 m    D. 2.5 km
13. The correct sequence of processes in a water treatment plant for rural water supply is  
A. Chlorination, aeration, sedimentation, rapid sand filter  
B. Coagulation, sedimentation, slow sand filter, chlorination  
C. Coagulation, flocculation, clarification, pressure filter  
D. Aeration, plain sedimentation, slow sand filter, chlorination
14. The maximum deflection of a fixed beam carrying a central load W is equal to  
A.  $\frac{WL^3}{48EI}$     B.  $\frac{WL^3}{96EI}$     C.  $\frac{WL^3}{192EI}$     D.  $\frac{5}{384} \frac{WL^3}{EI}$
15. A simply supported beam of span L carries a concentrated load W at its mid-span. If the width 'b' of the beam is constant throughout

the span, then, when the permissible bending stress is ' $f$ ', the beam's mid-span depth will be

- A.  $3WL/2bf$
  - B.  $3WL/2bf$
  - C.  $6WL/bf$
  - D.  $6WL/bf$
16. Consider the following statements :1. A recovery ratio of less than 1 implies that the soil has compressed.2. A recovery ratio greater than 1 implies that the soil has swelled.3. A recovery ratio of less than 1 implies that the soil has swelled.4. A recovery ratio greater than 1 implies that the soil has compressed.Which of the following statements given above is/are correct ?
- A. 1 and 2      B. 1 only      C. 3 and 4      D. 4 only
17. The force in the member 'AB' of the truss shown in the given figure is
- A. 25 kN compressive
- B. 25 2 tensile
- C. 25 2kN compressive
- D. 25 kN tensile
18. What are the distribution factors at joint B for the members BA and BC respectively, in the figure at side ?
- A. 0.57 and 0.43      B. 0.43 and 0.57      C. 0.50 and 0.50      D. 0.36 and 0.64
19. If the gradient of a ground is -3%, that of another ground intersecting with the former is 5%, and the horizontal length of the vertical curve to be drawn is 600 m, then the vertical offset 'e' from the vertex of the vertical curve to the mid-point of the curve will be
- A. 1.5 m      B. 6 m      C. 15 m      D. 75 m
20. Why is super plasticizer added to concrete?1. To reduce the quantity of mixing water.2. To increase the consistency.3. To reduce the quantity of cement.4. To increase resistance to freezing and thawing.Select the correct answer using the code given below :
- A. 1, 2 and 3      B. 1, 3 and 4      C. 2 and 3      D. 4 only
21. In an aerial photo, the image of the top of a tower is found to be 10 cm from the centre of thephotograph. If the height of the tower is 100 m and the flying height of the aircraft is 1000 m above the average terrain height, then the height displacement of the image from the true position will be
- A. 10 mm      B. 20 mm      C. 50 mm      D. 100 mm
22. Which of the following are the requirements for the design of a transition curve for a highway system ?1. Rate of change of grade2. Rate

- of change of radial acceleration3. Rate of change of super elevation4. Rate of change of curvatureSelect the correct answer using the code given below :
- A. 1, 2 and 3      B. 2, 1 and 4      C. 1, 3 and 4      D. 2, 3 and 4
23. The void-pressure diagram is shown above. What is the coefficient of compressibility ?
- A.  $0.5 \text{ m}^2/\text{t}$   
 B.  $0.73 \text{ m}^2/\text{t}$   
 C.  $0.20 \text{ m}^2/\text{t}$   
 D.  $0.25 \text{ m}^2/\text{t}$
24. A propped cantilever of span 'L' is subjected to a concentrated load at mid-span. If  $M_p$  is plastic moment capacity of the beam, then the value of the collapse load will be
- A.  $\frac{12M_p}{L}$       B.  $\frac{8M_p}{L}$       C.  $\frac{6M_p}{L}$       D.  $\frac{4M_p}{L}$
25. A propped cantilever of span 'l' carries uniformly distributed load of 'w' per unit over its entire span. The value of prop react to keep the beam horizontal is
- A.  $\frac{wl}{3}$       B.  $\frac{3}{8} wl$       C.  $\frac{wl}{2}$       D.  $\frac{5}{8} wl$
26. When two roads with two-lane, two-way traffic, cross at an uncontrolled intersection, the total number of potential major conflict points would be
- A. 32      B. 24      C. 16      D. 4
27. If the load, warping and frictional stresses in a cement concrete slab are  $210 \text{ N/mm}^2$ ,  $290 \text{ N/mm}^2$  and  $10 \text{ N/mm}^2$  respectively, the critical combination of stresses during summer midday is
- A.  $290 \text{ N/mm}^2$       B.  $390 \text{ N/mm}^2$       C.  $490 \text{ N/mm}^2$       D.  $590 \text{ N/mm}^2$
28. From a circular plate of diameter D, whose centre is C, another circular plate of diameter AC is cut, removed and kept over CB (in the given figure). The thickness of the plate is uniform. The shift of the centroid due to this operation will be
- A.  $D/4$  to the left of C  
 B.  $D/8$  to the right of C  
 C.  $D/4$  to the right of C  
 D.  $3D/8$  to the right of C
29. Consider the following statements :1. Infiltration galleries are placed along the river beds at a depth of 4 to 6 m.2. The draw-down for the infiltration galleries is more than that for radial wells.3. Clogging of

- pipe pores in infiltration galleries is less than that for radial wells.4. The cost of extracting unit volume of water is more in case of infiltration galleries as compared to radial wells. Which of the statements given above is/are correct ?  
A. 1 and 2    B. 1, 2 and 3    C. 2, 3 and 4    D. 4 only
30. What is the actual ground area covered by a 20 cm x 20 cm size vertical aerial photograph, at an average scale of 1 cm = 200 m having 60% forward overlap and 30% side overlap ?  
A. 1.92 km<sup>2</sup>    B. 4.48 km<sup>2</sup>    C. 6.72 km<sup>2</sup>    D. 2.88 km<sup>2</sup>
31. Non-collodial liquids are :  
A. Newtonian fluids  
B. Plastic fluids  
C. ideal fluids  
D. dilatant fluids
32. Consider the following statements with respect to tunnelling methods:1. Full face excavation is suitable for small size tunnel of short length in compact rock. It is not suitable in urban areas.2. Heading and Benching method is suitable for soft rock tunnelling of medium size.3. Drift method is suitable for large tunnels in difficult or incompetent rock. Which of the statements given above are correct ?  
A. 1 and 3    B. 1, 2 and 3    C. 2 and 3    D. 1 and 2
33. For excavating utility trenches with precise control of depth the excavation equipment used is:  
A. Hoe  
B. Shovel  
C. Dragline  
D. None of the above
34. Sewage sickness is a term used for  
A. persons who become sick after drinking polluted water  
B. a treatment plant which does not function properly  
C. a stream where the flora and fauna die due to sewage inflow  
D. the condition of land where sewage is applied continuously for a long period.
35. Which one of the following conditions is a typical characteristic of critical flow (symbols have the usual meanings)  
A.  $\frac{Q^2 T}{g A^3} = 1$     B.  $\frac{Q T^2}{g A^3} = 1$     C.  $\frac{Q^2}{g A^3} = 1$     D.  $\frac{Q^2 T^2}{g A^3} = 1$
36. Consider the following statements- with reference to a continuous beam supported at A, C and E for which the shear force diagram

is shown in the given figure. There is 1. a concentrated load acting at point B 2. a concentrated load acting at point D 3. a uniformly distributed load acting on the portion CE. Of these statements:

- A. 1, 2 and 3 are correct
  - B. 1 and 2 are correct
  - C. 2 and 3 are correct
  - D. 1 and 3 are correct
37. A bullet of mass 0.01 kg moving with a velocity of 401 m/s strikes a block of mass 4 kg which is free to move in the direction of the bullet, and gets embedded in it. The overall loss of kinetic energy is  
A. 80.2 Nm      B. 401 Nm      C. 802 Nm      D. 1604 Nm
38. A Treadle bar is used for  
A. Interlocking points and signal  
B. Setting points and crossings  
C. Setting marshalling yard signals  
D. track maintenance
39. A vehicle is moving up an incline when the driver applies its brakes and the vehicle retards at  $0.5 \text{ m/s}^2$ . Then according to D'Alembert's principle  
A. inertia force will be directed in the direction of motion  
B. inertia force will be directed opposite to the direction of motion  
C. magnitude of the inertia force will depend on the angle of inclination  
D. magnitude of the inertia force will depend on coefficient of friction between the wheels and the road surface
40. Consider the following statements : A : The load factor for live load is greater than that for dead load. R : The live loads are more uncertain than dead loads. Of these statements :  
A. Both A and R are true and R is the correct explanation of A  
B. Both A and R true but R is not a correct explanation of A  
C. A is true but R is false  
D. A is false but R is true
41. According to Boussinesq's theory, the vertical stress at a point in a semi-infinite soil mass depends upon  
A. point load, coordinates of the point and modulus of elasticity of soil  
B. point load, coordinates of the point, modulus of elasticity of soil and its Poisson's ratio  
C. point load and coordinates of the point



- D. point load, coordinates of the point, modulus of elasticity of soil and its density.
42. A star is observed at its western elongation. If the latitude of place of observation is  $\theta$ , the declination of star is  $\delta$ , altitude of star at elongation is  $\alpha$ , then the hour angle of star is given by
- $\cos H = \cos \delta \cdot \sec \theta$
  - $\cos H = \tan \theta \cdot \cot \delta$
  - $\cos H = \tan \theta \cdot \cot \alpha$
  - $\cos H = \tan \delta \cdot \cot \theta$
43. For the simply supported beam in the figure, C is the centre of the span. C is also the point through which the resultant of the column load W passes. The column rests on the beam over a small length symmetrically on either side of C. What is the shearing force at C ?
- $W/2$
  - $W/4$
  - $W$
  - 0
44. A 20 m chain was found to be 10 cm too long after chaining a distance of 2000 m. It was found to be 18 cm too long at the end of the day's work after chaining a total distance of 4000 m. What is the true distance if the chain was correct before the commencement of the day's work ?
- 3962 m
  - 4019 m
  - 3981 m
  - 4038 m
45. Timber can be made reasonably fire-resistant by
- soaking it in Ammonium Sulphate
  - coating with Tar paint
  - pumping creosote oil into timber under high pressure
  - seasoning process
46. A jet of water issues from a 5 cm diameter nozzle, held vertically upwards, at a velocity of 20 m/sec. If air resistance consumes 10% of the initial energy of the jet, then it would reach a height, above the nozzle, of
- 18.35 m
  - 19.14 m
  - 19.92 m
  - 20.00 m
47. A given material has Young's modulus E, modulus of rigidity G and Poisson's ratio of Young's modulus to modulus of rigidity of this material is,
- 3.75
  - 3
  - 2.5
  - 1.5
48. The force in the member BD of the truss shown in the given figure is
- 4 kN tensile
  - 4 kN compressive
  - zero
  - 12 kN compressive

49. Which of the following instruments have both horizon glass and index glass ?1. Optical square2. Line ranger3. Box sextant4. PedometerSelect the correct answer using the code given below :  
A. 2, 3 and 4      B. 1, 3 and 4      C. 1 and 3 only      D. 2 and 4 only
50. Which of the following equations are used for the derivation of the differential equation for water surface profile in open channel flow :1. Continuity equation2. Energy equation3. Momentum equationSelect the correct answer using the codes given below :  
A. 1, 2 and 3      B. 1 and 3      C. 2 and 3      D. 1 and 2

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	A	C	C	C	D	A	B	D	C
10	A	C	D	C	B	A	B	C	B	A
20	A	D	C	C	B	B	C	B	C	B
30	C	A	A	D	A	D	C	A	A	B
40	C	B	D	B	D	A	C	B	C	A

## Section 17

- If the difference of height between two points is 1 m and the slope distance between them is 100 m, then accuracy of slope correction determination could be 1 in 1, 00, 000, provided the heights are measured with an accuracy of  
A.  $\pm 0.1$  cm    B.  $\pm 0.5$  cm    C.  $\pm 1.0$  cm    D.  $\pm 5.0$  cm
- Which one of the following is a method of extending the length of record for a frequency curve at a station ?  
A. Double Mass Curve method  
B. The Station Year method  
C. Thiessen method  
D. Isohyetal method
- Consider the following statements regarding a simply supported beam subjected to a uniformly distributed load over the entire span :1. The bending moment is maximum at the central position.2. The shear force is zero at the central position.3. The slope is maximum at the middle position.Of these statements :  
A. 1, 2 and 3 are correct  
B. 1 and 2 are correct  
C. 2 and 3 are correct  
D. 1 and 3 are correct
- Given that:  $d$  = effective depth,  $b$  = width and  $D$  = overall depth.The maximum area of compression reinforcement in a beam is  
A.  $0.04 bd$     B.  $0.04 bD$     C.  $0.12 bd$     D.  $0.12 bD$
- Which one of the following is not a standard spike for railways ?  
A. Dog spike    B. Cat spike    C. Screw spike    D. Round spike
- A column section as indicated in the given figure is loaded with a concentrated load at a point 'F' so as to produce maximum bending stress due to eccentricities about  $xx$  axis and  $yy$  axis as  $5 \text{ t/m}^2$  and  $8 \text{ t/m}^2$  respectively. If the direct stress due to loading is  $15 \text{ t/m}^2$  (compressive), then the intensity of resultant stress at the corner 'B' of the column section is  
A.  $2 \text{ t/m}$  (compressive)  
B.  $12 \text{ t/m}$  (compressive)  
C.  $18 \text{ t/m}^2$  (tensile)  
D.  $28 \text{ t/m}^2$  (compressive)
- A vertical gate  $6 \text{ m} \times 6 \text{ m}$  holds water on one side with the free surface at its top. The moment about the bottom edge of the gate of the water force will be ( $\gamma$  is the specific weight of water)  
A.  $18 \gamma$     B.  $36 \gamma$     C.  $72 \gamma$     D.  $216 \gamma$

8. A beam of square beam is given by section 'a' is used with its diagonal horizontal. The modulus of section of the
- A.  $\frac{a^4}{6\sqrt{2}}$       B.  $\frac{a^4}{12\sqrt{2}}$       C.  $\frac{a^3}{6\sqrt{2}}$       D.  $\frac{a^3}{12\sqrt{2}}$
9. An isosceles triangular plate of base 3 m and altitude 3 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate coincides with the free surface of oil. The centre of pressure will lie at a distance of (from free surface)
- A. 2.5 m      B. 2 m      C. 1.5 m      D. 1 m
10. Consider the following statements regarding the swedish circle method of analysing stability of slopes :1. It is a general method of analysing stability of slopes.2. It satisfied only the overall moment equation of equilibrium.3. It considers the forces action on the sides of individual slices.4. It gives a factor of safety which are on the safeside.Of the statements :
- A. 1, 2 and 3 are correct  
B. 1, 2 and 4 are correct  
C. 2, 3 and 4 are correct  
D. 1, 3 and 4 are correct
11. A pin-jointed truss is loaded as shown in the given figure. The force in member CE is
- A. 10 tonnes tensile  
B. 10 tonnes compressive  
C. 5 tonnes tensile  
D. 5 tonnes compressive
12. What type of noise can be abated by providing lining on walls and ceiling with sound absorbing material?
- A. Source noise  
B. Reflection noise  
C. Structural noise  
D. Direct air-borne noise
13. Which of the following treatment(s) will be indicated for a rural water supply from a deep groundwater source ?1. Sedimentation.2. Alum dosage.3. Potassium permanganate dosing.4. Bleaching powder application.Select the correct answer using the codes given below :
- A. 1, 2 and 3      B. 1, 2 and 4      C. 3 and 4      D. 4 alone
14. Maximum gross take-off weight of an aircraft is
- A. equal to the maximum structural landing weight  
B. less than the maximum structural landing weight

- C. more than the maximum structural land weight  
 D. equal to the empty operating weight plus the payload
15. For a circular column having its ends hinged, the slenderness ratio is  
 160. The  $l/d$  ratio of the column is  
 A. 80      B. 57      C. 40      D. 20
16. A simply supported beam of span 'l' is loaded (as shown in the given figure) with a uniformly varying load of intensity  $w_1$ /unit length at 'A' to  $w_2$ /unit length at 'B'. A The shear force at the support 'B' is given by  
 A.  $\frac{(w_1 + w_2) l}{3}$       B.  $\frac{(w_1 + w_2) l}{6}$       C.  $\frac{w_1 l}{6} + \frac{w_2 l}{3}$       D.  $\frac{w_1 l}{3} + \frac{w_2 l}{6}$
17. In the PERT analysis, which one of the following is followed by the time estimate of activities and probability of either occurrence ?  
 A. Normal distribution  
 B. Poisson's distribution  
 C.  $\beta$  - distribution  
 D. Binomial distribution.
18. The cable for a prestressed concrete simply supported beam subjected to uniformly distributed load over the entire span should ideally be :  
 A. placed at the centre of cross-section over the entire span  
 B. placed at some eccentricity over the entire span  
 C. varying linearly from the centre of cross-section at the ends to maximum eccentricity at the middle section  
 D. parabolic with zero eccentricity at the ends and maximum eccentricity at the center of the span
19. The effort 'P' to be applied horizontally to pull a weight 'W' on a plane inclined at an angle  $\alpha$  with the horizontal is given by ( $\tan \theta$  is the coefficient of friction)  
 A.  $P = W \tan (\alpha + \theta)$   
 B.  $P = W \tan (\alpha - \theta)$   
 C.  $P = \frac{W \sin(\alpha + \phi)}{\cos(\alpha - \phi)}$   
 D.  $P = \frac{W \sin(\alpha - \phi)}{\cos(\alpha + \phi)}$
20. If two triangulation signals of 6.75 m height each, are to be just visible over ground mutually, what is the maximum distance between their locations on the ground surface ?  
 A. 10 km      B. 20 km      C. 30 km      D. 40 km

21. The approximate proportion of dry cement mortar required for brick work is  
A. 60%    B. 45%    C. 30%    D. 10%
22. The waste stabilization ponds can be  
A. aerobic  
B. anaerobic  
C. facultative  
D. any of the above
23. The changes that take place during the process of consolidation of a saturated clay would include  
A. an increase in pore water pressure and an increase in effective pressure  
B. an increase in pore water pressure and a decrease in effective pressure  
C. a decrease in pore water pressure and a decrease in effective pressure  
D. a decrease in pore water pressure and an increase in effective pressure
24. Consider the following statements :1. Water hammer can develop in an unsteady flow only.2. Time required for rapid closure of valve is between  $2L/C$  and  $4L/C$  where  $L$  is the pipe length and  $C$  is the celerity of wave.3. In flexible water column theory, pipe may expand and water may compress in the flow system.4. Joukowsky has carried out the mathematical analysis of water hammer. Which is the above statements relating to water hammer in pipes are correct ?  
A. 1, 2 and 3    B. 1, 2 and 4    C. 2, 3 and 4    D. 1, 3 and 4
25. It is required to determine by periodical soundings, the rate at which silting or scouring is taking place in a harbour. Which one of the following methods is best suited for locating the positions of the soundings?  
A. Range and time intervals  
B. Two angles from the boat  
C. Tachometric observations  
D. Intersecting ranges
26. For the motion represented by the graph shown in the given figure, the numerical value of velocity, when acceleration will be  
A. 1 m/sec    B. 2 m/sec    C. 3 m/sec    D. 4 m/sec
27. A star is observed at its upper culmination when it is north of zenith. The latitude of the place of observation is  $30^\circ\text{N}$  and declination of the

star is  $50^\circ\text{N}$ . The zenith distance of the star is

A.  $10^\circ$     B.  $20^\circ$     C.  $40^\circ$     D.  $80^\circ$

28. For flow under a sluice gate where the upstream depth is 1.2 m and the depth at vena contracta is 0.3 m, the discharge per meter width would be nearly  
A.  $0.36 \text{ m}^3$     B.  $1.5 \text{ m}^3$     C.  $1.7 \text{ m}^3$     D.  $4.0 \text{ m}^3$
29. At what value of saturation does the zero air voids curve in a compaction test represent the dry density?  
A. 0%    B. 80%    C. 100%    D. 50%
30. Which steel member section among the following combinations can carry maximum load ?  
A. A pair of angles welded on opposite sides of a gusset plate, but not tack welded  
B. A pair of angles welded on opposite sides of a gusset plate, and tack welded along its length.  
C. A pair of angles back to back on same side of a gusset plate, and tack welded.  
D. A pair of angles on same side of a gusset plate, but not tack welded
31. The saturated and dry densities of a soil are respectively  $2000 \text{ kg/m}^3$  and  $1500 \text{ kg/m}^3$ . The water content (in percentage) of the soil in the saturated state would be  
A. 25    B. 33.33    C. 50    D. 66.66
32. The beam ABC shown in the given figure is horizontal. The distance to the point of contraflexure from the fixed end 'A' is  
A. 0.333 m    B. 0.666 m    C. 0.25 m    D. 0.75 m
33. A horizontal beam is hinged at 'R' and supported on rollers at the end 'S'. It carries inclined loads. To determine the support reactions, the funicular polygon  
A. must start only from the support 'S'  
B. must start only from the support 'R'  
C. could start only from anywhere on the vertical line through 'S'  
D. could start from anywhere between 'R' and 'S'
34. A timber beam of rectangular section 100 mm x 50 mm is simply supported at the ends, has a 30 mm x 10 mm steel strip securely fixed to the top surface as shown in the given figure. The centroid of the "Equivalent timber beam" in this case from the top surface  
A. is 5 mm  
B. is 30 mm

- C. is 15 mm  
D. cannot be predicted
35. What is eutrophication of lakes primarily due to ?  
A. Multiplication of bacteria  
B. Excessive inflow of nutrients  
C. Increase in benthic organisms  
D. Thermal and density currents
36. Given that ' $\phi$ ' is the angle of internal friction, ' $p$ ' is the safe bearing capacity and  $\gamma$  is the unit weight of soil, the minimum depth of foundation of a masonry footing is given by  
A.  $\frac{p}{\gamma} \left( \frac{1 + \sin \phi}{1 - \sin \phi} \right)$  B.  $\frac{p}{\gamma} \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)$  C.  $\frac{p}{\gamma} \left( \frac{1 + \sin \phi}{1 - \sin \phi} \right)^2$  D.  $\frac{p}{\gamma} \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$
37. Which one of the following can be a set of velocity components of a two-dimensional flow ?  
A.  $u = x + y$  and  $v = x^2 + y^2$   
B.  $u = x + y$  and  $v = x - y$   
C.  $u = xy$  and  $v = \frac{x}{y}$   
D.  $u = x^2 + y^2$  and  $v = x^2 - y^2$
38. When is a soil mass said to have entered the solid phase ?  
A. When loss in water is not accompanied by a corresponding reduction in the volume of soil mass  
B. When reduction in the volume of the soil mass is nearly equal to the volume of water lost.  
C. When the soil mass becomes brittle  
D. When the soil mass shows a small shearing resistance as the water content is reduced.
39. A centrifugal pump is required to lift 2.8 cu.m.s of water to a height of 7.5 m. If the total loss of head in the pipe system is 0.25 m and the efficiency of the pump is 80%, then the brake horse power will be  
A.  $\frac{1000 \times 2.8 \times 7.5 \times 0.8}{75}$  B.  $\frac{1000 \times 2.8 \times 7.75}{0.8}$  C.  $\frac{1000 \times 2.8 \times 7.75}{0.8 \times 75}$   
D.  $\frac{1000 \times 2.8 \times 7.5}{0.8}$
40. Which among the following assumptions are made in the design roof trusses ?  
1. Roof truss is restrained by the reactions  
2. Axes of the members meeting at a joint intersect at a common point  
3. Riveted joints act as frictionless hinges  
4. Loads act normal to roof surface  
Select



the correct answer using the codes given below:

A. 1, 2 and 4      B. 2, 3 and 4      C. 1, 3 and 4      D. 1, 2 and 3

41. A ladder AB of weight  $W$  and length  $l$  is held in equilibrium by a horizontal force  $P$  as shown in the figure given above. Assuming the ladder to be idealized as a homogeneous rigid bar and the surfaces to be smooth, which one of the following is correct ?

A.  $P = \frac{1}{2} W \tan \theta$

B.  $P = \frac{1}{2} W \operatorname{cosec} \theta$

C.  $P = \frac{1}{2} W \cos \theta$

D.  $P = 2 W \cos \theta$

42. In the structure shown in the given figure, the fixed end moment at joint 'A' is

A.  $PL/16$       B.  $5PL/48$       C.  $7PL/64$       D.  $PL/8$

43. Wearing locations of rails and their reasons are listed below :  
 1. Wear at end of rails : Loose fish bolts  
 2. Wear at sides of rail head : Constant rake application  
 3. Wear on the top of rail head on tangent track : Rigidity of wheel base  
 4. Wear on top of rail head on curves : Lesser area of contact between wheel and rail  
 Which of the pairs given above are correctly matched ?

A. 1 and 4      B. 1 and 2      C. 2 and 3      D. 1, 2, 3 and 4

44. The cleaning of slow sand filter is done by

A. reversing the direction of flow of water  
 B. passing air through the filter  
 C. passing a solution of alum and lime through the filter  
 D. scraping off the top layers of sand and admitting water

45. In the plane truss shown above, how many members have zero force?

A. 3      B. 5      C. 7      D. 9

46. In a laminar boundary layer, the velocity distribution can be assumed to be given, in usual notations, as  
 Which one of the following is the correct expression for the displacement thickness  $\delta^*$  for this boundary layer ?

A.  $\delta^* = \delta$       B.  $\delta^* = \delta/2$       C.  $\delta^* = \delta/4$       D.  $\delta^* = \delta/6$

47. In a plate load test, how is the ultimate load estimated from the load settlement curve on a log-log graph ?

A. Directly  
 B. By drawing tangents to the curve at the initial and final points  
 C. By the secant method

- D. At 0.2 percent of the maximum settlement
48. The standard Proctor compaction curve of a clay is depicted in the above figure. Points A, B and C correspond to three compaction states of the soil, which fall on this curve. For which point(s) is the coefficient of permeability minimum ?  
 A. A and C      B. A      C. B      D. C
49. In which one of the following grades of a highway is an emergency escape ramp provided ?  
 A. 1 in 200      B. Zero grade      C. Downgrade      D. Upgrade
50. Ratio of the width of the car parking area required at kerb for 30° parking relative to 60° parking is approximately  
 A. 0.5      B. 0.7      C. 0.8      D. 2.0

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	B	B	B	B	A	D	C	C	D
10	B	B	D	C	C	C	C	D	A	B
20	C	D	D	C	D	A	B	B	C	B
30	B	A	B	B	B	D	B	A	C	B
40	A	B	D	D	C	B	A	C	C	D

**Explanation**

22. Waste or Wastewater Stabilization Ponds (WSPs) are large, man-made water bodies in which blackwater, greywater or faecal sludge are treated by natural occurring processes and the influence of solar light, wind, microorganisms and algae . The ponds can be used individually, or linked in a series for improved treatment. There are three types of ponds, (1) anaerobic, (2) facultative and (3) aerobic (maturation), each with different treatment and design characteristics.

Source: <https://www.sswm.info/node/8199> 44.

A small biological sand filter (slow sand filter or Biosand filter) is maintained or cleaned by actively managing only the top 5 cm of sand. This top layer is either removed and replaced when the flow rate becomes unacceptable (typically 4 to 6 months) with clean sand or "wet harrowed" meaning the sand is gently agitated causing partial break up of the biological surface. This may be slightly different for a very large slow sand filter; more sand and more work.

A rapid sand filter is maintained and cleaned by forcefully injecting water backwards through the entire sand bed every 2 or 3 days. Backwashing a biological sand filter will destroy it and may result in people getting very sick if water from it is being consumed.

## Section 18

1. An equipment is purchased for Rs. 40, 000.00 and is fully depreciated by straight line method over 8 years. Considering interest on average annual cost at 15% p.a., the charge on the Company due to use of this equipment, if made uniformly over the 8 years, is  
A. Rs. 5, 750      B. Rs. 8, 000      C. Rs. 8, 375      D. Rs. 14, 000
2. A vane shear test on a soil sample gives a moment of total resistance  $M$ . The shear stress at failure, 'S' being more or less uniform at top bottom and surface of cylinder of soil is given by (where  $H$  = height of vane,  $D$  = Diameter of vane)

$$\begin{array}{llll} \text{A. } S = \frac{2M}{\pi D^2 H} & \text{B. } S = \frac{2M}{\pi D^2 (H + D)} & \text{C. } S = \frac{2M}{\pi D^2 \left[ \frac{H + D}{3} \right]} & \text{D. } S = \frac{2M}{\pi DH} \end{array}$$

3. The most important purpose of frog in a brick is to :  
A. emboss manufacturer's name  
B. reduce the weight of brick  
C. form keyed joint between brick and mortar  
D. improve insulation by providing 'hollows'.
4. Gross flange area for a riveted plate girder is to be designed considering net area as 80% of its gross area. Consider width of the flange as 500 mm while web plate as 1000 mm x 12 mm. The girder is to resist a maximum BM of 4500 kNm. Maximum allowable bending stress in tension is 150 MPa. Gross flange area is  
A. 22000 mm<sup>2</sup>      B. 35500 mm<sup>2</sup>      C. 46000 mm<sup>2</sup>      D. 73000 mm<sup>2</sup>
5. Uniformity coefficient of filter sand is given by :  
A.  $D_{50}/D_{10}$       B.  $D_{50}/D_{10}$       C.  $D_{60}/D_{10}$       D.  $D_{60}/D_{10}$
6. For the compound bar shown in the below figure, the ratio of stresses in the portions AB : BC : CD will be  
A. 4 : 1 : 2      B. 1 : 2 : 4      C. 1 : 4 : 2      D. 4 : 2 : 1
7. Compression index of a soil helps to determine  
A. total time required for consolidation  
B. time required for 50 percent consolidation  
C. total settlement of clay water  
D. pre-consolidation pressure of clay

8. At what distance from left support of the beam, is the shear force zero ?  
 A. 1 m      B. 1.25 m      C. 1.5 m      D. 2.5 m
9. What is the volume of a 6 m deep tank having rectangular shaped top 6 m x 4 m and bottom 4 m x 2 m (computed through the use of prismoidal formula) ?  
 A.  $96 \text{ m}^3$       B.  $94 \text{ m}^3$       C.  $92 \text{ m}^3$       D.  $90 \text{ m}^3$
10. Why are intermediate vertical stiffeners provided in plate girders ?  
 A. To eliminate web buckling  
 B. To eliminate local buckling  
 C. To transfer concentrated loads  
 D. To prevent excessive deflection.
11. Under load, the void ratio of a submerged saturated clay decreases from 1.00 to 0.92. What will be the ultimate settlement of the 2 m thick clay due to consolidation ?  
 A. 20 mm      B. 40 mm      C. 80 mm      D. 160 mm
12. Ultimate strength of cement is influenced by which one of the following ?  
 A. Tricalcium silicate  
 B. Dicalcium silicate  
 C. Tricalcium aluminate  
 D. Tetracalcium alumino-ferrite
13. Among the following, which is/are not pre-treatment unit (s) ?  
 A. Bar screen and grit chamber  
 B. Flow equalization and proportioning tank  
 C. Neutralization for pH adjustment tank  
 D. Nutrient removal tank
14. A solid sphere will be in stable equilibrium if its centre of gravity lies  
 A. vertically above its geometric centre  
 B. vertically below its geometric centre  
 C. on the horizontal line through its centre  
 D. at the centre
15. The reaction at B due to the load as shown the given figure is  
 A.  $\frac{W}{3}$       B.  $\frac{W}{2}$       C.  $2 W$       D.  $3 W$
16. If 'p' is the precipitation, 'a' is the area represented by a rainguage, and n is the number of raingauges in a catchment area, then the weighted

mean rainfall is

- A.  $\frac{\sum ap^3}{\sum a^2}$     B.  $\frac{\sum ap}{n}$     C.  $\frac{\sum ap}{ap}$     D.  $\frac{\sum ap^5}{\sum a^3}$

17. For the beam shown in the given figure, the maximum positive bending moment is equal to negative bending moment. The value of L1 is

- A.  $\frac{L}{\sqrt{2}}$     B.  $\frac{L}{\sqrt{3}}$     C.  $\frac{L}{2}$     D.  $\frac{L}{2\sqrt{2}}$

18. A plane pin-jointed truss is shown in the figure. The force resisted by the member AD is

- A. zero  
B. 5002 kg. (compression)  
C. 5002 kg. (tension)  
D. 10002 kg. (tension)

19. In the figure shown aside, which one of the following correctly represents effective stress at C ? (Symbols have the usual meanings).

- A.  $(h + z)\gamma - \omega$   
B.  $z.\gamma - \omega$   
C.  $z.\gamma - \text{sub}$   
D.  $h.\gamma - \omega + Z.\gamma_{sat}$

20. What is range of values of Poisson's ratio for ductile materials ?

- A. 0.10 to 0.15    B. 0.16 to 0.20    C. 0.21 to 0.24    D. 0.25 to 0.33

21. What is the magnitude of the resultant of parallel force system as shown in the figure ?

- A. 70 kNm  
B. zero  
C. 70 KNm couple anti clock wise  
D. 90 KN vertical force and a moment of 70 kNm clock wise.

22. A rod shown in the given figure is such that the lower part is made of steel and the upper part is made of copper. Both the ends of the rod are rigidly clamped. If an axial force P is applied at the junction of the two metals, given that the ratio  $E_{\text{steel}}/E_{\text{copper}}$  is equal to 2, then the force in the copper rod would be

- A.  $P/5$  tension  
B.  $P/3$  tension  
C.  $P/3$  compression  
D.  $P/5$  compression

23. 'Air binding' may occur in  
 A. Sewers      B. Artesian well      C. Aerator      D. Filter
24. For a vertical concentrated load acting on the surface of a semi-infinite elastic soil mass, the vertical normal stress at depth  $z$  is proportional to  
 A.  $z$       B.  $z^2$       C.  $z^3$       D.  $1/z^2$
25. Presence of nitrogen in waste water sample is due to the decomposition of  
 A. Carbohydrates      B. Proteins      C. Fats      D. Vitamins
26. The effective length of a fillet weld of length ' $L$ ' and size ' $s$ ' is given by  
 A.  $L - s$       B.  $L - 2s$       C.  $L - \frac{s}{\sqrt{2}}$       D.  $L$
27. Two reservoirs are connected by two pipes A and B of same length in series. If the diameter of A is 30% larger than that of B, what is the ratio of head loss in A to that of B ?  
 A. 0.77      B. 0.59      C. 0.50      D. 0.27
28. A smooth sphere of weight  $W$  is supported in contact with a smooth vertical wall by a string fastened to a point on its surface, the other end being attached to a point in the wall as shown in the given figure. If the length of the string is equal to the diameter of the sphere, then the tension in the string and the reaction of the wall respectively will be  
 A.  $4W/3, 2W/3$   
 B.  $2W/3, W/3$   
 C.  $5W/3, W/3$   
 D.  $3W/3, W/3$
29. In an external focussing tacheometer, the fixed interval between the stadia hairs is 5 mm; the focal length of the objective is 25 cm ; and the distance of the vertical axis of the instrument from the optical centre of the objective is 15 cm. The constants of the tacheometer are  
 A. 50 ; 0.40 m      B. 50 ; 0.25 m      C. 100 ; 0.40 m      D. 30 ; 0.10 m
30. On a single rail track, goods trains loaded with heavy iron material run starting from A to B and then empty wagons run from B to A. The amount of creep in the rails  
 A. will be more in the direction of B to A  
 B. will be more in the direction of A to B  
 C. will be maximum in the direction of A and B  
 D. cannot be determined from the given data

31. What is the value of camber rate that should be provided in case of WBM pavement surface in an area of heavy rainfall ?  
 A. 1 in 30      B. 1 in 48      C. 1 in 60      D. 1 in 72
32. In the given figure, the latitude of the place of observation will be equal to declination of the star plus its co-altitude when the position of the star on the meridian is between  
 A. horizon and Pole  
 B. horizon and equator  
 C. equator and zenith  
 D. Pole and zenith
33. The following are the sewage treatment processes :1. Primary sedimentation2. Screening3. Grit removal4. Secondary sedimentation. When only preliminary treatment is to be given for sewage, select the required treatment processes including their correct sequence from the codes given below:  
 A. 2, 3      B. 2, 3, 1      C. 1, 2, 3, 4      D. 3, 1, 2, 4
34. Consider the AoA network of a project shown in the given figure. (Activities are designated by alphabets and durations are shown around the stem of the arrow.) The critical path will be  
 A. 1-2-3-6-7-8      B. 1-2-3-5-7-8      C. 1-2-4-5-7-8      D. 1-2-4-6-7-8
35. Consider the following statements regarding the working stress design of under-reinforced RC sections:1. The neutral axis depth will be greater than that of a balanced section2. The stress in steel in tension will reach its maximum permissible value first3. The moment of resistance will be less than that of the balanced section4. The concrete on the tension side is also to be considered for calculating the moment of resistance of the section. Of these statements :  
 A. 1 and 2 are correct  
 B. 1 and 4 are correct  
 C. 3 and 4 are correct  
 D. 2 and 3 are correct
36. The force in member FD in the given figure is  
 A. 50 kN compression  
 B. 50 kN tension  
 C. 150 kN tension  
 D. 100 kN compression
37. The ratio of the flexural strengths to two beams of square cross-section, the first beam being placed with its top and bottom sides horizontally and the second beam being placed with one diagonal horizontally, is  
 A. 3      B. 1/3      C. 1/2      D. 2

38. The standard plasticity chart to classify fine grained soils is shown in the given figure. The area marked 'X' represents
- silt of low plasticity
  - clay of high plasticity
  - organic soil of medium plasticity
  - clay of intermediate plasticity
39. Which one of the following statements is correct ? In the lime-soda process of water softening
- lime reduces carbonate hardness while soda removes non-carbonate hardness
  - only carbonate hardness is removed
  - lime reduces non-carbonate hardness while soda removes carbonate hardness
  - Only non-carbonate hardness is removed.
40. In standard penetration test, the splitspoon sampler is penetrated into the soil stratum by giving blows from a drop weight whose weight (in kg) and free fall (in cm) are, respectively,
- 30 and 60
  - 60 and 30
  - 65 and 75
  - 75 and 65
41. The following data pertain to a waste-water sample :Initial D.O. = 8 mg/lFinal D.O. = 2 mg/lDilution = 1%.The B.O.D. of the given wastewater sample is
- 600 mg/l
  - 6 mg/l
  - 0.6 mg/l
  - 1 mg/l
42. If  $p$  is the specific gravity of the material used in the design of a masonry dam of triangular section, then the ratio between the height and base width of the dam for structural safety and stability is equal to
- $2p$
  - $p$
  - $1/p$
  - $1/p$
43. Consider the following statements relating to the stability of floating as well as submerged bodies :1. A submerged body is stable when the centre of gravity is below the centre of buoyancy.2. A floating body is stable when the centre of gravity is above the centre of buoyancy.3. A floating body is stable when the centre of gravity is below the meta-centre.4. A submerged body is in stable equilibrium when the centre of gravity coincides with the centre of buoyancy.Of these statements :
- 1, 2 and 3 are correct
  - 2, 3 and 4 are correct
  - 1, 2 and 4 are correct
  - 1, 3 and 4 are correct
44. A vehicle was stopped in two seconds by fully jamming the brakes. The skid marks measured 9.8 metre's. The average skid resistance



coefficient will be

A. 0.7      B. 0.5      C. 0.4      D. 0.25

45. Consider the following statements pertaining to intermediate stiffeners :1. Stiffeners are provided to exclusively bear concentrated loads.2. Stiffeners should bear tightly against top and bottom flanges.3. Maximum spacing of stiffeners is restricted  $180t$ , where  $t$  is the thickness of web.Which of the statements given above is are/correct ?  
A. 1, 2 and 3      B. 1 and 2 only      C. 3 only      D. 2 only
46. A brick masonry wall of nominal thickness 200 mm carries an axial load of 26 kN/m and another load of 19 kN/m acting at an eccentricity of 45 mm. The resultant eccentricity and eccentricity ratio are respectively  
A. 19 mm, 0.095      B. 19 mm, 1.00      C. 22 mm, 1.10      D. 24 mm, 1.20
47. What is the correct sequence of formation of the following compounds during chlorination of water in which ammonia is present ?1.  $\text{NCl}_3$  2.  $\text{NH}_2\text{Cl}$ 3.  $\text{NHCl}_2$ Select the correct answer using the codes given below:  
A. 1, 2, 3      B. 2, 3, 1      C. 3, 1, 2      D. 2, 1, 3
48. Which one of the following statements is not correct ?  
A. Settling and sludge digestion occur in septic tanks in one compartment  
B. Settling and sludge digestion occur in Imhoff tank in different compartments  
C. Septic tank is a low-rate anaerobic unit whereas an Imhoff tank is a high rate anaerobic unit  
D. The rate of sludge accumulation in septic tank is approximately 40-70 litres/capita/year
49. In a project logic, four activities M, N, O and P are required to be completed before starting activity Q. If the finish times of M, N, O and P are 12 days, 14 days, 15 days and 17 days respectively, the earliest event occurrence time for the activity Q is  
A. 12 days      B. 14 days      C. 15 days      D. 17 days
50. A square column section of size 350 mm is 350 mm is reinforced with four bars of 25 mm diameter and four bars of 16 mm diameter. Then the transverse steel should be :  
A. 5 mm dia @ 240 mm c/c  
B. 6 mm dia @ 250 mm c/c  
C. 8 mm dia @ 250 mm c/c  
D. 8 mm dia @ 350 mm c/c

<b>Answer Key</b>		1	2	3	4	5	6	7	8	9	0
	0	C	C	C	B	D	C	D	C	C	A
	10	C	B	A	B	A	C	D	C	D	B
	20	C	A	D	D	B	B	D	B	A	B
	30	A	B	B	B	D	B	D	D	A	C
	40	A	B	D	B	C	A	B	C	D	C

## Section 19

1. A rectangular channel of 2.5 m width and 2 m depth of water carries a flow of 10 m<sup>3</sup>/s. The specific energy for the flow is given by  
A. 1.18 m    B. 3.4 m/s    C. 2.0 m/s    D. 2.2 m
2. Which of the following pollutants is responsible for depletion of ozone layer ?  
A. Unburnt hydrocarbon  
B. UV rays  
C. Chlorofluoro carbons  
D. Oxides of nitrogen
3. If a composite bar of steel and copper is heated, then the copper bar will be subjected to  
A. compression    B. shear    C. tension    D. torsion
4. Consider the following discharge measurement devices :1. Cylindrical mouthpiece flowing full2. Sharp-edged orifice3. Convergent-divergent mouthpiece4. Borda's re-entrant mouthpiece flowing freeThe correct sequence of increasing order of their discharge coefficients is  
A. 4-2-1-3    B. 4-2-3-1    C. 2-4-3-1    D. 2-4-1-3
5. A square framework formed of uniform heavy rods of equal weight joined together is hung by one corner. A weight  $W$  is suspended from each of the three lower corners and the shape of the square is preserved .with the help of a light rod along the horizontal diagonal. The thrust of the light rod is  
A.  $2 W$     B.  $3 W$     C.  $4 W$     D.  $6 W$
6. The maximum bending moment at the left quarter point of a simple beam due to crossing of UDL of length shorter than the span in the direction left to right, would occur after the load had just crossed the section by  
A. one-fourth of its length  
B. half of its length  
C. three-fourth of its length  
D. its full length
7. The formulation for BOD assimilation in a stream should include  
A. BOD rate constant  
B. Sedimentation of organic matter  
C. BOD rate constant and sedimentation of organic matter  
D. Pathogenic bacterial decay coefficient
8. A truss is shown in the given figure. The cross-sectional area of each member is 'A' and the modulus of elasticity of the material is E. The

strain energy in the member XY is given by

- A.  $P2L/2AE$     B.  $P2L/QAE$     C.  $P2L/3AE$     D. zero

9. For the simply supported beam shown in the given figure, at what distance from the support A, is the shear force zero?

- A.  $\frac{L}{4}$     B.  $\frac{L}{3}$     C.  $\frac{L}{2}$     D.  $\frac{L}{\sqrt{3}}$

10. The elements that are normally subjected to combined bending and axial forces are

- A. struts in reinforced concrete members  
B. the members in long span bridges  
C. columns in framed structures  
D. space truss members

11. A uniform simply supported beam is subjected to a clockwise moment at the left end. What is the moment required at the right end so that rotation of the right end is zero ?

- A. 2 m    B. m    C. m/2    D. m/3

12. A cylindrical bar of 20 mm diameter and 1 m length is subjected to a tensile test. Its longitudinal strain is 4 times that of its lateral strain. If the modulus of elasticity is  $2 \times 10^5$  N/mm<sup>2</sup>, then its modulus of rigidity will be

- A.  $8 \times 10^6$  N/mm<sup>2</sup>  
B.  $8 \times 10^5$  N/mm<sup>2</sup>  
C.  $0.8 \times 10^4$  N/mm<sup>2</sup>  
D.  $0.8 \times 10^5$  N/mm<sup>2</sup>

13. Clapeyron's theorem is applied to

- A. simply supported beam  
B. fixed and continuous beam  
C. propped cantilever beam  
D. continuous beam only

14. A fill having a volume of 150, 000 cm is to be constructed at a void ratio of 0.8. The borrow pit soil has a void ratio of 1.4. The volume of soil required (in cubic metres) to be excavated from the borrow pit will be

- A. 1, 87, 500    B. 2, 00, 000    C. 2, 10, 000    D. 2, 50, 000

15. A fixed beam as shown in Fig. I is loaded with a U.D.L. over the entire span, the total load being W; when load was just increased to W1, the deformed shape as shown in Fig. II was seen. The value of

W1 (plastic moment of resistance =  $M_p$ ) is

- A.  $\frac{24M_p}{L}$       B.  $\frac{16M_p}{L}$       C.  $\frac{12M_p}{L}$       D.  $\frac{8M_p}{L}$

16. The resultant of the coplanar, concurrent system of forces  $F_1$ ,  $F_2$ ,  $F_3$  and  $F_4$  shown in the above figure is
- 20kN acting vertically upwards
  - zero
  - 20 kN acting vertically downwards
  - 20 kN acting horizontally from left to right
17. During seepage through an earth mass, the direction of seepage is
- parallel to the equipotential lines
  - perpendicular to the stream lines
  - perpendicular to the equipotential lines
  - along the direction of gravity
18. Consider the following statements :The effect of sea water on hardened concrete is to
- increase its strength
  - reduce its strength
  - retard setting
  - decrease its durability.
- Of these statements :
- 1 and 3 are correct
  - 2 and 3 are correct
  - 2 and 4 are correct
  - 1 and 4 are correct
19. A doubly reinforced concrete beam has effective cover  $d'$  to the centre of compression reinforcement.  $x_u$  is the depth of neutral axis, and  $d$  is the effective depth to the centre of tension reinforcement. What is the maximum strain in concrete at the level of compression reinforcement?
- $0.0035 (1 - d'/d)$
  - $0.0035(1 - d'/x_u)$
  - $0.002(1 - d'/x_u)$
  - $0.002(1 - d'/d)$
20. By what percentage is length of a runway increased for every 300 m rise above M.S.L. ?
- 3%
  - 4%
  - 6%
  - 7%
21. The percentage of time in a year during which the cross wind component remains within the limit, is :
- Wind coverage
  - Headwind
  - Prevailing wind

- D. Cross wind
22. Consider the following statements :A concrete mixer is specified by the :1. volume of the mixing drum.2. horse power of the prime mover.3. volume of mixed concrete discharged.4. mixer drum speed.5. feeding arrangement.Of these statements :
- 1, 2 and 5 are correct
  - 1, 3 and 4 are correct
  - 3 and 5 are correct
  - 2 and 4 are correct
23. Choose the correct statement about horizontal component of resultant hydrostatic pressure on a curved submerged surface :
- It is equal to the product of pressure at the centroid and the curved area
  - It is equal to the weight of the liquid above the curved surface acting at 0.5 depth of the surface
  - It is equal to the projected area of the surface on a vertical plane multiplied by the pressure at the centre of gravity of area
  - It is equal to the weight of the liquid above the curved surface multiplied by the projected area on a vertical plane.
24. A circular area of radius 'R' on the surface of a semi-infinite soil mass is uniformly loaded with a loading intensity of 'q'. The vertical stress  $\sigma_z$  directly below its centre at a depth 'z', is given by
- $\frac{q}{z} \cdot \frac{2}{\pi} \left[ \frac{1}{1 + (R/z)^2} \right]^2$
  - $q \left[ 1 - \frac{1}{1 + (R/Z)^2} \right]^{3/2}$
  - $\frac{3q}{2\pi z^2} \left[ \frac{1}{1 + (R/Z)^2} \right]^{5/2}$
  - $\frac{q}{2\pi z} \left[ \frac{1}{1 + (R/Z)^2} \right]^{3/2}$
25. The thickness of web for unstiffened plate girder with clear distance d between the flanges shall not be less than
- $\frac{d}{200}$
  - $\frac{d}{85}$
  - $\frac{d}{100}$
  - $\frac{d}{160}$
26. A simply supported beam of span 'L' and uniform flexural rigidly EI, carries a central load 'W' and total uniformly distributed load 'W' throughout the span. The maximum deflection is given by
- $\frac{13}{96} \frac{WL^3}{EI}$
  - $\frac{5}{384} \frac{WL^3}{EI}$
  - $\frac{5}{96} \frac{WL^3}{EI}$
  - $\frac{13}{384} \frac{WL^3}{EI}$

27. In the design of storm sewers, time of concentration relevant of determine the
- rainfall intensity
  - velocity in the sewer
  - time of travel
  - area served by the sewer
28. Given that the density of earth is  $\omega$ , the angle of repose is  $\phi$  and  $h$  is the height of the wall and the earth retained is level, the active earth Pressure 'P' on retaining wall is given by
- $\frac{\omega h^2}{3} \times \frac{1 - \sin\phi}{1 + \sin\phi}$
  - $\frac{\omega h^2}{2} \times \frac{1 - \sin\phi}{1 + \sin\phi}$
  - $\frac{\omega h^2}{2} \times \frac{1 + \sin\phi}{1 - \sin\phi}$
  - $\frac{\omega h^2}{2} \times \frac{1 + \sin\phi}{1 - \sin\phi}$
29. A cantilever carries a load  $P$  at  $C$  as shown in the given figure. The deflection at  $B$  is
- $\frac{Pl^2}{2EI} (L - l)$
  - $\frac{Pl^2}{3EI} (L - l)$
  - $\frac{Pl^2}{2EI} (L + l/3)$
  - $\frac{Pl^2}{2EI} (L - l/3)$
30. As the elevation increases, the runways length has to be changed at what rate ?
- Decreased @ 5% per 300 m rise in elevation above M.S.L.
  - Increased @ 7% per 300 m rise in elevation above M.S.L.
  - Decreased @ 9% per 300 m rise in elevation above M.S.L.
  - Increased @ 15% per 300 m rise in elevation above M.S.L.
31. Which one of the following statements is correct ? In a plane truss, influence line values
- vary parabolically between panel points
  - vary exponentially between panel points
  - vary linearly between panel points
  - vary following a cubic relationship between panel points
32. In a 4 m wide rectangular channel with 0.8 m depth of flow, a sharp-crested weir of 2.5 m length with its sill 0.3 m above the channel bed is fixed symmetrically across the width of the channel. Taking the flow to be free but with end contractions, what would be the discharge neglecting approach velocity effect? (Take  $C_d = 0.625$ )
- $1.39 \text{ m}^3/\text{s}$
  - $1.42 \text{ m}^3/\text{s}$
  - $1.49 \text{ m}^3/\text{s}$
  - $1.56 \text{ m}^3/\text{s}$

33. A structural member carrying a pull of 700 kN is connected to a gusset plate using rivets. If the pulls required to shear the rivet, to crush the rivet and to tear the plate per pitch length are respectively 60 kN, 35 kN and 70 kN, then the number of rivets required will be  
A. 22    B. 20    C. 18    D. 12
34. In the cantilever truss shown in the given figure, the reaction at A is  
A. 10 t    B. 20 t    C. 30 t    D. 40 t
35. The degree of indeterminacy of the beam given in the given figure is  
A. zero    B. one    C. two    D. three
36. Following data refer to precise measurement of an angle A on the field : (i)  $2A = 20^\circ 10'$  - weight 2 (ii)  $4A = 40^\circ 10'$  - weight 3 What is the most probable value of angle A ?  
A.  $10^\circ 01' 06''$     B.  $10^\circ 02' 07''$     C.  $10^\circ 02' 51''$     D.  $10^\circ 22' 51''$
37. A torsion member is fabricated from two concentric thin tubes. At the ends, the tubes are welded to rigid discs so that both the tubes are twisted as a unit. The radius of the outer tube is  $2r$  and that of the inner tube is  $r$ . If the shear stresses developed in the outer tube is  $\tau$ , then the shear stress in the inner tube will be.  
A.  $\tau$     B.  $0.25 \tau$     C.  $0.75 \tau$     D.  $0.5 \tau$
38. Figure given below shows a fixed beam of steel: At the point of collapse, the value of load W will be  
A.  $\frac{10M_p}{L}$     B.  $\frac{15M_p}{L}$     C.  $\frac{20M_p}{L}$     D.  $\frac{25M_p}{L}$
39. A mild steel flat of width 120 mm and thickness 10 mm is bent into an arc of a circle of radius 10 m by applying a pure moment 'M' If E is  $2 \times 10^5$  N/mm<sup>2</sup>, then the magnitude of the pure moment 'M' will be  
A.  $2 \times 10^6$  N-mm  
B.  $2 \times 10^5$  N-mm  
C.  $0.2 \times 10^5$  N-mm  
D.  $0.2 \times 10^4$  N-mm
40. The deflection at the free end of a uniformly loaded cantilever of length 1 m is 7.5 mm. What is the slope at the free end ?  
A. 0.01 radian    B. 0.015 radian    C. 0.02 radian    D. 0.025 radian
41. What will be the curve lead for a 1 in 8 1/2 turnout taking off from a straight broad gauge track?  
A. 28.49 m    B. 21.04 m    C. 14.24 m    D. 7.45 m
42. A timber beam of 100 mm width and 200 mm depth is reinforced with two steel plates of 100 mm width and 5 mm thickness as shown in



figures. Which one of the following statements is correct for the same value of bending stress in the timber ?

- A. Moment of resistance in figure I will be more than that in figure II
  - B. Moment of resistance in figure II will be more than that in figure I
  - C. Moment of resistance in figure I will be equal to that in figure II
  - D. No logical comparison can be made
43. The following statements relate to the pressure exerted by a fluid on a Submerged curved surface :1. The vertical component of hydrostatic force acting on a submerged curved surface acts through the centre of volume of the fluid directly above the submerged area.2. The horizontal component of the force acting on a curved surface is the hydrostatic force acting on the vertical projection of the curved surface.3. The resultant force on a curved surface acts on the bottom of the curved surface.Of these statements :
- A. 1, 2 and 3 are correct
  - B. 2 and 3 are correct
  - C. 1 and 2 are correct
  - D. 1 and 3 are correct
44. The lost time due to starting delay on a traffic signal is noted to be 3s, the actual green time is 25s and yellow time is 3s. How much is the effective green time ?
- A. 31s    B. 28s    C. 25s    D. 22s
45. Consider the following locations of a turnout:1. Tongue rail2. Lead rail3. Toe of switch4. Crossing.Which is the correct sequence for a train to pass over the turnout from the facing direction?
- A. 3 - 1 - 2 - 4    B. 4 - 2 - 1 - 3    C. 3 - 2 - 1 - 4    D. 4 - 1 - 2 - 3
46. Which one of the following expresses the height of rise or fall of a liquid in a capillary tube ?( $w$  = Specific weight of the liquid  $\alpha$  = Angle of contact of the liquid surface  $\sigma$  = Surface tension)
- A.  $\frac{4 w d}{\sigma \cos \alpha}$     B.  $\frac{\sigma \cos \alpha}{4 w d}$     C.  $\frac{4 \sigma \cos \alpha}{w d}$     D.  $\frac{w d}{4 \sigma \cos \alpha}$
47. Given that Plasticity Index (PI) of local soil = 15 and PI of sand = zero, for a desired PI of 6, the percentage of sand in the mix should be
- A. 70    B. 60    C. 40    D. 30
48. Two closely-coiled springs A and B of the same material, same wire and same number of turns are subjected to an axial load of W. The mean diameter of spring A is half that of spring B. The ratio of deflection

of spring B to that of spring A will be

- A. 8    B. 4    C. 1/4    D. 1/8

49. A column ABCD ( $2y_1 \times 2y_2$ ) of rectangular section carries a load P at Z having the co-ordinates (x, y) as shown in the given figure. If the compressive stresses are taken as positive and area  $A = 2y_1 \times 2y_2 = 4y_1 y_2$  and the moment of inertia about x and y axis being  $I_{xx}$  and  $I_{yy}$  respectively, then the stress at the corner D is

- A.  $\frac{P}{A} + \frac{P \cdot y}{I_{xx}} \cdot y_1 + \frac{P \cdot x}{I_{yy}} \cdot y_2$     B.  $\frac{P}{A} - \frac{P \cdot y}{I_{xx}} \cdot y_1 - \frac{P \cdot x}{I_{yy}} \cdot y_2$     C.  $\frac{P}{A} + \frac{P \cdot y}{I_{yy}} \cdot y_1 + \frac{P \cdot x}{I_{xx}} \cdot y_2$   
D.  $\frac{P}{A} - \frac{P \cdot y}{I_{yy}} \cdot y_1 - \frac{P \cdot x}{I_{xx}} \cdot y_2$

50. What are leaping weirs ?

- A. sewage flow measuring devices  
B. storm regulators  
C. velocity control devices  
D. sewer out falls

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	C	A	A	C	C	A	D	D	C
10	B	D	C	B	B	B	C	C	B	D
20	A	B	C	C	B	D	A	B	D	B
30	C	D	B	C	D	C	D	C	B	A
40	A	A	C	C	A	C	B	C	B	B

## Section 20

1. Why are gate valves provided in distribution system ?
  - A. To minimize the flow pressure in the network
  - B. To maximize the usage of the distribution system
  - C. To control the flow in the pipe network
  - D. To identify the loss through illegal connections.
2. While designing the superelevation of a highway, its maximum value is fixed considering the need to
  - A. avoid toppling of slow moving vehicles in mixed traffic flow
  - B. avoid transverse skidding
  - C. provide drainage
  - D. counteract centrifugal force due to 75% of design speed
3. The map projection in which the angle between any pair of short lines is represented correctly is called
  - A. conformal projection
  - B. equidistant projection
  - C. azimuthal projection
  - D. equal area projection
4. At a Tee-Junction between a IVa brick wall and a 1 brick wall, one uses a
  - A. half-queen closer in each course
  - B. half-queen closer in every alternate course
  - C. three-quarter bat in each course
  - D. half-bat in every alternate course
5. A symmetrical three-hinged parabolic arch of span  $L$  and rise  $h$  is hinged at springings and crown. It is subjected to a U.d.l.  $W$  throughout the span. Which the bending moment at a section  $L/4$  from the left support.
  - A.  $WL^2/8$
  - B.  $WL^2/16$
  - C.  $WL^2/8 h$
  - D. zero
6. Sheep-foot rollers are recommended for compacting
  - A. granular soils
  - B. cohesive soils
  - C. hard rock
  - D. any type of soil

7. The given figure shows the section of a wooden beam stiffened with two steel plates each of thickness 't' securely fixed to the sides. The second moment of area of the flitched beam about the X-X axis is (given: d = overall depth of the beam, b = width of the wooden section and m = modular ratio of the moduli of elasticity of steel and wood)
- A.  $\frac{bd^3}{12}$       B.  $\frac{(b + 2t) d^3}{12}$       C.  $(b + 2 mt) \frac{d^3}{12}$       D.  $\frac{bd^3}{12} + \frac{2t(md)^3}{12}$
8. The portal frame shown in the given figure is statically indeterminate to the
- A. first degree  
B. second degree  
C. third degree  
D. None of the above
9. A fixed beam and a simply supported beam having same span and develop same maximum bending moment due to uniformly distributed load on entire span. What is the ratio of uniformly distributed load on fixed beam to that on simply supported beam ?
- A. 0.5      B. 1      C. 1.5      D. 3
10. Which one of the following method is employed to manufacture pre-stressed concrete sleepers for the railways ?
- A. Post-tensioning  
B. Pre-tensioning  
C. Pre-tensioning followed by post-tensioning  
D. Partial pre-stressing
11. What is the BOD<sub>5</sub> at 20°C of a waste that yields an oxygen consumption of 2 mg/l from a 0.5% diluted sample ?
- A. 50 mg/l      B. 400 mg/l      C. 200 mg/l      D. 250 mg/l
12. The given figure shows roughly, the daily mass curves of supply to and demand from an elevated service reservoir (ESR). The minimum required capacity of the reservoir is given by
- A. (A - B)  
B. (A + B)  
C. A x B  
D. larger of A or B
13. Stresses obtained from Boussinesq's theory are considered reasonably satisfactory in foundation engineering because:
- A. they represent stress distribution in homogeneous soil below loaded area  
B. they account for anisotropy of soil properly

- C. they give due regard to plastic behaviour of soils, particularly of settlement analysis
  - D. they consider elastic soil medium, and the intensity of allowable stresses below foundations in most cases are quit small and justify elastic solutions
14. A septic tank of 7 m<sup>3</sup> in volume serves for 5 people. If the rate of accumulation of sludge is 70 litres per capita per year and sludge is removed when it occupies 50% of its volume, what is the cleaning interval of septic tank ?  
A. 3 years    B. 5 years    C. 7.5 years    D. 10 years
  15. The load carrying capacity of an individual friction pile is 200 kN. What is the total load carrying capacity of a group of 9 such piles with group efficiency factor of 0.8 ?  
A. 1800 kN    B. 1640 kN    C. 1440 kN    D. 900 kN
  16. In which one of the following zones is a logarithmic spiral shape of failure surface assumed in the case of bearing capacity analysis of  $C-\phi$  soils ?  
A. Active zone  
B. Passive zone  
C. Radial shear zone  
D. Surcharge zone
  17. The optimum number of revolutions over which concrete is required to be mixed in a mixer machine, is  
A. 10    B. 20    C. 50    D. 100
  18. A model of a weir made to a horizontal scale of 1/40 and vertical scale of 1/9 discharges 1 litre/sec. Then the discharge in the prototype is estimated as  
A. 1 lps    B. 108 lps    C. 1080 lps    D. 10800 lps
  19. Which one of the following statements is the correct description of the structure of fibre board ?  
A. Thin slices of superior quality of wood are glued and pressed on the surface of inferior wood  
B. Steamed mass of wood dusts, wood wool and other vegetable fibres are pressed hard to a thickness varying from 3 mm to 12 mm  
C. Thin and narrow wood shavings are soaked in a refractory binder material and pressed hard  
D. Wood veneer backed by fabric mat
  20. What is the normal depth in a wide rectangular channel carrying 0.5 m<sup>3</sup>/s discharge at a bed slope of 0.0004 and Manning's  $n = 0.01$  ?  
A. 0.13 m    B. 0.32 m    C. 0.43 m    D. 0.50 m

21. The best design of an arch dam is when
- all horizontal water loads are transferred horizontally to the abutments
  - the dam is safe against sliding at various levels
  - the load is divided between the arches and cantilevers and the deflections at the conjugal points being equal
  - the deflections of the cantilevers are equal at different points
22. Which one of the following is the appropriate field test for estimating the angle of shearing resistance  $\phi$  of a sand deposit ?
- Field vane shear test
  - Plate load test
  - Standard penetration test
  - Electrical resistivity test
23. In setting out a long straight line for the position of transmission towers, it is recommended that the forward point be set out with face-right and face-left with reference to preceding point and the mean position taken. This field procedure eliminates instruments error where the
- trunnion axis is not perpendicular to vertical axis
  - vertical axis is not perfectly vertical time of observation
  - line of collimation is not perpendicular to the vertical axis
  - line of collimation is not perpendicular to the horizontal axis
24. A vane 20 cm long and 10 cm in diameter was pressed into a soft marine clay at the bottom of a bore hole. Torque was applied gradually and failure occurred at 1000 kg cm. The cohesion of the clay in kg/cm<sup>2</sup> is :
- $\frac{1}{\pi} \times \frac{6}{7}$
  - $\frac{1}{\pi} \times \frac{5}{7}$
  - $\frac{1}{\pi} \times \frac{4}{7}$
  - $\frac{1}{\pi} \times \frac{3}{7}$
25. Which one of following is not correct for container ports ?
- The berth capacity is great
  - Overall transit time is less
  - There is minimal damage to cargo
  - Minimal land is required for the marshalling area
26. A thin cylindrical shell of internal diameter D is subject to an internal pressure 'p'. If  $\sigma_y$  is the yield stress of the material of the cylinder, then based on the maximum shear theory, the thickness of the cylinder will be (in kg/cm<sup>2</sup>) is
- $\frac{pD}{2\sigma_y}$
  - $\frac{pD}{4(\sigma_y - p)}$
  - $\frac{pD}{4\sigma_y}$
  - $\frac{pD}{2(\sigma_y - p)}$

27. A shaft of diameter 'd' is subjected to bending moment 'M' and twisting moment 'T'. The developed principal stress will be
- A.  $\frac{\pm 16}{\pi d^3} \sqrt{M^2 + T^2}$       B.  $\frac{16}{\pi d^3} (M \pm \sqrt{M^2 + T^2})$       C.  $\frac{16}{\pi d^3} (T \pm \sqrt{M^2 + T^2})$   
D.  $\frac{16}{\pi d^3} \sqrt{M^2 + T^2} \pm M$
28. There are ten instrument stations occupied in succession during a traverse survey. An observer makes equal error in each station, the magnitude of which is  $\delta \theta$  in each instance at all the stations. What is the probable error of the final bearing at the end of the traverse?
- A.  $\pm 10 \delta \theta$   
B.  $\pm 100(\delta \theta)^2$   
C.  $\pm 10 (\delta \theta)$   
D.  $\pm 10 \delta \theta$
29. At a certain station, the mean of the average temperature is  $25^\circ\text{C}$  and mean of the maximum daily temperature is  $40^\circ\text{C}$ . What is the airport reference temperature (ART)?
- A.  $46.6^\circ\text{C}$       B.  $45^\circ\text{C}$       C.  $35^\circ\text{C}$       D.  $30^\circ\text{C}$
30. The area between the two isohyets 45 cm and 55 cm is  $100 \text{ km}^2$ , and that between 55 cm and 65 cm is  $150 \text{ km}^2$ . What is the average depth of annual precipitation over the basin of  $250 \text{ km}^2$ ?
- A. 50 cm      B. 52 cm      C. 56 cm      D. 60 cm
31. In a design of storm sewers, if the time taken by rain-water to flow from the farthest point of the watershed to the sewer inlet is ' $t_i$ ' and the time of flow of water from the sewer inlet to the point in the sewer that is under consideration is ' $t_f$ ', then the time of concentration will be
- A.  $t_i$   
B.  $t_f$   
C.  $t_i + t_f$   
D.  $t_i$  or  $t_f$  whichever is greater
32. End A of the beam AB shown in the figure is on rollers and end B is hinged. C and D are the points on normals drawn at A and B to the beam at A and B respectively. To determine for reactions, funicular polygon must start at
- A. A      B. B      C. C      D. D
33. Which one of the following statements is correct? Cant deficiency is the difference between
- A. actual cant provided at the time of construction and at the time of renewal.

- B. the equilibrium cant necessary for the maximum permissible speed and actual cant provided.
  - C. cant required at maximum speed and minimum speed
  - D. two parallel rails after 10 years.
34. Consider the following statements related to interchanges:1. In diamond interchange there is the possibility of illegal wrong-way turns.2. Diamond interchange is far superior to cloverleaf design. Which of the statements given above is/are correct ?
- A. 1 only
  - B. 2 only
  - C. Both 1 and 2
  - D. Neither 1 nor 2
35. The frame shown is redundant to
- A. single degree      B. two degree      C. three degrees      D. four degrees
36. Two pipe systems in series are said to be equivalent when
- A. the average diameter in both systems is same
  - B. the average friction factor in both systems is same
  - C. the total length of the pipes is same in both the systems
  - D. the discharge under the same head is same in both the systems
37. A summit curve is formed at the intersection of a 3% upgrade and a 5% downgrade. What is the length of the summit curve in order to provide a stopping distance of 128 m ?
- A. 271m      B. 298 m      C. 322 m      D. 340 m
38. Two spheres of mass 15 kg and 20 kg, move along a straight line in the same direction with velocities of 20 m/s and 5 m/s, respectively. If the coefficient of restitution is 0.7, then the velocity of the 15 kg mass after collision will be
- A. 5.43 m/s      B. 15.93 m/s      C. 18.72 m/s      D. 16.16 m/s
39. What is the effective net width of plate shown in the given sketch, for carrying tension ?
- A. 212.5 mm      B. 237.5 mm      C. 250 mm      D. 275 mm
40. In a project, the contractor is paid on the basis of the running bill for a month. The rate contract for concreting is Rs. 1000/m<sup>3</sup> of concrete. The consumption of number of cement of bags of weight 50 kg is 527. The mix proportion for the concrete is 1: 1.4 : 2.75 with W/C ratio of 0.52. The approximate billing amount of the month will be
- A. Rs. 5, 27, 000      B. Rs. 1.49, 404      C. Rs. 62, 252      D. Rs. 26, 350



41. A train starts from rest on a curved track of radius 800 m. Its speed increases uniformly and after 3 minutes it is 72 km/hr. Its normal acceleration after 2 minutes is
- A.  $\frac{1}{18} \text{ m/sec}^2$       B.  $\frac{2}{18} \text{ m/sec}^2$       C.  $\frac{3}{18} \text{ m/sec}^2$       D.  $\frac{4}{18} \text{ m/sec}^2$
42. A hollow cylinder made of wood (sp. gr. = 0.8) has an external diameter of 1.0 m and an internal diameter of 0.6 m. It floats in water with its axis vertical and is in stable equilibrium. This is possible only when the length of the cylinder is equal to or less than
- A. 0.72 m      B. 0.95 m      C. 1.03 m      D. 1.20 m
43. In a fillet weld the weakest section is the
- A. smaller side of the fillet  
B. throat of the fillet  
C. side perpendicular to force  
D. side parallel to force
44. A beam ABC is simply-supported at A and B with an overhang BC as shown in the given figure. It carries loads as shown in the figure. If both the reactions are equal then W will be equal to
- A.  $8P/5$       B.  $5P/8$       C.  $5P/4$       D.  $4P/5$
45. Which one of the following is the correct statement ? Smaller size of aggregates in a concrete mix :
- A. provides larger surface area for bonding with the mortar matrix which increases the compressive strength and reduces the stress concentration at the mortar-aggregate interface  
B. is economical as the concrete mix is more dense  
C. requires lesser cement for a particular water-cement ratio and hence is economical  
D. is beneficial as these aggregates can pass through the reinforcement bars more easily
46. If  $\Delta p$  is increment of pressure on a normally consolidated saturated soil mass, as per Terzaghi's theory at the instant of application of pressure increment i.e. when time  $t = 0$ , what is the pore pressure developed in the soil mass ?
- A. Zero  
B. Very much less than  $\Delta p$   
C. Equal to  $\Delta p$   
D. Greater than  $\Delta p$
47. A normally consolidated clay layer settles by 25 mm when the effective stress is increased from 15 kPa to 30 kPa. If the effective stress is later

increased further from 30 kPa to 60 kPa, then the additional settlement would be

- A. 25 mm      B. 50 mm      C. 75 mm      D. 100 mm

48. Assuming the safe stopping sight distance to be 80 m on a flat highway section and with a setback distance of 10 m, what would be the radius of the negotiable horizontal curve ?

- A. 800 m      B. 160 m      C. 80 m      D. 70 m

49. What is the time by which the completion of an activity can be delayed without affecting the start of succeeding activities, called ?

- A. Total float  
B. Interfering float  
C. Independent float  
D. Free float

50. Which one of the following is the angular distance between the observer's meridian and the vertical circle passing through a star measured along the celestial horizon ?

- A. Right ascension  
B. Azimuth  
C. Declination  
D. Hour angle

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	D	A	B	A	B	D	C	D	B
10	B	B	D	D	C	C	B	C	B	C
20	C	C	D	A	B	A	B	D	D	C
30	C	B	B	A	A	C	B	A	D	A
40	D	C	B	D	A	C	A	C	D	D

## Section 21

1. Consider the following statements regarding the phenomenon of bulking of sand :1. It is due to film of water around sand particles.2. It is due to capillary action.3. It is more in finer sands.Which of the following statements given above is/are correct ?  
A. 1, 2 and 3     B. 1 and 3     C. 2 and 3     D. 1 and 2
2. The magnitude of acceleration is given by the  
A. slope of distance-time curve  
B. length of velocity-time curve  
C. slope of velocity-time curve  
D. length of distance-time curve
3. A 100 m tape is held 1 m out of line. The true length is  
A. 100.0050 m     B. 99.9950 m     C. 100.0100 m     D. 99.9800 m
4. Which one of the following types of settling phenomenon can be analysed by the classic sedimentation laws of Newton and Stokes ?  
A. Discrete settling  
B. Flocculent settling  
C. Hindered settling  
D. Compression settling
5. Window sills in residential houses are normally kept at  
A. 83 to 90 cm above the floor level  
B. 80 to 90 cm above the floor level  
C. 78 to 88 cm above the floor level  
D. 75 to 85 cm above the floor level
6. Lime stabilisation method is particularly suitably and has been found successful in stabilising  
A. clayey soil with expansive nature in water-logged areas  
B. sandy desertic area  
C. soils having liquid limit less than 30%  
D. wind-blown soil deposits
7. The optimistic, most likely and pessimistic time estimates of an activity are 5, 10 and 21 days respectively. What are the expected time and standard deviation ?  
A. 12, 3     B. 11, 4     C. 11,     D. 10, 16
8. What is the minimum number of longitudinal bars provided in a reinforced concrete column of circular cross section?  
A. 4     B. 5     C. 6     D. 8

9. The odour of drying paint or varnish is derived from which of the following chemical compounds?
  - A. Organic gases
  - B. Volatile organic compounds
  - C. Ethylene
  - D. Acetylene
10. D'Alembert's principle
  - A. is based on the law of conservation of energy
  - B. is based on the law of conservation of angular momentum
  - C. provides no special advantage over Newton's law
  - D. enables a dynamic problem to be treated akin to a problem of statics
11. For sampling saturated sands and other soft and wet soils satisfactorily, the most suitable soil sampler is
  - A. open drive thin-walled tube sampler
  - B. standard split-spoon sampler
  - C. stationary piston sampler
  - D. rotary sampler
12. A 30 cm diameter friction pile is embedded 10 m into a homogeneous consolidated deposit. Unit adhesion developed between clay and pile shaft is 4 t/m<sup>2</sup> and adhesion factor is 0.7. The safe load for factor of safety 2.5 will be
 

A. 21.50 t    B. 11.57 t    C. 10.55 t    D. 6.35 t
13. Consider the following statements :1. Point of contraflexure is the point where the bending moment is maximum.2. Point of cantraflexure is the point where the bending moment changes sign.3. Point of contraflexure is the point where the shear force is zero.Which of these statements is/are correct ?
 

A. 1, 2 and 3    B. 2 and 3    C. 2 only    D. 1 only
14. What is the significant purpose of monitoring a project through its implementation phase ?
  - A. To fix responsibility for delays
  - B. To revalue the project with control over cost over-run
  - C. To revalue the project with minimum time over-run
  - D. To revalue the project with optimal time and cost over-run
15. The yield of a well depends upon
  - A. permeability of soil
  - B. area of aquifer opening into the wells

- C. actual flow velocity  
D. all of the above
16. The coordinates of two end-points A and B traverse line AB are  $X_A = 1000.00$  m,  $Y_A = 1000.00$  m  $X_B = 2000.00$  m,  $Y_B = 1000.00$  m The bearing of the line AB will be  
A.  $0^\circ 0' 00''$     B.  $60^\circ 0' 00''$     C.  $90^\circ 0' 00''$     D.  $180^\circ 0' 00''$
17. Consider the following statements relating to compressible flow :1. In a contracting conduit, sonic velocity is reached in the minimum cross-sectional area.2. In a contracting conduit, supersonic velocities are reached only in the expanding section downstream from the minimum section.3. An expansion shockwave is physically possible and can be exhibited.4. In the Laval nozzle it is possible to obtain a velocity greater than the velocity of sound in the expanding section of nozzle.Of these statements :  
A. 1, 2 and 3 are correct  
B. 1, 2 and 4 are correct  
C. 2, 3 and 4 are correct  
D. 1, 3 and 4 are correct
18. Consider the following factors :1. Elevation2. Temperature3. Gradient4. Trip length.For finding the runway length, which of these are taken into reckoning ?  
A. 1 and 3    B. 2 and 4    C. 1 and 2    D. 1, 2, 3 and 4
19. Which one of the following is the reaction of the cantilever at B as shown in the figure ?  
A.  $\frac{3}{8} wl$     B.  $\frac{5}{8} wl$     C.  $\frac{6}{17} wl$     D.  $\frac{3}{21} wl$
20. If a road surface is adequately superelevated on horizontal curve, which one of the following is the proper distribution of pressure on the vehicle wheels ?  
A. Pressure on both outer and inner wheels is equal  
B. Pressure on inner wheels is more than the outer wheels  
C. Pressure on inner wheels is less than the outer wheels  
D. Pressure on front wheels is thrice the pressure on rear wheels
21. The role of superplasticizer in a cement paste is to  
A. disperse the particles  
B. disperse the particles and to remove air bubbles  
C. disperse the particles, remove air bubbles and to retard setting  
D. retard setting
22. For stability analysis of slopes of purely cohesive soils, the critical centre is taken to lie at the intersection of

- A. the perpendicular bisector of the slope and the locus of the centre
  - B. the perpendicular drawn at one-third slope from the toe and the locus of the centre
  - C. the perpendicular drawn at two-third slope from the toe and the locus of the centre
  - D. directional angles
23. A prismatic bar of uniform cross-sectional area of 5 cm<sup>2</sup> is subjected to axial loads as shown in the given figure. Portion BC is subjected to an axial stress of
- A. 400 kg/cm<sup>2</sup> tension,
  - B. 2000 kg/m<sup>2</sup> compression
  - C. 1000 kg/cm<sup>2</sup> tension
  - D. 600 kg/cm<sup>2</sup> tension
24. Which one of the following methods would give accurate results in determining the direction of the observer's meridian ?
- A. Observation of circumpolar stars on the same vertical
  - B. Observation of circumpolar stars at culmination
  - C. Extra-meridian observation of a circumpolar star
  - D. Observation of the sun at equal altitudes
25. In a truss work as shown in the figure given above, what is the force induced in the member DE ?
- A. 50 kN (tensile)
  - B. zero
  - C. 50 kN (compressive)
  - D. 25 kN (compressive)
26. The process by which a mass of saturated soil is caused by external forces to suddenly lose its shear strength and to behave as a fluid is called
- A. piping
  - B. slide
  - C. quick condition
  - D. liquefaction
27. In steady laminar flow of a liquid through a circular pipe of internal diameter  $D$ , carrying a constant discharge, the hydraulic gradient is inversely proportional to
- A.  $D$
  - B.  $D^2$
  - C.  $D^4$
  - D.  $D^5$
28. A pipe line, 2000 m long, carries water. Velocity of propagation of pressure wave is 1000 m/s. If the valve at the low stream end is

instantaneously closed at time,  $t = 0$ , negative water hammer pressure at the valve will last for

- A. 0 - 4 S    B. 2 - 4 S    C. 4 - 8 S    D. 8 - 12 S

29. Consider the following statements related to triaxial test :1. Failure occurs along pre-determined plane.2. Intermediate and minor principal stresses are equal.3. Volume changes can be measured.4. Field conditions can be simulated.Of these statements :

- A. 1, 2 and 3 are correct  
B. 1, 2 and 4 are correct  
C. 1, 3 and 4 are correct  
D. 2, 3 and 4 are correct

30. What is the magnitude of the force in the member BD in the figure given above ?

- A. 5 kN    B. 7 kN (App)    C. 42kN    D. Zero

31. Consider the following statements :Cement concrete is a/an :1. Elastic material.2. Visco-elastic material.3. Visco-plastic material.Which of the statements given above is/are correct ?

- A. 1, 2 and 3    B. 2 and 3    C. 2 only    D. 1 only

32. Water present in an artesian aquifer is usually

- A. at sub atmospheric pressure  
B. at atmospheric pressure  
C. at 0.5 times of the atmospheric pressure  
D. above atmospheric pressure

33. What is the shape of influence line diagram for the maximum bending moment in respect of a simply supported beam ?

- A. Rectangular    B. Triangular    C. Parabolic    D. Circular

34. Consider the following statements about a hydraulic ram :1. Hydraulic ram does not need external power. 2. It works on the fundamental principle of water hammer.3. The efficiency of a hydraulic ram is only of the order of 8 to 10%.4. It can be termed as a low, intermittent discharge low-head pumping installation. Which of these statements are correct ?

- A. 2 and 3    B. 1, 2, 3 and 4    C. 1 and 2    D. 1 and 3

35. Which of the following are the purposes of a groyne as a river training structure ?1. It contracts a river channel to improve its depth.2. It protects the river bank.3. It does not allow silt to deposit in the vicinity.4. It trains the flow along a certain course.Select the correct answer using the code given below :

- A. 1 and 2    B. 1, 2 and 3    C. 1 and 3    D. 2, 3 and 4

36. What is the permissible tensile stress in bolts used for column bases?  
(Where  $f_y$  is the yield stress of the steel)  
A.  $120 \text{ N/mm}^2$     B.  $150 \text{ N/mm}^2$     C.  $0.6 f_y$     D.  $0.4 f_y$
37. King closers are related to  
A. doors and windows  
B. king post truss  
C. queen post truss  
D. bricks masonry
38. The area of a plot is to be determined using Simpson's rule. The following offsets were taken to a boundary from points along a chain line all measurements being in metres 12, 15, 22, 29, 36, 38, 31, 22, 17. There were taken at 100 m intervals. Consider the following steps in this regard.  
1. Sum of the odd ordinates =  $22 + 36 + 1 = 893$ .  
Sum of the even ordinates =  $15 + 29 + 38 + 22 = 1044$ .  
 $12 + 17 = 395$ .  
Area =  $100 (19.5 + 89 + 104)6$ .  
Area =  $(39 + 2 \times 89 + 4 \times 104)7$ .  
Area  $100 \times 19.5 (104 - 89)$   
The area of the plot can be determined by using the steps listed above :  
A. 1, 2, 3 and 5    B. 1, 3, 4 and 6    C. 1, 2, 4 and 7    D. 2, 3, 4 and 6
39. At a cross-section of a beam, the maximum compressive stress at top is  $800 \text{ kg/cm}^2$  and its maximum tensile stress at bottom is  $200 \text{ kg/cm}^2$ . The depth of cross-section is 10 cm. The depth of the neutral axis from the top of the section is  $n$ . The  $n$  is equal to  
A. 2 cm    B. 4 cm    C. 6 cm    D. 8 cm
40. A buttress in a wall is intended to provide  
A. lateral support to roof slab only  
B. lateral support to wall  
C. to resist vertical loads only  
D. lateral support to roof beams only
41. A shaft turns at 150 rpm under a torque of 1500 Nm. Power transmitted is  
A.  $15 \pi \text{ kW}$     B.  $10 \pi \text{ kW}$     C.  $7.5 \pi \text{ kW}$     D.  $5 \pi \text{ kW}$
42. Consider the following factors :  
1. Initial prestress  
2. Losses in prestress  
3. Depth of cable from extreme compression fibre.  
Those which affect the ultimate moment capacity of a prestressed concrete beam would include  
A. 1 and 2    B. 1 and 3    C. 1 alone    D. 3 alone
43. If the stream function is  $\psi = 2xy$ , then the velocity at a point (1, 2) is equal to  
A. 2    B. 4    C. 20    D. 16



44. The cantilever frame shown in the given figure is supported by vertical links at B and C and carries loads as shown. The force in the bar AE is  
A. 500 kg    B. 1000 kg    C. zero    D. 2500 kg
45. Two piles, one a bored cast-in-situ pile and another a precast driven pile, both of same length and diameter are constructed in a loose sand deposit. If the bearing capacity of the bored pile is  $Q_1$ , and that of the precast driven pile is  $Q_2$ , then which of the following is correct ?  
A.  $Q_1 < Q_2$   
B.  $Q_1 = Q_2$   
C.  $Q_1 > Q_2$   
D. No specific comparison may hold good
46. Two perfectly elastic spheres of equal mass moving in the same direction with their velocities in the ratio 2 : 1 have an impact. After the impact, the two spheres will  
A. move in the same direction  
B. have in velocity in the ratio of 1 : 2  
C. move in opposite directions with velocity the ratio of 1: 2  
D. move in the same direction with velocity the ratio of 1: 2
47. For the design of a simply supported RCC T-beam, the ratio of the effective span to the overall depth of the beam should not exceed  
A. 10    B. 20    C. 30    D. 40
48. The typical density in kg/cm (in situ) of well-compacted municipal solid waste in landfill is in the range of  
A. 100 to 300    B. 310 to 500    C. 550 to 850    D. 900 to 1100
49. What is the y-coordinate of the centroid of the area ABCDE shown in the figure given aside ?  
A. 3.2    B. 3.3    C. 3.4    D. 3.5
50. In a plate load test on sandy soil, the test plate of 60 cm x 60 cm undergoes a settlement of 5 mm at a pressure of  $12 \times 10^4$  N/m<sup>2</sup>. What will be the expected settlement of 3 m x 3 m footing under same pressure ?  
A. 25 mm    B. 20 mm    C. 15 mm    D. 9 mm

Answer Key

	1	2	3	4	5	6	7	8	9	0
0	A	A	B	A	D	A	C	C	C	D
10	A	C	B	D	D	C	A	D	C	A
20	C	D	B	B	B	C	B	B	D	D
30	C	D	C	C	D	A	D	D	D	B
40	C	D	C	C	A	D	B	B	B	D

## Section 22

1. A bar 4 cm in diameter is subjected to an axial load of 41. The extension of the bar over a gauge length of 20 cm is 0.03 cm. The decrease in diameter is 0.0018 cm. The Poisson's ratio is  
A. 0.25    B. 0.30    C. 0.33    D. 0.35
2. The kinetic energy in Nm of a circular disc of 20 m diameter and 10 cm thick, of material weighing 100 kg/m<sup>3</sup>, rotating above an axis through its centre at right angles to its place and making 2000 rpm is  
A.  $\frac{1}{3} \times 10^7 \pi^3$   
B.  $\frac{2}{3} \times 10^7 \pi^3$   
C.  $2 \times 10^8 \pi^3$   
D.  $4 \times 10^8 \pi^3$
3. The upper limit of area ratio for which the amount of disturbance of soil sample can be considered to be small is  
A. 10%    B. 15%    C. 20%    D. 25%
4. For the beam shown in figure, what are the distribution factors at joint B ?  
A. 0.4, 0.6    B. 0.5, 0.5    C. 0.6, 0.4    D. 0.65, 0.35
5. Consider the following statements :The daily per capita consumption of water apparently increases with  
1. higher standard of living of people.  
2. availability of sewerage in the city.  
3. metered water supply.  
4. wholesome and potable quality of water.  
Which of these statements are correct ?  
A. 1, 2 and 3    B. 2, 3 and 4    C. 1, 3 and 4    D. 1, 2 and 4
6. A river model is constructed to a horizontal scale of 1:1000 and a vertical scale of 1:100. A model discharge in the prototype, of what magnitude ?  
A.  $10^2 \text{ m}^3/\text{s}$   
B.  $10^3 \text{ m}^3/\text{s}$   
C.  $10^4 \text{ m}^3/\text{s}$   
D.  $10^5 \text{ m}^3/\text{s}$
7. If a 30 m length can be taped with a precision of  $\pm 0.01 \text{ m}$ , then the standard error of measuring 1.08 km with the same precision will be  
A.  $\pm 0.54 \text{ m}$     B.  $\pm 0.45 \text{ m}$     C.  $\pm 0.36 \text{ m}$     D.  $\pm 0.06 \text{ m}$
8. a grit chamber of dimensions 12.0 m x 1.50 x 800 m liquid depth has a flow of 720 m<sup>3</sup>/hr. Its surface loading rate and detention time are, respectively,

- A.  $40000 \text{ m}^3/\text{hr}/\text{m}^2$  and 1.2 minute  
 B.  $40000 \text{ l ph}/\text{m}^2$  and 40 minutes  
 C.  $40 \text{ m}/\text{hr}/\text{m}^2$  and 12 minutes  
 D.  $40000 \text{ l ph}/\text{m}^2$  and 1.2 minute
9. In signals system design of Railways the distance at which the outer signal is to be placed is decided on basis of the  
 A. Allowable speed  
 B. Running speed  
 C. Minimum speed  
 D. Journey speed
10. Which one of the following is the best method for the stabilization of the clayey subgrade in water-logged area ?  
 A. Cement stabilization  
 B. Lime stabilization  
 C. Bitumen stabilization  
 D. Stabilization by grouting
11. The stress distribution at a depth beneath a loaded area is determined using Newmark's influence chart which indicates an influence value of 0.005. The number of segments covered by the loaded area in the chart is 20 and the intensity of loading on the area is  $10 \text{ T}/\text{m}^2$ . The intensity of stress distribution at that depth is  
 A.  $1 \text{ T}/\text{m}^2$   
 B.  $2 \text{ T}/\text{m}^2$   
 C.  $5 \text{ T}/\text{m}^2$   
 D.  $10 \text{ T}/\text{m}^2$
12. A two-hinged semicircular arch of radius 'R' carries a concentrated load 'W' at the crown. The horizontal thrust is  
 A.  $\frac{W}{2\pi}$       B.  $\frac{W}{\pi}$       C.  $\frac{2W}{3\pi}$       D.  $\frac{4W}{3\pi}$
13. The adjoining figures show funicular diagram and polar diagram for a beam subjected to vertical forces. x is the distance of the pole from the vector line. If x is doubled, then the ordinate in the funicular diagram will be  
 A. doubled      B. halved      C. unaffected      D. tripled
14. In a cohesionless soil deposit having a unit weight of  $1.5 \text{ t}/\text{m}^3$  and an angle of internal friction of  $30^\circ$  the active and passive lateral earth pressure intensities (in  $\text{t}/\text{m}^2$ ) at a depth of 10 m will, respectively, be  
 A. 15 and      B. 5 and 15      C. 10 and 20      D. 20 and 10

15. A three-hinged loaded semicircular arch ACB is shown in the figure given. What is the shearing force at the hinge C ?
- 20 kN
  - 20.2 kN
  - 10 kN
  - 10.2 kN
16. A clay sample has a void ratio of 0.50 in dry state and specific gravity of solids = 2.70. Its shrinkage limit will be
- 12%
  - 13.5%
  - 18.5%
  - 22%
17. A catchment has an area of 150 hectares and a run-off/rainfall ratio of 0.40. If due to 10 cm rainfall over the catchment, a stream flow at the catchment outlet lasts for 10 hours, what is the average stream flow in the period ?
- 60,000 m<sup>3</sup>/hour
  - 100 m<sup>3</sup>/minute
  - 3.5 m<sup>3</sup>/s
  - 1.33 m<sup>3</sup>/s
18. The head loss in a pipe of diameter  $d$ , carrying oil at a flow rate  $Q$  over a distance  $l$  is  $h$ . The pipe is replaced by another with half the diameter, all other things remaining the same. The head loss in this case will be
- 0.5  $h$
  - 2.0  $h$
  - 8.0  $h$
  - 32.0  $h$
19. A very tiny sphere is settling down in a viscous liquid at Reynolds number = 0.2. Its drag coefficient is equal to
- 320
  - 120
  - 80
  - 5
20. An ascending gradient of 1 in 100 meets a descending gradient of 1 in 50, The length of summit curve required to provide overtaking sight distance of 500 m will be
- 938 m
  - 781m
  - 470 m
  - 170 m
21. In a situation where torsion is dominant, which one of the following is the desirable section ?
- Angle section
  - Channel section
  - I-section
  - Box type section
22. Consider the following statements : (a) Setting and hardening of cement takes place after the addition of water. (b) Water causes hydration and hydrolysis of the constituent compounds of cement which act as binders Which of the statements given above is/are correct ?

- A. 1 only  
B. 2 only  
C. Both 1 and 2  
D. Neither 1 nor 2
23. The effective length of the member shown in the given figure is equal to  
A. 1.2 L      B. 1.5 L      C. 2.0 L      D. 3.0 L
24. A surface longitudinally centered on the extended runway centre line and extending outward and upward from each end of the primary surface is known as  
A. conical surface  
B. transition surface  
C. approach surface  
D. horizontal surface
25. A flownet for an earth dam on impervious foundation consists of 4 flow channels and 15 equipotential drops. The full reservoir level is 15 m above the downstream horizontal filter. Given that horizontal permeability is  $9 \times 10^{-6}$  m/s and vertical permeability is  $1 \times 10^{-6}$  m/s, the quantity of seepage through the dam will be  
A. 36 ml/s/m      B. 25 ml/s/m      C. 20 ml/s/m      D. 15 ml/s/m
26. Which of the following are the disadvantages of non-tilting type concrete mixers ?  
1. They are not favoured when large sized aggregates are used.  
2. Mixing of the concrete occurs through both rolling and pulling from buckets.  
3. Content of fines is increased.  
4. They are not easy to clean.  
Select the correct answer using the codes given below:  
A. 1, 2 and 3      B. 1, 3 and 4      C. 1, 2 and 4      D. 2, 3 and 4
27. A round bar made of same material consists of 3 parts each of 100 mm length having diameters of 40 mm, 50 mm and 60 mm respectively. If the bar is subjected to an axial load of 10 kN, the total elongation of the bar would be (E is the modulus of elasticity in kN/mm<sup>2</sup>)  
A.  $\frac{0.4}{\pi E} \left( \frac{1}{16} + \frac{1}{25} + \frac{1}{36} \right) \text{ mm}$       B.  $\frac{4}{\pi E} \left( \frac{1}{16} + \frac{1}{25} + \frac{1}{36} \right) \text{ mm}$       C.  $\frac{4\sqrt{2}}{\pi E} \left( \frac{1}{16} + \frac{1}{25} + \frac{1}{36} \right) \text{ m}$   
D.  $\frac{40}{\pi E} \left( \frac{1}{16} + \frac{1}{25} + \frac{1}{36} \right) \text{ mm}$
28. Which of the following factors have to be considered for the design of the flexible pavement for a highway ?  
1. Design wheel load  
2. Strength of pavement component material  
3. Expansion joints  
4. Climatic factors  
Select the correct answer using the codes given below :  
A. 1, 2 and 3      B. 2, 3 and 4      C. 1, 3 and 4      D. 1, 2 and 4

29. For practically impervious type of soil, the coefficient of permeability is determined using
- variable head test
  - constant head test
  - consolidation test
  - pumping test
30. The basic action involved in sheep foot rolling is
- Kneading
  - Pressing
  - Tamping
  - Vibration
31. Consider the following oxides : 1.  $\text{Al}_2\text{O}_3$  2.  $\text{CaO}$  3.  $\text{SiO}_2$  The correct sequence in increasing order of their percentage in an ordinary portland cement is
- 2, 1, 3
  - 1, 3, 2
  - 3, 1, 2
  - 1, 2, 3
32. The modules of elasticity (E) of concrete is given by
- $E = 1000 f_{ck}$
  - $E = 5700 f_{ck}$
  - $E = 5700 f_{ck}$
  - $E = 10,000 f_{ck}$
33. A 6 hour storm has 6 cm of rainfall and the resulting runoff was 3 cm. If  $\phi$  = index remains at the same value, which one of the following is the runoff due to 12 cm of rainfall in 9 hours in the catchment?
- 4.5 cm
  - 6.0 cm
  - 7.5 cm
  - 9.0 cm
34. In the plot of residual chlorine versus chlorine dose applied shown in the above figure, the curve will not have any (0, 0) point because
- of experimental error
  - chlorine escapes into the atmosphere
  - chlorine requires some contact time
  - chlorine is consumed for disinfection
35. Which of the following pairs regarding the defects in timber are correctly matched ?
- Upsets....due to overmaturity and unventilated storage of wood.
  - Fewness....due to crushing of fibres running transversely.
  - Star shakes....radial splits widest at the circumference and diminishing towards the centre.
  - Heart shakes....cracks widest at the centre and diminishing towards the outer circumference.
- Select the correct answer using the codes given below.
- 1 and 2
  - 3 and 4
  - 1 and 4
  - 2 and 4
36. The description of solid waste collected is as follows : Night soil - 35 t Rubbish - 40 t Debris - 25 t Garbage - 40 t The organic solids in the above composition is
- 35 t
  - 60 t
  - 100 t
  - 75 t

37. Lacustrine soils are soils
- transported by rivers and streams
  - transported by glaciers
  - deposited in sea beds
  - deposited in lake beds
38. If a sluice gate produces a change in the depth of water from 3.0 m to 0.6 m, then the force on the gate is about
- 9.5 kN/m
  - 19.0 kN/m
  - 38.0 kN/m
  - 76.0 kN/m
39. When the bubble of a level tube was moved by 10 divisions, the change in staff intercept was 0.05 m. If the distance between the staff and the instrument was 100 m, then the sensitiveness of the bubble tube is given by
- 1.03 sec of arc
  - 10.3 sec of arc
  - 20.6 sec of arc
  - 103 sec of arc
40. Self-cleansing velocity is
- the minimum velocity of flow required to maintain a certain amount of solids in the flow
  - the maximum velocity of flow required to maintain a certain amount of solids in the flow
  - such flow velocity as would be sufficient to flush out any deposited solids in the sewer
  - such flow velocity as would be sufficient to ensure the sewage does not remain in the sewer
41. What is the total degree of indeterminacy, both internal and external of the plane frame ?
- 10
  - 11
  - 12
  - 14
42. In the design of two-way slab restrained at all edges, torsional reinforcement required is :
- 0.75 times the area of steel provided at midspan in the same direction
  - 0.375 times the area of steel provided at midspan in the same direction
  - 0.375 times the area of steel provided in the shorter span
  - Nil
43. Two bars AO and BO are of uniform area 'A' each and are hinged at O as shown in the given figure. A load W is applied at O. The vertical

deflection of O will be

- A.  $\frac{Wl}{AE}$       B.  $\frac{Wl}{2AE}$       C.  $\frac{W^2l}{AE}$       D.  $\frac{W^2l}{2AE}$

44. The length of a transition curve for a circular curve of radius 300 m and for a design speed of 15 m/s, when the rate of change of centrifugal acceleration is  $0.3 \text{ m/s}^3$  is  
A. 30 m      B. 37.5 m      C. 45 m      D. 60 m
45. Two closed-coil springs of stiffness  $s$  and  $2s$  are arranged in series in one case and in parallel in the other case. The ratio of stiffness of springs connected in series to parallel is  
A.  $\frac{1}{3}$       B.  $\frac{1}{9}$       C.  $\frac{2}{3}$       D.  $\frac{2}{9}$
46. The rigid portal frame shown in the given figure will not have any sidesway if  $I_1 =$  the moment of inertia of the column cross-section  $I_2 =$  the moment of inertia of the beam cross-section  
A. it is subjected to vertical loading only  
B.  $I_2 = 2I_1$   
C. the loading is symmetrical about its centre line  
D. loaded in any manner.
47. Two similar round bars A and B are each 30 cm long as shown in the given figure. The ratio of the energies stored by the bars A and B, is  
A.  $3/2$       B. 1.0      C.  $5/8$       D.  $2/3$
48. Consider the following statements :The effect of air entrainment in concrete is to  
1. increase resistance to freezing and thawing.  
2. improve workability.  
3. decrease strength.  
Which of these statements are correct ?  
A. 2 and 3      B. 1 and 3      C. 1 alone      D. 1, 2 and 3
49. The state of stress at a point in a stressed element is shown in the given figure. The maximum tensile stress in the element will be  
A.  $20 \text{ N/mm}^2$   
B.  $102 \text{ N/mm}^2$   
C.  $10 \text{ N/mm}^2$   
D. zero
50. The shear modulus of a material is half of its Young's modulus. What is the value of its Poisson's ratio ?  
A. - 1      B. - 0.5      C. Zero      D. 0.5



	1	2	3	4	5	6	7	8	9	0
0	B	B	A	B	D	D	D	D	A	B
10	A	B	C	B	C	C	B	D	B	B
20	D	C	C	C	A	B	D	D	A	A
30	B	C	C	C	C	D	D	C	A	C
40	A	A	A	B	D	C	A	D	A	C

**Answer Key**

**Explanation**

16.

You can find the answer here.

<http://www.meritanswers.com/questions/shrinkage-limit-of-a-clay-sample/13282->

1-1

## Section 23

1. A saturated clay stratum of thickness 10 m, bounded on top and bottom by medium coarse sand layers, has a coefficient of consolidation of  $0.002 \text{ cm}^2/\text{s}$ . If this stratum is subjected to loading, it is likely that it would undergo 50% of its primary consolidation in  
A. 1136 days    B. 227 days    C. 284 days    D. 568 days
2. In a plane truss, if 'M' is the number of members, 'R' is the number of reactions and 'J' is the number of joints, then for this truss to be determinate  
A.  $J = M + R$   
B.  $J = 2M + R$   
C.  $3J = M + 2R$   
D.  $2J = M + R$
3. Which one of the following methods is generally considered the best for tunnel ventilation ?  
A. Driving a drift through the tunnel  
B. 'Blow in' method  
C. 'Blow out' method  
D. Combination of 'Blow in' and 'Blow out' methods
4. A circular shaft subjected to torsion undergoes a twist of  $1^\circ$  in a length of 120 cm. If the maximum shear stress induced is limited to  $1000 \text{ kg/cm}^2$  and if modulus of rigidity  $G = 0.8 \times 10^6 \text{ kg/cm}^2$ , then the radius of the shaft should be  
A.  $\pi/18$     B.  $18/\pi$     C.  $\pi/27$     D.  $27/\pi$
5. Which one of the following types of sleepers has the best shock absorbing capacity as well as dampening property ?  
A. CST sleeper  
B. Wooden sleeper  
C. Concrete sleeper  
D. Steel sleeper
6. Which of the following Pairs regarding explanations and the terminologies pertaining to masonry are correctly matched ?  
1. Reveal....projecting stone to serve as support for joist.  
2. Throating....groove provided on the underside of projecting elements like sills.  
3. Gable....triangle shaped masonry works provided at the ends of sloped roof.  
4. Freeze....vertical sides of finished opening for doors and windows.  
Select the correct answer using the codes given below :  
A. 1 and 2    B. 2 and 3    C. 3 and 4    D. 1 and 4

7. Which of the following are the purposes for use of steel bars reinforcement in cement concrete pavements ?  
 1. To increase the flexural strength of concrete  
 2. To prevent the onset of cracks  
 3. To allow wider spacing of joints.  
 Select the correct answer using the code given below :  
 A. 1 and 2 only      B. 2 and 3 only      C. 1 and 3 only      D. 1, 2 and 3
8. A simply supported beam of span 'L' carries a concentrated load 'W' at mid-span. If the width 'b' of the beam is constant and its depth is varying throughout the span, then what should be its mid-span depth, when design stress is 'f' ?  
 A.  $\sqrt{\frac{6WL}{bf}}$       B.  $\frac{6WL}{bf}$       C.  $\sqrt{\frac{3WL}{2bf}}$       D.  $\frac{3WL}{bf}$
9. The following readings were taken with a Dumpy level and a 4 m levelling staff on a continuously sloping ground at 30 m intervals :  
 0.680 m, 1.455 m, 1.855 m, 2.330 m, 2.885 m, 3.380 m, 1.055 m. The R.L. of the fourth point was calculated to be 79.100 m. The R.L. of the point that was read 0.680 m is  
 A. 80.750 m      B. 79.780 m      C. 78.420 m      D. 77.740 m
10. Consider the following statements :  
 1. In the laboratory consolidation test, initial compression is the result of displacement of soil particles.  
 2. Primary consolidation is due to dissipation of pore water pressure.  
 3. Secondary compression starts after complete dissipation of pore water pressure.  
 4. Primary consolidation and secondary compression occur simultaneously.  
 Which of the statements given above are correct ?  
 A. 1 and 4 only      B. 2 and 3 only      C. 2 and 4 only      D. 1 and 3 only
11. Given that for a channel section, the width of flange = b, the depth of the web between centres of flanges = h, the thickness of flange = t, the moment of inertia of the channel about the axis of bending = I, the distance 'e' of the shear centre outside the channel section from the mid-thickness of the web is:  
 A.  $\frac{t h^2 b^2}{I}$       B.  $\frac{t^2 h^2 b}{4I}$       C.  $\frac{t h^2 b^2}{4I}$       D.  $\frac{t^2 h b^2}{I}$
12. The effective flange area in tension of a plate girder is equal to (where  $A_f$  is the area of each flange and  $A_w$  is the web area).  
 A.  $A_f$       B.  $A_f + \frac{A_w}{2}$       C.  $A_f + \frac{A_w}{8}$       D.  $A_f + \frac{A_w}{6}$
13. For complete hydration of cement the W/C ratio needed is  
 A. less than 0.25  
 B. more than 0.25 but less than 0.35

- C. more than 0.35 but less than 0.45  
D. more than 0.45 but less than 0.60
14. A hollow circular column at internal diameter 'd' and external diameter '1.5 d' is subjected to compressive load. The maximum distance of the point of application of load from the centre for no tension is  
A.  $d/8$     B.  $13d/48$     C.  $d/4$     D.  $13d/96$
15. Consider the following statements :1. Alum coagulation decreases the alkalinity of water.2. Alum coagulation increases permanent hardness of water.3. Alum coagulation decreases pH of water.4. Alum coagulation produces aluminium hydroxide flocks in the flocculation process.Which of the statements given above are correct ?  
A. 1, 2, 3 and 4  
B. 1, 3 and 4 only  
C. 1 and 2 only  
D. 2, 3 and 4 only
16. A seamless pipe with 80 cm diameter carries a fluid under a pressure of 2 N/mm<sup>2</sup>. If the permissible tensile stress is 100 N/mm<sup>2</sup>, the minimum required thickness of the pipe is  
A. 2 mm    B. 4 mm    C. 8 mm    D. 16 mm
17. A simply supported beam of span l and flexural rigidity EI, carries a unit point load at its centre. The strain energy in the beam due to bending is  
A.  $\frac{\beta^3}{48EI}$     B.  $\frac{\beta^3}{192EI}$     C.  $\frac{\beta^3}{96EI}$     D.  $\frac{\beta^3}{16EI}$
18. A beam carries a uniformly distributed load throughout its length. In which of the following configurations will the strain energy be maximum ?  
A. Cantilever  
B. Simply supported beam  
C. Propped cantilever  
D. Fixed beam
19. If carbon monoxide is released at the rate of 0.03 m<sup>3</sup>/min from a gasoline engine and 50 ppm is the threshold limit for an 8-hour exposure, the quantity of air which dilutes the contaminant to a safe level will be  
A. 60 m<sup>3</sup>/min  
B. 600 m<sup>3</sup>/min  
C. 600 m<sup>3</sup>/s  
D. 60 m<sup>3</sup>/s

20. Consider the following factors :1. Provision of a suitable slope to the top of the sill.2. Proper throating of the sill to throw off the water outside.3. Giving a projection of not less than 50 mm to the sill.4. Providing damp-proof course below the sill to check the entry of moisture inside the main wall.Those considered while constructing a brick sill would include  
A. 1 and 2      B. 1, 3 and 4      C. 2, 3 and 4      D. 1, 2, 3 and 4
21. Due to horizontal pull of 60 kN at C, what is the force induced in the member AB?  
A. 0      B. 40 kN      C. 80 kN      D. 100 kN
22. California Bearing Ratio (CBR) is a :  
A. measure of soil strength  
B. method of soil identification  
C. measure to indicate the relative strengths of paving materials  
D. measure of shear strength under lateral confinement
23. Consider the following statements :1. Masonry in rich cement mortar though having good strength with high shrinkage is much liable for surface cracks. 2. Lime mortar possesses poor workability and poor water retentivity and also suffers high shrinkage.3. Masonry in lime mortar has better resistance against rain penetration and is less liable to crack when compared to masonry in cement mortar.Which of these statements are correct ?  
A. 1, 2 and 3      B. 1 and 2      C. 2 and 3      D. 1 and 3
24. For a given stress, the ratio of the moment of resistance of a beam of square section when placed with one diagonal horizontal to the moment of resistance of the same beam when placed with two sides horizontal will be  
A.  $\frac{1}{2}$       B. 2      C. 1.414      D.  $\frac{1}{1.414}$
25. A water jet 0.02 m<sup>2</sup> in area has a velocity of 15 m/s. If the jet impinges normally on a plate which is moving at a velocity 5 m/s in the direction of the jet, what is the force on the plate due to this impact ? (Density = 1000 kg/m<sup>3</sup>)  
A. 200 N      B. 2000 N      C. 20000 N      D. 4000 N
26. Which one of the following would help prevent the escape of foul sewer gases from a water closet ?  
A. Air gap  
B. Vent pipe  
C. Gulley trap  
D. None of the above

27. The beam shown in the given figure has a design bending moment value of  
 A. 8 kNm      B. 6 kNm      C. 4 kNm      D. 2 kNm
28. Length of line measured with a 20 m chain was found to be 634.4 m. If the chain was 5 cm too long, throughout the measurement, then the true length of the line is  
 A. 635.990 m      B. 635.986 m      C. 632.818 m      D. 632.814 m
29. What does the Williot-Morr diagram yield ?  
 A. Forces in members of a truss  
 B. Moments in a fixed beam  
 C. Reactions at the supports  
 D. Joint displacement of a pinjointed plane frame
30. The runway length after correcting for elevation and temperature is 2845 m. If the effective gradient on runway is 0.5 per cent, then the revised runway length will be  
 A. 2845 m      B. 2910 m      C. 3030 m      D. 3130 m
31. Which of the following advantages accrue to the use of Articulate Dump Trucks (ADT) over Rigid Dump Trucks (RDT) for construction and earth moving work ?  
 1. Higher manoeuvrability  
 2. Low turning radius  
 3. Lower fleet costs  
 Select the correct answer using the code given below :  
 A. 1, 2 and 3      B. 1 and 2      C. 1 and 3      D. 2 and 3
32. A bar of square cross-section, having area of cross-section 'A' is subjected to a compressive force 'P' as shown in the figure. The intensity of the tangential stress on the oblique plane is given by  
 A.  $P \sin 2\theta$       B.  $P \cos 2\theta$       C.  $\frac{P}{2} \sin 2\theta$       D.  $\frac{P}{2} \cos 2\theta$
33. Which one of the following statements is correct ?  
 Linear arch is one which represents :  
 A. centre line of an arch  
 B. variation of bending moment  
 C. thrust line  
 D. variation of shear force
34. The two-peg test in the adjustment of a dumpy level employs the principle that  
 A. equal lengths at back sight and fore sight do not affect the difference in level.  
 B. reciprocal levelling eliminates errors of non-parallel instrument and collimation axes.

- C. two readings from the same station will minimize errors in bubble tube axis.
  - D. correction is made for vertical axis at one peg and for horizontal axis at the other peg.
35. Undisturbed soil samples are required for conducting
- A. hydrometer test
  - B. shrinkage limit test
  - C. consolidation test
  - D. specific gravity test
36. In a plastic analysis of structures, the segment between any two successive plastic hinges is assumed to deform as :
- A. A plastic material
  - B. A rigid material
  - C. An elastic material
  - D. An inelastic material
37. Consider the following assumptions :1. The shearing stress in all the rivets is uniform2. The bearing stress is not uniform3. Bending of rivets can be neglectedThe assumptions made while designing a riveted joint would include
- A. 1, 2 and 3
  - B. 1 and 2
  - C. 2 and 3
  - D. 1 and 3
38. Surkhi is added to lime mortar to
- A. prevent shrinkage
  - B. decrease setting time
  - C. increase bulk
  - D. impart hydraulicity.
39. The Trap used for a water closet is called
- A. gully trap
  - B. *p*-trap
  - C. intercepting trap
  - D. anti-siphon trap
40. For a sleeper density of  $(n + 5)$ , the number of sleepers required for constructing a broad gauge (BG) railway track of length 650 m is
- A. 975
  - B. 918
  - C. 900
  - D. 880
41. Consider the following statements in respect of a thick cylinder subjected to internal pressure:1. The stress on an element on the outer wall is unidirectional2. The stresses on an element on the inner wall are principal stresses.3. The constants of the Lames equation are positive.Which of these statements are correct ?
- A. 1 and 2
  - B. 1 and 3
  - C. 2 and 3
  - D. 1, 2 and 3

42. Consider the following statements: An aqueduct is a cross drainage work in which (a) a canal is carried over the drainage channel (b) a drainage channel is carried over the canal (c) both drainage channel and canal are at the same level. Which of the statements given above is/are correct ?  
 A. 1 only      B. 1 and 2 only      C. 2 and 3 only      D. 1, 2 and 3
43. Two shafts of same material and same length are connected in series and subjected to a torque 'T' as shown in the given figure. If , what is the value of the ratio ? (Where  $\tau_1$  and  $\tau_2$  are the extreme shear stresses in either of two segments)  
 A. 4      B. 2      C. 8      D. 16
44. Which one of the following is the most critical rivet in the joint shown in the figure given?  
 A. No. 1      B. No. 2      C. No. 3      D. No. 4
45. A good brick when immersed in water bath for 24 hours, should not absorb more than  
 A. 20% of its dry weight  
 B. 30% of its saturated weight  
 C. 10% of its dry weight  
 D. 20% of its saturated weight
46. A truss ABC, carries two horizontal and two vertical loads, as shown in the figure. The horizontal and vertical components of the reaction at A will be  
 A.  $H_A = 1000 \text{ kN}$  ;  $V_A = 1706.25 \text{ kN}$   
 B.  $H_A = 2000 \text{ kN}$  ;  $V_A = 2550 \text{ kN}$   
 C.  $H_A = 1000 \text{ kN}$  ;  $V_A = 2550 \text{ kN}$   
 D.  $H_A = 2000 \text{ kN}$  ;  $V_A = 1706.25 \text{ kN}$
47. Contour interval on a map sheet denotes  
 A. vertical distance of contour lines above the datum plane  
 B. vertical distance between two successive contour lines  
 C. slope distance between two successive contour lines  
 D. horizontal distance between two successive contour lines
48. Which one of the following is the correct statement ? A particle in simple harmonic motion while passing through the mean position will have  
 A. minimum kinetic energy and minimum potential energy  
 B. maximum kinetic energy and maximum potential energy  
 C. maximum potential energy and minimum kinetic energy  
 D. maximum kinetic energy and minimum potential energy



49. What are the phenomena of global warming and acid rain formation attributed to ?
- SO<sub>2</sub> and CO<sub>2</sub> respectively
  - CO and SO<sub>2</sub>, respectively
  - CO<sub>2</sub> and SO<sub>2</sub>, respectively
  - CO and CO<sub>2</sub>, respectively
50. The following observation relate to designing of laced column :1. Single lacing systems on opposite planes shall preferably be in the same direction so that one is the shadow of the other.2. Lacing bar should only be a flat.3. The slenderness ratio of the lacing bars for compression shall not exceed 180.4. Laced compression members are to be provided with tie plates of ends.Of these observations :
- 1, 2, 3 and 4 are correct
  - 1, 3 and 4 are correct
  - 2 and 3 are correct
  - 1 and 4 are correct

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	D	D	D	C	B	B	C	A	C
10	C	C	C	B	A	C	C	A	A	A
20	D	C	A	D	B	D	D	B	D	D
30	B	C	C	A	C	B	D	A	B	C
40	D	A	C	C	A	B	B	D	C	D

## Section 24

1. For Froude number of a hydraulic jump is 5.5. The jump can be classified as a/an:
  - A. undular jump
  - B. oscillating jump
  - C. weak jump
  - D. steady jump
2. A cantilever pin-jointed truss carries one load  $P$  at the point  $Z$  as shown in the given figure. The hinges in the vertical wall are at  $A$  and  $D$ . The truss has only three horizontal members  $AC$ ,  $CG$  and  $GZ$ . The nature of force in member  $AB$ 
  - A. is tensile
  - B. is zero
  - C. is compressive
  - D. cannot be predicted
3. A saturated stiff clay has unit weight  $2 \text{ gm/cm}^3$  and unconfined compressive strength  $2 \text{ kg/cm}^2$ . The depth of tension crack that would develop in this clay is
  - A. 2 m
  - B. 5 m
  - C. 10 m
  - D. 20 m
4. Consider the following statements :
  1. In a member subjected to uniaxial tensile force the maximum normal stress is the external load divided by the maximum cross-sectional area.
  2. When the structural member is subjected to uniaxial loading, the shear stress is zero on a plane where the normal stress is maximum.
  3. In a member subjected to uniaxial loading, the normal stress on the planes of maximum shear stress is less than the maximum.Of these statements :
  - A. 1 and 2 are correct
  - B. 1 and 3 are correct
  - C. 2 and 3 are correct
  - D. 1, 2 and 3 are correct
5. The displacement thickness of a boundary layer is
  - A. The distance to the point where  $(v/V) = 0.99$
  - B. the distance where the velocity  $v$  is equal to the shear velocity  $V^*$  that is where  $v = V^*$
  - C. the distance by which the main flow is to be shifted from the boundary to maintain the continuity equation
  - D. one-half the actual thickness of the boundary layer
6. The axial load which just produces the condition of elastic instability in a column is

- A. Rankine load      B. Euler load      C. Yield load      D. Crushing load
7. If  $R$  is the radius of the circular railway curve in metres and  $D$  is the degree of the curve, then which one of the following is the expression for  $D$  ?
- A.  $D = 360/R$   
 B.  $D = 1080/R$   
 C.  $D = 1720/R$   
 D.  $D = 720/R$
8. Given below are methods of compaction :1. Vibration technique 2. Flooding the soil 3. Sheeps-foot roller 4. Tandem roller 5. Heavy weights dropped from a height. The methods suitable for cohesionless soils include
- A. 1, 2 and 3      B. 2, 3 and 4      C. 1, 2 and 5      D. 3, 4 and 5
9. The ratio of torsional moments of resistance of a solid circular shaft of diameter  $D$  and a hollow shaft having external diameter  $D$  and internal diameter  $d$  is given by
- A.  $\frac{D^4}{D^4 - d^4}$       B.  $\frac{D^4 - d^4}{D^4}$       C.  $\frac{D^3}{D^3 - d^3}$       D.  $\frac{D^3 - d^3}{D^3}$
10. Consider the following statements relating to triaxial tests :1. Change in length of the specimen in a triaxial shear test is required to be accounted for in the calculation of stresses at failure. 2. In 'Drained Triaxial Shear Test', drainage is permitted under a specified all-round pressure until consolidation is complete. The principal stress difference is then applied with no drainage being permitted. 3. Unconfined compression test is a special case of triaxial shear test. Of these statements :
- A. 1 and 2 are correct  
 B. 1 and 3 are correct  
 C. 2 and 3 are correct  
 D. 1, 2 and 3 are correct
11. The given figure shows the arrow diagram for a particular project. The arrow 'A' is known as
- A. critical activity  
 B. sub-critical activity  
 C. logic arrow  
 D. dummy activity
12. In a plane strain problem in  $XY$  plane, the shear strain  $= 12 \times 10^{-6}$ , and the normal strain in  $X$  and  $Y$  direction  $= 0$ , For this state of

- strain, what is the diameter of the Mohr's Circle of strain ?  
 A.  $6 \times 10^{-6}$     B.  $8 \times 10^{-6}$     C.  $12 \times 10^{-6}$     D.  $24 \times 10^{-6}$
13. A horizontal fixed beam is fixed at both its ends A and B. During loading, the right support sinks by an amount  $\delta$ . Flexural rigidity of the beam is uniform and is equal to  $EI$ . Length of the beam is  $L$ . What is the moment developed at the centre of the beam due to sinking of the support ?  
 A.  $6 EI \delta / L^2$   
 B. zero  
 C.  $3 EI \delta / L^2$   
 D.  $12 EI \delta / L^2$
14. A lighthouse is visible just above the horizon at a certain station at the sea level. The distance between the station and the lighthouse is 40 km. The height of the lighthouse is approximately  
 A. 187 m    B. 137.7 m    C. 107.7 m    D. 87.3 m
15. Which of the following are the additional moments considered for design of slender compression member in lieu of deflection in  $x$  and  $y$  directions ? (Where  $P_u$  is axial load;  $l_{ex}$  and  $l_{ey}$  are effective lengths in respective directions;  $D$  depth of section  $\perp$  to major axis;  $b$  width of the member)  
 A.  $\frac{P_u l_{ex}^2}{2000 D}$  and  $\frac{P_u l_{ey}^2}{2000 D}$     B.  $\frac{P_u l_{ex}}{2000}$  and  $\frac{P_u l_{ey}}{2000}$     C.  $\frac{P_u l_{ex}^2}{2000 D}$  and  $\frac{P_u l_{ey}^2}{2000 b}$   
 D.  $\frac{P_u l_{ex}^2}{200 D}$  and  $\frac{P_u l_{ey}^2}{200 D}$
16. A close-coiled helical spring has 100 mm mean diameter and is made of 20 turns of 10 mm diameter steel wire. The spring carries an axial load of 100 N. Modulus of rigidity is 84 GPa. The shearing stress developed in the spring in  $N/mm^2$  is  
 A.  $120/\pi$     B.  $160/\pi$     C.  $100/\pi$     D.  $80/\pi$
17. Consider the following statements pertaining to plane table survey:  
 1. Two-point problem is solved by mechanical method.  
 2. Three-point problem is solved by Bessel's method.  
 3. In two-point problem, auxiliary station is required.  
 Of these statements :  
 A. 1 and 2 are correct  
 B. 1 and 3 are correct  
 C. 2 and 3 are correct  
 D. 1, 2 and 3 are correct
18. If a member is subjected to tensile stress of  $p_x$ , compressive stress of  $p_y$  and tensile stress of  $p_z$  along the  $x$ ,  $y$  and  $z$  directions respectively,

then the resultant strain 'ex' along the 'x' direction would be (E is Young's modulus of elasticity,  $\mu$  is Poisson's ratio)

- A.  $\frac{1}{E} (\rho_x + \mu\rho_y - \mu\rho_z)$       B.  $\frac{1}{E} (\rho_x + \mu\rho_y + \mu\rho_z)$       C.  $\frac{1}{E} (\rho_x - \mu\rho_y + \mu\rho_z)$   
D.  $\frac{1}{E} (\rho_x - \mu\rho_y - \mu\rho_z)$

19. A cantilever is subjected to a uniformly distributed load W over its whole length 'L' and a concentrated upward force W at its free end. The deflection of the free end is

- A. zero      B.  $\frac{1}{384} \frac{WL^3}{EI} \downarrow$       C.  $\frac{5}{24} \frac{WL^3}{EI} \uparrow$       D.  $\frac{1}{2} \frac{WL^3}{EI} \downarrow$

20. The local sidereal time (LST) is always

- A. ahead of the local mean time (LMT) by about 2 hours per month  
B. behind LMT by about 2 hours per month  
C. ahead of LMT by about 4 hours per month  
D. equal to LMT

21. Consider the following statements :I: To insert a 28 mm nominal diameter rivet, 29.5 mm rivet hole is made.II: Provision is made to allow temperature expansion of the bolt.

- A. both I and II are true  
B. I is true but II is false  
C. I is false but II is true  
D. both I and II are false

22. Consider the following statements :A : For beams, I-sections are more economical than rectangular section. R : Most of the material is concentrated away from the centroid. Of these statements :

- A. Both A and R are true and R is the correct explanation of A  
B. Both A and R are true but R is not a correct explanation of A  
C. A is true but R is false  
D. A is false but R is true.

23. Two different granular soils are placed in a permeameter tube and flow is allowed to take place under a constant total head. The total head and pressure head at point A in centimeters, are respectively.

- A. 75, 75      B. 25, 75      C. 25, 25      D. 75, 25

24. When the degree of consolidation is 50%, the time factor is about

- A. 0.2      B. 0.5      C. 1.0      D. 2.0

25. General shrinkage in cement concrete is caused by

- A. carbonation

- B. stresses due to external load
  - C. drying the starting with a stiff consistency
  - D. drying starting with a wetter consistency.
26. The distribution system configuration shown in the following figure is called
- A. dead end system
  - B. grid iron system
  - C. radial system
  - D. ring system
27. The phenomenon of reflection cracking is observed in which of the following ?
- A. Bituminous overlays provided over cracked cement concrete pavements
  - B. Cement concrete overlays provided over cracked bituminous pavements.
  - C. Bituminous overlays constructed in cold weather
  - D. Cement concrete overlays provided over cement concrete pavements.
28. What are the gases produced by landfills primarily comprised of?
- A. Carbon monoxide and hydrogen sulphide.
  - B. Methane and carbondioxide
  - C. Sulphur dioxide and nitrogendioxide
  - D. Ethane and oxygen.
29. Consider the following statements regarding specific energy of flow in an open channel :1. There is only one specific energy curve for a given channel.2. Alternate depths are the depths of flow at which the specific energy is the same.3. Critical flow occurs when the specific energy is minimum.Of these statements :
- A. 1 and 2 are correct
  - B. 1 and 3 are correct
  - C. 2 and 3 are correct
  - D. 1, 2 and 3 are correct
30. A motor shaft rotating with a speed of 90 rpm decelerates uniformly when the motor is switched off and stops in 40 sec. The number of revolutions made by the shaft in this time would be
- A. 10      B. 20      C. 30      D. 40
31. Which one of the following statements is correct ?The portal method of structural analysis is generally suitable for

- A. tall buildings  
 B. low-rise buildings  
 C. low-rise buildings with uniform framing  
 D. low-rise buildings with non-uniform framing.
32. How high should a helicopter pilot rise at a point. A just to see the horizon at point B, if the distance AB is 40 km ?  
 A. 101.75 m    B. 110.50 m    C. 107.75 m    D. 105.50 m
33. A cantilever beam 'A' with rectangular cross-section is subjected to a concentrated load at its free end. If width and depth of another cantilever beam 'B' are twice those of beam A, then the deflection at free end of the beam 'B' as compared to that of 'A' will be  
 A. 6.25%    B. 14%    C. 23.6%    D. 28%
34. A bar of square section is subjected to a pull of 10000 kg. If the maximum allowable shear stress on any section is 500 kg/cm<sup>2</sup>, then the side of the square section will be  
 A. 5 cm    B. 10 cm    C. 15 cm    D. 20 cm
35. A clay sample has a void ratio of 0.54 in dry state. The specific gravity of soil solids is 2.7. What is the shrinkage limit of the soil ?  
 A. 8.5%    B. 10.0%    C. 17.0%    D. 20.0%
36. Consider the following statements related to Los Angeles Abrasion test on aggregates :1. It evaluates hardness of source - rock2. It has a coefficient of variation of about 30 percentWhich of the statements given above is/are correct ?  
 A. 1 only  
 B. 2 only  
 C. Both 1 and 2  
 D. Neither 1 nor 2
37. A bar of uniform cross-section of 400 mm<sup>2</sup> is loaded as shown in the figure. The stress at section 1-1 is  
 A. 50 N/mm<sup>2</sup>    B. 100 N/mm<sup>2</sup>    C. 25 N/mm<sup>2</sup>    D. 200 N/mm<sup>2</sup>
38. Due to settlement of support at A of propped cantilever shown in the figure given below, what is the vertical reaction at B ?  
 A.  $\frac{12EI \Delta}{\beta^3}$     B.  $\frac{6EI \Delta}{\beta^3}$     C.  $\frac{4EI \Delta}{\beta^3}$     D.  $\frac{3EI \Delta}{\beta^3}$
39. A wooden plank (sp. gr. 0.5) 1 m x 1 m x 0.5 m floats in water with 1.5 kN load on it with 1 m x 1 m surface horizontal. The depth of plank lying below water surface shall be  
 A. 0.178 m    B. 0.250 m    C. 0.403 m    D. 0.500 m

40. A parabolic vertical curve is to be set out connecting two uniform grades of +0.6% and +.0%. The rate of change of grade is to be 0.06% per 30 m. The length of the curve will be  
A. 66 2/3 m    B. 133 1/3 m    C. 200 M    D. 266 2/3 m
41. For an activity 201-207 in an AOA network, the EET values, LET values and activity duration are shown in the figure. Between free float, interference float and independent float, which one of the following is the correct sequence in the decreasing magnitude order ?  
A. Free float - Interference float - Independent float  
B. Free float - Independent float - Interference float  
C. Interference float - Free float - Independent float  
D. Interference float - Independent float - Free float
42. Consider the following statements :1. Dock is a marine structure for mooring up vessels, loading and unloading of passengers and/or cargo.2. Dry dock is generally used only for carrying out repairs, inspections and painting.3. Wet dock is an enclosed or partially enclosed basin provided with locks and entrance gate to keep the water level at a fairly constant level.Which of the statements given above are correct ?  
A. 1, 2 and 3    B. 2 and 3    C. 1 and 2    D. 1 and 3
43. Which one of the following statements is true to trickling filter sludge ?  
A. It has a comparatively low sludge volume index  
B. It is more difficult to dewater than activated sludge  
C. It has a comparatively low concentration of sludge solids  
D. It is bulky
44. In the case of a column of length 'l', moment of inertia of cross-section 'I' and Young's modulus of the material of the column 'E' being hinged at both ends, the buckling load, according to Euler's column  
A.  $\frac{4 \pi^2 EI}{l^2}$     B.  $\frac{2 \pi^2 EI}{l^2}$     C.  $\frac{\pi^2 EI}{l^2}$     D.  $\frac{\pi^2 EI}{4l^2}$
45. What is the correct sequence of the following steps in the graphical determination of stresses in the members of a loaded plane truss ?1. Vector diagram to determine the end reactions.2. Space diagram.3. Stress diagram.Select the correct answer using the codes given below :  
A. 1, 2, 3    B. 1, 3, 2    C. 2, 1, 3    D. 2, 3, 1
46. A steel rod of 16 mm diameter has been used as a tie in a bracing system, but may subject to possible reversal of stress due to the wind.



What is the maximum permitted length of the member ?

A. 1600 mm    B. 1400 mm    C. 1200 mm    D. 1000 mm

47. The total number, of independent equations that form the Lacey's regime theory is

A. 2    B. 3    C. 4    D. 6

48. The following methods are used for structural analysis :1. Macaulay method 2. Column analogy method3. Kani's method 4. Method of sectionsThose used for indeterminate structural analysis would include

A. 1 and 2    B. 1 and 3    C. 2 and 3    D. 2, 3 and 4

49. In the case of S2 water surface profile ( $y$  = depth of flow,  $y_0$  = normal depth,  $y_c$  = critical depth)

A.  $y - 0 < y - y_c < y$

B.  $y_c < y - 0 < y$

C.  $y_c < y < y - 0$

D.  $y < y_c < y - 0$

50. A summit vertical curve is to be set joining + 2 percent grade with -3 percent grade. If the tangents intersect at an elevation of 60 m and the rate of change of grade is - 1 percent per 100 m, then the elevation of the beginning point of the vertical curve will be

A. 58.5 m    B. 57.5 m    C. 55.0 m    D. 52.5 m

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	A	A	A	A	C	C	A	D
10	C	C	B	C	C	D	D	D	C	A
20	C	A	B	A	D	B	A	B	D	C
30	D	C	A	B	D	A	B	B	C	A
40	C	A	A	C	A	B	B	C	C	C

## Section 25

1. If an element is subjected to pure shearing stress  $\tau_{xy}$  then the maximum principal stress is equal to  
 A.  $2\tau_{xy}$       B.  $\tau_{xy}/2$       C.  $\tau_{-xy}$       D.  $1 - (\tau_{xy})^2$
2. The wall friction of the retaining wall:
  - A. decreases active earth pressure but increases passive earth pressure
  - B. decreases passive earth pressure but increases active earth pressure
  - C. decreases both active and passive earth pressures
  - D. increases both active and passive earth pressures
3. Consider the following statements :The salient features of a bar chart over network are that :1. It is simple to draw and easy to understand.2. It is unable to depict interdependence of activities.3. It clearly distinguishes between critical and non-critical activities.4. It is not possible to crash activities to get optimum and minimum duration of the project.Which of the following statements given above are correct ?  
 A. 1, 2, 3 and 4      B. 2 and 3      C. 1, 2 and 4      D. 1, 3 and 4
4. Which one of the following is the best method for locating sounding to estimate the dredged material from the harbours ?
  - A. Two angles from shore
  - B. Two angles from boat
  - C. One angle from shore and other from the boat
  - D. Fixed intersecting ranges
5. An open channel carrying super critical flow is provided with a smooth expansion along the direction of flow. When no other considerations interfere, then the water surface.
  - A. before transition will rise
  - B. after transition will rise
  - C. before transition will drop
  - D. after transition will drop
6. A sewer is laid from a manhole A to a manhole B, 250 m apart along a downward gradient of 1 in 250. If the reduced level of the invert at A is 205.75 m and the height of the boring rod is 3 m, then, reduced level of the sight rail at B, is  
 A. 202.75 m      B. 206.75 m      C. 208.75 m      D. 211.75 m
7. A body of mass 4 kg moving at 12 m/s collides with another body of mass 8 kg and adheres to it. The resultant velocity of the total mass in m/s will be  
 A. 4.0      B. 5.0      C. 6.0      D. 7.0

8. A soil sample is having a specific gravity of 2.60 and a void ratio of 0.78. The water content in percentage required to fully saturate the soil at the void ratio would be  
A. 10      B. 30      C. 50      D. 70
9. A rectangular channel carries a discharge of 5 m<sup>3</sup>/s. The channel is 2 m wide. What is the critical depth of the flow ?  
A. 1.25 m      B. 1.07 m      C. 0.565 m      D. 0.86 m
10. The discharge per unit drawdown at the well is known as :  
A. Specific yield  
B. Specific storage  
C. Specific retention  
D. Specific capacity
11. At a certain point in a strained material, there are two mutually perpendicular stresses  $\sigma_x = 100$  N/mm<sup>2</sup> (Tensile) and  $\sigma_x = 50$  N/mm<sup>2</sup> (Compressive). [Notations : Tension (+); Compression (-)] What are the values of the principal stresses in N/mm<sup>2</sup> at that point ?  
A. 100, -50      B. -100, 50      C. 75, -25      D. -75, 25
12. Which of the following materials are used as landfill salients for the control of gas and leachate moments ? 1. Lime 2. Sand 3. Bentonite 4. Fly ash 5. Butyl rubber  
Select the correct answer from the codes given below :  
A. 1, 2 and 3      B. 4 and 5      C. 3 and 5      D. 1, 2 and 4
13. In a three-dimensional incompressible flow, the velocity component in the X and Y directions are  $u = 2x^2 + z^2 + 6$  and  $v = y^2 + 2z^2 + 7$ . What is the velocity component in the z-direction ?  
A.  $2xz + 2yz + f(x, y)$   
B.  $2xz + 4yz + f(x, y)$   
C.  $4xz + 2yz + f(x, y)$   
D.  $-4xz - 2yz + f(x, y)$
14. Which one of the following shovel excavators is considered most efficient in loading carriers ?  
A. Dipper shovel      B. Dragline      C. Backhoe      D. Clamshell
15. Brake is applied on a vehicle which then skids a distance of 16 m before coming to stop. If the developed average coefficient of friction between the tyres and the pavement is 0.4, then the speed of the vehicle before skidding would have been nearly  
A. 20 kmph      B. 30 kmph      C. 40 kmph      D. 50 kmph
16. A right-angled triangular channel, symmetrical in section about the vertical, carries a discharge of 5 m<sup>3</sup> /s with a velocity of 1.25 m/s.

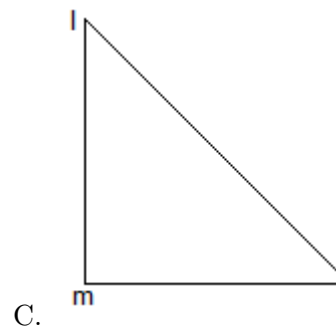
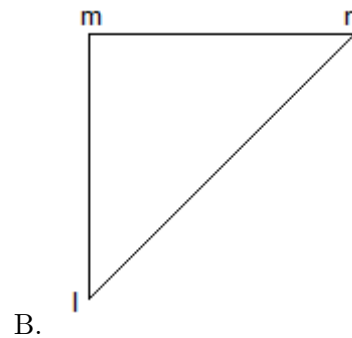
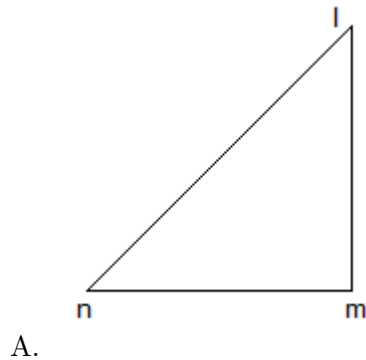
- What is the approximate value of the Froude number of the flow ?  
 A. 0.3      B. 0.4      C. 0.5      D. 0.6
17. Which one of the following pairs is not correctly matched ?  
 A. Water losses....Evaporation  
 B. Runoff....Stream flow  
 C. Percolation....Soil Erosion  
 D. Storm....Precipitation
18. Which of the following pairs is correctly matched ?  
 A. Froude's number .... Inertial to surface tension force  
 B. Mach number .... Inertial to elastic force  
 C. Euler number .... Inertial to gravity force  
 D. Reynolds number .... Inertial to pressure force
19. A section of a solid circular shaft with diameter D is subjected to bending moment 'M' and torque (T). The expression for maximum principal stress at the section is  
 A.  $\frac{2M + T}{\pi D^3}$       B.  $\frac{16\pi}{D^3} (M + \sqrt{M^2 - T^2})$       C.  $\frac{16\pi}{D^3} (\sqrt{M^2 - T^2})$       D.  $\frac{16\pi}{D^3} (M + \sqrt{M^2 + T^2})$
20. The flownet of activities of a project is shown in the given figure. The duration of the activities are written along the arrows. The critical path of the activities is along  
 A. 1-2-4-5-7-8  
 B. 1-2-3-5-7-8  
 C. 1-2-3-6-7-8  
 D. 1-2-4-5-3-6-7-8
21. Consider the following statement :1. Hydraulic gradient required to initiate "quick" condition is independent of the ratio of volume of voids of solids in a soil mass.2. Initiation of piping under hydraulic structures can be prevented by increasing the length of flow path of water.3. Seepage pressure is independent of the coefficient of permeability. Of these statement :  
 A. 1, 2 and 3 are correct  
 B. 1 and 2 are correct  
 C. 1 and 3 are correct  
 D. 2 and 3 are correct
22. Which of the following waste disposal tasks are achieved by a septic tank with its dispersion trench ?1. Aerobic sludge digestion2. Settling and anaerobic sludge digestion3. Anaerobic sewage stabilisation4. Bio-oxidation of effluent  
 Select the correct answer using the

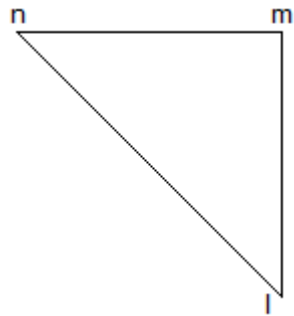
codes given below :

A. 1 and 3      B. 3 and 4      C. 2 and 4      D. 1 and 4

23. The expansion and shrinkage of plywoods are comparatively very low as
- A. they are held in position by adhesives
  - B. they are glued under pressure
  - C. plies are placed at right angles to each other
  - D. they are prepared from veneers
24. Which one of the following methods is usually adopted for site welding of rails ?
- A. Gas pressure welding
  - B. electric arc welding
  - C. Thermit welding
  - D. Flash butt welding
25. In a simply supported beam AB of span  $L$ , the midpoint is C. In case-1, the beam is loaded by a central concentrated load  $W$ . In case-2, the beam is subjected to a U.D.L. of intensity  $w$  such that  $wL = W$ . The ratio of central deflection in case-1 to that in case-2 is
- A.  $5/3$       B.  $3/5$       C.  $5/8$       D.  $8/5$
26. An imaginary line passing through the optical centre of the objective and the optical centre of the eye-piece in the telescope of a surveying instrument is called the
- A. horizontal axis
  - B. line of collimation
  - C. optical axis of the telescope
  - D. reference axis
27. Which of the following air pollutants is/are responsible for photochemical smog ? 1. Oxides of nitrogen 2. Ozone 3. Unburnt hydrocarbons 4. Carbon monoxide Select the correct answer from the codes given below :
- A. 1 alone      B. 2, 3 and 4      C. 1, 3 and 4      D. 1 and 3
28. Consider the following statements : Excess of sulphur in steel results in 1. red shortness 2. segregation 3. cold shortness. Of these statements :
- A. 1 alone is correct
  - B. 2 alone is correct
  - C. 2 and 3 are correct
  - D. 1 and 2 are correct
29. Which one of the following pairs is not correctly matched ?

- A. Declination : Horizontal angle between magnetic meridian & true meridian
- B. Bowditch's rule : Employed to adjust closing error of a closed traverse
- C. Deflection angle : Measured in case of open traverse instead of measuring included angle
- D. Reconnaissance survey : Employed for detailed and precise survey
30. Consider the following statements :Some amount of chlorides is allowed in drinking water because1. it helps in killing bacteria.2. small quantity of chlorides adds to the taste3. it is not injurious to human health.4. it is not economical to remove it completely.Which of these statements are correct ?
- A. 1, 2 and 4      B. 1, 2 and 3      C. 2, 3 and 4      D. 1, 3 and 4
31. A simply supported rectangular beam of span 'L' and depth 'd' carries a central load 'W' What ratio of maximum deflection to maximum bending stress is
- A.  $L^2/6Ed$
- B.  $L^2/8Ed$
- C.  $L^2/48Ed$
- D.  $L^2/12Ed$
32. A cantilever truss with joints labelled as 1, 2, and 3 is shown in the given figure. It carries a - vertical load of 10 kN at joint 2.





D.

33. A short bar element of uniform cross-section is subjected to concentrated axial forces at its two ends. The longitudinal stress distribution on the cross-section is uniform at
- all sections
  - the two ends only
  - the mid-section only
  - sections reasonably away from the two ends of the bar
34. When power shovels are operated under different site conditions (in terms of material handled), what is the correct sequence in the increasing order of the output for the following materials ?  
 1. Well - blasted rock  
 2. Hard and tough clay  
 3. Poorly blasted rock  
 4. Moist loam or sand  
 Select the correct answer using the code given below :
- 1 - 2 - 3 - 4
  - 1 - 4 - 3 - 2
  - 4 - 2 - 3 - 1
  - 4 - 3 - 1 - 2
35. In a saturated clay layer undergoing consolidation with single drainage at its top, the pore water pressure would be the maximum at its
- top
  - middle
  - bottom
  - top as well as the bottom
36. A flownet constructed to determine the seepage through an earth dam which is homogeneous but anisotropic, gave four flow channels and sixteen equipotential drops. The coefficients of permeability in the horizontal and vertical directions are  $4 \times 10^{-7}$  m/s and  $1.0 \times 10^{-7}$  m/s, respectively. If the storage head was 20 m, then the seepage per unit length of the dam (in  $\text{m}^3/\text{s}$ ) would be
- $5 \times 10^{-7}$
  - $10 \times 10^{-7}$
  - $20 \times 10^{-7}$
  - $40 \times 10^{-7}$
37. A roaring rail has which one of the following defects ?
- Split on head of rail
  - Minute depression and waves on the surface of rails
  - Split on web portion of rail

- D. Square cracks on the surface of rail
38. While aligning a hill road with a ruling gradient of 1 in 20, horizontal curve of radius 80 m is encountered. The compensated gradient on the curve will be  
 A. 1 in 15      B. 1 in 17      C. 1 in 25      D. 1 in 27
39. Stratification of water with depth in reservoir (with free surface) is based on temperature. The dark stagnant cooler water layer is known as  
 A. Epilimnion      B. Hypolimnion      C. Metalimnion      D. Boundary
40. The following steps are involved in arriving at a unit hydrograph.1. Estimating the surface runoff in depth.2. Estimating the surface runoff in volume.3. Separation of base flow.4. Dividing surface runoff ordinates by depth of runoff.The correct sequence of the steps is :  
 A. 3 2 1 4      B. 2 3 4 1      C. 3 1 2 4      D. 4 3 2 1
41. What type of vibrator is used for concreting thin section as well as heavily reinforced section?  
 A. Vibrating needle  
 B. Internal vibrator  
 C. Surface vibrator  
 D. Form vibrator
42. The difference between the sum of the angles of a plane triangle and the sum of the angles of a spherical triangle is one second when the triangle on the earth surface has an area of about  
 A. 105 sq.km.      B. 135 sq.km.      C. 159 sq.km.      D. 195 sq.km.
43. Consider the following statements :1. The standard penetration test is a reliable method for measuring the relative density of granular soils.2. For a sand having the same relative density, N-values remain the same at all depths.3. For a sand having the same relative density, N-values are different at different depths.Which of the statements given above is/are correct ?  
 A. 1, 2 and 3      B. 1 and 2      C. only 3      D. 1 and 3
44. In a plane table survey, the plane table station position was to be fixed with respect to three reference points. It was found that one of the reference points was not visible due to some obstruction. It was, therefore decided to make use of the other two points only. Which one of the following statements is true regarding the determination of station position ?  
 A. The work can be done faster.  
 B. Two settings of the plane table will be needed but the work will be accurate.



- C. Only one setting of the table is needed, however the work will be less accurate.  
D. The work will be less accurate and time consuming.
45. Putty is made up of  
A. white lead and turpentine  
B. powdered chalk and raw linseed oil  
C. red lead and linseed oil  
D. zinc oxide and boiled linseed oil
46. Why are weep holes provided at the back of retaining walls ?  
A. To reduce the active earth pressure on the walls  
B. To reduce the build - up of hydrostatic pressure  
C. To provide better compaction  
D. To increase the passive earth pressure
47. For the frame shown in the figure, the distribution factors for members BC and BA at joint B are  
A. 0.4, 0.6      B. 0.5, 0.5      C. 0.6, 0.4      D. 0.7, 0.3
48. Force in the member AB of the frame shown in the given figure will be:  
A. zero      B.  $W$       C.  $W/2$       D.  $\frac{W}{\sqrt{2}}$
49. What should be the minimum grade of reinforced concrete in and around sea coast construction?  
A. M 35      B. M 30      C. M 25      D. M 20
50. A sand deposit has a porosity of  $1/3$  and its specific gravity is 2.5. The critical hydraulic gradient to cause sand boiling in the stratum will be  
A. 1.5      B. 1.25      C. 1.0      D. 0.75

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	A	C	C	B	B	A	B	D	D
10	A	C	D	C	C	B	A	B	D	B
20	D	C	C	B	D	B	D	A	D	D
30	A	C	A	C	C	B	B	C	B	B
40	D	D	D	B	B	B	C	A	B	C

## Section 26

1. What is the correct sequence of the following events in rock tunnelling :1. Marking tunnel profile 2. Loading explosive and blasting3. Checking misfire 4. Mucking5. Removing foul gas 6. Setting up and drilling7. GunningSelect the correct answer using the codes given below :
  - A. 1, 6, 5, 3, 4, 2, 7
  - B. 1, 2, 6, 3, 5, 4, 7
  - C. 1, 6, 2, 5, 4, 3, 7
  - D. 1, 6, 2, 5, 3, 4, 7
2. Which of the following are the criteria associated with the design of sag vertical curve ?1. Provision of minimum stopping distance during day time2. Adequate drainage3. Comfortable operation4. Pleasant appearanceSelect the correct answer using the codes given below:
  - A. 1, 2 and 4
  - B. 2 and 3
  - C. 2, 3 and 4
  - D. 1 and 3
3. Which one of the following is the correct statement ?Refractory bricks resist:
  - A. high temperature
  - B. chemical action
  - C. dampness
  - D. all the above three
4. The following quantities refer to a channel section used as a beam : b = width of flange (upto centre of web thickness).h = depth of web (c/c of flange thickness). t = thickness of flange and web.I = moment of inertia of channel about xx axis.e = distance of shear centre, outside the channel from the mid thickness of the web.The value of 'e' is given by
  - A.  $tb^2/4Ih^2$
  - B.  $th^2b^2/4I$
  - C.  $h^2I/4tb^2$
  - D.  $h^2b^2/4tI$
5. Which of the following statements is NOT correct ?
  - A. Chlorides in potable water may be present from 300 ppm to 500 ppm.
  - B. In order to be safe against pathogenic bacteria residual chlorine should remain between 0.05 ppm and 0.20 ppm.
  - C. Presence of iron and manganese in excess of 0.3 ppm in drinking water is objectionable.
  - D. pH value for pure water is nearly 7.

6. The velocity distribution for flow over a plate is given by  $u = 0.5 y - y^2$  where  $u$  is the velocity in m/s at a distance  $y$  metre above the plate. If the dynamic viscosity of the fluid is  $0.9 \text{ N/m}^2$ , then what is the shear stress at  $0.20 \text{ m}$  from the boundary?  
A.  $0.9 \text{ N/m}^2$     B.  $1.8 \text{ N/m}^2$     C.  $2.25 \text{ N/m}^2$     D.  $0.09 \text{ N/m}^2$
7. Consider the following :1. Initial consolidation.2. Primary consolidation.3. Secondary consolidation.4. Final consolidation.The three stages which would be relevant to consolidation of a soil deposit includes  
A. 1, 2 and 3    B. 2, 3 and 4    C. 1, 3 and 4    D. 1, 2 and 4
8. Consider the following statements :1. Mastic asphalt is a mixture of hard grade bitumen or blown bitumen, minerals filler and fine aggregates.2. % of binder content in the mastic asphalt is 17-20 percent by weight of the aggregates. Which of the statements given above is/are correct ?  
A. 1 only  
B. 2 only  
C. Both 1 and 2  
D. Neither 1 nor 2
9. An element is subjected to stress as given in figure. For this state of stress, what is the maximum shear stress ?  
A.  $2.5 \text{ MPa}$     B.  $5 \text{ MPa}$     C.  $10 \text{ MPa}$     D.  $15 \text{ MPa}$
10. What is the maximum possible value of Poisson's ratio for a non-dilatant material ?  
A.  $0.67$     B.  $0.50$     C.  $0.33$     D.  $0.25$
11. Consider the following statements :Curing of concrete is necessary because(a) concrete needs more water for chemical reaction(b) it is necessary to protect the water initially mixed in concrete from being lost during evaporation(c) penetration of surrounding water increases the strength of concrete Which of the statements given above is/are correct ?  
A. 1, 2 and 3    B. 1 and 3 only    C. 2 only    D. 3 only
12. The combined correction for curvature and refraction for a distance of  $1400 \text{ m}$  is  
A.  $0.153 \text{ m}$     B.  $0.132 \text{ m}$     C.  $0.094 \text{ m}$     D.  $0.021 \text{ m}$
13. Given that for a soil deposit,  $K_0$  = earth pressure coefficient at rest,  $K_a$  = active earth pressure coefficient,  $K_p$  = passive earth pressure coefficient and  $\mu$  = Poisson's ratio, the value of  $(1 - \mu)$  is given by  
A.  $K_a/K_p$     B.  $K_0/K_a$     C.  $K_p/K_a$     D.  $1/K_0$
14. In water treatment process, the chemical used for defluoridation is

- A. Alum  
B. Lime  
C. Potassium permanganate  
D. Sodium aluminate
15. An elastic bar of length 'l', cross-sectional area A, Young's modulus of elasticity E and self-weight W is hanging vertically. It is subjected to a load P applied axially at the bottom end. The total elongation of the bar is given by.
- A.  $WI/AE + PI/AE$   
B.  $WI/2AE + PI/AE$   
C.  $WI/2AE + PI/2AE$   
D.  $WI/AE + PI/2AE$
16. A gradually applied load W is suspended by with ropes AB and CD as shown in the figure. The wires AB and CD, made of the same material and of the same cross-section are connected to a rigid block from which the load W is suspended in such a way that both the ropes stretch by the same amount. If the stress in AB and CD are  $p_1$  and  $p_2$  respectively, then the ratio - will be
- A.  $\frac{3}{2}$       B.  $\frac{2}{3}$       C.  $\frac{4}{9}$       D.  $\frac{9}{4}$
17. For a state of plane stress  $\sigma_1 = \sigma_x = 40$  MPa, and  $\sigma_2 = \sigma_y = 20$  MPa. What are the values of the maximum in-plane shearing stress and absolute maximum shearing stress ?
- A.  $(\pm 10, 20)$  MPa  
B.  $(\pm 10, 10)$  MPa  
C.  $(\pm 20, 10)$  MPa  
D.  $(\pm 20, 20)$  MPa
18. A T-beam roof section has the following particulars : Thickness of slab 100 mm Width of rib 300 mm Depth of beam 500 mm Centre to centre distance of beams 3.0 m Effective span of beams 6.0 m Distance between points of contraflexure is 3.60 m. The effective width of flange of the beam is
- A. 3000 mm      B. 1900 mm      C. 1600 mm      D. 1500 mm
19. A dry sand specimen is put through a triaxial test. The cell pressure is 50 kPa and the deviator stress at failure is 100 Pa. The angle of internal friction for the sand specimen is
- A.  $15^\circ$       B.  $30^\circ$       C.  $37^\circ$       D.  $45^\circ$
20. A channel of bed slope 0.0009 carries a discharge of 30 m<sup>3</sup>/s when the depth of flow is 1.0 m. What is the discharge carried by an exactly

similar channel at the same depth of flow if the slope is decreased to 0.0001 ?

- A.  $10 \text{ m}^3/\text{s}$
  - B.  $15 \text{ m}^3/\text{s}$
  - C.  $60 \text{ m}^3/\text{s}$
  - D.  $90 \text{ m}^3/\text{s}$
21. Which one of the following would contain water with the maximum amount of turbidity ?  
A. Lakes      B. Oceans      C. Rivers      D. Wells
  22. The following steps are necessary to obtain sufficient accuracy with the tape :1. Keeping uniform tension on tape for each measurement:2. "Breaking" tape on slopes are necessary to keep the tape level.3. Keeping accurate count of the stations.4. Keeping the tape on the line being measured.The correct sequence of these steps is  
A. 4, 2, 1, 3      B. 2, 3, 4, 1      C. 4, 1, 2, 3      D. 3, 2, 1, 4
  23. A bar of length  $l$  is uniformly tapering from a diameter  $d_1$  at one end to a diameter  $d_2$  at the other end. The bar is subjected to an axial tensile loads. What is the total elongation (where  $E$  = Young's modulus of elasticity. )  
A.  $\frac{4Pl}{\pi E d_1 d_2}$       B.  $\frac{4Pl^2}{\pi E d_1 d_2}$       C.  $\frac{4Pl^2}{\pi E d_1^2 d_2}$       D.  $4 + \frac{4Pl}{\pi E d_1 d_2}$
  24. A welded steel plate girder consisting of two flange plates of 350 mm x 16 mm and a web plate of 1000 mm x 6 mm, requires  
A. nostiffeners  
B. vertical stiffeners  
C. intermediate vertical stiffeners  
D. vertical and horizontal stiffeners
  25. ABCD is a beam of length  $5l$  which is supported at B and C (having supported length  $BC = 'l'$ ) and having two equal overhangs AB and CD of length  $2l$  each. It carries a u.d.l. of intensity  $p$  per unit length throughout the beam as shown in the given figure.The points of contraflexure will occur  
A. at  $B$  and  $C$   
B. no where in the beam  
C. at the mid-point of  $BC$   
D. at the mid-points of  $AB$  and  $CD$
  26. Which one of the following is employed to determine strength of hardened existing concrete structure ?  
A. Bullet test

- B. Kelly ball test  
C. Rebound hammer test  
D. Cone penetrometer
27. Which one of following statements associated with groynes :1. Hydraulic behaviour of a system of groynes is influenced by the characteristics of particles that constitute the littoral drift.2. Groyne is constructed approximately parallel to shore.Which of the statements given above is/are correct ?  
A. 1 only  
B. 2 only  
C. Both 1 and 2  
D. Neither 1 nor 2
28. Reinforced concrete door and window frames can be compacted using :1. needle vibrator2. plate vibrator3. form vibrator4. tappingThe correct sequence of these equipment in order of preference (from the best to the worst) is  
A. 2, 3, 4, 1      B. 3, 2, 1, 4      C. 2, 3, 1, 4      D. 3, 2, 4, 1
29. If the Froude number of flow in an open channel is more than 1.0 then the flow is said to be  
A. critical      B. shooting      C. streaming      D. transitional
30. Due to some point load anywhere on a fixed beam, the maximum free bending moment is  $M$ . The sum of fixed end moment is  
A.  $M$       B.  $1.5M$       C.  $2.0M$       D.  $3.0M$
31. In a particular material, if the modulus of rigidity is equal to the bulk modulus, then the Poisson's ratio will be  
A.  $\frac{1}{8}$       B.  $\frac{1}{4}$       C.  $\frac{1}{2}$       D. 1
32. The weight of aggregate having specific gravity 2.65, completely filled into a cylinder of volume 0.003 m<sup>3</sup> is 5.2 kg. What is the value of the angularity index of aggregate (approximately) as given by Murdock ?  
A. 1      B. 0.34      C. 0.15      D. 0.05
33. Which of the following pairs in respect of ordinary Portland cement (OPC) are correctly matched1. Initial setting time....30 minutes2. Final setting time....10 hours3. Normal consistency....10%Select the correct answer from the codes given below :  
A. 1, 2 and 3      B. 2 and 3      C. 1 and 2      D. 1 and 3
34. A spillway of an irrigation project is to be studied by means of a model constructed to a scale of 1 : 9. The prototype discharge is 1000 m<sup>3</sup>/s. Neglecting the viscous and surface tension effects, the required flow rate for the model is

- A.  $12.35 \text{ m}^3/\text{s}$   
 B.  $111.11 \text{ m}^3/\text{s}$   
 C.  $4.11 \text{ m}^3/\text{s}$   
 D.  $1.37 \text{ m}^3/\text{s}$
35. Which one of the following is the correct differential equation of the shape of the cable (similar to electrical cables) of unit weight 'q' with small slopes, as shown in the given figure ?
- A.  $\frac{d^2y}{dx^2} = \frac{q}{H} \frac{ds}{dx}$       B.  $\frac{d^2y}{dx^2} = \frac{q}{H}$       C.  $\frac{d^2y}{dx^2} = \frac{q}{H} \sin \theta$       D.  $\frac{d^2y}{dx^2} = \frac{q}{H} \cos \theta$
36. A reinforced concrete beam is designed for the limit states of collapse in flexure a shear. Which of the following limit states of serviceability have to be checked ? 1. Deflection 2. Cracking 3. Durability Select the correct answer using the codes given below :
- A. 1 alone      B. 1 and 2      C. 2 and 3      D. 1, 2 and 3
37. Two men, one stronger than the other have to lift a load of 1200 N which is suspended from a light rod of length 3 m. The load is suspended between the two persons positioned at the two ends of the rod. The weaker of the two persons can carry a load up to 400 N only. The distance of the load to be suspended from the stronger person such that the weaker person has the full share of 400 N is
- A. 0.5 m      B. 1.0 m      C. 1.5 m      D. 2.0 m
38. In a closed theodolite traverse, the sum of the latitudes is + 5.080 m and the sum of the departures is -51.406 m. The sum of the traverse legs is 20.525 km. The accuracy of traverse is nearly equal to
- A. 1 : 300      B. 1 : 400      C. 1 : 500      D. 1 : 1000
39. Consider the following statements :1. Pumps in series operation allow the head to increase.2. Pumps in series operation increase the flow rate.3. Pumps ill parallel operation increase the flow rate.4. Pumps in parallel operation allow the head to increase.Which of these statements are correct ?
- A. 1 and 3      B. 1 and 4      C. 2 and 4      D. 3 and 4
40. The shape factor for a solid circular section of diameter D is equal to
- A.  $\frac{D}{2\pi}$       B.  $\frac{15}{2\pi}$       C.  $\frac{16}{3\pi}$       D.  $\frac{\pi D}{8}$
41. What is the wave velocity for a uniform train of wave beyond the storm centre for a wave length of 20 m in 14 m deep water ?
- A. 5.5 m/s      B. 11.2 m/s      C. 4.5 m/s      D. 9 m/s
42. Maximum shear stress developed in a beam of rectangular section bears a constant ratio to its average shear stress and this ratio is

equal to

A. 1.33    B. 1.5    C. 2.0    D. 2.5

43. A circular pipe of radius  $R$  carries a laminar flow of a fluid. The average velocity is indicated as the local velocity at what radial distance, measured from the centre ?  
A.  $0.50 R$     B.  $0.71 R$     C.  $0.67 R$     D.  $0.29 R$
44. Radial splits in timber originating from 'Bark' and narrowing towards the 'Pith' are known as  
A. heart shakes    B. star shakes    C. cup shakes    D. knots
45. What is the condition for maximum transmission of power through a nozzle at the end of a long pipe ? (where  $H$  = total head at the inlet of the nozzle,  $h_f$  = head loss due to friction )  
A.  $H = h_f/3$   
B.  $h_f = H/2$   
C.  $h_f = H/3$   
D.  $H = h_f/2$
46. A simply supported beam AB of span  $L$  is subjected to a concentrated load  $W$  at the centre  $C$  of the span. According to Mohr's moment area method, which one of the following gives the deflection under the load ?  
A. Moment of the area of  $M/EI$  diagram between A and  $C$  taken about  $C$ .  
B. Moment of the area of  $M/EI$  diagram between A and B taken about B.  
C. Moment of the area of  $M/EI$  diagram between A and  $C$  taken about A.  
D. Moment of the area of  $M/EI$  diagram between A and  $C$  taken about B.
47. A bar of circular cross-section varies uniformly from a cross-section  $2D$  to  $D$ . If extension of the bar is calculated treating it as a bar of average diameter, then the percentage error will be  
A. 10    B. 25    C. 33.33    D. 50
48. While concreting in cold weather where frosting is also likely, one uses  
A. high quality portland cement with minimum volumes of added water  
B. high alumina cement with calcium chloride additives  
C. portland cement together with calcium chloride additives  
D. a mixture of high alumina cement and portland cement.



49. A 600 mm long and 50 mm diameter rod of steel ( $E = 200 \text{ GPa}$ ,  $\alpha = 12 \times 10^{-6}/^{\circ}\text{C}$ ) is attached at the ends to unyielding supports. When the temperature is  $30^{\circ}\text{C}$  there is no stress in the rod. After the temperature of the rod drops to  $-20^{\circ}\text{C}$ , the axial stress in the rod will be
- 24 MPa (compressive)
  - 72 MPa (compressive)
  - 120 MPa (tensile)
  - 144 MPa (compressive)
50. The correct sequence, in the direction of the flow of water for installations in the hydro-power plant is
- reservoir, surge tank turbine, penstock
  - reservoir, penstock, surge tank, turbine
  - reservoir, penstock, turbine, surge tank
  - reservoir, surge tank, penstock, turbine

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	C	A	B	A	D	A	C	B	C
10	C	B	D	A	B	A	A	D	B	A
20	C	C	A	C	C	C	C	D	B	A
30	A	B	C	C	A	C	D	B	A	C
40	C	B	B	B	C	C	B	C	C	B

## Section 27

- Vibratory rollers are more useful for compacting which of the following ?  
A. Sandy soils      B. Silty soils      C. Clayey soils      D. Mixed soils
- What does the wind Rose Diagram (WRD) for orientation of airport runway give ?  
A. Direction of wind  
B. Direction and duration of wind  
C. Direction, duration and intensity of wind  
D. None of the above
- The head loss caused due to sudden expansion of pipe from area  $A_1$  to area  $A_2$  and the velocity from  $V_1$  to  $V_2$  is given by  
A.  $\left(1 - \frac{A_1}{A_2}\right)^2 \frac{V_1^2}{2g}$       B.  $\left(1 - \frac{A_1}{A_2}\right)^2 \frac{V_2^2}{2g}$       C.  $\left(1 - \frac{A_2}{A_1}\right)^2 \frac{V_2^2}{2g}$       D.  $\left(1 - \frac{A_2}{A_1}\right)^2 \frac{V_1^2}{2g}$
- A simply supported continuous beam with two equal spans carries uniformly distributed load  $w$  on entire length of the beam. If each span has a length  $L$ , the bending moment at the central support is  
A.  $\frac{wL^2}{12}$       B.  $\frac{wL^2}{8}$       C.  $\frac{wL^2}{4}$       D.  $\frac{wL^2}{2}$
- Which one of the following represents a circumpolar star ?  
A. Upper culmination above horizon, lower culmination below horizon  
B. Both upper and lower culminations below horizon  
C. Both upper and lower culminations above horizon  
D. Altitude at upper culmination is minimum
- What is the ratio of maximum shear stress to average shear stress for a circular section ?  
A. 2      B.  $\frac{3}{2}$       C.  $\frac{4}{3}$       D.  $\frac{3}{4}$
- If a circular shaft is subjected to a torque  $T$  and a bending moment 'M' the ratio of the maximum shear stress to the maximum bending stress is given by :  
A.  $2M/T$       B.  $T/2M$       C.  $2T/M$       D.  $M/2T$
- Which one of the following statements is not correct ?  
A. Models are always smaller than the prototypes.  
B. Dynamic similarity between a model and a prototype can be verified by equating Reynold's number in a viscous flow.

- C. Mach number achieves significance when the velocity of fluid approaches or exceeds the sonic velocity.
  - D. Distorted models are always exaggerated on a vertical scale.
9. The construction of impounding reservoir is required when
- A. average annual flow in the stream is lower than average demand
  - B. the rate of flow in the stream, in dry season is more than the demand
  - C. the rate of flow in the stream, in dry season is less than the demand
  - D. the rate of flow in the stream is equal to the demand
10. The method of plane tabling commonly used for establishing the instrument station is a method of
- A. radiation      B. intersection      C. resection      D. traversing
11. A fixed beam of uniform section is carrying a point load at its mid-span. If the moment of inertia of the middle half length is now reduced to half its previous value, then the fixed end moments will
- A. Increase
  - B. decrease
  - C. remain constant
  - D. change their directions
12. The moisture content of a clayey soil is gradually decreased from a large value. What will be the correct sequence of the occurrence of the following limits ? 1. Shrinkage limit 2. Plastic limit 3. Liquid limit Select the correct answer from the codes given below :
- A. 1, 2, 3      B. 1, 3, 2      C. 3, 2, 1      D. 3, 1, 2
13. For the movement of vehicles at an intersection of two roads without any interference, which type of grade separation is generally preferred ?
- A. Delta      B. Diamond      C. Trumpet      D. Cloverleaf
14. Which one of the following stresses is independent of yield stress as a permissible stress for steel members ?
- A. Axial tensile stress
  - B. Maximum shear stress
  - C. Bearing stress
  - D. Stress in slab base
15. Permissible limit of cant deficiency for Broad Gauge (B.G.) is
- A. 50 mm      B. 60 mm      C. 75 mm      D. 88 mm
16. If the line of sight between two stations A and B, on sea, and 80 km apart, makes tangent at point A, then the minimum elevation of the

signal required at B (considering the coefficient of refraction "m" = 0.08 and the mean radius of earth as 6400 km) will be

A. 42 m      B. 210 m      C. 420 m      D. 840 m

17. A simply supported beam of uniform cross-section is subjected to a maximum bending moment of 2.25 t.m. If it has rectangular cross-section with width 15 cm and depth 30 cm, then the maximum bending stress induced in the beam will be  
A. 50 kg/cm<sup>2</sup>      B. 100 kg/cm<sup>2</sup>      C. 150 kg/cm<sup>2</sup>      D. 225 kg/cm<sup>2</sup>
18. Consider the following statements regarding underreamed piles :1. They are used in expansive soils.2. They are of precast reinforced concrete.3. The ratio of bulb to shaft diameters is usually 2 to 3.4. Minimum spacing between the piles should not be less than 1.5 times the bulb diameter. of these statements :  
A. 1, 2 and 3 are correct  
B. 1, 3 and 4 are correct  
C. 2, 3 and 4 are correct  
D. 1, 2 and 4 are correct
19. What is efflorescence ?  
A. Formation of white patches on the brick surface due to insoluble salts in the brick clay  
B. Swelling of brick due to presence of carbonaceous matter and gas  
C. Deformation of brick due to exposure to rain  
D. Impurities in the brick clay which show after burning
20. Consider the following statements regarding a beam of uniform cross-section simply supported at its ends and carrying a concentrated load at one of its third points :1. Its deflection under the load will be maximum.2. The bending moment under the load will be maximum.3. The deflection at the mid-point of the span will be maximum.4. The slope at the nearer support will be maximum.Of these statements :  
A. 1 and 3 are correct  
B. 2 and 4 are correct  
C. 1 and 2 are correct  
D. 3 and 4 are correct
21. What is the recommended grade of tar for grouting purpose ?  
A. RT - 1      B. RT - 2      C. RT - 3      D. RT - 5
22. Which of the following statements is/are true in relation to the term 'detention period' in a settling tank?1. It may be determined by introducing a dye in the inlet and timing its appearance at the outlet.2.

Greater the detention period, greater the efficiency of removal of settleable matter.3. It is the time taken for any unit of water to pass through the settling basin.4. It is usually more than the flowthrough period. Select the correct answer using the codes given below :

A. 1, 2, 3 and 4    B. 2, 3 and 4    C. 1 and 3    D. 4 alone

23. If a soil sample of weight 0.18 kg having a volume of  $10^{-4}$  m<sup>3</sup> and dry unit wt. of 1600 kg/m<sup>3</sup> is mixed with 0.02 kg of water then the water content in the sample will be  
A. 30%    B. 25%    C. 20%    D. 15%
24. With 'n' variables and 'm' fundamental dimensions in a system, which one of the following statements relating to the application of the Buckingham's Pi Theorem is incorrect ?  
A. With experience, pi terms can be written simply by inspection of variables in a flow system  
B. Buckingham's pi theorem is not directly applicable in compressible flow problem  
C. Buckingham's pi theorem yields dimensionless pi terms given by the difference between the number of variables and the number of fundamental dimensions  
D. Buckingham's pi theorem reduces the number of variables by the number of fundamental dimensions involved.
25. Two sources generate noise levels of 90 dB and 94 dB respectively. The cumulative effect of these two noise levels on the human ear is  
A. 184 dB    B. 95.5 dB    C. 94 dB    D. 92 dB
26. A cohesionless soil having an angle of shearing resistance of  $\phi$ , is standing at a slope angle of  $i$ . The factor of safety of the slope is  $\tan i$   
A.  $\frac{\tan i}{\tan \phi}$     B.  $\tan i - \tan \phi$     C.  $\frac{\tan \phi}{\tan i}$     D.  $\tan \phi - \tan i$
27. Sewage sickness occurs when  
A. Sewage contains pathogenic organisms  
B. sewage enters the water supply system  
C. sewers get clogged due to accumulation of solids  
D. voids of soil get closed due to continuous application of sewage on a piece of land
28. A steel cable of 2 cm diameter is used to lift a load of  $500\pi$  kg. Given that,  $E = 2 \times 10^6$  kg/cm<sup>2</sup> and the length of the cable is 10 m, the elongation of the cable due to the load will be  
A. 0.5 cm    B. 0.25    C. 1 cm    D.  $1/\pi$  cm
29. Consider the following statements regarding tensile test diagrams for carbon steel with varying carbon contents :As the carbon content in-

creases 1. the ultimate strength of steel decreases 2. the elongation before fracture increases 3. the ductility of the metal decreases 4. the ultimate strength increases. Of these statements :

- A. 3 and 4 are correct
  - B. 1 and 3 are correct
  - C. 1, 2 and 3 are correct
  - D. 1 and 2 are correct
30. Negative skin friction on a pile under vertical compressive load acts
- A. downwards and increases the load carrying capacity of the pile
  - B. downwards and reduces the load carrying capacity of the pile
  - C. upwards and increases the load carrying capacity of the pile
  - D. downwards and maintains the same load carrying capacity of the pile
31. The defect which develops due to uncontrolled and non-uniform loss of moisture from wood is known as which one of the following ?
- A. Kont
  - B. Shake
  - C. Warping
  - D. Cross grain
32. Consider the following statements in respect of the critical depth of flow in a prismatic rectangular channel: 1. For known specific energy, discharge is minimum. 2. For known discharge, the specific energy is minimum. Which of the statements given above is/are correct ?
- A. 1 only
  - B. 2 only
  - C. Both 1 and 2
  - D. neither 1 nor 2
33. On the basis of the data given in the following figures, the bending moment under the load would work out to
- A. 2 kN.m
  - B. 4 kN.m
  - C. 6 kN.m
  - D. 12 kN.m
34. What is the innermost portion of approach zone which is the most critical portion from obstruction viewpoint, called ?
- A. Outer horizontal surface
  - B. Conical surface
  - C. Inner horizontal surface
  - D. Clear zone
35. A circular plate 100 mm diameter is welded to another plate by means of 6 mm fillet weld. If the permissible shearing stress in the weld equals 10 kg/mm<sup>2</sup>, then the greatest twisting moment that can be resisted by the weld will be
- A.  $424 \pi$  kg.m
  - B.  $300 \pi$  kg.m
  - C.  $212 \pi$  kg.m
  - D.  $60 \pi$  kg.m

36. A fixed beam is subjected to moment  $M_0$  as shown in the figure. The fixed end moments will be :  
 A. zero    B.  $M_0$     C.  $M_0/2$     D.  $2M_0$
37. Consider the following steps :1. Driving sheet piles surrounding a vibration-receiving structure.2. Digging a trench around a source of vibration.3. Placing rubber mountings between a machine causing vibration and its base. Active isolation of vibration can be achieved by  
 A. 1 and 2    B. 1 and 3    C. 2 and 3    D. 3 alone
38. Two reservoirs at different surface elevations are connected by a set of two pipes A and B of same diameter and length in parallel. If the friction factor of A is 4 times that of the pipe B, what is the ratio of the discharge in A to that in B ?  
 A. 0.25    B. 4.0    C. 2.0    D. 0.5
39. Which of the following should be employed to provide lateral support to the beams ?1. Bracing of compression flanges.2. Shear connectors.3. Bracing of tension flanges4. Embedding compression flanges into R.C.C. slab. Select the correct answer using the codes given below :  
 A. 1 only    B. 1 and 4    C. 2 and 3    D. 1, 2 and 4

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	A	A	B	C	C	B	A	C	C
10	A	C	D	D	C	C	B	B	A	B
20	D	A	B	B	B	C	D	B	C	B
30	C	C	D	B	C	C	B	C	D	

## 10 Building Construction

### Section 1

1. In case of Raymond pile
  - A. lengths vary from 6 m to 12 m
  - B. diameter of top of piles varies from 40 cm to 60 cm
  - C. diameter of pile at bottom varies from 20 cm to 28 cm
  - D. thickness of outer shell depends upon pile diameter
  - E. all the above.
2. Queen closer may be placed
  - A. in header course
  - B. in stretcher course
  - C. in header course next to first brick
  - D. in stretcher course next to first brick
  - E. in any position.
3. Dado is usually provided in
  - A. dinning halls
  - B. bath rooms
  - C. living rooms
  - D. veran-  
dah
  - E. roofs.
4. The foundation in which a cantilever beam is provided to join two footings, is known as
  - A. strip footing
  - B. strap footing
  - C. combined footing
  - D. raft footing
  - E. none of these.
5. The foundations are placed below ground level, to increase
  - A. strength
  - B. workability
  - C. stability of structure
  - D. all the above.
6. Stud(s) of a common wooden partition
  - A. are vertical wooden members
  - B. is the upper horizontal wooden member
  - C. is the lower horizontal wooden member
  - D. are the intermediate horizontal wooden members.
7. Pick up the correct statement from the following :



- A. inclined borings are made for taking samples under existing structures
  - B. inclined borings are occasionally used instead of vertical holes.
  - C. the spacing of inclined borings is kept such that one bore hole is vertically above the bottom of an adjacent bore hole.
  - D. all the above.
8. Pick up the commonly adopted geophysical method in civil engineering from the following :
- A. the seismic method
  - B. electrical resistivity method
  - C. gravitational method
  - D. magnetic method
  - E. both (a) and (b) of the above.
9. To ensure that supporting area of an offset footing of a boundary wall is fully compressive, the C.G. of load must act
- A. at the centre of the base
  - B. within the middle third of the base
  - C. within the middle fifth of the base
  - D. neither (a), (b) nor (c).
10. The 9 cm x 9 cm side of a brick as seen in the wall face, is generally known as
- A. stretcher      B. face      C. front      D. header      E. side.
11. The taper of precast concrete pile should not be more than
- A. 1 cm per metre length
  - B. 2 cm per metre length
  - C. 4 cm per metre length
  - D. 5 cm per metre length.
12. The under surface of an arch, is called
- A. soffit      B. intrados      C. haunch      D. back.
13. The raft slab is projected beyond the outer walls of the structure by
- A. 5 to 10 cm      B. 15 to 20 cm      C. 25 to 30 cm      D. 30 to 45 cm      E. 60 cm.
14. The process of making the back ground rough, before plastering, is
- A. dubbing      B. hacking      C. blistering      D. peeling.
15. Black cotton soil is unsuitable for foundations because its
- A. bearing capacity is low
  - B. permeability is uncertain
  - C. particles are cohesive

- D. property to undergo a volumetric change due to variation of moisture content.
16. The loose pockets in soil mass can be bridged safely by providing a raft foundation provided the soft area is smaller than
    - A. the column spacing
    - B. one-third the column spacing
    - C. half the column spacing
    - D. three-fourth the column spacing
    - E. none of these.
  17. The portion of a brick cut across the width, is called
    - A. closer    B. half brick    C. bed    D. bat.
  18. The concrete slump recommended for beams and slabs ; is
    - A. 25 to 50 mm    B. 25 to 75 mm    C. 30 to 125 mm    D. 50 to 100 mm    E. none of these.
  19. The member which is placed horizontally to support common rafter of a sloping roof, is
    - A. purlin    B. cleat    C. batten    D. strut.
  20. Pick up the correct statement from the following:
    - A. Louvered door is generally provided in bath rooms
    - B. Flush door is generally provided in dinning room
    - C. Revolving door is generally provided in cinema halls
    - D. Sliding door is generally provided in show rooms
    - E. All the above.
  21. Grillage foundation
    - A. is used to transfer heavy structural loads from steel columns to a soil having low bearing capacity
    - B. is light and economical
    - C. does not require deep cutting as the required base area with required pressure intensity is obtained at a shallow depth
    - D. is constructed by rolled steel joists (R.S.J.) placed in single or double tier
    - E. all the above.
  22. The exterior angle between outer faces of a wall, is known as
    - A. turn    B. junction    C. quion    D. all the above.
  23. In jack arch floor, the rise is kept
    - A. 1/6th of the span
    - B. 1/8th of the span
    - C. 1/10th of the span

- D. 1/12th of the span
  - E. 1/15th of the span.
24. While designing a stair, the product of rise and going is approximately kept equal to  
A. 350      B. 420      C. 450      D. 500      E. 600.
25. For constructing a terrazzo floor. Pick up the incorrect statement from the following :
- A. a base course is prepared as in cement concrete flooring
  - B. a 32 mm thick layer of cement concrete (1 : 2 : 4) is laid on the base course and the surface is made smooth by trowelling
  - C. glass strips are driven into the layer according to the pattern required
  - D. after final grinding is over, oxalic acid mixed with water is spread over and rubbed hard with soft material
  - E. none of these.
26. The entrained concrete is used in lining walls and roofs for making
- A. heat insulated
  - B. sound insulated
  - C. neither (a) nor (b)
  - D. both (a) and (b).
27. The pile which is provided with a bulb filled with concrete at its lower end, is known as
- A. Simplex pile
  - B. Mac-Arthur pile
  - C. Raymond pile
  - D. Franki pile
  - E. none of these.
28. In case of multi-storeyed buildings, the forms to be removed first are
- A. sides of beams and girders
  - B. column forms
  - C. bottom of beams and girders
  - D. all the above at the same time.
29. For providing a raft foundation, the following activities are involved ramming the foundation bedexcavation of the soil upto required depth-laying the reinforcement over the foundation bedcuring the cement concrete placed over reinforcementpouring the cement concrete over the reinforcement. The correct sequence is  
A. 1, 2, 3, 4, 5      B. 5, 4, 3, 2, 1      C. 2, 1, 3, 5, 4      D. 3, 2, 5, 1, 4.

30. The maximum permissible deflection of a timber beam supporting a roof, is  
 A.  $L/100$     B.  $L/150$     C.  $L/260$     D.  $L/360$     E. none of these.
31. The angular steps used for changing direction of the stairs, are called  
 A. round steps  
 B. angular steps  
 C. winders  
 D. radial steps  
 E. circular steps.
32. During percussion drilling  
 A. ground water observations are hindered due to entry of the slurry in the soil below the bottom of the hole  
 B. caving or mixing of strata are caused in soft soils or cohesionless soils  
 C. the soil to a considerable depth below the bottom of the hole gets disturbed  
 D. all the above.
33. In English garden wall bond  
 A. one course of headers to three or five course of stretchers  
 B. queen closer is provided in each heading course  
 C. the middle course of stretchers is started with a header to give proper vertical joints  
 D. all the above.
34. A projecting piece usually provided to support a truss, is  
 A. cornice    B. coping    C. frieze    D. lintel.
35. The line of intersection of the surfaces of a sloping roof forming an external angle exceeding  $180^\circ$ , is  
 A. ridge    B. hip    C. valley    D. none of these.
36. A solid core of rock is formed inside the cylinder in the case of  
 A. auger boring  
 B. percussion drilling  
 C. diamond drilling  
 D. wash boring.
37. The single stage well point system of dewatering an excavation can be used if the depth of excavation does not exceed  
 A. 5 m    B. 10 m    C. 15 m    D. 20 m    E. 25 m.
38. The piece of a brick cut with its one corner equivalent to half the length and half the width of a full brick, is known as

- A. queen closer
  - B. bevelled closer
  - C. king closer
  - D. half king closer.
39. The brick laid with its breadth parallel to the face of a wall, is known as
- A. header      B. stretcher      C. closer      D. none of these.
40. A wooden block hinged on post outside a door, is known
- A. cleat      B. stop      C. horn      D. none of these.
41. Pick up the incorrect statement from the following :
- A. The function of foundation is to distribute the load of super structure over a large bearing area
  - B. No timbering is required for shallow trenches
  - C. Shallow foundations can be constructed on made-up soil
  - D. Grillage foundation is classified as a shallow foundation
  - E. Black cotton soil is very good for foundation bed.
42. In horizontal D.P.C, thickness of cement concrete (1 : 2 : 4) is
- A. 2 cm      B. 4 cm      C. 6 cm      D. 8 cm      E. 10 cm.
43. Which one of the following factors is considered for the orientation of buildings :
- A. the direction of the prevailing winds in the area
  - B. the exposure of the walls and roof of the buildings to the rays of sun
  - C. the extent up to which the sunrays penetrate with the verandah.
  - D. all the above.
44. Pick up the incorrect statement from the following :
- A. Cement is added to lime mortar to increase its hydraulic properties only
  - B. Lime surkhi mortar is used for pointing the walls
  - C. Lime should be slaked before preparing lime mortar
  - D. High early strength concrete is generally used in cold weather.
45. Which one of the following rocks is used for monumental buildings :
- A. granite      B. marble      C. sand stone      D. slate.
46. The Auger borings are not common
- A. in soils that require lateral support
  - B. in cohesive soils
  - C. in soft soils
  - D. none of the above.

47. The form work from the underside of slabs, can be removed only after  
 A. 1 day      B. 4 days      C. 7 days      D. 14 days.
48. Arches in the form of masonry arcs struck from more than four centres, are called  
 A. two curved arches  
 B. gothic arches  
 C. ogee arches  
 D. drop gothic arches.
49. If  $(\phi)$  is the angle of repose of soil of weight  $w$  kg/m<sup>3</sup>, the horizontal pressure  $p$  at a depth of  $h$  metres per metre length of wall, is  
 A.  $wh \times \frac{1 - \sin \phi}{1 + \sin \phi}$       B.  $\frac{wh}{2} \times \frac{1 - \sin \phi}{1 + \sin \phi}$       C.  $wh \times \sqrt{\frac{1 - \sin \phi}{1 + \sin \phi}}$       D.  $wh \times \sqrt{\frac{1 + \sin \phi}{1 - \sin \phi}}$
50. According to Rankine's formula, minimum depth of foundations, is  
 A.  $\frac{P}{w} \times \left( \frac{1 + \sin \phi}{1 - \sin \phi} \right)^2$       B.  $\frac{P}{w} \times \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$       C.  $\frac{P}{2w} \times \left( \frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$   
 D.  $\frac{P}{w} \times \left( \frac{1 + \sin \phi}{1 - \sin \phi} \right)$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	E	C	B	B	C	A	D	E	B	D
10	B	A	D	B	D	B	D	C	A	C
20	E	C	D	B	B	D	B	A	C	D
30	C	D	D	C	B	C	A	C	A	A
40	E	B	D	A	B	A	C	C	A	B

## Section 2

1. Cast iron piles
  - A. are suitable for works under sea water
  - B. resist shocks or vibrations
  - C. are suitable for use as batter piles
  - D. are useful for heavy vertical loads.
2. The depth of an arch is the distance between
  - A. ground level and springing line
  - B. crown and springing line
  - C. crown and ground level
  - D. intrados and extrados.
3. Expansion joints in masonry walls are provided if length exceeds
  - A. 10 m
  - B. 20 m
  - C. 30 m
  - D. 40 m
  - E. 50 m.
4. The platform at the end of a series of steps, is known as
  - A. platform
  - B. relief
  - C. rest
  - D. landing
  - E. stop.
5. Raft foundation are generally preferred to when the area required for individual footing, is more than
  - A. 25% to total area
  - B. 30% of total area
  - C. 40% to total area
  - D. 50% of total area.
6. You are asked to design and supervise a truss for a factory to have spans 6 m to 9 m. The type of the truss you will use, is
  - A. mansored truss
  - B. queen post truss
  - C. king post truss
  - D. collar truss
  - E. none of these.
7. Pick up the incorrect statement from the following:
  - A. The retaining wall should be structurally capable to resist the applied earth pressure
  - B. The section of the retaining wall should be so proportioned that it may not overturn by the lateral pressure
  - C. The retaining wall should be safe against sliding
  - D. The foundation of the retaining wall should not be stressed beyond safe bearing capacity ; due to its weight and the force resulting from the earth pressure

- E. to drain off water from the earth retained, weep holes are provided near the top of the retaining wall.
8. The arrangement of supporting an existing structure by providing supports underneath, is known as  
A. shoring    B. underpinning    C. jacking    D. piling
  9. The process of keeping concrete moist for a certain period after its finishing, is known as  
A. finishing of concrete  
B. curing of concrete  
C. placing of concrete  
D. compaction of concrete  
E. none of these.
  10. The inclined surface of an abutment to receive the arch, is known as  
A. skew back    B. soffit    C. spandril    D. haunch.
  11. The strength of brick masonry in 1:6 cement mortar, is  
A. 20 tonnes/m<sup>2</sup>  
B. 40 tonnes/m<sup>2</sup>  
C. 50 tonnes/m<sup>2</sup>  
D. 60 tonnes/m<sup>2</sup>  
E. 75 tonnes/m<sup>2</sup>.
  12. The dimensions of a half queen closer, are  
A. 9 cm x 9 cm x 9 cm  
B. 9 cm x 9 cm x 4.5 cm  
C. 9 cm x 4.5 cm x 9 cm  
D. 1.8 cm x 4.5 cm x 9 cm.
  13. In case of foundations on sandy soil, maximum permissible differential settlement, is usually limited to  
A. 15 mm    B. 25 mm    C. 35 mm    D. 45 mm    E. 55 mm.
  14. For heavy embankments and dams, of height  $h$ , the depth of exploration of soil should not be less than  
A.  $h/4$     B.  $1/2 h$     C.  $h$     D.  $2 h$ .
  15. For different layers of cement concrete floor. Pick up the incorrect statement from the following :  
A. The lowest layer consists of consolidated ground  
B. A 10 cm thick clean sand is laid on consolidated ground  
C. A 10 cm lime concrete (1 : 4 : 8) is laid on clean sand  
D. A 10 cm thick cement concrete (1 : 2 : 4) is laid on top layer.
  16. Rotary drilling



- A. is not suitable for deposits containing very coarse gravel
  - B. hinders the ground water observations and permeability test
  - C. is not economical for holes of less than 10 cm.
  - D. all the above.
17. In places where the soil is soft and has small resistance to the flow of concrete, which one of the following types of piles, is used
- A. vibro pile     B. pressure pile     C. Franki pile     D. pedestal pile.
18. In grillage foundations a minimum 15 cm cover is provided on
- A. upper flange of top tier
  - B. lower beam of lower tier
  - C. ends of external beams
  - D. none to these.
19. The skirting/dado in a bath roof should be upto
- A. ceiling
  - B. 15 cm above floor level
  - C. 200 cm
  - D. level of the tap.
20. The maximum bearing capacity of soil is that of
- A. black cotton soil
  - B. loose fine sandy soil
  - C. dry coarse sandy soil
  - D. hard rocks
  - E. soft clay soil.
21. The columns of multi-storeyed buildings are designed to withstand the forces due to
- A. dead loads     B. live loads     C. wind loads     D. earthquakes
  - E. all of these.
22. The black cotton soil
- A. undergoes volumetric changes
  - B. swells excessively when wet
  - C. shrinks excessively when dry
  - D. has a tendency of swelling and shrinking due to clay particles
  - E. all the above.
23. Pick up the incorrect statement from the following:
- A. In dog-legged stairs, no space between its flights is provided
  - B. In open newel stair, a rectangular well is provided

- C. In geometric stair, a curved shaped well between forward and backward flights, is provided
  - D. In geometrical stair, two quarter space landing is provided.
24. Exposed portions of vertical surface at right angles to the door or window frame, are known as  
 A. jambs      B. lintels      C. reveals      D. soffits.
25. To obtain good bonding in brick masonry  
 A. first class bricks are used  
 B. vertical joints in alternate courses are kept in plumb line  
 C. bats are used where necessary  
 D. all the above.
26. Raft foundations are used for :  
 A. providing increased area of foundation over poor bearing capacity of soil  
 B. spanning over small soft or loose pockets  
 C. counter acting the hydrostatic effect  
 D. all the above.
27. For brick construction, the lime-sand mortar, is  
 A. 1:1      B. 1:2      C. 1:3      D. 1:4      E. 1:5.
28. An arch constructed with finely dressed stones, is known  
 A. ashlar arch      B. rubble arch      C. gauged arch      D. axed arch.
29. Cavity wall is generally provided for  
 A. heat insulation  
 B. sound insulation  
 C. prevention of dampness  
 D. all the above.
30. Dampness causes  
 A. efflorescence  
 B. bleaching of paints  
 C. crumbling of plaster  
 D. growth of termites  
 E. none of these.
31. The foundation which consists of a thick reinforced cement slab covering whole area to support heavy concentrated structural loads, is known as  
 A. combined footing  
 B. strap footing

- C. raft footing
  - D. none of these.
32. Bearing capacity of soils cannot be improved by
- A. draining sub-soil water
  - B. ramming crushed stone in soil
  - C. driving sand piles
  - D. watering surface of soil
  - E. none of these.
33. To support a heavy structure in sandy soil, the type of foundation generally used, is
- A. combined footing
  - B. raft footing
  - C. pier footing
  - D. strap footing
  - E. none of these.
34. A floor constructed with 3 mm marble chips, is known
- A. mosaic floor    B. terrazo floor    C. chips floor    D. marble floor.
35. The position of a brick when laid on its side 9 cm x 9 cm with its frog in the vertical plane, is called
- A. brick on edge
  - B. brick on end
  - C. brick on bed
  - D. brick held vertically.
36. Dutch bond is a modification of
- A. English bond
  - B. stretcher bond
  - C. header bond
  - D. single Flemish bond.
37. The 19 cm x 9 cm side of a brick as seen in the wall face, is generally known as
- A. stretcher    B. face    C. front    D. header    E. side.
38. The depth of the ground water table may be ascertained by
- A. looking through the well in the vicinity
  - B. standing on the well in the vicinity
  - C. measuring the depth of water in the well
  - D. none of the above.

39. Pick up the correct statement from the following :
- the pile driven in sand is called sand pile
  - the drilled hole filled with sand is called sand pile
  - the sand piles are used for bearing purposes
  - None of these.
40. Pick up the correct statement from the following :
- the cost of square rooms is less
  - the expenditure on the foundation and roof for the double storeyed building is nearly half of that for the ground storeyed building.
  - the cost of construction of a house may be minimised by restricting the height floors
  - all the above.
41. The maximum permissible differential settlement, in case of foundations in clayey soil, is usually limited to
- 10 mm
  - 20 mm
  - 30 mm
  - 40 mm
  - 50 mm.
42. The compaction of concrete in the drilled pile hole is done by compressed air in the case of
- simplex pile
  - Franki pile
  - pressure pile
  - vibro pile.
43. The opening provided in sloping roof with its top parallel to the roof surface, is called
- dormer window
  - sky light window
  - lantern window
  - louvered window.
44. The type of ashlar masonry in which stones are finely chisel dressed and thickness of joints does not exceed 3 mm, is
- chamfered ashlar masonry
  - ashlar facing masonry
  - random coursed ashlar masonry
  - coursed ashlar masonry.
45. The lower half portion between crown and skew back of the arch, is called
- spandril
  - haunch
  - springing
  - soffit.
46. The angle between skew back of a flat arch and the horizontal, is kept approximately equal to
- $0^\circ$
  - $30^\circ$
  - $60^\circ$
  - $90^\circ$
  - $120^\circ$ .
47. In clay soil
- swelling and shrinkage characteristics prevail

- B. consolidation continues even after several years of construction.  
 C. differential settlement is generally prevalent  
 D. all the above.
48. Pick up the incorrect statement from the following :
- A. the width of the wall is constructed thicker at the base in a stepped fashion  
 B. a long vertical load transferring concrete structure is called a concrete pile  
 C. in pile which transfers the load to the soil by the friction between the pile and the surrounding soil is called friction pile.  
 D. the pile which transfers the load to a hard rock bed at certain depth is called load bearing  
 E. none of the these.
49. Depth of lean concrete bed placed at the bottom of a wall footing, is kept
- A. 10 cm  
 B. 15 cm  
 C. equal to its projection beyond wall base  
 D. less than its projection beyond wall base.
50. For a wall carrying heavy load on low bearing capacity soil,
- A. lean concrete bed is provided  
 B. thick concrete bed is provided  
 C. reinforced concrete bed is provided  
 D. (a) and (c) of the above  
 E. (b) and (c) of the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	D	D	D	C	E	B	B	A
10	C	C	B	D	D	D	A	B	C	D
20	E	E	D	C	D	D	B	A	D	D
30	C	D	C	B	B	A	A	C	A	D
40	D	C	B	D	B	C	D	D	C	D

### Section 3

1. In grillage foundations, distance between flanges of grillage beams, is kept
  - A. 40 cm
  - B. equal to flange width
  - C. twice the flange width
  - D. maximum of (a), (b) and (c).
2. Herringbone bond is used for
  - A. walls having thickness more than 4 bricks
  - B. architectural finish to the face work
  - C. ornamental panels in brick flooring
  - D. all the above.
3. A cut in frame of a door to receive the shutter, is called
  - A. louver
  - B. stop
  - C. horn
  - D. rebate.
4. The alignment of a cross joint along the plumb line is
  - A. bed block
  - B. perpend
  - C. lintel
  - D. vertical line.
5. A temporary rigid structure having platforms to enable masons to work at different stages of a building, is known as
  - A. scaffolding
  - B. dead shore
  - C. raking shore
  - D. under pinning.
6. The additional piles which are driven to increase the capacity of supporting loads on vertical piles, are known
  - A. construction piles
  - B. raking piles
  - C. eccentric piles
  - D. sinking piles
  - E. none of these.
7. The bearing capacity of piles is determined by
  - A. dynamic formula
  - B. static formula
  - C. pile load tests
  - D. all the above.
8. A covering of concrete placed on the exposed top of an external wall, is known as
  - A. cornice
  - B. coping
  - C. frieze
  - D. lintal.
9. Auger boring
  - A. is the most primitive method for making a hole in the ground

- B. is generally employed in cohesive and other self soils above water table
- C. is most economical upto a depth of 5 metres
- D. is done by portable power driven helical augers those diameters range from 7.5 to 30 cm
- E. all the above.
10. A roof which slopes in four directions, is called  
A. shed roof    B. gable end roof    C. hipped roof    D. gambrel roof.
11. The stone whose crushing strength is least, is  
A. granite    B. chalk    C. marble    D. slate    E. sand stone.
12. Best type of piles for soft soil having little resistance to the flow of concrete, is  
A. Simplex pile    B. Vibro pile    C. Raymond pile    D. Franki pile.
13. A wall constructed to resist the pressure of an earth filling, is called  
A. retaining wall    B. breast wall    C. buttress    D. parapet wall.
14. Engineering news formula for obtaining safe bearing capacity of pile for drop hammer, is,  
A.  $Q = \frac{W \cdot h}{6(S + 2.5)}$     B.  $Q = \frac{W \cdot h}{2.5(S + 6)}$     C.  $Q = \frac{W \cdot 6}{h(S + 2.5)}$     D.  $Q = \frac{W \times 2.5}{6(S + h)}$
15. The bearing capacity of a water logged soil, may be improved by  
A. grouting  
B. chemical action  
C. drainage  
D. compaction.
16. The inclined support at the ends of treads and rises of a stair, is known as  
A. baluster    B. header    C. string    D. beam.
17. The depth of concrete bed of the foundation depends upon  
A. the projection of the concrete block beyond the footing over it  
B. the upward soil pressure  
C. the mix of the concrete  
D. all the above.
18. The vertical side member of a shutter frame, is known  
A. style    B. reveal    C. mullion    D. post.
19. The brick laid with its length parallel to the face of a wall, is a known as  
A. header    B. stretcher    C. closer    D. none of these.

20. Couple roof is used for spans
- 3.5 m or less
  - 3.5 m but less than 5 m
  - 5 m but less than 6.5 m
  - 6.5 m but less than 8 m.
21. Two columns 50 cm x 50 cm and 60 cm x 60 cm carry 80 tonnes and 120 tonnes of loads respectively. The centre to centre distance between columns is 5.00 metres. The permissible bearing capacity of the soil is 20 t/m<sup>2</sup>. If the footing is not to project more than 25 cm beyond the outside of the smaller column, pick up the correct design parameters of the footing from the following:
- distance of C.G. of the loads from the smaller column = 3.00 m
  - the length of the foundation slab = 7.00 m
  - area of footing slab = 11.00 m<sup>2</sup>
  - width of the footing = 1.57 m.
  - all the above.
22. Pick up the correct specification of one-room quarters generally adopted from the following :
- six quarters in a row
  - the size of room is either 3.5 m x 3 m or 4.2 m x 2.5 m
  - the front verandah is kept 2 m wide.
  - all the above.
23. Negative skin friction
- is a downward drag acting on a pile due to downward movement of the surrounding compressible soil relative to the pile
  - develops due to lowering of ground water
  - both (a) and (b)
  - neither (a) nor (b).
24. The type of stone masonry in which stones of same height are laid in layers, is called
- random rubble masonry
  - course rubble masonry
  - uncoursed rubble masonry
  - ashlar masonry.
25. The range of spread from the wall base to outer edge of a brick work foundation does not exceed
- 1/2 horizontal to 1 vertical
  - 2/3 horizontal to 1 vertical



- C. 1 horizontal to 1 vertical
  - D. 2 horizontals to 1 vertical.
26. Which one of the following piles has a cast iron shoe even after removal of the hollow cylindrical steel casing
- A. simplex pile
  - B. pedastal pile
  - C. Franki pile
  - D. vibro pile
  - E. both (a) and (d) of the above.
27. If height of the first storey of a building is 3.2 m and riser is 13 cm, the number of treads required, is
- A. 12    B. 18    C. 24    D. 25    E. 30.
28. Pick up the correct statement from the following :
- A. the sand in the sand pile is well compacted
  - B. the sand is kept moist at the time of placing and tamping
  - C. the top one metre of the pile is filled up with cement concrete to provide a cap for the filled up sand
  - D. sand piles are generally used under column loads
  - E. all of the above.
29. Pick up the incorrect statement from the following :
- A. In king post truss, one vertical post is used
  - B. In a queen post truss, one vertical post is used
  - C. In a queen post truss, two vertical posts are used
  - D. None of these.
30. For effective drainage, the finished surface of flat roof should have a minimum slope of
- A. 1 in 20    B. 1 to 50    C. 1 in 10    D. 1 in 5.
31. If the depth of an excavation is 20 metres, number of single stage well points to be installed at various levels, is
- A. 5    B. 4    C. 3    D. 2    E. 6.
32. The minimum distance between the centres of bulb of diameter  $d_u$ , of a multi under reamed piles, is
- A.  $d_u$     B.  $1.25 d_u$     C.  $1.5 d_u$     D.  $1.75 d_u$     E.  $2 d_u$ .
33. The method of moving each brick through a small horizontal distance before it is finally laid in any brick wall and pressing it by means of brick hammer, is known as
- A. trowelling    B. laying    C. grouting    D. placing.
34. The stone whose crushing strength is maximum, is
- A. granite    B. chalk    C. slate    D. sand stone    E. marble.

35. The vertical member running through middle of a shutter frame, is  
A. style    B. reveal    C. mullion    D. post.
36. The formWork including the props can be removed from beams, only after  
A. 3 day    B. 7 days    C. 14 days    D. 21 days.
37. The type of bond in a brick masonry containing alternate courses of stretchers and headers, is called  
A. Flemish bond    B. English bond    C. Stretcher bond    D. Header bond.
38. While investigating the site, a thick layer of fairly firm clay over a deep layer of soft clay is encountered. In such a situation, the following type of foundation is useful :  
A. pile formation  
B. raft foundation  
C. grillage foundation  
D. none of these.
39. The concrete slump recommended for columns, is  
A. 25 to 50 mm    B. 25 to 75 mm    C. 75 to 125 mm    D. 50 to 100 mm.
40. The inner section of a cavity wall, is generally known as  
A. buttress    B. leaf wall    C. pillaster    D. pillar.
41. Nogging of a common wooden partition is  
A. upper horizontal wooden member  
B. lower horizontal wooden member  
C. intermediate horizontal wooden member  
D. vertical wooden member.
42. Ornamental moulded course placed on the top of a wall, is  
A. cornice    B. coping    C. frieze    D. lintal.
43. The size of a floor tile commonly used, is  
A. 15 cm x 15 cm x 1.8 cm  
B. 20 cm x 20 cm x 2 cm  
C. 22.5 x 22.5 cm x 2.2 cm  
D. all the above.
44. The triangular portion between any two adjacent arches and the tangent to their crowns, is  
A. haunch    B. spandril    C. soffit    D. rise.
45. The depth of excavation of foundations, is generally measured with a  
A. ranging rod

- B. steel tape  
C. levelling staff  
D. bonning rod.
46. The floor is rubbed with oxalic acid, for making its surface  
A. free from voids  
B. glossy  
C. durable  
D. uniform.
47. For the construction of flyovers in sandy soils, the type of foundation provided, is  
A. strap footing  
B. raft footing  
C. combined footing  
D. pier footing  
E. none of these.
48. If  $a$  is the offset of concrete bed in cms, and  $d$  is the depth of concrete bed in cms, then  
A.  $d = 0.445 a$   
B.  $0.557 a$   
C.  $d = 0.775 a$   
D. none of these.
49. The type of bond in which every course contains both headers and stretchers, is called  
A. English bond      B. Flemish bond      C. Russian band      D. Mixed bond.
50. Pile foundation is generally provided if soil is  
A. compressible      B. water logged      C. made up      D. all the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	D	D	B	A	B	D	B	E	C
10	B	B	A	A	C	C	D	A	B	A
20	E	D	C	B	C	E	C	E	B	A
30	C	C	B	A	C	C	B	B	C	B
40	C	A	D	B	D	B	D	C	B	D

## Section 4

1. To stagger vertical joints in successive courses of a wall, a piece of brick is generally used at the end of the course, which is known as  
A. bat      B. header      C. stretcher      D. closer.
2. The concrete slump recommended for foundations, is  
A. 25 to 50 mm      B. 30 to 125 mm      C. 50 to 100 mm      D. 75 to 125 mm      E. none of these.
3. The minimum thickness of walls built in cement mortar (1 : 6) for a single storey building, is  
A. 10 cm      B. 15 cm      C. 20 cm      D. 25 cm      E. 30 cm.
4. The form work from the slabs excluding props, can be removed only after  
A. 1 day      B. 4 days      C. 7 days      D. 14 days
5. The pile provided with one or more bulges in its vertical shaft, is generally known as  
A. under-ream pile  
B. friction pile  
C. bearing pile  
D. sheet pile.
6. To construct a 10 cm thick partition wall, you will prefer  
A. English bond  
B. Flemish bond  
C. Header bond  
D. Stretcher bond.
7. The pile which supports the load due to friction between pile face and surrounding soil, is generally known as  
A. bearing pile      B. friction pile      C. sheet pile      D. battered pile.
8. The voussoir placed at crown of an arch, is known as a  
A. key      B. soffit      C. springer      D. haunch.
9. The vertical members fixed between steps and hand rail, are known  
A. balusters      B. strings      C. newel posts      D. soffits.
10. Pick up the consideration to be taken while designing a hospital from the following :  
A. the operation theatre unit to be detached as it requires sterilized zone but near the ward for the patients and doctor  
B. the mortuary should be detached from the main circulation with a postmortem room

- C. causalty unit should be provided a separate entrance
  - D. all the above.
11. Pick up the incorrect statement from the following :
    - A. Horizontal D.P.C. is provided at plinth level in internal walls
    - B. D.P.C. is provided under door and verandah openings
    - C. Vertical D.P.C. is not provided in internal walls
    - D. Cement concrete is a rigid damp-proofing material.
  12. For plastering the exposed brick walls, the cement sand mortar should be
    - A. 1:2      B. 1:3      C. 1:4      D. 1:6      E. 1:8.
  13. The construction joints in buildings are provided after
    - A. 10 m      B. 15 m      C. 20 m      D. 40 m      E. 60 m.
  14. The arrangement made to support an unsafe structure temporarily, is known as
    - A. shoring      B. scaffolding      C. underpinning      D. jacking      E. none of these.
  15. Pick up the correct statement from the following :
    - A. D.P.C. should be continuous
    - B. D.P.C. should be of good impervious material
    - C. D.P.C. may be horizontal or vertical
    - D. All the above.
  16. An arch may fail due to
    - A. uneven settlement of abutments
    - B. sliding of voussoirs
    - C. crushing of the material
    - D. all the above.
  17. Pick up the correct statement from the following :
    - A. Cavity of a cavity wall should start near ground level
    - B. Cavity of a cavity wall should terminate near eaves level of sloping roof
    - C. Cavity of a cavity wall should terminate near coping of flat roof with parapet wall
    - D. Damp proof course for two leaves of a cavity wall, is laid separately but at the same level
    - E. All the above.
  18. In soft clay of low bearing capacity, the type of steel pile generally used, is
    - A. H-pile      B. screw pile      C. disc pile      D. pipe pile      E. raking pile.

19. Stability of an existing structure may be disturbed by
- A. rising of water table
  - B. vibrations caused by traffic movements
  - C. mining in the neighbourhood
  - D. excavation in the neighbourhood
  - E. all the above.
20. According to National Building Code, the hydrants in water mains is provided at minimum interval of
- A. 50 m      B. 60 m      C. 75 m      D. 90 m.
21. Open test pit is only suitable upto a depth of
- A. 2 metres
  - B. 2.5 metres
  - C. 3 metres
  - D. none of the above.
22. Pick up the correct statement from the following :
- A. English bond is used for brick masonry to support heavy loads
  - B. Double-flemish bond is suitable for brick masonry to give uniform face appearance
  - C. The double-flemish bond is used for the construction of single brick residential building
  - D. The stretcher bond is used for the construction of half brick masonry brick
  - E. all the above.
23. The projections of head or sill of a door or window frame, are
- A. transoms      B. horns      C. stops      D. chocks.
24. Pick up the correct statement from the following :
- A. the first coat of stucco plaster is called scratch coat
  - B. the second coat of stucco plaster is called brown coat
  - C. the third coat of stucco plaster is called white coat
  - D. all the above.
25. The local swelling of a finished plaster, is termed
- A. cracking      B. dubbing      C. blistering      D. hacking.
26. The form work from the sides of beams can be removed only after
- A. 1 day      B. 4 days      C. 7 days      D. 14 days.
27. In soils possessing low bearing capacity, the type of foundation generally provided, is
- A. column footing
  - B. grillage footing

- C. raft footing
  - D. mat footing
  - E. all the above.
28. Which one of the following activities is not correct as applicable to brick corbels
- A. the maximum projection of the corbel should not be more than the thickness of the wall
  - B. the maximum projection of each corbel course should be limited to a quarter brick at a time
  - C. the discontinuous corbels are used to carry heavy concentrated loads
  - D. stretcher bond is generally used for the construction of brick corbel.
29. Pick up the correct statements from the following :
- A. cracks appear on the plastered surface in the form of hair cracks
  - B. in brick work, the efflorescence is removed by applying a solution of zinc sulphate and water
  - C. excessive thermal variations in the backing or plaster causes the plaster to fall
  - D. all the above.
30. Rotary drilling is the fastest method in case of
- A. rocky soils      B. clay soils      C. sandy soil      D. all of these.
31. The type of pointing in which upper side of mortar joints is kept about 12 mm inside the face of the masonry and bottom is kept flushed with face of wall, is
- A. truck pointing
  - B. recessed pointing
  - C. struck pointing
  - D. grooved pointing.
32. The steel pile which is generally sunk in soft clay or loose sand of low bearing capacity, is
- A. H-pile      B. pipe pile      C. screw pile      D. disc pile      E. none of these.
33. The stepped structure provided for lateral support of a structure, is
- A. retaining wall      B. breast wall      C. buttress      D. parapet wall.
34. In the method of tube boring of soil investigation, the following is essential :
- A. a tube of about 2 metres length and 20 cm diameter with a cutting edge

- B. a flap valve at the bottom of tube is provided to extract the soil sample
  - C. the tube is raised and lowered by 4 thick rope moving over a pulley suspended on a tripod stand
  - D. the tube is dropped to fall under gravity in side a metalic casing pipe which is driven as the depth of excavation proceeds.
  - E. all the above.
35. For each storey of a building, the depth of exploration should be
- A. 1 metre      B. 2 metres      C. 3 metres      D. 4 metres.
36. Pick up the correct statement from the following :
- A. lime mortar with cement in the ratio of in 10 is cheaper and better for outside plaster
  - B. the lime with surkhi used as mortor for construction reduces the cost and provides equal strength to wall
  - C. for very cold or very hot climate, a compact and closed plan should be provided
  - D. on the sea coast, an exposed and open house is generally preferred
  - E. all the above.
37. Pile foundations are suitable for
- A. water logged soils
  - B. soft rocks
  - C. compact soils
  - D. multistoreyed buildings
  - E. none of these.
38. In verandah floors outward slope is
- A. 1 in 40      B. 1 in 50      C. 1 in 60      D. 1 in 70      E. 1 in 100.
39. A floor constructed with the 4 to 6 mm marble chips, is known
- A. reinforced marble floor
  - B. terrazo floor
  - C. marble floor
  - D. chip floor
  - E. mosaic floor.
40. In flat roof of reinforced cement concrete, the recommended angle of slope, is
- A. zero      B. a few degrees      C. 10°      D. 200°.
41. Safe bearing capacity of black cotton soil varies from
- A. 2 to 3 t/m<sup>2</sup>
  - B. 5 to 7.5 t/m<sup>2</sup>



- C. 8 to 10 t/m<sup>2</sup>  
D. 10 to 12 t/m<sup>2</sup>.
42. Crown is located at  
A. highest point on the extrados of the arch  
B. highest point on the intrados of the arch  
C. skew-back of the arch  
D. none of these.
43. The nominal thickness of an expansion joint in brick walls, is kept more than  
A. 5 mm      B. 10 mm      C. 15 mm      D. 20 mm      E. 40 mm.
44. The nominal thickness of one brick wall in mm, is  
A. 90 mm      B. 150 mm      C. 190 mm      D. 200 mm.
45. The pile which supports the load partly by friction and partly by resting on hard stratum, is called  
A. friction pile  
B. bearing pile  
C. friction bearing pile  
D. rough pile.
46. The sound which continues even after its source is cut off, is called  
A. reverberation  
B. echo  
C. intensity of sound  
D. interference.
47. Pick up the incorrect statement from the following :  
A. In Flemish bond, headers and stretchers are laid alternately in the same course  
B. In Flemish bond every header in each course lies centrally over every stretcher of the underlying course  
C. In English bond, stretchers are laid in every course  
D. In English bond, headers and stretchers are laid in alternate courses  
E. None of these.
48. Which of the following metal sheets is most effective in preventing dampness ?  
A. Copper sheets  
B. lead sheets  
C. aluminium sheets  
D. all the above.

49. The least bearing capacity of soil is that of
- hard rock
  - moist clay
  - soft rock
  - laminated
  - coarse sandy soil.
50. Pick up the correct statement from the following :
- the roof slabs of multi-storeyed buildings are constructed monolithically to carry the various floor loads
  - the beams of multi-storeyed buildings rest on girders and are the main load transferring members to the columns
  - the slab is spanned across the secondary beams provided between the main beams
  - All of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	C	C	B	A	D	B	A	A	D
10	B	C	D	A	D	D	E	B	E	C
20	C	E	B	D	C	A	E	D	D	D
30	C	C	C	E	C	E	A	C	B	B
40	B	A	D	D	C	A	C	D	B	D

## Section 5

1. The sill of a common wooden partition is
  - A. vertical wooden member on either end
  - B. lower horizontal wooden member
  - C. upper horizontal wooden member
  - D. intermediate horizontal wooden member.
2. Suitable spacing of timber piles, is
  - A. 50 cm
  - B. 60 cm
  - C. 70 cm
  - D. 80 cm
  - E. 90 cm.
3. The members which support covering material of a sloping roof, are
  - A. rafters
  - B. purlins
  - C. battens
  - D. struts.
4. An ordinary concrete may be made water proof by adding
  - A. pudlo
  - B. impermo
  - C. snowcem
  - D. cico
  - E. all of these.
5. The Auger boring method is not suitable for
  - A. very hard soil
  - B. cemented soil
  - C. vary soft soil
  - D. fully saturated cohesionless soils
  - E. all the above.
6. The mortar in which both cement and lime are used as binding materials, is called
  - A. cement mortar
  - B. lime mortar
  - C. fire resistant mortar
  - D. gauged mortar
  - E. light weight mortar.
7. The rock formed from the solidification of molten matter (magma) is called :
  - A. sedimentary rock
  - B. metamorphic rock
  - C. igneous rock
  - D. none of the above.
8. The minimum width of a stair in residential buildings, is
  - A. 55 cm
  - B. 70 cm
  - C. 85 cm
  - D. 100 cm
  - E. 120 cm.
9. The bond in which headers and stretchers are laid in alternate courses and every stretcher course is started with a three fourth brick bat, is known as
  - A. English cross bond

- B. Dutch bond
  - C. Monk bond
  - D. Rat-trap bond.
10. The vertical faces of a door opening which support frame of the door, are  
 A. jambs      B. posts      C. reveals      D. styles.
11. The type of pointing in which a V-shaped projection outside the wall surface, is provided, is called  
 A. recessed pointing  
 B. weather pointing  
 C. V-pointing  
 D. tuck pointing.
12. Pick up the correct statement from the following:  
 A. In a king post truss, principal rafter and tie beams are jointed together with a bridle joint.  
 B. Joint between the principal rafter and the king post is made by making tenon and mortice respectively  
 C. Joint between strut and king post, is generally of mortice and tenon type  
 D. All the above.
13. Pick up the correct statement about silt soil from the following :  
 A. the silt soil has particle size from 0.02 mm to 0.06 mm.  
 B. in organic fine grained silt soil possesses no plasticity.  
 C. the least plastic type normally consists of more or less equi-dimensional grains of quartz  
 D. all the above.
14. Pick up the correct statement from the following :  
 A. The bearing capacity of a pile is defined as the load which can be sustained by the pile without producing excessive settlement  
 B. The ultimate bearing capacity of a pile is defined as the maximum load which the pile carries and continues to sink without any further increases of load  
 C. The safe bearing capacity of a pile is obtained by dividing the ultimate bearing capacity with a suitable factor of safety  
 D. The factor of safety for piles is taken as 6  
 E. All the above.
15. Pick up the correct statement from the following:  
 A. Plain cement concrete is equally strong in compression as well as in tension

- B. Slump test is performed to check concrete strength
  - C. Curing of concrete is done for proper compaction of cement
  - D. Fineness modulus is the index number expressing the relative sizes of both coarse and fine aggregates
  - E. Concrete is a mixture of binding material, coarse aggregate and water.
16. A pre-stressed concrete pile is
- A. easy to handle
  - B. lighter in weight
  - C. extremely durable
  - D. suitable for heavy load
  - E. all the above.
17. The highest line of sloping roof, where two opposite slopes meet, is known as
- A. rafter
  - B. ridge
  - C. crown
  - D. eave.
18. The vertical sides of a door and window openings provided in a wall, are known as
- A. verticals
  - B. reveals
  - C. jambs
  - D. none of these.
19. The piece of a brick cut along the centre of width in such a way that its length is equal to that of full brick, is called
- A. half brick
  - B. queen closer
  - C. king closer
  - D. bevelled closer.
20. A stair should not have pitch more than
- A.  $25^\circ$
  - B.  $30^\circ$
  - C.  $40^\circ$
  - D.  $50^\circ$
  - E.  $60^\circ$ .
21. The window which is provided in flat roof of a room, is known
- A. dormer window
  - B. lantern window
  - C. louvered window
  - D. sky window.
22. Gravels
- A. are cohesionless aggregates
  - B. vary in size between 2 to 20 mm
  - C. never swell when they come into contact with water
  - D. seldom shrink when dried
  - E. all the above.

23. A wooden block fixed on back side of a door frame on its post, is known as  
A. cleat      B. stop      C. horn      D. none of these.
24. Brick nogging type of partition wall, is constructed by  
A. laying bricks as stretchers in cement mortar  
B. laying bricks as headers in cement mortar  
C. reinforcing brick wall with iron straps  
D. constructing brick work within a wooden framework.
25. In high mountaneous region, the type of roof generally recommended for buildings, is  
A. shed type      B. gable type      C. gambrel type      D. mansord type.
26. The stone masonry of finely dressed stones laid in cement or lime, is  
A. random rubble masonry  
B. coursed rubble masonry  
C. dry rubble masonry  
D. ashlar masonry.
27. The process of filling hollow spaces of walls before plastering, is known  
A. hacking      B. dubbing out      C. blisnering      D. peeling      E. all the above.
28. The stone blocks approximately triangular in shape, used as steps, are known  
A. stone steps      B. built up steps      C. spandril steps      D. none of these.
29. A concrete structure is set on fire and the temperature raises to 1000°C. The strength of concrete as compared to original strength reduces to  
A. 10%      B. 15%      C. 20%      D. 25%.
30. Pick up the correct statement from the following :  
A. A mortar joint having a concave finishing in brick masonry, is called keyed joint  
B. A mortar joint projecting beyond the face of a masonry wall, is called tucked joint  
C. A mortar joint having an inward-upward slope in brick masonry, is called weathered joint  
D. A mortar joint having a recess in it, is called ruled joint  
E. All the above.
31. The window which projects outside a room of a building for admitting more light and air, is known  
A. bay window

- B. casement window
  - C. lantern window
  - D. dormer window.
32. Weep holes are provided in retaining and breast walls
- A. to drain off the water from the filling
  - B. to ventilate the stone masonry
  - C. to add architectural beauty
  - D. to reduce the weight of the earth retained
  - E. to increase compaction of the earth retained.
33. The window which is provided on a sloping roof of a building, is called
- A. lantern window
  - B. dormer window
  - C. louvered window
  - D. rash window
  - E. air window.
34. Vertical construction joints are provided where the shearing forces are minimum in the case of
- A. slabs      B. beams      C. girders      D. all of these.
35. Pick up the correct statement from the following :
- A. Isolated footing is provided under column to transfer the load safely to soil bed
  - B. column footings may have steps or projections in the concrete base
  - C. heavily loaded column base must be provided steel reinforcement in both directions
  - D. the concrete offset should be at least 15 cm on all sides
  - E. all the above.
36. The bearing capacity of granite is generally
- A. 5 to 10 kg/cm<sup>2</sup>
  - B. 15 to 20 kg/cm<sup>2</sup>
  - C. 30 to 35 kg/cm<sup>2</sup>
  - D. 40 to 45 kg/cm<sup>2</sup>.
37. A wall constructed with stones to protect slopes of cuttings in natural ground from the action of weathering agents, is called
- A. retaining wall      B. breast wall      C. buttress      D. parapet wall.
38. Pick up the correct statement from the following :
- A. sand consists of coarse particles of silica formed due to the disintegration of rocks.

- B. the grains of sand are not affected by frost
  - C. sand beds are permeable and do not allow water to rise up between pores due to capillary action
  - D. all the above.
39. The ceiling height of a building is
- A. between ceiling and ground level
  - B. between ceiling and floor level
  - C. upto roof above ground level
  - D. upto ceiling from the ground level.
40. Pick up the correct statement from the following :
- A. A combined footing is so proportioned that centre of gravity of supporting area coincides with centre of gravity of two column loads
  - B. A combined footing may be either rectangular or trapezoidal in shape
  - C. Rectangular footings are provided if two column loads are equal or interior column carries relatively greater load
  - D. Trapezoidal shaped footings may be provided under any loading
  - E. All the above.
41. For a rectangular foundation of width  $b$ , eccentricity of load should not exceed
- A.  $b/2$     B.  $b/3$     C.  $b/4$     D.  $b/5$     E.  $b/6$ .
42. The width of the hollow space between two walls of a cavity wall should not exceed
- A. 5 cm    B. 7.5 cm    C. 10 cm    D. 15 cm.
43. The service area in a building means the area occupied by
- A. stairs
  - B. toilets
  - C. light and shafts
  - D. all the above.
44. The X-ray rooms are plastered with
- A. Plaster of Paris
  - B. Barium plaster
  - C. Martin's cement
  - D. Keen's cement.
45. Slate
- A. is a metamorphic rock
  - B. splits into thin sheets along its bedding planes



- C. has a smooth surface and contains alumina and silica  
 D. possesses good water absorption capacity  
 E. is found in many colours.
46. The line of intersection of two surfaces of a sloping roof forming an internal angle less than  $180^\circ$ , is known as  
 A. ridge    B. hip    C. valley    D. none of these.
47. The process of working a flat for the finishing coat, is known  
 A. dubbing out    B. floating    C. knetting    D. blistering.
48. The type of arch used for high class buildings where appearance is of prime importance, is known as  
 A. ashlar arch  
 B. rubble arch  
 C. gauged brick arch  
 D. axed brick arch.
49. The minimum strength of the mortar used in load bearing brick masonry, is  
 A.  $50 \text{ N/cm}^2$   
 B.  $100 \text{ N/cm}^2$   
 C.  $150 \text{ N/cm}^2$   
 D.  $200 \text{ N/cm}^2$ .
50. In ordinary residential and public buildings, the damp proof course is generally provided at  
 A. ground level  
 B. plinth level  
 C. water table level  
 D. midway ground level and watertable level.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	E	A	E	E	D	C	C	B	A
10	B	D	D	E	D	E	B	C	B	C
20	B	E	B	D	C	D	B	C	C	E
30	A	A	B	D	E	C	B	D	B	E
40	E	C	D	B	A	C	B	A	B	B

## Section 6

1. Under reamed piles are generally used for
  - A. machine foundations
  - B. factory building
  - C. transmission linetowers
  - D. tall structures.
  - E. All the above.
2. The thickness of a reinforced brick partition wall, is generally kept
  - A. 5 cm      B. 10 cm      C. 15 cm      D. 20 cm      E. 25 cm.
3. The wedge shaped bricks forming an arch ring, are called
  - A. Soffits      B. voussoirs      C. haunchs      D. spandrils.
4. A pointed arch which forms isosceles or equilateral triangle, is generally known as
  - A. three centred arch
  - B. two centred arch
  - C. Lancet arch
  - D. Bull's eye arch.
5. The art of bringing the floor to a true level surface by means of screads, is called
  - A. topping      B. bedding      C. screading      D. none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	E	B	B	C	C					

## 11 Concrete Technology

### Section 1

1. For quality control of Portland cement, the test essentially done is
  - A. setting time
  - B. soundness
  - C. tensile strength
  - D. consistency
  - E. all the above.
2. If 1500 g of water is required to have a cement paste 1875 g of normal consistency, the percentage of water is,  
A. 20%    B. 25%    C. 30%    D. 35%    E. 40%
3. Under normal conditions using an ordinary cement, the period of removal of the form work, is :
  - A. 7 days for beam soffits
  - B. 14 days for bottom slabs of spans 4.6 m and more
  - C. 21 days for bottom beams over 6 m spans
  - D. 2 days for vertical sides of columns
  - E. all the above.
4.  $W_p$  and  $W_f$  are the weights of a cylinder containing partially compacted and fully compacted concrete. If the compaction factor is 0.95, the workability of concrete is  
A. extremely low    B. very low    C. low    D. high    E. none of these.
5. For given water content, workability decreases if the concrete aggregates contain an excess of
  - A. thin particles
  - B. flat particles
  - C. elongated particles
  - D. flaky particles
  - E. all the above.
6. M10 grade of concrete approximates
  - A. 1 : 3 : 6 mix
  - B. 1 : 1 : 2 mix
  - C. 1 : 2 : 4 mix
  - D. 1 : 1.5 : 3 mix
  - E. none of these.
7. For ensuring quality of concrete, use

- A. single sized aggregates
  - B. two sized aggregate
  - C. graded aggregates
  - D. coarse aggregates.
8. According to I.S. : 456, the number of grades of concrete mixes, is  
A. 3    B. 4    C. 5    D. 6    E. 7
9. The mixture of different ingredients of cement, is burnt at  
A. 1000°C    B. 1200°C    C. 1400°C    D. 1600°C    E. 1800°C
10. The risk of segregation is more for  
A. wetter mix  
B. larger proportion of maximum size aggregate  
C. coarser grading  
D. all the above.
11. After casting, an ordinary cement concrete on drying  
A. expands    B. mix    C. shrinks    D. none of these.
12. Hydration of cement is due to chemical action of water with  
A. Tricalcium silicate and dicalcium silicate  
B. Dicalcium silicate and tricalcium aluminate  
C. Tricalcium aluminate and tricalcium aluminoferrite  
D. All the above.
13. To obtain cement dry powder, lime stones and shales or their slurry, is burnt in a rotary kiln at a temperature between  
A. 1100° and 1200°C  
B. 1200° and 1300°C  
C. 1300° and 1400°C  
D. 1400° and 1500°C  
E. 1500° and 1600°C
14. Permissible compressive strength of M 300 concrete grade is  
A. 100 kg/cm<sup>2</sup>    B. 150 kg/cm<sup>2</sup>    C. 200 kg/cm<sup>2</sup>    D. 250 kg/cm<sup>2</sup>    E. 300 kg/cm<sup>2</sup>
15. The standard sand now a days used in India, is obtained from  
A. Jaipur (Rajasthan)  
B. Jullundur (Punjab)  
C. Hyderabad (Andhra Pradesh)  
D. Ennore (Madras)  
E. Cuttuck (Orissa).
16. The maximum amount of dust which may be permitted in aggregates is

- A. 5% of the total aggregates for low workability with a coarse grading
  - B. 10% of the total aggregates for low workability with a fine grading
  - C. 20% of the total aggregates for a mix having high workability with fine grading
  - D. all the above.
17. Proper proportioning of concrete, ensures
- A. desired strength and workability
  - B. desired durability
  - C. water tightness of the structure
  - D. resistance to water
  - E. all the above.
18. The bulk density of aggregates does not depend upon :
- A. size and shape of aggregates
  - B. specific gravity of aggregates
  - C. grading of aggregates
  - D. size and shape of the container
  - E. none of these.
19. Curing
- A. reduces the shrinkage of concrete
  - B. preserves the properties of concrete
  - C. prevents the loss of water by evaporation
  - D. all of the above.
20. While compacting the concrete by a mechanical vibrator, the slump should not exceed
- A. 2.5 cm      B. 5.0 cm      C. 7.5 cm      D. 10 cm      E. 15 cm
21. Construction joints are provided
- A. where B.M. and S.F. are small
  - B. where the member is supported by other member
  - C. at 18 m apart in huge structures
  - D. in concrete wall at sill level of windows
  - E. all the above.
22. An aggregate is said to be flaky if its least dimension is less than
- A. 1/5th of mean dimension
  - B. 2/5th of mean dimension
  - C. 3/5th of mean dimension
  - D. 4/5th of mean dimension

- E. none of these.
23. The following proportion of the ingredients of concrete mix, is not in conformation to arbitrary method of proportioning  
 A. 1 : 1 : 2    B. 1 : 2 : 4    C. 1 : 3 : 6    D. 1 : 2 : 8    E. 1 : 4 : 10
24. The increased cohesiveness of concrete, makes it  
 A. less liable to segregation  
 B. more liable to segregation  
 C. more liable to bleeding  
 D. more liable for surface scaling in frosty weather  
 E. none of these.
25. The ratio of the length to breadth of a wooden float, is  
 A. 4.5    B. 5.5    C. 6.5    D. 7.5    E. 8.5
26. To ensure constant moisture content in aggregates  
 A. area of each aggregate pile should be large  
 B. height of each aggregate pile should not exceed 1.50 m  
 C. aggregate pile should be left for 24 hours before aggregates are used  
 D. conical heaps of aggregates should be avoided to prevent moisture variation  
 E. all the above.
27. Workability improved by adding  
 A. air-entraining agent  
 B. foaming agent  
 C. oily-agent  
 D. aluminium compound  
 E. all the above.
28. The commonly used material in the manufacture of cement is  
 A. sand stone    B. slate    C. lime stone    D. graphite.
29. If 20 kg of coarse aggregate is sieved through 80 mm, 40 mm, 20 mm, 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 micron, 300 micron and 150 micron standard sieves and the weights retained are 0 kg, 2 kg, 8 kg, 6 kg, 4 kg respectively, the fineness modulus of the aggregate, is  
 A. 7.30    B. 7.35    C. 7.40    D. 7.45    E. none of these.
30. Curing a concrete for long period ensures better  
 A. volume stability  
 B. strength  
 C. water resistance

- D. water tightness and durability  
E. all the above.
31. For the construction of cement concrete floor, the maximum permissible size of aggregate, is  
A. 4 mm      B. 6 mm      C. 8 mm      D. 10 mm      E. 12 mm
32. The process of proper and accurate measurement of concrete ingredients for uniformity of proportion, is known  
A. grading      B. curing      C. mixing      D. batching      E. none of these.
33. Pick up the correct statement from the following:  
A. Insufficient quantity of water makes the concrete mix harsh  
B. Insufficient quantity of water makes the concrete unworkable  
C. Excess quantity of water makes the concrete segregated  
D. Excess quantity of water causes bleeding in concrete  
E. All the above.
34. The preliminary test is repeated if the difference of compressive strength of three test specimens, exceeds  
A. 5 kg/cm<sup>2</sup>      B. 8 kg/cm<sup>2</sup>      C. 10 kg/cm<sup>2</sup>      D. 12 kg/cm<sup>2</sup>  
E. 15 kg/cm<sup>2</sup>
35. Pick up the correct proportions of chemical ingredients of cement  
A. Lime : Silica : Alumina : Iron oxide : 63 : 22 : 6 : 3  
B. Silica : Lime : Alumina : Iron oxide : 63 : 22 : 6 : 3  
C. Alumina : Silica : Lime : Iron oxide : 63 : 22 : 6 : 3  
D. Iron oxide : Alumina : Silica : Lime : 63 : 22 : 6 : 3
36. Transport of concrete by pumps, is done for a distance of  
A. 100 m      B. 200 m      C. 300 m      D. 400 m      E. none of these.
37. If X, Y and Z are the fineness moduli of coarse, fine and combined aggregates, the percentage (P) of fine aggregates to combined aggregates, is  
A.  $P = \frac{Z - X}{Z - Y} \times 100$   
B.  $P = \frac{X - Z}{Z - Y} \times 100$   
C.  $P = \frac{X - Z}{Z + Y} \times 100$   
D.  $P = \frac{X + Z}{Z - Y} \times 100$   
E.  $P = \frac{Z - X}{Y - Z} \times 100$
38. Slump test is done for  
A. clay      B. sand      C. lime      D. concrete.
39. The high strength of rapid hardening cement at early stage, is due to its  
A. finer grinding

- B. burning at high temperature
  - C. increased lime cement
  - D. higher content of tricalcium.
40. Pick up the correct statement from the following:
- A. The weight of ingredients of concrete mix, is taken in kilograms
  - B. Water and aggregates are measured in litres
  - C. The finished concrete is measured in cubic metres
  - D. 20 bags of cement make one tonne
  - E. All the above.
41. Concrete mainly consists of
- A. cement      B. aggregates      C. admixture      D. water      E. all the above.
42. Vicat's apparatus is used for
- A. fineness test
  - B. consistency test
  - C. setting time test
  - D. soundness test
  - E. compressive strength test.
43. M 150 grade of concrete approximates
- A. 1 : 3 : 6 mix
  - B. 1 : 1 : 2 mix
  - C. 1 : 2 : 4 mix
  - D. 1 : 1.5 : 3 mix
  - E. none of these.
44. Workability of concrete is measured by
- A. Vicat apparatus test
  - B. Slump test
  - C. Minimum void method
  - D. Talbot Richard test.
45. The rock which is not calcareous, is :
- A. lime stone      B. macl      C. chalk      D. laterite      E. none of these.
46. Internal friction between the ingredients of concrete, is decreased by using
- A. less water
  - B. fine aggregates
  - C. rich mix



- D. more water and coarse aggregates  
E. none of these.
47. For road pavements, the cement generally used, is  
A. ordinary Portland cement  
B. rapid hardening cement  
C. low heat cement  
D. blast furnace slag cement  
E. none of these.
48. Construction joints are generally provided in concrete  
A. roads  
B. retaining walls  
C. lining of canals  
D. lining of tunnels  
E. all the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	E	B	E	D	E	A	C	E	C	D
10	C	D	D	E	D	D	E	D	D	B
20	E	C	E	A	D	E	E	C	C	E
30	D	D	E	E	A	D	B	D	C	E
40	E	B	C	B	D	D	B	E		

## Section 2

1. Separation of coarse aggregates from mortar during transportation, is known  
A. bleeding      B. creeping      C. segregation      D. shrinkage      E. none of these.
2. According to the recommendations of IS : 456-1978, the expansion joints  
A. are provided where plane changes abruptly  
B. are provided to ensure minimum resistance  
C. are supported on separate columns  
D. do not carry reinforcement across them  
E. all the above.
3. Grading of sand causes great variation in  
A. workability of concrete  
B. strength of concrete  
C. durability of concrete  
D. handling and placing of concrete  
E. all the above.
4. Shrinkage in concrete can be reduced by using  
A. low water cement ratio  
B. less cement in the concrete  
C. proper concrete mix  
D. presaturated aggregates  
E. all the above.
5. Ordinary concrete is not used for concrete grade  
A. M 100      B. M 150      C. M 200      D. M 250      E. M 400
6. I.S. Sieve Nos. 10 mm and 4.75 mm are generally used for grading of  
A. coarse aggregates  
B. fine aggregates  
C. neither (a) nor (b)  
D. both (a) and (b)  
E. none of these.
7. Pick up the correct statement from the following:  
A. The free water is the amount of water added while mixing and the amount of water held on the surface of the aggregates prior to mixing  
B. The total water is the free water and the amount actually absorbed by the aggregates

- C. Neither (a) nor (b)
  - D. Both (a) and (b).
8. Addition of pozzolana to ordinary port land cement, causes
- A. decrease in early strength
  - B. reduction in chemical action with sulphates
  - C. increase in shrinkage
  - D. reduction bleeding
  - E. all the above.
9. Too wet concrete may cause
- A. weakness of concrete
  - B. excessive laitance
  - C. segregation
  - D. lower density
  - E. all the above.
10. Addition of pozzolana to cement causes
- A. reduction in permeability
  - B. loss of heat of hydration
  - C. reduction in bleeding
  - D. increase in curing time
  - E. all the above.
11. Hardening of cement occurs at
- A. rapid rate during the first few days and afterwards it continues to increase at a decreased rate
  - B. slow rate during the first few days and afterwards it continues to increase at a rapid rate
  - C. uniform rate throughout its age
  - D. none of these.
12. Pick up the correct statement from the following:
- A. Lime in excess, causes the cement to expand and disintegrate
  - B. Silica in excess, causes the cement to set slowly
  - C. Alumina in excess, reduces the strength of the cement
  - D. Magnesium oxide in excess, remains in free state and makes the cement unsound
  - E. All the above.
13. Batching error means inaccuracy in the quantity of
- A. aggregates      B. cement      C. water      D. all the above.
14. Pick up the correct statement from the following i.

- A. Higher workability indicates unexpected increase in the moisture content
  - B. Higher workability indicates deficiency of sand
  - C. If the concrete mix is dry, the slump is zero
  - D. Concrete mix having zero slump, is unsuitable for high strength.
  - E. All the above.
15. You are asked to construct a massive dam, the type of cement you will use, is
- A. ordinary Portland cement
  - B. rapid hardening cement
  - C. low heat cement
  - D. blast furnace slag cement
  - E. white cement.
16. The produce impermeable concrete
- A. thorough mixing of concrete is required
  - B. proper compaction of concrete is required
  - C. proper curing of concrete is required
  - D. properly graded and non-porous aggregates are required
  - E. all the above.
17. Water required per bag of cement, is
- A. 7 kg    B. 14 kg    C. 21 kg    D. 28 kg    E. 35 kg
18. Pick up the incorrect statement from the following:
- A. The bottom and top ends of slump mould are parallel to each other
  - B. The axis of the mould is perpendicular to the end faces
  - C. The internal surface of the mould is kept clean and free from set cement
  - D. The mould is in the form of a frustum of hexagonal pyramid
  - E. None of these.
19. ISI has specified full strength of concrete after
- A. 7 days    B. 14 days    C. 21 days    D. 28 days    E. none of these.
20. For construction of structures in sea water, the cement generally preferred to, is
- A. Portland-pozzolana cement
  - B. quick setting cement
  - C. low heat Portland cement
  - D. rapid hardening cement

- E. none of these.
21. Percentage of pozzolanic material containing clay upto 80% used for the manufacture of pozzolana cement, is  
A. 30%    B. 40%    C. 50%    D. 60%    E. 70%
  22. For batching 1:3:6 concrete mix by volume, the ingredients required per bag of 50 kg cement, are:  
A. 70 litres of sand and 120 litres of aggregates  
B. 70 kg of sand and 140 litres of aggregates  
C. 105 litres of sand and 140 litres of aggregates  
D. 105 litres of sand and 210 litres of aggregates  
E. none of these.
  23. The process of hardening the concrete by keeping its surface moist is known  
A. placing    B. wetting    C. curing    D. compacting    E. none of these.
  24. The grade of concrete not recommended by I.S. : 456, is  
A. M 100    B. M 200    C. M 300    D. M 400    E. M 500
  25. C.R.R.I. charts are used to obtain a relationship between strength of concrete and  
A. water cement ratio  
B. workability  
C. grading of aggregate  
D. fineness modulus  
E. none of these.
  26. Proper batching ensures  
A. economy    B. durability    C. workability    D. strength    E. all the above.
  27. Workability of concrete for a given water content is good if the aggregates, are  
A. rounded aggregate  
B. irregular aggregate  
C. angular aggregate  
D. flaky aggregates.
  28. Pick up the correct statement from the following:  
A. Bulking of sand is caused due to formation of a thin film of surface moisture  
B. Fine sand bulks more than coarse sand  
C. With 10% moisture content by weight, the bulking of sand is increased by 50%.

- D. The volume of fully saturated sand, is equal to the volume of dry and loose sand
  - E. All the above.
29. For compacting plain concrete road surface of thickness less than 20 cm, we use
- A. internal vibrator
  - B. screed vibrator
  - C. form vibrator
  - D. none of these.
30. Pick up the correct statement from the following:
- A. Construction joints are necessarily planned for their locations
  - B. Expansion joints are provided to accommodate thermal expansion
  - C. Construction joints are provided to control shrinkage cracks
  - D. Expansion joints need not be provided in foundation concrete
  - E. All the above.
31. Pick up the correct statement from the following:
- A. Segregation is necessary for a workable concrete
  - B. Consistency does not affect the workability of concrete
  - C. If the slump increases, workability decreases
  - D. If the concrete mix is dry, the slump is maximum
  - E. None of these.
32. Specified compressive strength of concrete is obtained from cube tests at the end of
- A. 3 days      B. 7 days      C. 14 days      D. 21 days      E. 28 days.
33. An aggregate is said to be flaky, if its least dimension is less than
- A.  $\frac{2}{3}$  mean dimension
  - B.  $\frac{3}{4}$  mean dimension
  - C.  $\frac{3}{5}$  mean dimension
  - D.  $\frac{5}{8}$  mean dimension
  - E. none of these.
34. Pick up the incorrect statement from the following:
- A. A rich mix of concrete possesses higher strength than that a lean mix of desired workability with excessive quantity of water
  - B. The strength of concrete decreases as the water cement ratio increases
  - C. If the water cement ratio is less than 0.45, the concrete is not workable and causes honey-combed structure

- D. Good compaction by mechanical vibrations, increases the strength of concrete
  - E. None of these.
35. The percentage of the aggregate of F.M. 2.6 to be combined with coarse aggregate of F.M. 6.8 for obtaining the aggregates of F.M. 5.4, is  
A. 30%    B. 40%    C. 50%    D. 60%.
36. The final operation of finishing floors, is known as  
A. screeding    B. floating    C. trowelling    D. finishing    E. all the above.
37. The internal dimensions of a ware house are 15 m x 5.6 m, and the maximum height of piles is 2.70 m, the maximum number of bags to be stored in two piles, are  
A. 1500 bags    B. 2000 bags    C. 2500 bags    D. 3000 bags    E. 4000 bags
38. For an ordinary Portland cement  
A. residual does not exceed 10% when sieved through IS Sieve No. 9  
B. soundness varies from 5 to 10 mm  
C. initial setting time is not less than 30 minutes  
D. compressive stress after 7 days, is not less than  $175 \text{ kg/cm}^2$   
E. all the above.
39. The maximum thickness of concrete floor of a cement warehouse, is  
A. 10 cm    B. 15 cm    C. 20 cm    D. 25 cm    E. 30 cm
40. A construction joint is provided where  
A. bending moment is small  
B. shear force is small  
C. the member is supported by other member  
D. all the above.
41. The compaction of concrete, improves  
A. density    B. strength    C. durability    D. all the above.
42. Pick up the correct statement from the following:  
A. Water cement paste hardens due to hydration  
B. During hardening cement binds the aggregates together  
C. Cement provides strength, durability and water tightness to the concrete  
D. All the above.
43. The light weight aggregates are obtained from  
A. sedimentary rocks

- B. metamorphic rocks
  - C. igneous rocks
  - D. volcanic source.
44. If the depth of moist sand in a cylinder is 15 cm and the depth of the sand when fully inundated with water is 12 cm, the bulking of the moist sand, is  
 A. 10%    B. 12%    C. 15%    D. 20%    E. 25%.
45. Pick up the correct statement from the following:
- A. According to the petrological characteristics, concrete aggregates are classified as heavy weight, normal weight and light weight
  - B. According to the shape of the particles, concrete aggregates are classified as rounded irregular, angular and flaky
  - C. According to the surface texture of the particles, the concrete aggregates are classified as glassy, smooth, granular, rough, crystalline, honey combed and porous
  - D. All the above.
46. Segregation is responsible for
- A. honey-combed concrete
  - B. porous layers in concrete
  - C. surface scaling in concrete
  - D. sand streaks in concrete
  - E. all the above.
47. Addition of pozzolana to cement
- A. decreases workability
  - B. increases strength
  - C. increases heat of hydration
  - D. decreases curing time
  - E. none of these.
48. The datum temperature for maturity by Plowman, is  
 A. 23°C    B. 0°    C. - 5.6°C    D. - 11.7°C
49. Pick up the incorrect statement from the following:
- A. The degree of grinding of cement, is called *fineness*
  - B. The process of changing cement paste into hard mass, is known as *setting of cement*
  - C. The phenomenon by virtue of which cement does not allow transmission of sound, is known as *soundness of cement*
  - D. The heat generated during chemical reaction of cement with water, is known as *heat of hydration*



E. None of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	E	E	E	E	D	D	E	E	E
10	D	E	D	E	C	E	E	D	E	A
20	A	D	C	E	A	E	A	E	B	E
30	E	E	C	A	C	C	D	C	D	D
40	D	D	D	E	D	E	E	D	C	

### Section 3

1. Permissible compressive strength of M 150 concrete grade is  
A. 100 kg/cm<sup>2</sup>    B. 150 kg/cm<sup>2</sup>    C. 200 kg/cm<sup>2</sup>    D. 250 kg/cm<sup>2</sup>    E. 300 kg/cm<sup>2</sup>
2. Slump test of concrete is a measure of  
A. consistency  
B. compressive strength  
C. tensile strength  
D. impact value.
3. Pozzolana cement is used with confidence for construction of  
A. dams  
B. massive foundations  
C. abutments  
D. R.C.C. structures  
E. all the above.
4. Water cement ratio is  
A. volume of water to that of cement  
B. weight of water to that of cement  
C. weight of concrete to that of water  
D. volume of concrete to that of water  
E. both (a) and (b) of the above.
5. Efflorescence in cement is caused due to an excess of  
A. alumina  
B. iron oxide  
C. silica  
D. alkalis  
E. magnesium oxide.
6. If the engineer-in-charge approves, the 10 cm cubes may be used for the work test of concrete provided maximum nominal size of aggregate, does not exceed  
A. 10 cm    B. 15 cm    C. 20 cm    D. 25 cm    E. 30 cm
7. The diameter of the Vicat plunger is 10 mm and its length varies from  
A. 20 mm to 30 mm    B. 30 mm to 40 mm    C. 40 mm to 50 mm  
D. 50 mm to 60 mm    E. none of these.
8. The shrinkage of concrete  
A. is proportional to water content in the mix  
B. is proportional to cement concrete

- C. increases with age of concrete  
D. all the above.
9. The ratio of various ingredients (cement, sand, aggregates) in concrete of grade M 200, is  
A. 1 : 2 : 4  
B. 1 : 3 : 6  
C. 1 :  $1\frac{1}{2}$  : 3  
D. 1 : 1 : 2  
E. 4 : 2 : 1
10. Separation of water or water sand cement from a freshly concrete, is known  
A. bleeding      B. creeping      C. segregation      D. flooding      E. none of these.
11. Slump test of concrete is a measure of  
A. consistency  
B. compressive strength  
C. tensile strength  
D. impact value.
12. According to Water-Cement Ratio Law, the strength of workable plastic concrete  
A. depends upon the amount of water used in the mix  
B. does not depend upon the quality of cement mixed with aggregates  
C. does not depend upon the quantity of cement mixed with aggregates  
D. all the above.
13. Pick up the incorrect statement from the following:  
A. In properly graded aggregates, bulk density is more  
B. In single size aggregates, bulk density is least  
C. In single size aggregates, bulk density is maximum  
D. None of these.
14. Saw dust can be rendered chemically inert by boiling it in water containing  
A. ferrous sulphate  
B. potassium chloride  
C. ammonia  
D. nitric acid

- E. sulphuric acid.
15. Pick up the correct statement from the following:
- A. High percentage of C<sub>3</sub>S and low percentage of C<sub>2</sub>S cause rapid hardening
  - B. High percentage of C<sub>3</sub>S and low percentage of C<sub>2</sub>S make the cement less resistive to chemical attack
  - C. Low percentage of C<sub>3</sub>S and high percentage of C<sub>2</sub>S contribute to slow hardening
  - D. Low percentage of C<sub>3</sub>S and high percentage of C<sub>2</sub>S provide greater resistance to chemical attack
  - E. All the above.
16. The factor which affects workability, is
- A. water content and its temperature
  - B. shape and size of the aggregates
  - C. grading and surface textures of the aggregates
  - D. air entraining agents
  - E. all the above.
17. The cement whose strength is a little lower than the ordinary cement during the first three months but attains afterwards the same strength, is known as
- A. low-heat Portland cement
  - B. rapid hardening Portland cement
  - C. Portland blast slag cement
  - D. Portland pozzolana cement
  - E. none of these.
18. Pick up the correct statement from the following:
- A. Sand stones may be divided into calcareous, siliceous and ferrugineous sand stones
  - B. Concrete using sand stones, cracks due to excessive shrinkage
  - C. Very hard and close grained crystalline lime stones are suitable aggregates but provide low strength
  - D. Broken bricks produce a concrete having good fire resisting qualities
  - E. All the above.
19. Pick up the correct statement from the following:
- A. Water enables chemical reaction to take place with cement
  - B. Water lubricates the mixture of gravel, sand and cement
  - C. Only a small quantity of water is required for hydration of cement

- D. Strength of concrete structure largely depends upon its workability
  - E. All the above.
20. Pick up the incorrect statement applicable to the field test of good cement.
- A. When one thrusts one's hand into a bag of cement, one should feel warm
  - B. The colour of the cement is bluish
  - C. A handful of cement thrown into a bucket of water should sink immediately
  - D. By rubbing cement in between fingers, one should feel rough
  - E. All the above.
21. Pick up the correct statement from the following:
- A. Calcium chloride acts as a retarder
  - B. Gypsum (calcium sulphate) acts as an accelerator
  - C. Gypsum (calcium sulphate) acts as a retarder
  - D. Calcium chloride acts as an accelerator
  - E. Both (c) and (d).
22. Joints in concrete structures, are provided
- A. to reduce the tensile stresses likely to be developed due to evaporation of water
  - B. to minimise the change in the dimensions of the slab
  - C. to minimise the necessary cracking
  - D. all the above.
23. If the effective working time is 7 hours and per batch time of concrete is 3 minutes, the output of a concrete mixer of 150 litre capacity, is
- A. 15, 900 litres      B. 16, 900 litres      C. 17, 900 litres      D. 18, 900 litres
24. The condition not applicable to water cement ratio law, is
- A. internal moisture conditions on hydration continue till complete strength is gained
  - B. concrete specimens may be tested at any temperature
  - C. concrete specimens need be of same age
  - D. concrete specimens need be of same size
  - E. none of these.
25. High temperature
- A. increases the strength of concrete
  - B. decreases the strength of concrete

- C. has no effect on the strength of concrete
  - D. none of these.
26. The bulk density of aggregates, is generally expressed as
- A. tonnes/cubic metre
  - B. kg/cubic metre
  - C. kg/litre
  - D.  $\text{g/cm}^3$
  - E. none of these.
27. The grade of concrete M 150 means that compressive strength of a 15 cm cube after 28 days, is
- A.  $100 \text{ kg/cm}^2$
  - B.  $150 \text{ kg/cm}^2$
  - C.  $200 \text{ kg/cm}^2$
  - D.  $250 \text{ kg/cm}^2$
  - E.  $300 \text{ kg/cm}^2$
28. Allowable shear strength of concrete, depends upon
- A. shear strength
  - B. tensile strength
  - C. compressive strength
  - D. none of these.
29. The most useless aggregate is one whose surface texture is
- A. smooth
  - B. granular
  - C. glassy
  - D. honey combed and porous.
30. To obtain a very high strength concrete, use very fine grained
- A. Granite
  - B. Magnetite
  - C. Barite
  - D. Volcanic scoria.
31. Concrete containing
- A. silicious aggregates, has higher co-efficient of expansion
  - B. igneous aggregates, has intermediate coefficient of expansion
  - C. lime stones, has lowest co-efficient of expansion
  - D. All the above.
32. An ordinary Portland cement when tested for its fineness, should not leave any residue on I.S. seive No. 9, more than
- A. 5%
  - B. 10%
  - C. 15%
  - D. 20%
  - E. 25%
33. The top diameter, bottom diameter and the height of a slump mould are :

- A. 10 cm, 20 cm, 30 cm
  - B. 10 cm, 30 cm, 20 cm
  - C. 20 cm, 10 cm, 30 cm
  - D. 20 cm, 30 cm, 10 cm
  - E. 30 cm, 20 cm, 10 cm
34. Workability of concrete mix with low water cement ratio is determined by
- A. tensile strength test
  - B. slump test
  - C. compaction factor test
  - D. flexural strength test
  - E. none of these.
35. While designing an air entrained concrete
- A. water cement ratio is reduced
  - B. proportion of aggregates is reduced
  - C. an allowance for the entrained air is made
  - D. strength of the concrete, is reduced
  - E. all the above.
36. Pick up the incorrect statemnt from the following. For performing compressive strength test of cement
- A. cement and standard sand mortar are used in the ratio of 1 : 3
  - B. water is added at the rate of  $\frac{P}{4} + 3.0$  percentage of water where  $P$  is the percentage of water for standard consistency
  - C. A cube mould of 10 cm x 10 cm x 10 cm is used
  - D. The perpared moulds are kept in a atmosphere of 50% relative humidity
  - E. The temperature of water in the submerged tank for curing moulds, should be  $27^{\circ} \pm 2^{\circ}\text{C}$ .
37. For concreting tunnel linings, tran-portation of concrete is done by
- A. pans
  - B. wheel borrows
  - C. containers
  - D. pumps
  - E. belt conveyors.
38. The operation of removing humps and hollows of uniform concrete surface, is known as
- A. floating
  - B. screeding
  - C. trowelling
  - D. finishing
  - E. none of these.

39. The void ratio of
- single size coarse aggregate is roughly 0.45.
  - graded coarse aggregate is roughly 0.040
  - fine aggregate is roughly 0.45
  - all the above.
40. The type of aggregates not suitable for high strength concrete and for pavements subjected to tension, is
- rounded aggregate
  - irregular aggregate
  - angular aggregate
  - flaky aggregate
  - none of these.
41. For the construction of R.C.C. slabs, columns, beams, walls, etc. the grade of concrete mix used, is
- 1 : 3 : 6
  - 1 :  $\frac{1}{2}$  : 3
  - 1 : 2 : 4
  - 1 : 1 : 2
  - 1 : 4 : 8.
42. The type of aggregates of same nominal size, which contain less voids when compacted, are
- rounded spherical
  - irregular
  - flaky
  - none of these.
43. For the construction of cement concrete dams, the maximum permissible size of the aggregates, is
- A. 40 mm      B. 50 mm      C. 60 mm      D. 70 mm      E. 80 mm
44. Permissible compressive strength of M 200 concrete grade is
- A. 100 kg/cm<sup>2</sup>      B. 150 kg/cm<sup>2</sup>      C. 200 kg/cm<sup>2</sup>      D. 250 kg/cm<sup>2</sup>      E. 300 kg/cm<sup>2</sup>
45. For preparing a test-specimen, it is necessary
- to mix cement and fine aggregate by dry hand
  - to mix coarse aggregates
  - to mix water to the cement, fine aggregates and coarse aggregates
  - to oil inner surface of the mould and the base plate, before placing concrete



- E. all the above.
46. The aggregate containing moisture in pores and having its surface dry, is known as
- moist aggregates
  - very dry aggregates
  - dry aggregates
  - saturated surface dry aggregate
  - none of these.
47. The commercial name of white and coloured cement in India, is
- colocrete
  - rainbow cement
  - silvicrete
  - snowcem
  - all the above.
48. Pick up the correct statement from the following:
- An increase in water content must be accompanied by an increase in cement content
  - Angular and rough aggregates reduce the workability of the concrete
  - Large size aggregates increase the workability due to lesser surface area
  - The slump of the concrete mix decreases due to an increase in temperature
  - All the above.
49. To hydrate 500kg of cement full water needed, is
- 100 kg
  - 110 kg
  - 120 kg
  - 130 kg
  - 140 kg

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	A	E	E	D	C	C	D	C	A
10	A	D	C	A	E	E	A	E	E	E
20	E	D	D	B	B	C	B	A	C	A
30	D	B	A	C	E	A	D	B	D	A
40	C	A	A	C	E	D	E	E	D	

## Section 4

1. Concrete gains strength due to
  - A. chemical reaction of cement with sand and coarse aggregates
  - B. evaporation of water from concrete
  - C. hydration of cement
  - D. All the above.
2. If aggregates completely pass through a sieve of size 75 mm and are retained on a sieve of size 60 mm, the particular aggregate will be flaky if its minimum dimension is less than
  - A. 20.5 mm
  - B. 30.5 mm
  - C. 40.5 mm
  - D. 50.5 mm
  - E. none of these.
3. Non-uniform compaction may cause the concrete
  - A. porous
  - B. non-homogeneous
  - C. reduced strength
  - D. all the above.
4. Los Angeles machine is used to test the aggregate for
  - A. crushing strength
  - B. impact value
  - C. abrasion resistance
  - D. water absorption
  - E. none of these.
5. If fineness modulus of sand is 2.5, it is graded as
  - A. very fine sand
  - B. fine sand
  - C. medium sand
  - D. coarse sand
  - E. very coarse sand.
6. Pozzolanic properties exist in
  - A. shales
  - B. fly ash
  - C. pumicite
  - D. diatomaceous clay
  - E. all the above.
7. An aggregate which passes through 25 mm I.S. sieve and is retained on 20 mm sieve, is said to be flaky if its least dimension is less than
  - A. 22.5 mm
  - B. 18.5 mm
  - C. 16.5 mm
  - D. 15.5 mm
  - E. 13.5 mm.

8. Expansion joints are provided if the length of concrete structures exceeds  
A. 10 m      B. 15 m      C. 15 m      D. 35 m      E. 45 m
9. Workability improved by adding  
A. fly ash  
B. hydrated lime  
C. calcium chloride  
D. bentonite  
E. all the above.
10. If the slump of a concrete mix is 60 mm, its workability is  
A. very low      B. low      C. medium      D. high      E. none of these.
11. Pick up the correct statement from the following:  
A. Sand obtained from pits, is washed to remove clay and silt  
B. Sand obtained from flooded pits, need not be washed before use  
C. Sea shore sand contains chlorides which cause efflorescence  
D. The chloride in sea shore sand and shingle may cause corrosion of reinforcement if the concrete is porous  
E. All the above.
12. The strength and quality of concrete, depend upon:  
A. grading of aggregates  
B. surface area of aggregates  
C. shape of aggregates  
D. surface texture of aggregates  
E. all the above.
13. The process of mixing, transporting, placing and compacting concrete using Ordinary Port land Cement should not take more than  
A. 30 minutes      B. 40 minutes      C. 60 minutes      D. 75 minutes  
E. 90 minutes.
14. Pick up the incorrect statement from the following. While performing preliminary test on concrete  
A. proportions of the material and water should be the same as to be used at the work site  
B. cement should be mixed by hand in order to maintain uniformity  
C. concrete mix should be stored in air-tight containers  
D. concrete ingredients should be kept at a temperature of  $37^{\circ} \pm 2^{\circ}\text{C}$   
E. none of these.
15. Sand requiring a high water cement ratio, belongs to  
A. Zone I      B. Zone II      C. Zone III      D. Zone IV.

16. Ordinary Portland cement is manufactured from
- A. lime stone and clay
  - B. gypsum and lime
  - C. pozzolana
  - D. lime, pozzolana and clay.
17. A flaky aggregate is said to be elongated if its length is
- A. equal to the mean size
  - B. twice the mean size
  - C. thrice the mean size
  - D. four times the mean size
  - E. five times the mean size.
18. To prevent segregation, the maximum height for placing concrete, is
- A. 100 cm    B. 125 cm    C. 150 cm    D. 200 cm    E. 250 cm
19. If the various concrete ingredients i.e. cement, sand and aggregates are in the ratio of 1:3:6, the grade of concrete, is
- A. M 100    B. M 150    C. M 200    D. M 250    E. M 300
20. Water cement ratio is generally expressed in volume of water required per
- A. 10 kg    B. 20 kg    C. 30 kg    D. 40 kg    E. 50 kg
21. For a good concrete
- A. aggregates should be hard and durable
  - B. cement should be sufficient to produce the required strength
  - C. water should be free from organic materials
  - D. mixing of ingredients should be done thoroughly so as to produce homogeneity
  - E. All the above.
22. If the effective plan area of a warehouse is 54 sq. m, and maximum height of piles permitted is 270 cm, the number of cement bags to be stored, is
- A. 2000 bags    B. 2200 bags    C. 2400 bags    D. 2700 bags    E. 3000 bags
23. Gypsum is added for
- A. colour
  - B. strength
  - C. controlling setting time
  - D. none of these.
24. A concrete having a slump of 6.5 cm, is said to be
- A. dry    B. earth moist    C. semi-plastic    D. plastic    E. none of these.

25. Strength of concrete with passage of time
- A. increases
  - B. decreases
  - C. fluctuates
  - D. remains constant.
26. Cement used for normal concrete construction, is obtained by burning a mixture of
- A. silicious and argillaceous materials
  - B. argillaceous and calcareous materials
  - C. silicious and catcareous materials
  - D. silicious, argillaceous and calcareous materials
  - E. none of these.
27. Pick up the correct statement from the following:
- A. The concrete gains strength due to hydration of cement
  - B. The concrete cured at a temperature below  $23^{\circ}\text{C}$ , gains strength up to 28 days
  - C. The concrete does not set at freezing point
  - D. The strength of concrete increases with its age
  - E. All the above.
28. Pick up the incorrect statement from the following:
- A. Admixtures accelerate hydration
  - B. Admixtures make concrete water proof
  - C. Admixtures make concrete acid proof
  - D. Admixtures give high strength
  - E. None of these.
29. Higher workability of concrete is required if the structure is
- A. made with cement concrete
  - B. thick and reinforced
  - C. thin and heavily reinforced
  - D. thick and heavily reinforced.
30. Setting time of cement increases by adding
- A. gypsum
  - B. hydrogen peroxide
  - C. calcium chloride
  - D. sodium oxide
  - E. none of these.

31. The dimensions of a 35 litre forma for measuring aggregates by volume, are :
- A. length 30 cm, breadth 25 cm, height 30 cm
  - B. length 39 cm, breadth 25 cm, height 32 cm
  - C. length 27 cm, breadth 27 cm, height 48 cm
  - D. length 220 cm, breadth 25 cm, height 40 cm
  - E. none of these.
32. The shuttering of a hall measuring 4 m x 5 m, can be removed after
- A. 5 days     B. 7 days     C. 10 days     D. 14 days     E. 21 days
33. Pick up the correct statement from the following:
- A. There should not be any loss of cement from the charged drum of the mixer
  - B. Cement should be mixed for at least one minute
  - C. 10% of water is placed in the rotating drum before adding dry material
  - D. 10% of water is added after placing the other ingredients in the drum
  - E. All the above.
34. If 50 kg of fine aggregates and 100 kg of coarse agregates are mixed in a concrete whose water cement ratio is 0.6, the weight of water required for harsh mix, is
- A. 8 kg     B. 10 kg     C. 12 kg     D. 14 kg     E. 15 kg.
35. The entrained air in concrete
- A. increases workability
  - B. decreases workability
  - C. decreases resistance to weathering
  - D. increases strength
  - E. neither affects workability nor strength.
36. Pick up the incorrect statement from the following:
- A. Tricalcium silicate (C<sub>3</sub>S) hydrates rapidly
  - B. Tricalcium silicate (C<sub>3</sub>S) generates more heat of hydration
  - C. Tricalcium silicate (C<sub>3</sub>S) develops early strength
  - D. Tricalcium silicate (C<sub>3</sub>S) has more resistance to sulphate attack
  - E. None of these.
37. Permissible compressive strength of M 200 concrete grade is
- A. 100 kg/cm<sup>2</sup>     B. 150 kg/cm<sup>2</sup>     C. 200 kg/cm<sup>2</sup>     D. 250 kg/cm<sup>2</sup>     E. 300 kg/cm<sup>2</sup>

38. In slump test, each layer of concrete is compacted by a steel rod 60 cm long and of 16 mm diameter for  
 A. 20 times    B. 25 times    C. 30 times    D. 40 times    E. 50 times
39. If the average compressive strength is 4000 kg/cm<sup>2</sup> and standard deviation is 500, the co-efficient of variation is  
 A. 10%    B. 12.5%    C. 15%    D. 18.5 %    E. 20%
40. For preparing ordinary concrete, the quantity of water used, is  
 A. 5% by weight of aggregates plus 20% of weight of cement  
 B. 10% by weight of aggregates plus 10% of weight of cement  
 C. 5% by weight of aggregates plus 30% of weight of cement  
 D. 30% by weight of aggregates plus 10% of weight of cement  
 E. none of these.
41. According to IS : 382-1963, a good aggregate should be  
 A. chemically inert  
 B. sufficiently strong  
 C. hard and durable  
 D. all the above.
42. The 28 days cube strength of mass concrete using aggregates of maximum size 5 cm for gravity dams should be  
 A. between 150 to 300 kg/cm<sup>2</sup>  
 B. between 350 to 600 kg/cm<sup>2</sup>  
 C. between 150 to 500 kg/cm<sup>2</sup>  
 D. below 200 kg/cm<sup>2</sup>  
 E. none of these.
43. If P, Y and Z are the weights of cement, fine aggregates and coarse aggregates respectively and W/C is the water cement ratio, the minimum quantity of water to be added to first batch, is obtained by the equation  
 A.  $0.1P + 0.3Y + 0.1Z = W/C \times P$   
 B.  $0.3P + 0.1Y + 0.01Z = W/C \times P$   
 C.  $0.4P + 0.2Y + 0.01Z = W/C \times P$   
 D.  $0.5P + 0.3Y + 0.01Z = W/C \times P$   
 E.  $0.2P + 0.5Y + 0.1Z = W/C \times P$
44. For the construction of thin R.C.C. structures, the type of cement to be avoided, is  
 A. ordinary Portland cement  
 B. rapid hardening cement

- C. low heat cement  
D. blast furnace slag cement  
E. sulphate resisting cement.
45. Vicat apparatus is used for  
A. fineness test  
B. consistency test  
C. test for setting time  
D. test for tensile strength  
E. none of these.
46. Pick up the incorrect statement from the following:  
A. Space between the exterior walls of a warehouse and bag piles should be 30 cm  
B. Cement bags should preferably be piled on wooden planks  
C. Cement bags should be placed such that bags of one layer does not touch the bags of the adjacent layer  
D. Width and height of the pile should not exceed 3 m and 2.70 m respectively  
E. None of these.
47. For the construction of the retaining structures, the type of concrete mix to be used, is  
A. 1 : 3 : 6  
B. 1 : 2 : 4  
C.  $1 : 1\frac{1}{2} : 3$   
D. 1 : 1 : 2  
E. 1 : 4 : 8.
48. An ideal ware house, is provided  
A. water proof masonry walls  
B. water proof roof  
C. few windows which remain generally closed  
D. 15 cm thick concrete floor laid on a dry course of soling  
E. all the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	C	D	C	B	E	E	E	E	C
10	E	E	A	D	A	B	B	C	A	E
20	E	D	C	D	A	D	E	A	D	A
30	C	B	E	C	A	D	C	B	B	C
40	D	D	B	D	B	E	C	E		



## Section 5

1. Concrete is unsuitable for compaction by a vibrator if it is  
A. dry    B. earth moist    C. semi-plastic    D. plastic    E. none of these.
2. Inert material of a cement concrete mix, is  
A. water    B. cement    C. aggregate    D. none of these.
3. Sands of zone I are  
A. coarse    B. medium    C. medium to fine    D. fine.
4. The lower water cement ratio in concrete, introduces  
A. smaller creep and shrinkage  
B. greater density and smaller permeability  
C. improved frost resistance  
D. greater wear resistance and improved bond strength  
E. all the above.
5. The cement becomes useless if its absorbed moisture content exceeds  
A. 1%    B. 2%    C. 3%    D. 4%    E. 5%
6. A concrete using an air entrained cement  
A. has strength less than 10% to 15%  
B. has more resistance to weathering  
C. is more plastic and workable  
D. is free from segregation and bleeding  
E. all the above.
7. Pick up the correct statement from the following:  
A. The maximum size of a coarse aggregate, is 75 mm and minimum 4.75 mm  
B. The maximum size of the fine aggregate, is 4.75 mm and minimum 0.075 mm  
C. The material having particles of size varying from 0.06 mm to 0.002 mm, is known as silt  
D. The material having particles of size less than 0.002 mm, is known as clay  
E. All the above.
8. Placing of concrete should preferably be done at a temperature of  
A. 0°C    B. 10°C    C. 20°C    D. 23°C    E.  $27 \pm 2^\circ\text{C}$
9. The aggregate impact value of the aggregate used in  
A. building concrete is less than 45  
B. road pavement concrete is less than 30

- C. runway concrete is less than 30
  - D. all the above.
10. The maximum percentage of chemical ingredient of cement is that of
- A. magnesium oxide
  - B. iron oxide
  - C. aluminium
  - D. lime
  - E. silica.
11. Pick up the incorrect statement from the following:
- A. Workability of the concrete mix decreases with an increase in the moisture content
  - B. Concrete for which preliminary tests are conducted, is called controlled concrete
  - C. Bulking of sand depends upon the fineness of grains
  - D. Concrete mix 1 : 6 : 12, is used for mass concrete in piers.
  - E. All the above.
12. Sand generally contains salt if it is obtained from:
- A. nala beds    B. river beds    C. sea beds    D. all the above
  - E. none of these.
13. The impurity of mixing water which affects the setting time and strength of concrete, is
- A. sodium sulphates
  - B. sodium chlorides
  - C. sodium carbonates and bicarbonates
  - D. calcium chlorides
  - E. calcium bicarbonates
14. Pick up the correct statement from the following:
- A. Continuous grading is not necessary for obtaining a minimum of air voids
  - B. The omission of a certain size of aggregate is shown by a straight horizontal line on the grading curve
  - C. The omission of a certain size of aggregate in concrete increases the workability but also increases the liability to segregation
  - D. All the above.
15. Di-calcium silicate (C<sub>2</sub>S)
- A. hydrates rapidly
  - B. generates less heat of hydration
  - C. hardens rapidly

- D. provides less ultimate strength to cement
  - E. has less resistance to sulphate attack.
16. On a grading curve, the gap grading is represented by
- A. a horizontal line
  - B. a vertical line
  - C. N.W. inclined line
  - D. N.E. inclined line
  - E. none of these.
17. Bulking of sand is
- A. mixing of different sizes of sand particles
  - B. mixing of lime with sand
  - C. maximum water with sand
  - D. swelling of sand when wetted.
18. Curing of pavements, floors, roofs and slabs, is done by
- A. membrane method
  - B. ponding method
  - C. covering surface with bags
  - D. sprinkling water method
  - E. shading concrete method.
19. Pick up the incorrect statement from the following:
- A. With passage of time, the strength of cement increases
  - B. With passage of time, the strength of cement decreases
  - C. After a period of 24 months, the strength of cement reduces to 50%
  - D. The concrete made with storage deteriorated cement, gains strength with time
  - E. None of these.
20. The surface where two successive placements of concrete meet, is known as
- A. Contraction joint
  - B. Expansion joint
  - C. Construction joint
  - D. both (a) and (b)
  - E. both (6) and (c).
21. An excess of flaky particles in concrete aggregates
- A. decreases the workability
  - B. increases the quantity of water and sand

- C. affects the durability of concrete
  - D. more than 15% are not desirable
  - E. all the above.
22. I.S.I. has specified the full strength of concrete after  
 A. 7 days    B. 14 days    C. 21 days    D. 28 days    E. 35 days
23. For given workability the grading requiring the least amount of water is one that gives  
 A. greatest surface area for the given cement and aggregates  
 B. least surface area for the given cement and aggregates  
 C. least weight for the given cement and aggregates  
 D. greatest weight for the given cement and aggregates  
 E. none of these.
24. The minimum percentage of chemical ingredient of cement is that of  
 A. magnesium oxide  
 B. iron oxide  
 C. alumina  
 D. lime  
 E. silica.
25. The specifications of a cement bag for storage, are  
 A. weight 50 kg  
 B. height 18 cm  
 C. plan area 3000 sq. cm  
 D. volume 35 litres  
 E. all the above.
26. The bulk density of aggregates, depends upon  
 A. shape    B. grading    C. compaction    D. all the above.
27. Pick up the correct statement from the following:  
 A. The bulk density of fine aggregate is usually about 10 per cent more than that of coarse aggregate of similar composition  
 B. The specific gravity of aggregate is important for the determination of the moisture content  
 C. The absorption and porosity of an aggregate influence the property of the concrete  
 D. A highly absorptive aggregate reduces the workability of concrete considerably  
 E. All the above.
28. Horizontal construction joints in concrete walls are generally provided at

- A. soffit level
  - B. window sill level
  - C. floor level
  - D. all the above.
29. Pick up the correct statement from the following:
- A. Construction joints in columns are provided a few cm below the junction of beam
  - B. Construction joints in columns are provided at the bottom haunching
  - C. Construction joints in beams and slabs are provided within middle third
  - D. Construction joints are generally provided in positions subjected to least shear force
  - E. All the above.
30. For a concrete mix 1:3:6 and water cement ratio 0.6 both by weight, the quantity of water required per bag, is
- A. 10 kg    B. 12 kg    C. 14 kg    D. 16 kg    E. 20 kg
31. The concrete mix which causes difficulty in obtaining a smooth finish, possess
- A. segregation
  - B. internal friction
  - C. harshness
  - D. bleeding
  - E. none of these.
32. Le-Chatelier's apparatus is used for testing
- A. soundness of cement
  - B. hardness of cement
  - C. strength of cement
  - D. durability of cement.
33. 'Ware house pack' of cement means
- A. full capacity of the ware house
  - B. pressure exertion of the bags of upper layers
  - C. pressure compaction of the bags on lower layers
  - D. packing the ware house
  - E. none of these.
34. In the method of voids for determination of the quantity of cement paste, it is assumed that
- A. Voids in coarse aggregates are filled by fine aggregates

- B. Voids in fine aggregates are filled by the cement paste
  - C. Volume of fine aggregates is equal to total voids in coarse aggregates plus 10% extra
  - D. Volume of cement paste required is equal to total volume of voids in fine aggregates plus 15% extra
  - E. All the above.
35. If a grading curve is horizontal between the portions of 20 mm I.S. Sieve and 4.75 mm I.S. Sieve, the graded aggregates do not contain
- A. 20 mm particles
  - B. 10 mm particles
  - C. 4.75 mm particles
  - D. all the above.
36. The size of fine aggregates does not exceed
- A. 2.75 mm    B. 3.00 mm    C. 3.75 mm    D. 4.75 mm    E. 5.75 mm
37. An aggregate is known as cyclopean aggregate if its size is more than
- A. 4.75 mm    B. 30 mm    C. 60 mm    D. 75 mm    E. 90 mm.
38. The main object of compaction of concrete, is:
- A. to eliminate air holes
  - B. to achieve maximum density
  - C. to provide intimate contact between the concrete and embedded materials
  - D. all the above.
39. Pick up the correct statement from the following:
- A. The quality of water governs the strength of concrete
  - B. The quantity of water required for concreting, depends upon the grading of aggregate and method of compaction
  - C. 10% excess of water reduces the strength of concrete by 15%
  - D. 30% excess of water reduces the strength of concrete by 50%
  - E. All the above.
40. Particles of 0.002 mm size are that of
- A. clay    B. sand    C. gravel    D. none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	C	A	E	E	C	E	E	D	D
10	E	C	C	D	B	A	D	B	A	C
20	E	D	A	A	E	D	E	D	E	C
30	C	A	C	E	D	D	D	D	E	A

## 12 Strength of Materials

### Section 1

1. A rectangular bar of width  $b$  and height  $h$  is being used as a cantilever. The loading is in a plane parallel to the side  $b$ . The section modulus is  
A.  $\frac{bh^3}{12}$     B.  $\frac{bh^2}{6}$     C.  $\frac{b^2h}{6}$     D. none of these.
2. As compared to uniaxial tension or compression, the strain energy stored in bending is only  
A.  $\frac{1}{8}$     B.  $\frac{1}{4}$     C.  $\frac{1}{3}$     D.  $\frac{1}{2}$
3. The ratio of strengths of solid to hollow shafts, both having outside diameter  $D$  and hollow having inside diameter  $D/2$ , in torsion, is  
A.  $1/4$     B.  $1/2$     C.  $1/16$     D.  $15/16$     E.  $3/8$
4. The weakest section of a diamond riveting, is the section which passes through  
A. first row  
B. second row  
C. central row  
D. one rivet hole of end row.
5. In a loaded beam, the point of contraflexure occurs at a section where  
A. bending moment is minimum  
B. bending moment is zero or changes sign  
C. bending moment is maximum  
D. shearing force is maximum  
E. shearing force is minimum.
6. The ratio of elongations of a conical bar due to its own weight and that of a prismatic bar of the same length, is  
A.  $\frac{1}{2}$     B.  $\frac{1}{3}$     C.  $\frac{1}{4}$     D.  $\frac{1}{5}$     E.  $\frac{1}{6}$
7. A three-hinged arch is said to be :  
A. statically determinate structure  
B. statically indeterminate structure  
C. a bent beam  
D. none of these.
8. The deflection due to couple  $M$  at the free end of a cantilever length  $L$  is  
A.  $\frac{ML}{EI}$     B.  $\frac{2ML}{EI}$     C.  $\frac{ML^2}{2EI}$     D.  $\frac{M^2L}{2EI}$

9. The shape of the bending moment diagram over the length of a beam, having no external load, is always  
 A. linear      B. parabolic      C. cubical      D. circular.
10. Pick up the incorrect statement  
 A. The cross-sectional area of the welded member is effective  
 B. A welded joint develops strength of its parent metal  
 C. Welded joints provide rigidity  
 D. Welded joints have better finish  
 E. Welding takes more time than riveting.
11. A uniform girder simply supported at its ends is subjected to a uniformly distributed load over its entire length and is propped at the centre so as to neutralise the deflection. The net B.M. at the centre will be  
 A.  $WL$       B.  $\frac{WL}{8}$       C.  $\frac{WL}{24}$       D.  $\frac{WL}{32}$       E.  $\frac{WL}{64}$
12. A beam of length  $L$  is pinned at both ends and is subjected to a concentrated bending couple of moment  $M$  at its centre. The maximum bending moment in the beam is  
 A.  $M$       B.  $M/2$       C.  $M/3$       D.  $ML/2$
13. If two forces acting at a joint are not along the straight line, then for the equilibrium of the joint  
 A. one of the forces must be zero  
 B. each force must be zero  
 C. forces must be equal and of the same sign  
 D. forces must be equal in magnitude but opposite in sign.
14. A closely coiled helical spring of radius  $R$ , contains  $n$  turns and is subjected to an axial load  $W$ . If the radius of the coil wire is  $r$  and modulus of rigidity of the coil material is  $C$ , the stress developed in the helical spring is  
 A.  $\frac{WR}{\pi r^3}$       B.  $\frac{2WR}{\pi r^3}$       C.  $\frac{2WR}{\pi r^2}$       D.  $\frac{4WR}{\pi r^2}$
15. If the shear force along a section of a beam is zero, the bending moment at the section is  
 A. zero  
 B. maximum  
 C. minimum  
 D. average of maximum-minimum  
 E. none of these.



16. In the cantilever truss as shown in below figure, the horizontal component of the reaction at A, is  
 A. 30 tonnes    B. 60 tonnes    C. 90 tonnes    D. 120 tonnes    E. 150 tonnes.
17. In case of an eccentric loading on a bracket subjected to moment M, the tangential force developed in any rivet, at right angles to its radius vector r is  
 A.  $\frac{Mr}{\Sigma r^2}$     B.  $\frac{\Sigma r^2}{Mr}$     C.  $\frac{Mr^2}{\Sigma r^2}$     D.  $\frac{\sqrt{Mr}}{\Sigma r^2}$
18. A simply supported beam of span L carries a concentrated load W at its mid-span. The maximum bending moment M is  
 A.  $\frac{WL}{2}$     B.  $\frac{WL}{4}$     C.  $\frac{WL}{8}$     D.  $\frac{WL}{12}$     E.  $\frac{WL}{16}$
19. The ratio of the maximum deflections of a beam simply supported at its ends with an isolated central load and that of with a uniformly distributed load over its entire length, is  
 A. 1    B.  $\frac{15}{24}$     C.  $\frac{24}{15}$     D.  $\frac{2}{3}$     E.  $\frac{3}{2}$
20. The shape of the bending moment diagram over the length of a beam, carrying a uniformly distributed load is always  
 A. linear    B. parabolic    C. cubical    D. circular.
21. The minimum number of rivets for the connection of a gusset plate, is  
 A. 1    B. 2    C. 3    D. 4
22. A triangular section having base b, height h, is placed with its base horizontal. If the shear stress at a depth y from top is q, the maximum shear stress is  
 A.  $\frac{3S}{bh}$     B.  $\frac{4S}{bh}$     C.  $\frac{4b}{Sh}$     D.  $\frac{3b}{bS}$
23. The slenderness ratio of a vertical column of a square cross-section of 2.5 cm sides and 300 cm length, is  
 A. 200    B. 240    C. 360    D. 416    E. 500
24. If n is the ratio of internal and external diameters of a hollow shaft, the ratio of the weight of the hollow shaft and that of solid shaft of same strength, will be  
 A.  $\frac{1 - n^2}{(1 - n^2)^{1/2}}$     B.  $\frac{1 - n^2}{(1 - n^4)^{2/3}}$     C.  $\frac{1 + n^3}{(1 + n^4)^{1/2}}$     D.  $\frac{1 + n^1}{(1 + n^4)^{2/3}}$
25. A rectangular beam 20 cm wide is subjected to a maximum shearing force of 10, 000 kg, the corresponding maximum shearing stress being

- 30 kg/cm<sup>2</sup>. The depth of the beam is  
 A. 15 cm    B. 20 cm    C. 25 cm    D. 30 cm.
26. The maximum twisting moment a shaft can resist, is the product of the permissible shear stress and  
 A. moment of inertia  
 B. polar moment of inertia  
 C. polar modulus  
 D. modulus of rigidity.
27. For a simply supported beam with a central load, the bending moment is  
 A. least at the centre  
 B. least at the supports  
 C. maximum at the supports  
 D. maximum at the centre.
28. For a given material Young's modulus is 200 GN/m<sup>2</sup> and modulus of rigidity is 80 GN/m<sup>2</sup>. The value of Poisson's ratio is  
 A. 0.15    B. 0.20    C. 0.25    D. 0.30    E. 0.40
29. The ratio of the moment of inertia of a circular plate and that of a square plate for equal depth, is  
 A. less than one    B. equal to one    C. more than one    D. equal to  $3\pi/16$     E. none of these.
30. The force in member U<sub>2</sub>L<sub>2</sub> of the truss shown in below figure, is  
 A. 10 T tension  
 B. 10 T compression  
 C. zero  
 D. 15 T compression.
31. If a shaft is rotating N revolutions per minute with an applied torque T kg-m, the horse power being transmitted by the shaft, is  
 A.  $\frac{2\pi NT}{550}$     B.  $\frac{2\pi NT}{750}$     C.  $\frac{2\pi NT}{4500}$     D.  $\frac{2\pi NT}{55}$     E. none of these.
32. If the width of a simply supported beam carrying an isolated load at its centre is doubled, the deflection of the beam at the centre is changed by  
 A. 1/2    B. 1/8    C. 2    D. 8    E. 4
33. For a simply supported beam of length L, the bending moment M is described as  $M = a(x - x^3/L^2)$ ,  $0 \leq x \leq L$ ; where a is a constant. The shear force will be zero at  
 A. the supports

- B.  $x = L/2$   
 C.  $x = L/3$   
 D.  $x = L/3$
34. The deflection of any rectangular beam simply supported, is  
 A. directly proportional to its weight  
 B. inversely proportional to its width  
 C. inversely proportional to the cube of its depth  
 D. directly proportional to the cube of its length  
 E. none of these.
35. If a rectangular beam measuring 10 x 18 x 400 cm carries a uniformly distributed load such that the bending stress developed is 100 kg/cm<sup>2</sup>. The intensity of the load per metre length, is  
 A. 240 kg    B. 250 kg    C. 260 kg    D. 270 kg    E. 280 kg.
36. Influence lines are drawn for structures  
 A. of any type  
 B. statically determinate  
 C. pin-jointed truss  
 D. none of these.
37. A shaft turning 150 r.p.m. is subjected to a torque of 150 kgm. Horse power transmitted by the shaft is  
 A.  $\pi$     B.  $10\pi$     C.  $\pi^2$     D.  $1/\pi$
38. A simply supported beam carrying a uniformly distributed load over its whole span, is propped at the centre of the span so that the beam is held to the level of the end supports. The reaction of the prop will be  
 A. half the distributed load  
 B. 3/8th the distributed load  
 C. 5/8th the distributed load  
 D. distributed load.  
 E. none of these.
39. The range within which a load can be applied on a rectangular column, to avoid any tensile stress, is  
 A. one-half of the base  
 B. one-third of the base  
 C. one-fourth of the base  
 D. one-fifth of the base  
 E. one sixth of the base on either side of centroid.
40. In a beam, the neutral plane

- A. may be its centre
  - B. passes through the C.G. of the area of cross-section
  - C. does not change during deformation
  - D. none of these.
41. When loads are applied proportionately to a frame structure containing its members in one plane, the structure is called
- A. grid frame      B. plane frame      C. space frame      D. truss frame.
42. The shear stress at any section of a shaft is maximum
- A. at the centre of the section
  - B. at a distance  $r/2$  from the centre
  - C. at the top of the surface
  - D. at a distance  $3/4 r$  from the centre
  - E. none of these.
43. The region of the cross-section of a column in which compressive load may be applied without producing any tensile stress, is known as the core of the cross-section. In circular columns the radius of the core, is
- A. one-half of the radius
  - B. one-third of the radius
  - C. one-quarter of the radius
  - D. one-fifth of the radius
  - E. one-sixth of the radius.
44. A beam is said to be of uniform strength, if
- A. B.M. is same throughout the beam
  - B. deflection is same throughout the beam
  - C. bending stress is same throughout the beam
  - D. shear stress is same throughout the beam
  - E. none of these.
45. In a tension test, the yield stress is  $300 \text{ kg/cm}^2$ , in the octa hedral shear stress at the point is:
- A.  $100 \sqrt{2} \text{ kg/cm}^2$
  - B.  $150 \sqrt{2} \text{ kg/cm}^2$
  - C.  $200 \sqrt{2} \text{ kg/cm}^2$
  - D.  $250 \sqrt{2} \text{ kg/cm}^2$ .
46. The radius of gyration of a rectangular section is not proportional to
- A. square root of the moment of inertia
  - B. square root of the inverse of the area
  - C. square root of the moment of inertia divided by area of the section

- D. none of these.
47. A reinforced concrete beam is assumed to be made of
- homogeneous material
  - heterogeneous material
  - isotropic material
  - none of these.
48. If the rivets in adjacent rows are staggered and outermost row has only one rivet, the arrangement of the rivets, is called
- chain riveting
  - zig-zag riveting
  - diamond riveting
  - none of these.
49. The energy stored in a beam of length  $L$  subjected to a constant B.M. is
- $\frac{M^2 L}{2EI}$
  - $\frac{ML^2}{2EI}$
  - $\frac{M^2 L}{EI}$
  - $\frac{ML^2}{EI}$
50. The force in DB of the truss shown in below figure is
- 3  $W$  compression
  - $W$  tension
  - 2  $W$  compression
  - 5  $W$  tension
  - 4  $W$  tension.

#### Answer Key

	1	2	3	4	5	6	7	8	9	0
0	C	C	D	A	B	B	A	C	A	E
10	D	A	B	B	B	A	A	B	C	B
20	B	A	D	B	C	C	D	C	D	B
30	C	A	C	C	D	A	B	C	B	C
40	B	C	C	C	A	D	B	C	A	B

#### Explanation

29.

For circular plate,  $MI = \pi \cdot d^4 / 64$ .

For square plate,  $MI = d^4 / 12$ .

So, Ratio = MI of circular plate / MI of square plate.

=  $3\pi / 16$ .

## Section 2

- Pick up the correct statement from the following :
  - A ductile material has large plastic zone
  - A brittle material has no plastic zone
  - A rigid material has no plastic zone
  - All the above.
- The number of points of contraflexure in a simple supported beam carrying uniformly distributed load, is  
A. 1      B. 2      C. 3      D. 0
- The maximum bending moment due to a moving load on a simply supported beam, occurs
  - at the mid span
  - at the supports
  - under the load
  - anywhere on the beam
  - none of these.
- A three hinged parabolic arch hinged at the crown and springings, has a horizontal span of 4.8 m and a central rise of 1 m. It carries a uniformly distributed load of 0.75 tonne per metre over half left hand span. The horizontal thrust at the support will be  
A. 10.8 tonnes      B. 1.08 tonnes      C. 1.8 tonnes      D. 0.8 tonnes  
E. none of these.
- The length of a column which gives the same value of buckling load by Euler and Rankine-Gordon formula, is equal to  
 A.  $\frac{\pi^2 EK}{fa - \pi^2 E_a}$       B.  $\sqrt{\frac{\pi^2 EK}{fa - \pi^2 E_a}}$       C.  $\sqrt{\frac{\pi^2 EK^2}{\pi^2 E_a - fa}}$       D. none of these.
- The length of a column, having a uniform circular cross-section of 7.5 cm diameter and whose ends are hinged, is 5 m. If the value of E for the material is 2100 tonnes/cm<sup>2</sup>, the permissible maximum crippling load will be  
A. 1.288 tonnes      B. 12.88      C. 128.8 tonnes      D. 288.0      E. none of these.
- If a three hinged parabolic arch carries a uniformly distributed load on its entire span, every section of the arch resists.
  - compressive force
  - tensile force
  - shear force
  - bending moment.

8. In a three hinged arch, the shear force is usually
  - A. maximum at crown
  - B. maximum at springings
  - C. maximum at quarter points
  - D. varies with slope.
9. An arch may be subjected to
  - A. shear and axial force
  - B. bending moment and shear force
  - C. bending moment and axial force
  - D. shear force and thrust
  - E. thrust, shear force and bending moment.
10. The law which states, "within elastic limits strain produced is proportional to the stress producing it", is known as
  - A. Bernoulli's law
  - B. Stress law
  - C. Hooke's law
  - D. Poisson's law
  - E. none of these.
11. A simply supported beam of span  $L$  carries a uniformly distributed load  $W$ . The maximum bending moment  $M$  is
  - A.  $\frac{WL}{2}$
  - B.  $\frac{WL}{4}$
  - C.  $\frac{WL}{8}$
  - D.  $\frac{WL}{12}$
  - E.  $\frac{WL}{16}$
12. A cantilever beam rectangular in cross-section is subjected to an isolated load at its free end. If the width of the beam is doubled, the deflection of the free end will be changed in the ratio of
  - A. 8
  - B.  $1/8$
  - C.  $1/2$
  - D. 2
  - E. 3
13. The phenomenon of slow extension of materials having constant load, i.e. increasing with the time is called
  - A. creeping
  - B. yielding
  - C. breaking
  - D. none of these.
14. The direction of the reaction at support B of a truss shown in below figure will be
  - A. East of North
  - B. West of North
  - C. East of South
  - D. West of South
  - E. Vertical.
15. The reaction at support A of the beam shown in below figure, is
  - A. zero
  - B.  $5 T$
  - C.  $10 T$
  - D.  $1 T$
  - E.  $4 T$ .
16. The maximum resistance against rotation, is offered by the weld at a point
  - A. most distant

- B. least distant
  - C. at either end
  - D. centrally located.
17. For structural analysis of forces, the method refers to
- A. moment-area-theorem
  - B. three-moment equation
  - C. Maxwell's reciprocal theorem
  - D. none of these.
18. The B.M. of a cantilever beam shown in below figure at A, is
- A. zero    B. 8 Tm    C. 12 Tm    D. 20 Tm.
19. If a member carries a tensile force P on its area of cross-section A, the normal stress introduced on an inclined plane making an angle  $\theta$  with its transverse plane, is
- A.  $\frac{P}{A} \sin^2 \theta$     B.  $\frac{P}{A} \cos^2 \theta$     C.  $\frac{P}{A} \tan^2 \theta$     D.  $\frac{P}{2A} \sin^2 \theta$     E.  $\frac{P}{2A} \cos 2\theta$
20. The reaction at the supports will be vertical to the plane of the support if the frame structure rests on
- A. roller supports
  - B. free supports
  - C. hinged supports
  - D. all the above.
21. A cylinder is said to be thin if the ratio of its thickness and diameter, is less than
- A. 1/25    B. 1/20    C. 1/15    D. 1/10    E. 1/5
22. The shear force on a simply supported beam is proportional to
- A. displacement of the neutral axis
  - B. sum of the forces
  - C. sum of the transverse forces
  - D. algebraic sum of the transverse forces of the section
  - E. curvature of the neutral axis.
23. An arch with three hinges, is a structure
- A. statically determinate
  - B. statically indeterminate
  - C. geometrically unstable
  - D. structurally sound but indeterminate
  - E. none of these.
24. Stress in members of statically determinate simple frames, can be determined by



- A. method of joints
  - B. method of sections
  - C. graphical solution
  - D. all the above.
25. While testing a cast iron beam (2.5 cm x 2.5 cm) in section and a metre long simply supported at the ends failed when a 100 kg weight is applied at the centre. The maximum stress induced is :
- A. 960 kg/cm<sup>2</sup>
  - B. 980 kg/cm<sup>2</sup>
  - C. 1000 kg/cm<sup>2</sup>
  - D. 1200 kg/cm<sup>2</sup>.
26. For a channel section, the shear centre lies at a distance of
- A.  $\frac{bdt}{2I}$
  - B.  $\frac{d^2bt}{3I}$
  - C.  $\frac{d^2b^2t}{4I}$
  - D.  $\frac{db^2t}{5I}$
27. When equal and opposite forces applied to a body, tend to elongate it, the stress so produced, is called
- A. shear stress
  - B. compressive stress
  - C. tensile stress
  - D. transverse stress.
28. Stress in a beam due to simple bending, is
- A. directly proportional
  - B. inversely proportional
  - C. curvilinearly related
  - D. none of these.
29. A cantilever carrying a uniformly distributed load W over its full length is propped at its free end such that it is at the level of the fixed end. The bending moment will be zero at its free end also at
- A. mid point of the cantilever
  - B. fixed point of the cantilever
  - C. 1/4th length from free end
  - D. 3/4th length from free end
  - E. half length from free end.
30. In rectangular columns (cross-section b x h), the core is a
- A. rectangle of lengths  $b/2$  and  $h/2$
  - B. square of length  $b/2$
  - C. rhombus of length  $h/2$

- D. rhombus of diagonals  $b/3$  and  $h/3$   
 E. none of the these.
31. The tensile force required to cause an elongation of 0.045 mm in a steel rod of 1000 mm length and 12 mm diameter, is (where  $E = 2 \times 10^6 \text{ kg/cm}^2$ )  
 A. 166 kg    B. 102 kg    C. 204 kg    D. 74 kg
32. According to Unwin's formula, the diameter  $d$  of a rivet of plate of thickness  $t$  is :  
 A.  $d = 6.05 t$   
 B.  $d = 1.5 t + 4$   
 C.  $d = 5 t$   
 D.  $d = t + 1.5$
33. In a bar of large length when held vertically and subjected to a load at its lower end, its own-weight produces additional stress. The maximum stress will be  
 A. at the lower cross-section  
 B. at the built-in upper cross-section  
 C. at the central cross-section  
 D. at every point of the bar.
34. If a shaft is simultaneously subjected to a torque  $T$  and a bending moment  $M$ , the ratio of maximum bending stress and maximum shearing stress is  
 A.  $\frac{M}{T}$     B.  $\frac{T}{M}$     C.  $\frac{2M}{T}$     D.  $\frac{2T}{M}$     E.  $\frac{MT}{2}$
35. Struts are load carrying members of a frame structure which are subjected to  
 A. axial tension loads  
 B. axial compressive loads  
 C. torsional loads  
 D. transverse loads.
36. A simply supported wooden beam 150 cm long and having a cross section 16 cm x 24 cm carries a concentrated load, at the centre. If the permissible stress  $f_t = 75 \text{ kg/cm}^2$  and  $f_s = 10 \text{ kg/cm}^2$  the safe load is  
 A. 3025 kg    B. 3050 kg    C. 3075 kg    D. 3100 kg.
37. If the normal cross-section  $A$  of a member is subjected to tensile force  $P$ , the resulting normal stress in an oblique plane inclined at angle  $\theta$  to transverse plane will be  
 A.  $\frac{P}{A} \sin^2 \theta$     B.  $\frac{P}{A} \cos^2 \theta$     C.  $\frac{P}{2A} \sin 2\theta$     D.  $\frac{P}{2A} \cos 2\theta$

38. The nature of the stress in horizontal members of the truss shown in below figure may be  
 A. compressive      B. tensile      C. shear      D. zero      E. all the above.
39. A solid cube is subjected to equal normal forces on all its faces. The volumetric strain will be  $x$ -times the linear strain in any of the three axes when  
 A.  $x = 1$       B.  $x = 2$       C.  $x = 3$       D.  $x = 4$
40. The structure shown in below figure is stable, if  
 A.  $x = \frac{\sqrt{3} y}{2}$   
 B.  $x = 2y$   
 C.  $x = y$   
 D.  $2x = y$ .
41.  $n$  and  $j$  are numbers of members and joints in a frame. It contains redundant members if  
 A.  $n = 2j - 3$   
 B.  $n = 3j - 2$   
 C.  $n < 2j - 3$   
 D.  $n < j - 2$   
 E.  $n < 2j - 3$
42. The materials which have the same elastic properties in all directions, are called  
 A. isotropic      B. brittle      C. homogeneous      D. hard.
43. The greatest eccentricity which a load  $W$  can have without producing tension on the cross-section of a short column of external diameter  $D$  and internal diameter  $d$ , is  
 A.  $\frac{4W}{\pi(D^2 - d^2)}$       B.  $\frac{\pi(D^4 - d^4)}{32D}$       C.  $\frac{(D^2 + d^2)}{8D}$       D.  $\frac{(D^2 - d^2)}{8D}$       E.  $\frac{(D + d)}{8D}$
44. In a three hinged arch, the third hinge is generally kept at  
 A. crown of the arch  
 B. midpoint of the crown and left support hinge  
 C. midpoint of the crown and right support hinge  
 D. none of these.
45. A bending moment may be defined as :  
 A. Arithmetic sum of the moments of all the forces on either side of the section  
 B. Arithmetic sum of the forces on either side of the section

- C. Algebraic sum of the moments of all the forces on either side of the section  
D. None of these.
46. The property of a material by which it can be beaten or rolled into thin plates, is called  
A. malleability    B. ductility    C. plasticity    D. elasticity.
47. If a constant section beam is subjected to a uniform bending moment throughout, its length bends to  
A. a circular arc  
B. a parabolic arc  
C. a catenary  
D. none of these.
48. A simply supported beam ( $l + 2a$ ) with equal overhangs ( $a$ ) carries a uniformly distributed load over the whole length, the B.M. changes sign if  
A.  $l < 2a$   
B.  $l > 2a$   
C.  $l = 2a$   
D.  $l = 4a$   
E.  $l = 3a$ .
49. The type of butt joints in common use, is :  
A. single inverted V-butt joint  
B. double V-butt joint  
C. double U-butt joint  
D. single V-butt joint.
50. For structural analysis, Maxwell's reciprocal theorem can be applied to :  
A. plastic structures  
B. elastic structures  
C. symmetrical structures  
D. all the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	C	B	B	B	A	B	E	C
10	C	C	A	A	A	A	A	A	B	D
20	D	D	A	D	A	C	C	A	D	D
30	B	A	B	C	B	C	B	B	C	D
40	E	A	C	A	C	A	A	A	A	B

### Section 3

- The ratio of the moments of resistance of a solid circular shaft of diameter  $D$  and a hollow shaft (external diameter  $D$  and internal diameter  $d$ ), is
 

A.  $\frac{D^4}{D^4 - d^4}$     B.  $\frac{D^3}{D^3 - d^3}$     C.  $\frac{D^4 - d^4}{D^4}$     D.  $\frac{D^3 - d^3}{D^3}$     E. none of these.
- A cantilever carries is uniformly distributed load  $W$  over its whole length and a force  $W$  acts at its free end upward. The net deflection of the free end will be
 

A. zero    B.  $\frac{5}{24} \frac{WL^3}{EI}$  upward    C.  $\frac{5}{24} \frac{WL^3}{EI}$  downward    D. none of these.
- The moment diagram for a cantilever carrying a concentrated load at its free end, will be
 

A. triangle  
B. rectangle  
C. parabola  
D. cubic parabola.
- In a shaft rotated by a couple, the shear force varies
 

A. from zero at the centre to a maximum at the circumference  
B. from minimum at the centre of maximum at the circumference  
C. from maximum at the centre to zero at the circumference  
D. equally throughout the section  
E. none of these.
- The section modulus of a rectangular light beam 25 metres long is 12.500 cm<sup>3</sup>. The beam is simply supported at its ends and carries a longitudinal axial tensile load of 10 tonnes in addition to a point load of 4 tonnes at the centre. The maximum stress in the bottom most fibre at the mid span section, is
 

A. 13.33 kg/cm<sup>2</sup> tensile  
B. 13.33 kg/cm<sup>2</sup> compressive  
C. 26.67 kg/cm<sup>2</sup> tensile  
D. 26.67 kg/cm<sup>2</sup> compressive  
E. none of these.
- The shape of the bending moment diagram over the length of a beam, carrying a uniformly increasing load, is always
 

A. linear    B. parabolic    C. cubical    D. circular.

7. When a rectangular beam is loaded longitudinally, shear develops on
- bottom fibre
  - top fibre
  - middle fibre
  - every-horizontal plane.
8. The tension coefficient of any member is
- force divided by the length
  - tension divided by the length
  - tension per unit area
  - tension in the member.
9. A steel rod of 2 cm diameter and 5 metres long is subjected to an axial pull of 3000 kg. If  $E = 2.1 \times 10^6$ , the elongation of the rod will be
- 2.275 mm
  - 0.2275 mm
  - 0.02275 mm
  - 2.02275 mm.
10. For a given material, if  $E$ ,  $C$ ,  $K$  and  $m$  are Young's modulus, shearing modulus, bulk modulus and poisson ratio, the following relation does not hold good
- $E = \frac{9KC}{3K + C}$
  - $E = 2K \left( 1 - \frac{2}{m} \right)$
  - $E = 2C \left( 1 + \frac{1}{m} \right)$
  - $\frac{1}{m} = \frac{3K - 2C}{6K + 2C}$
  - $E = 3C \left( 1 - \frac{1}{m} \right)$
11. If the width  $b$  and depth  $d$  of a beam simply supported with a central load are interchanged, the deflection at the centre of the beam will be changed in the ratio of
- $b/d$
  - $d/b$
  - $(d/b)^2$
  - $(b/d)^2$
  - $(b/d)^3$ .
12. In the given below figure, the rivets with maximum stress, are :
- 1 and 2
  - 1 and 3
  - 3 and 4
  - 2 and 4
13. The maximum stress intensity due to a suddenly applied load is  $x$ -times the stress intensity produced by the load of the same magnitude applied gradually. The value of  $x$  is
- 1
  - 2
  - 3
  - $\frac{1}{2}$
  - $\frac{3}{4}$
14. For the beam shown in below figure, the maximum positive bending moment is nearly equal to negative bending moment when  $L_1$  is equal to

- A.  $1.0 L$
  - B.  $0.7 L$
  - C.  $0.5 L$
  - D.  $0.35 L$ .
15. Strain energy of a member may be equated to
- A. average resistance x displacement
  - B.  $\frac{1}{2}$  stress x strain x area of its cross-section
  - C.  $\frac{1}{2}$  stress x strain x volume of the member
  - D.  $\frac{1}{2} (\text{stress})^2 \times \text{volume of the member} + \text{Young's modulus } E$ .
16. If the stress in each cross-section of a pillar is equal to its working stress, it is called
- A. body of equal
  - B. body of equal section
  - C. body of equal strength
  - D. none of these.
17. A composite member shown in below figure was formed at  $25^\circ\text{C}$  and was made of two materials a and b. If the coefficient of thermal expansion of a is more than that of b and the composite member is heated upto  $45^\circ\text{C}$ , then
- A.  $a$  will be in tension and  $b$  in compression
  - B. both will be in compression
  - C. both will be in tension
  - D.  $a$  will be in compression and  $b$  in tension.
18. The stress at which extension of a material takes place more quickly as compared to the increase in load, is called
- A. elastic point
  - B. plastic point
  - C. breaking point
  - D. yielding point.
19. In a square beam loaded longitudinally, shear develops
- A. on middle fibre along horizontal plane
  - B. on lower fibre along horizontal plane
  - C. on top fibre along vertical plane
  - D. equally on each fibre along horizontal plane
  - E. none of these.

20. Shear deflection of a cantilever of length  $L$ , cross sectional area  $A$  and shear modulus  $G$ , under a concentrated load  $W$  at its free end, is
- A.  $\frac{2}{3} \frac{WL}{AG}$     B.  $\frac{1}{3} \frac{WL^2}{EIA}$     C.  $\frac{3}{2} \frac{WL}{AG}$     D.  $\frac{3}{2} \frac{WL^2}{AG}$
21. The point of contraflexure occurs in
- A. cantilever beams only  
B. continuous beams only  
C. over hanging beams only  
D. all types of beams  
E. both (a) and (b).
22. An open-ended cylinder of radius  $r$  and thickness  $t$  is subjected to internal pressure  $p$ . The Young's modulus for the material is  $E$  and Poisson's ratio is  $\mu$ . The longitudinal strain is
- A. zero    B.  $\frac{pr}{tE}$     C.  $\frac{pr}{2tE}$     D. none of these.
23. The force in BD of the truss shown in below figure is :
- A. 500 kg compressive  
B. 500 kg tensile  
C. 1500 kg tensile  
D. 1500 kg compressive  
E. zero.
24. The bending moment at E for the structure shown in below figure, is
- A. zero    B. 10 Tm    C. 20 Tm    D. 40 Tm.
25. A member which is subjected to reversible tensile or compressive stress may fail at a stress lower than the ultimate stress of the material. This property of metal, is called
- A. plasticity of the metal  
B. elasticity of the metal  
C. fatigue of the metal  
D. workability of the metal.
26. For a simply supported beam carrying uniformly distributed load  $W$  on its entire length  $L$ , the maximum bending moment is
- A.  $\frac{WL}{4}$     B.  $\frac{WL}{8}$     C.  $\frac{WL}{2}$     D.  $\frac{WL}{3}$     E.  $\frac{WL}{6}$
27. Euler's formula states that the buckling load  $P$  for a column of length  $l$ , both ends hinged and whose least moment of inertia and modulus of elasticity of the material of the column are  $I$  and  $E$  respectively, is given by the relation



- A.  $P = \frac{\pi^2 EI}{l^2}$
- B.  $P = \frac{\pi l^2}{EI}$
- C.  $P = \frac{\pi EI}{l^2}$
- D.  $P = \frac{\pi^2 EI}{l^3}$
- E.  $P = \pi El^2$ .
28. The stiffness factor for a prismatic beam of length  $L$  and moment of inertia  $I$ , is
- A.  $\frac{IE}{L}$     B.  $\frac{2EI}{L}$     C.  $\frac{3EI}{L}$     D.  $\frac{4EI}{L}$     E.  $\frac{EI}{2L}$
29. The stress in the wall of a cylinder in a direction normal to its longitudinal axis, due to a force acting along the circumference, is known as
- A. yield stress
- B. longitudinal stress
- C. hoop stress
- D. circumferential stress
- E. ultimate stress.
30. In a simply supported beam  $(l + 2a)$  with equal overhangs  $(a)$  and carrying a uniformly distributed load over its entire length, B.M. at the middle point of the beam will be zero if
- A.  $l = 2a$
- B.  $l = 4a$
- C.  $l < 2a$
- D.  $l < a$
- E.  $l < 3a$ .
31. At either end of a plane frame, maximum number of possible bending moments, are
- A. one    B. two    C. three    D. four    E. zero.
32. The principal stresses at a point are 100, 100 and -200 kgf/cm<sup>2</sup>, the octahedral shear stress at the point is :
- A. 100  $\sqrt{2}$  kg/cm<sup>2</sup>
- B. 200  $\sqrt{2}$  kg/cm<sup>2</sup>
- C. 300  $\sqrt{2}$  kg/cm<sup>2</sup>
- D. 400  $\sqrt{2}$  kg/cm<sup>2</sup>

- E.  $500 \text{ kg/cm}^2$ .
33. During a tensile test on a ductile material
- nominal stress at fracture is higher than the ultimate stress
  - true stress at fracture is higher than the ultimate stress
  - true stress at fracture is the same as the ultimate stress
  - none of these.
34. Rankine-Golden formula accounts for direct as well as buckling stress and is applicable to
- very long columns
  - long columns
  - short columns
  - intermediate columns
  - all the above.
35. Pick up the correct statement from the following :
- The point through which the resultant of the shear stresses, passes is known as shear centre
  - In the standard rolled channels, the shear centre is on the horizontal line passing through and away from the C.G. beyond web
  - In equal angles, the shear centre is on the horizontal plane and away from the C.G., outside of the leg projection
  - In T-sections, the shear centre is at the C.G. of the section
  - All the above.
36. In a three hinged arch, the bending moment will be zero
- at right hinge only
  - at left hinge only
  - at both right and left hinges
  - at all the three hinges.
37. The ratio of the tensile stress developed in the wall of a boiler in the circumferential direction to the tensile stress in the axial direction, is
- A. 4    B. 3    C. 2    D. 1
38. The force in the member DE of the truss shown in below figure will be
- zero
  - $2 W$  tensile
  - $2 W$  compressive
  - $4 W$  compressive
  - $4 W$  tensile.

39. In a shaft shear stress intensity at a point is not
- directly proportional to the distance from the axis
  - inversely proportional to the distance from the axis
  - inversely proportional to the polar moment of inertia
  - directly proportional to the applied torque.
40. Along the neutral axis of a simply supported beam
- fibres do not undergo strain
  - fibres undergo minimum strain
  - fibres undergo maximum strain
  - none of these.
41. A joint of a frame is subjected to three tensile force P, Q and R equally inclined to each other. If P is 10 tonnes, the other forces will be
- $Q = 10$  tonnes and  $R = \text{zero}$
  - $R = 10$  tonnes and  $Q = \text{zero}$
  - $Q + R = 10$  tonnes
  - $Q - R = \text{zero}$
  - $Q$  and  $R$  each is equal to 10 tonnes.
42. If a member is subjected to a tensile force P, having its normal cross-section A, the resulting shear stress in an oblique plane inclined at an angle  $\theta$  to its transverse plane, is
- $\frac{P}{A} \sin^2 \theta$
  - $\frac{P}{2A} \sin 2\theta$
  - $\frac{P}{2A} \cos 2\theta$
  - $\frac{P}{A} \cos^2 \theta$
  - $\frac{A}{P} \sin 2\theta$
43. A simply supported beam carries two equal concentrated loads W at distances L/3 from either support. The maximum bending moment
- $\frac{WL}{3}$
  - $\frac{WL}{4}$
  - $\frac{5WL}{4}$
  - $\frac{3WL}{12}$
  - $\frac{3WL}{5}$
44. If a solid shaft is subjected to a torque T at its end such that maximum shear stress does not exceed  $f_s$  the diameter of the shaft will be
- $\frac{16 T}{\pi f_s}$
  - $\sqrt{\frac{16 T}{\pi f_s}}$
  - $\sqrt[3]{\frac{16 T}{\pi f_s}}$
  - none of these.
45. Pick up the correct statement from the following :
- The distance of the eccentric axial load from the C.G. beyond which tension develops, is known as kern distance
  - In visco-elastic material, stress-strain relation is dependent on time
  - An isotropic material has different properties in different directions

- D. An orthotropic material has different properties in three mutually perpendicular directions
- E. All the above.
46. In a simply supported beam L with a triangular load W varying from zero at one end to the maximum value at the other end, the maximum bending moment is
- A.  $\frac{WL}{3}$       B.  $\frac{WL}{9\sqrt{3}}$       C.  $\frac{WL}{4}$       D.  $\frac{WL^3}{9\sqrt{3}}$       E.  $\frac{WL}{8}$
47. Maximum deflection of a cantilever due to pure bending moment M at its free end, is
- A.  $\frac{ML^2}{3EI}$       B.  $\frac{ML^2}{4EI}$       C.  $\frac{ML^2}{6EI}$       D.  $\frac{ML^2}{2EI}$       E.  $\frac{ML^2}{5EI}$
48. Along the principal plan subjected to maximum principal stress
- A. maximum shear stress acts
- B. minimum shear stress acts
- C. no shear stress acts
- D. none of these.
49. A diagram which shows the variations of the axial load for all sections of the span of a beam, is called
- A. bending moment diagram
- B. shear force diagram
- C. thrust diagram
- D. stress diagram
- E. none of these.
50. A member which does not regain its original shape after removed of load producing deformation is said
- A. plastic      B. elastic      C. rigid      D. none of these.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	B	A	A	C	C	D	B	B	C
10	D	D	B	D	D	C	D	D	D	C
20	C	A	A	A	C	B	A	A	C	A
30	E	A	B	D	E	D	C	C	B	A
40	E	B	A	C	E	D	D	C	C	A

## Section 4

1. The bending moment is maximum on a section where shearing force  
A. is maximum    B. is minimum    C. is equal    D. changes sign.
2. Pick up the correct statement from the following :  
A. The rate of change of bending moment is equal to rate of shear force  
B. The rate of change of shear force is equal to rate of loading  
C. neither (a) nor (b)  
D. both (a) and (b).
3. A short masonry pillar is 60 cm x 60 cm in cross-section, the core of the pillar is a square whose side is  
A. 17.32 cm    B. 14.14 cm    C. 20.00 cm    D. 22.36 cm    E. 25.22 cm.
4. A rectangular log of wood is floating in water with a load of 100 N at its centre. The maximum shear force in the wooden log is  
A. 50 N at each end  
B. 50 N at the centre  
C. 100 N at the centre  
D. none of these.
5. The following assumption is not true in the theory of pure torsion :  
A. The twist along the shaft is uniform  
B. The shaft is of uniform circular section throughout  
C. Cross-section of the shaft, which is plane before twist remains plane after twist  
D. All radii get twisted due to torsion.
6. The under mentioned type is simple strain  
A. tensile strain  
B. compressive strain  
C. shear strain  
D. volumetric strain  
E. all the above.
7. The ratio of the effective length of a column and minimum radius of gyration of its cross-sectional area, is known  
A. buckling factor  
B. slenderness ratio  
C. crippling factor  
D. none of these.

8. The bending moment at C of a portal frame shown in below figure is (1st distance 4m)  
 A. 8 t-m      B. 4 t-m      C. 28 t-m      D. 16 t-m      E. zero.
9. Failure of riveted joints is due to  
 A. Tearing of the plates between the rivet hole and the edge of the plate  
 B. Tearing of plates between rivets  
 C. Shearing of rivets  
 D. Crushing of rivets  
 E. All the above.
10. The maximum load to which a fillet joint of length L can be subjected to, is  
 A.  $0.7 \times S \times \text{fillet size} \times L$   
 B.  $2 \times S \times \text{fillet size} \times L$   
 C. permissible shear stress  $\times$  fillet size  $\times L$   
 D.  $\frac{S \times \text{fillet size} \times L}{3}$   
 E. none of these.
11. Pick up the correct assumption of the theory of simple bending  
 A. The value of the Young's modulus is the same in tension as well as in compression  
 B. Transverse section of a beam remains plane before and after bending  
 C. The material of the beam is homogeneous and isotropic  
 D. The resultant pull or thrust on transverse section of a beam is zero  
 E. All the above.
12. The neutral axis of a beam cross-section must  
 A. pass through the centroid of the section  
 B. be equidistant from the top of bottom fibres  
 C. be an axis of symmetry of the section  
 D. none of these.
13. If the beam is supported so that there are only three unknown reactive elements at the supports. These can be determined by using the following fundamental equation of statics  
 A.  $\sum H = 0$   
 B.  $\sum V = 0$   
 C.  $\sum H = 0$ ;  $\sum V = 0$

- D.  $\sum H = 0$ ;  $\sum V = 0$ ;  $\sum M = 0$   
 E.  $\sum M = 0$ ;  $\sum H = 0$
14. In a solid arch, shear force acts  
 A. vertically upwards  
 B. along the axis of the arch  
 C. perpendicular to the axis of arch  
 D. tangentially to the arch  
 E. none of these.
15. A three hinged arch is loaded with an isolated load 1000 kg at a horizontal distance of 2.5 m from the crown, 1 m above the level of hinges at the supports 10 metres apart. The horizontal thrust is  
 A. 1250 kg    B. 125 kg    C. 750 kg    D. 2500 kg    E. 2325 kg.
16. For keeping the stress wholly compressive the load may be applied on a circular column anywhere within a concentric circle of diameter  
 A.  $d/2$     B.  $d/3$     C.  $d/4$     D.  $d/8$     E.  $d/10$
17. A member is balanced at its end by two inclined members carrying equal forces. For equilibrium the angle between the inclined bars must be  
 A.  $3^\circ$     B.  $45^\circ$     C.  $60^\circ$     D.  $90^\circ$     E.  $120^\circ$
18. For a cantilever with a uniformly distributed load  $W$  over its entire length  $L$ , the maximum bending moment is  
 A.  $WL$   
 B.  $\frac{1}{2} WL$   
 C.  $\frac{1}{3} WL$   
 D.  $\frac{1}{2} W^2 L$   
 E.  $\frac{1}{3} WL^2$
19. To ascertain the maximum permissible eccentricity of loads on circular columns, the rule generally followed, is  
 A. middle half rule of columns  
 B. middle third rule of columns  
 C. middle fourth rule of columns  
 D. none of these.
20. If  $Z$  and  $I$  are the section modulus and moment of inertia of the section, the shear force  $F$  and bending moment  $M$  at a section are related by  
 A.  $F = \frac{My}{I}$     B.  $F = \frac{M}{Z}$     C.  $F = \frac{dM}{dx}$     D.  $F = \int M dx$

21. A closely coiled helical spring of radius R, contains n turns and is subjected to an axial load W. If the radius of the coil wire is r and modulus of rigidity of the coil material is C, the deflection of the coil is
- A.  $\frac{WR^3n}{Cr^4}$     B.  $\frac{2WR^3n}{Cr^4}$     C.  $\frac{3WR^3n}{Cr^4}$     D.  $\frac{4WR^3n}{Cr^4}$
22. The width of a beam of uniform strength having a constant depth d length L, simply supported at the ends with a central load W is
- A.  $\frac{2WL}{3fd^2}$     B.  $\frac{3WL}{2fd^2}$     C.  $\frac{2fL}{3Wd^4}$     D.  $\frac{3fL^2}{2Wd}$
23. Beams of uniform strength are preferred to those of uniform section because these are economical for
- A. large spans    B. heavy weights    C. light weights    D. short spans.
24. The moment diagram for a cantilever whose free end is subjected to a bending moment, will be a
- A. triangle  
B. rectangle  
C. parabola  
D. cubic parabola.
25. Reactions at the supports of a structure can be determined by equating the algebraic sum of
- A. horizontal forces to zero  
B. vertical forces to zero  
C. moment about any point to zero  
D. all the above.
26. If a steel rod of 20 mm diameter and 5 metres long elongates by 2.275 mm when subjected to an axial pull of 3000 kg, the stress developed, is
- A. 9.5541 kg/cm<sup>2</sup>  
B. 95.541 kg/cm<sup>2</sup>  
C. 955.41 kg/cm<sup>2</sup>  
D. 9554.1 kg/cm<sup>2</sup>.
27. Shear force for a cantilever carrying a uniformly distributed load over its length, is
- A. triangle  
B. rectangle  
C. parabola



- D. cubic parabola.
28. If the width of a simply supported beam carrying an isolated load at its centre is doubled, the deflection of the beam at the centre is changed by  
 A. 2 times      B. 4 times      C. 8 times      D. 1/2 times      E. 3 times.
29. For a stable frame structure, number of members required, is  
 A. three times the number of joints minus three  
 B. twice the number of joints minus three  
 C. twice the number of joints minus two  
 D. twice the number of joints minus one  
 E. none of these.
30. When a rectangular beam is loaded transversely, the maximum compressive stress develops on  
 A. bottom fibre  
 B. top fibre  
 C. neutral axis  
 D. every cross-section.
31. The maximum deflection of a simply supported beam of length  $L$  with a central load  $W$ , is  
 A.  $\frac{WL^2}{48 EI}$       B.  $\frac{W^2L}{24 EI}$       C.  $\frac{WL^3}{48 EI}$       D.  $\frac{WL^2}{8 EI}$       E.  $\frac{WL^2}{36 EI}$
32. In a continuous bending moment curve the point where it changes sign, is called  
 A. point of inflexion  
 B. point of contraflexure  
 C. point of virtual hinge  
 D. all the above.
33. A beam of length  $L$  supported on two intermediate rollers carries a uniformly distributed load on its entire length. If sagging B.M. and hogging B.M. of the beam are equal, the length of each overhang, is  
 A.  $0.107 L$       B.  $0.207 L$       C.  $0.307 L$       D.  $0.407 L$       E.  $0.5 L$ .
34. A long vertical member, subjected to an axial compressive load, is called  
 A. a column      B. a strut      C. a tie      D. a stanchion      E. all the above.
35. The property by which a body returns to its original shape after removal of the force, is called  
 A. plasticity      B. elasticity      C. ductility      D. malleability.

36. The ratio of the maximum deflection of a cantilever beam with an isolated load at its free end and with a uniformly distributed load over its entire length, is
- A. 1      B.  $\frac{24}{15}$       C.  $\frac{3}{8}$       D.  $\frac{8}{3}$       E.  $\frac{5}{8}$
37. For a beam of uniform strength keeping its depth constant, the width will vary in proportion to
- A. bending moment ( $M$ )  
 B.  $M$   
 C.  $M^2$   
 D. none of these.
38. A shaft 9 m long is subjected to a torque 30 t-m at a point 3 m distant from either end. The reactive torque at the nearer end will be
- A. 5 tonnes metre  
 B. 10 tonnes metre  
 C. 15 tonnes metre  
 D. 20 tonnes metre  
 E. none of these.
39. The width  $b$  and depth  $d$  of a beam cut from a wooden cylindrical log of 100 cm diameter for maximum strength are :
- A.  $b = 57.73$  cm  $d = 81.65$  cm  
 B.  $b = 81.65$  cm  $d = 57.73$  cm  
 C.  $b = 50.00$  cm  $d = 50.00$  cm  
 D.  $b = 40.00$  cm  $d = 80.00$  cm  
 E.  $b = 30.00$  cm  $d = 60.00$  cm.
40. If the stress produced by a prismatic bar is equal to the working stress, the area of the cross-section of the prismatic bar, becomes
- A. zero      B. infinite      C. maximum      D. minimum.
41. The section modulus of a rectangular section is proportional to
- A. area of the section  
 B. square of the area of the section  
 C. product of the area and depth  
 D. product of the area and width  
 E. half moment of inertia of the section.
42. The property of a material by which it can be drawn to a smaller section, due to tension, is called
- A. plasticity      B. ductility      C. elasticity      D. malleability.

43. The distance between the centres of adjacent rivets in the same row, is called
- pitch
  - lap
  - gauge
  - staggered pitch.
44. Shear deflection of a cantilever of length  $L$ , cross sectional area  $A$  and shear modulus  $G$ , subjected to  $w/m$  u.d.l., is
- $\frac{3}{4} \frac{L^2 w}{GA}$
  - $\frac{3}{2} \frac{L^2 w}{GA}$
  - $\frac{2}{3} \frac{L^3 w}{GA}$
  - $\frac{3}{2} \frac{Lw}{GA^2}$
45. Columns of given length, cross-section and material have different values of buckling loads for different end conditions. The strongest column is one whose
- one end is fixed and other end is hinged
  - both ends are hinged or pin jointed
  - one end is fixed and the other end entirely free
  - both the ends are fixed
  - none of the these.
46. As the elastic limit reaches, tensile strain
- increases more rapidly
  - decreases more rapidly
  - increases in proportion to the stress
  - decreases in proportion to the stress.
47. The ratio of the flexural strengths of two square beams one placed with its two sides horizontal and the other placed with one diagonal vertical, diagonal, is
- 2
  - 2
  - 5
  - 7
48. Simple bending equation is
- $\frac{M}{I} = \frac{R}{E} = \frac{F}{Y}$
  - $\frac{I}{M} = \frac{E}{R} = \frac{Y}{F}$
  - $\frac{M}{I} = \frac{E}{R} = \frac{F}{Y}$
  - $\frac{M}{I} = \frac{R}{E} = \frac{Y}{F}$
  - none of these.
49. Every material obeys the Hooke's law within its
- elastic limit
  - plastic point
  - limit of proportionality
  - none of these.
50. The maximum compressive stress at the top of a beam is  $1600 \text{ kg/cm}^2$  and the corresponding tensile stress at its bottom is  $400 \text{ kg/cm}^2$ . If

the depth of the beam is 10 cm, the neutral axis from the top, is  
A. 2 cm      B. 4 cm      C. 6 cm      D. 8 cm      E. 10 cm.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	D	B	C	D	E	B	E	E	A
10	E	A	D	C	A	C	E	B	C	C
20	D	B	A	B	D	C	A	C	B	B
30	C	D	B	A	B	D	A	D	A	B
40	A	B	A	A	D	A	A	C	C	D

## Section 5

- The stress necessary to initiate yielding, is considerably
  - more than that necessary to continue it
  - less than that necessary to continue it
  - more than that necessary to stop it
  - less than that necessary to stop it.
- If a circular beam of diameter  $d$  experiences a longitudinal strain and a lateral strain the volumetric strain is
  - $\left(\frac{P}{E} + \frac{2P}{mE}\right)$
  - $\left(\frac{P}{E} - \frac{2P}{mF}\right)$
  - $\left(\frac{P}{E} + \frac{mE}{2P}\right)$
  - $\left(\frac{P}{E} - \frac{mE}{2P}\right)$
  - none of these.
- Strain energy of any member may be defined as work done on it
  - to deform it
  - to resist elongation
  - to resist shortening
  - all the above.
- If the length of a cantilever carrying an isolated load at its free end is doubled, the deflection of the free end will increase by
  - 8
  - 1/8
  - 1/3
  - 2
  - 3
- If  $b$  is the width of a plate joined by diamond riveting of diameter  $d$ , the efficiency of the joint is given by
  - $\frac{b+d}{b}$
  - $\frac{b-d}{b}$
  - $\frac{d-b}{d}$
  - $\frac{b-d}{d}$
- The B.M. diagram of the beam shown in below figure, is
  - a rectangle
  - a triangle
  - a trapezium
  - a parabola
  - a circle.
- The value of Poisson's ratio always remains
  - greater than one
  - less than one
  - equal to one
  - none of these.
- For a beam having fixed ends, the unknown element of the reactions, is
  - horizontal components at either end
  - vertical components at either end
  - horizontal component at one end and vertical component at the other

- D. horizontal and vertical components at both the ends.
9. If all the dimensions of a bar are increased in the proportion  $n : 1$ , the proportion with which the maximum stress produced in the prismatic bar by its own weight, will increase in the ratio
- A.  $1 : n$     B.  $n : 1$     C.  $1 : \frac{1}{n}$     D.  $\frac{1}{n} : 1$     E.  $1 : n$ .
10. The slenderness ratio of a vertical column of square cross- section of 10 cm side and 500 cm long, is
- A. 117.2    B. 17.3    C. 173.2    D. 137.2    E. 13.72
11. If the depth of a simply supported beam carrying an isolated load at its centre, is doubled, the deflection of the beam at the centre will be changed by a factor of
- A. 2    B.  $1/2$     C. 8    D.  $1/8$     E. 4
12. The equivalent length of a column fixed at one end and free at the other end, is
- A.  $0.5 l$     B.  $0.7 l$     C.  $l$     D.  $2 l$     E.  $1.5 l$ .
13. A cast iron T section beam is subjected to pure bending. For maximum compressive stress to be three times the maximum tensile stress, centre of gravity of the section from flange side is
- A.  $h/4$     B.  $h/3$     C.  $h/2$     D.  $2/3 h$ .
14. The equivalent length of a column fixed at both ends, is
- A.  $0.5 l$     B.  $0.7 l$     C.  $l$     D.  $2 l$     E.  $1.5 l$ .
15. The rise of a parabolic arch at quarter points, is equal to
- A.  $\frac{1}{3}$  times the rise of the crown
- B.  $\frac{1}{4}$  times the rise of the crown
- C.  $\frac{1}{2}$  times the rise of the crown
- D.  $\frac{3}{4}$  times the rise of the crown
- E.  $\frac{5}{8}$  times the rise of the crown.
16. The effect of arching a beam, is
- A. to reduce the bending moment throughout
- B. to increase the bending moment throughout
- C. nothing on the bending throughout
- D. all the above.
17. The phenomenon of slow growth of strain under a steady tensile stress, is called
- A. yielding    B. creeping    C. breaking    D. none of these.

18. Hooke's law states that stress and strain are
- directly proportional
  - inversely proportional
  - curvilinearly related
  - none of these.
19. If  $S$  is the shear force at a section of an I-joist, having web depth  $d$  and moment of inertia  $I$  about its neutral axis, the difference between the maximum and mean shear stresses in the web is,
- $\frac{Sd^2}{8I}$
  - $\frac{Sd^2}{12I}$
  - $\frac{Sd^2}{16I}$
  - $\frac{Sd^2}{24I}$
20. A 8 metre long simply supported rectangular beam which carries a distributed load 45 kg/m. experiences a maximum fibre stress 160 kg/cm<sup>2</sup>. If the moment of inertia of the beam is 640 cm<sup>4</sup>, the overall depth of the beam is
- 10 cm
  - 12 cm
  - 15 cm
  - 16 cm
  - 18 cm.
21. A column is said to be of medium size if its slenderness ratio is between
- 20 and 32
  - 32 and 120
  - 120 and 160
  - 160 and 180
  - 180 and 200
22. A solid circular shaft of diameter  $d$  is subjected to a torque  $T$ . The maximum normal stress induced in the shaft, is
- zero
  - $\frac{16 T}{\pi d^3}$
  - $\frac{32 T}{\pi d^3}$
  - none of these.
23. If  $p$  is the internal pressure in a thin cylinder of diameter  $d$  and thickness  $t$ , the developed hoop stress, is
- $\frac{Pd}{2t}$
  - $\frac{Pd}{4t}$
  - $\frac{Pd}{t}$
  - $\frac{2Pd}{t}$
  - $\frac{Pd}{3t}$
24. Ties are load carrying members of a frame, which are subjected to
- transverse loads
  - axial tension loads
  - axial compressive loads
  - torsional loads.
25. At either end of a plane frame, maximum number of possible transverse shear forces, are
- one
  - two
  - three
  - four
  - zero.
26. The cross sections of the beams of equal length are a circle and a square whose permissible bending stress are same under same maximum bending. The ratio of their flexural weights is,
- 1.118
  - 1.338
  - 1.228
  - 1.108

27. When two plates butt together and are riveted with two cover plates with two rows of rivets, the joint is known as
- lap joint
  - butt join
  - single riveted single cover butt joint
  - double riveted double cover butt joint.
28. The moment diagram for a cantilever which is subjected to a uniformly distributed load will be a
- triangle
  - rectangle
  - parabola
  - cubic parabola.
29. The areas of cross-section of a square beam and a circular beam subjected to equal bending moments, are same.
- circular beam is more economical
  - square beam is more economical
  - both the beams are equally strong
  - both the beams are equally economical
  - none of these.
30. For the same height, the bottom width for no tension,
- for triangular section is more than rectangular section
  - for rectangular section is more than triangular section
  - for triangular section is same as that of a rectangular section
  - none of these.
31. Maximum deflection of a
- Cantilever beam carrying a concentrated load  $W$  at its free end  
is  $\frac{WL^3}{3EI}$
  - simply supported beam carrying a concentrated load  $W$  at mid-span is  $\frac{WL^3}{48EI}$
  - cantilever beam, carrying a uniformly distributed load over span  
is  $\frac{WL^3}{8EI}$
  - simply supported beam carrying a uniformly distributed load over  
the span is  $\frac{5WL^3}{384EI}$
  - All the above.



32. A beam is said to be of uniform strength, if
- B.M. is same throughout the beam
  - shear stress is same throughout the beam
  - deflection is same throughout the beam
  - bending stress is same at every section along its longitudinal axis.
33. For a beam, if fundamental equations of statics are not sufficient to determine all the reactive forces at the supports, the structure is said to be
- determinate
  - statically determinate
  - statically indeterminate
  - none of these.
34. The moment diagram for a cantilever carrying linearly varying load from zero at its free end and to maximum at the fixed end will be a
- triangle
  - rectangle
  - parabola
  - cubic parabola.
35. The maximum deflection of
- a simply supported beam carrying a uniformly increasing load from either end and having the apex at the mid span is  $\frac{WL^3}{60 EI}$
  - a fixed ended beam carrying a distributed load over the span is  $\frac{WL^3}{384 EI}$
  - a fixed ended beam carrying a concentrated load at the mid span is  $\frac{WL^3}{192 EI}$
  - a cantilever beam subjected to a moment  $M$  at the free end is  $\frac{WL^3}{3 EI}$
  - All the above.
36. If two tensile forces mutually perpendicular act on a rectangular parallel piped bar are equal, the resulting elongation of the pipe, is
- $\frac{P}{E} (1 - m)$
  - $\frac{E}{P} (m - 1)$
  - $\frac{E}{P} (1 - m)$
  - $\frac{P}{E} (1 + m)$
  - $\frac{P}{E} (1 + m^2)$

37. The intensity of direct longitudinal stress in the cross-section at any point distant  $r$  from the neutral axis, is proportional to

- A.  $r$       B.  $\frac{1}{r}$       C.  $r^2$       D.  $\frac{1}{r^2}$       E.  $r^3$ .

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	B	D	A	B	A	B	D	B	C
10	D	D	A	A	D	A	B	A	D	A
20	B	B	A	B	A	A	D	C	B	C
30	E	D	C	D	E	A	A			

## 13 Tunnelling

### Section 1

1. Which one of the following statements is not correct for heading and benching method of tunnelling ?
  - A. Drilling and mucking can be done simultaneously
  - B. Benching provides a platform for working on heading
  - C. Removal of muck from the heading is very easy
  - D. None of these.
2. The difference of heights of the tunnels above rail tops of BG and MG tracks is kept
  - A. 0.30 m
  - B. 0.45 m
  - C. 0.60 m
  - D. 0.75 m
3. In case of drift method of tunnelling, the drift may be excavated at
  - A. the centre
  - B. the bottom
  - C. the top
  - D. the side
  - E. All of the above.
4. A tunnel is found more advantageous as compared to the alternate routes because it:
  - A. remains free from snow
  - B. reduces the cost by reducing the route distance
  - C. reduces the maintenance cost
  - D. avoids interference with surface rights
  - E. All the above.
5. For B.G. single track railway, the height of the tunnel above top of rails should be
  - A. 5.5 m to 5.8 m
  - B. 5.8 m to 6.2 m
  - C. 6.7 m to 7.3 m
  - D. 7.3 m to 7.5 m
6. Pick up the correct statement regarding drilling a tunnel from the following:
  - A. Holes are drilled by pneumatically operated rock drills
  - B. One drill is required for each 4 to 5 m<sup>2</sup> face area
  - C. The diameter of the bore hole at the deepest point should be 6 mm more than the diameter of the cartridge
  - D. All of the above.
7. For tunnels exceeding 300 m in length, the grade should be provided below

- A. 50% of the ruling gradient
  - B. 60% of the ruling gradient
  - C. 75% of the ruling gradient
  - D. 80% of the ruling gradient.
8. The method of draining in the tunnels, is generally known as
- A. foredrainage
  - B. dewatering
  - C. permanent drainage
  - D. All of the above.
9. Pick up the correct statement from the following during tunnel excavation,
- A. Oxygen should not be less than 19.5%
  - B. Carbondioxide should not be more than 0.5%
  - C. Hydrogen sulphide should not be more than 0.001%
  - D. Carbon mono-oxide should not be more than 0.01%
  - E. All of the above.
10. To attain the required shape of the tunnel section, we use :
- A. easers      B. trimmers      C. cut holes      D. chisels.
11. The most commonly adopted pattern of cut holes is :
- A. horizontal wedge cut
  - B. pyramid cut
  - C. fan cut
  - D. V-cut
  - E. All the above.
12. Which one of the following linings is suitable for shield driven tunnels particularly in the subaqueous regions :
- A. Brick lining
  - B. stone lining
  - C. timber line
  - D. cast iron lining
  - E. concrete lining.
13. In case of railways,
- A. a detour round the hill is preferred
  - B. a open cut is preferred
  - C. tunnelling is preferred
  - D. All the above.

14. The following tunnels were constructed in different countries for different purposes : 1. Emperor Claudius built the first Roman tunnel2. The first highway tunnel was constructed in Hungary3. The first underground railway tunnel was constructed in Great Britain4. The first navigational tunnel was constructed in France.The correct chronological development of these tunnels is:  
A. 4 1 3 2      B. 1 4 2 3      C. 2 3 1 4      D. 3 2 4 1
15. The following operations are generally employed for tunnelling in hard rock. 1. Removing ground water, 2. Loading holes and firing the explosive3. Setting up and drilling4. Grouting and lining5. Removing muck6. Ventilation and removing explosion dustThe correct sequence is :  
A. 3 2 6 5 1 4      B. 3 4 6 1 5 2      C. 4 1 2 3 6 5      D. 5 4 2 1 3 6
16. Pick up the mechanical ventilation method used for tunnels from the following:  
A. blowing fresh air by ducts to the face of tunnel  
B. exhausting foul air by ducts from the face of the tunnel and permitting fresh air through the tunnel  
C. blowing fresh air and exhausting foul air by ducts  
D. all the above.
17. Which one of the following methods of tunnelling does not require the use of time bearing :  
A. Linear plate method  
B. Shield method  
C. Compressed air method  
D. Mechanical tunneler *i.e.* mole method  
E. All the these.
18. For highways, tunnelling is preferred to if the open cut exceeds :  
A. 10 metres depth  
B. 15 metres depth  
C. 20 metres depth  
D. 25 metres depth.
19. The following operations are required for tunnelling in rocky terrain :1. Removing the foul gases2. Marking the tunnel profile3. Setting up and drilling4. Checking misfire5. MuckingThe correct sequence is :  
A. 1 2 3 4 5      B. 2 3 5 4 1      C. 4 2 1 3 5      D. 2 3 1 4 5
20. The advantages of providing a pair of tunnels as compared to only one large highway tunnel is :  
A. economy in cost of construction

- B. avoidance of head on collisions
  - C. provision of separate exit and entrance of two traffic streams
  - D. facility in carrying out repairs
  - E. All the above.
21. Which one of the following statements is not correct in respect of setting of an inclined tunnel:
- A. Reference points are constructed at every 300 m.
  - B. The alignment is fixed from upper/lower apex point.
  - C. The level of the invert at the heading is marked by a tape.
  - D. Reference points are constructed on the roof of tunnels
  - E. None the above.
22. Forepoling method is generally adopted for tunnelling in :
- A. soft ground      B. firm ground      C. running ground      D. None of these.
23. Concrete lining is provided concurrently with the driving operation in case of
- A. rock terrain      B. soft rock      C. running soil      D. none of these.
24. The concentration of the dust particles of the size 0.5 to 5 microns adjacent to the working face should not be more than
- A. 200 particles/cm<sup>3</sup>
  - B. 250 particles/cm<sup>3</sup>
  - C. 300 particles/cm<sup>3</sup>
  - D. 450 particles/cm<sup>3</sup>
  - E. 400 particles/cm<sup>3</sup>
25. Which one of the following statements is not correct with regard to heading and benching method of tunnelling.
- A. Driving of tunnel is done in two portions of its section
  - B. Driving the top portion is done in advance of the bottom portion.
  - C. After driving the top portion 3 m to 3.5 m holes are drilled into the head and bench.
  - D. The holes in head and bench are loaded together with explosive for blasting.
  - E. Firing of head holes is done just before the bench holes are fired.
26. Which one of the following methods is generally used for the layout of the muck-car tracks
- A. the grass hopper method
  - B. passing track method
  - C. the cherry picker

- D. California crossing, Dixon conveyor  
E. All the above.
27. For transferring the tunnel alignment through shafts, we adopt the following steps :1. Hanging two or more plumb lines in the shaft2. Determining the bearing of the plumb lines i.e. plumb plane3. Suspending a 35 kg weight by each plumb line4. Immersing the weights of both the plumb lines in the buckets containing water.The correct sequence of steps is :  
A. 1 2 3 4      B. 4 3 2 1      C. 1 3 2 4      D. 2 1 4 3
28. For initial surveys of tunnels, the following activities are involved:1. Marking portal point with concrete pillars on the ground2. Marking tunnel obligatory points on the topographical maps3. Preliminary setting of the tunnel on the topographical Survey of India maps3. Driving lines between the fixed obligatory points.The correct sequence of the activities is :  
A. 3 2 4 1      B. 1 2 3 4      C. 4 3 1 2      D. 2 4 3 1
29. For full face method, the excavation to be done is generally divided into  
A. two sections      B. three sections      C. four sections      D. five sections.
30. The tunnels, the artificial underground passages are constructed for :  
A. highways  
B. railways  
C. sewerage  
D. water supply project  
E. All the above.
31. In the wooded bulk-head, used for mucking in steep grade tunnels,  
A. one opening is provided  
B. two openings are provided  
C. three openings are provided  
D. no opening is provided.
32. Railway tunnels, are generally  
A. polycentric      B. rectangular      C. parabolic      D. circular      E. none of these.
33. Pick up the explosive used for tunnelling in soft rocks from the following :  
A. blasting gelatine  
B. special gelatine  
C. ammonia dynamite

- D. semi-gelatine.
34. The cut of a tunnel face is shown in given figure. This is called
- Michigan cut
  - Burn cut
  - Fan cut
  - Horizontal cut.
35. For B.G. single track, the section of the tunnel must have a width
- 4.2 m to 4.5 m
  - 4.5 m to 4.8 m
  - 4.9 m to 5.5 m
  - 5.5 m to 5.8 m
36. Which one of the following methods is generally adopted for tunnelling in firm ground
- Full face method
  - Top heading and benching method
  - Drift method
  - All the above.
37. An overhead track on a large truss frame is required in case of car changer by
- the grass hopper method
  - the passing track method
  - California crossing method
  - Dixon conveyor method.
38. Pick up the correct statement from the following:
- The topographical maps of the Survey of India are useful in the mountainous region for tunnelling.
  - The height point on the ridge is fixed with the help of reciprocal ranging
  - The accuracy of 1 in 10, 000 is required for planimetric control
  - 1 second theodolite is used for angular measurement to achieve an angular error of  $15^\circ/N$  where  $N$  is number of angles
  - All the above.
39. In the given figure drill holes, heading, mucking and benching are numbered as 1, 2, 3, 4 The correct sequence is :
- 4 1 2 3
  - 1 2 3 4
  - 4 1 3 2
  - 3 4 1 3
40. The length of the needle beam used in needle beam method of tunnelling is usually
- 2 m to 4 m
  - 2.5 m to 6 m
  - 4 m to 7 m
  - 5 m to 6 m
41. High pressure grouting is generally restored for concreting in the lining if the rock strata is:



- A. highly fissured  
 B. poor  
 C. likely to get seepage of water  
 D. All of the above.
42. For hauling muck from the tunnel, the following type of muck-car is used :  
 A. muck box      B. balle-ship      C. side dump car      D. U-bottom  
 E. All of these.
43. Which one of the following methods is adopted for permanent drainage of tunnels :  
 A. provision of longitudinal drains  
 B. continuous open drains  
 C. concrete lining  
 D. grouting with cement or chemicals  
 E. All the above.

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	C	E	E	C	D	C	D	E	B
10	E	D	C	B	A	D	E	B	D	E
20	E	A	A	D	E	E	A	A	B	E
30	B	A	C	A	C	D	A	E	C	D
40	D	E	E							

## 14 Engineering Economy

### Section 1

1. Which one of the following questions is relevant to the construction estimates :
  - A. Did the estimators precisely evaluate site conditions ?
  - B. Did the estimators use short cut methods which may be unrealistic in their situation ?
  - C. How much money will the contractor's risk, losing if he were to submit bid on the raw estimate of cost.
  - D. All of these
2. The ratio obtained by dividing 'quick assets' by current liabilities is called
  - A. Turnover ratio
  - B. Acid test ratio
  - C. Solvency ratio
  - D. None of these.
3. Which one of the following definitions, is correct ?
  - A. The ratio of total debt to share holder's equity is called 'debt ratio'.
  - B. The ratio debt-to-total assets is called Debt-to-total asset ratio.
  - C. The ratio of earnings before interest and taxes for a particular reporting period to the amount of interest charges for the period, is called interest coverage ratio.
  - D. All of these
4. Pick up the element of the cost from the following:
  - A. direct material
  - B. direct labour
  - C. Over head
  - D. All of these
5. The estimator for definitive estimates must be able :
  - A. and an all-around construction expert.
  - B. to read the plans and specifications to determine accurate quantities of permanent materials and installed Equipment.
  - C. to express the job material requirements in dimensions suitable for costing and construction supplies.
6. Pick up the correct statement from the following:

- A. The change in the amount of money over a given time period is called 'time value' of money, a most important concept in engineering economy.
  - B. The manifestation of the time value of money is termed as interest.
  - C. Interest on borrowing = present amount owed - original loan
  - D. The original investment (or loan) is referred to as principal.
  - E. All of these.
7. Which one of the following is included in financial ratios of the firm ?
- A. Profitability ratio
  - B. Liquidity ratio
  - C. Turnover ratio
  - D. Ratio of overall performances
  - E. All of these
8. Pick up the correct statement from the following:
- A. The financial ratio summarises some aspect of the firm's financial condition at the time of preparing a balance sheet.
  - B. Both the numerator and denominator of financial ratios come directly from the balance sheet.
  - C. Income statement ratios compare one 'flow' item from the income statement to another flow item from the income statement.
  - D. Income statement ratios compare a flow item from the income statement to another flow item from the income statement
  - E. All of these
9. Refer to the cash flow diagram of uniform gradient in a cash flow (in the given figure), the gradient is :
- A. Rs 10000 per year
  - B. Rs 15000 per year
  - C. Rs 20000 per year
  - D. Rs 25000 per year
10. In the cash-flow diagram shown in the given figure
- A. Equal deposits of Rs 3000 per year (A) are made, starting now.
  - B. The rate of interest is 10% per yearaccount
  - C. The amount accumulated after the seventh deposit is to be computed
  - D. All of these
11. The estimate based on a detailed quantity survey and furnishes the most accurate and reliable estimate possible is known as

- A. Conceptual estimate
  - B. Definitive estimate
  - C. Probabilistic estimate
  - D. None of these
12. The sunk costs include :
- A. a past expenditure
  - B. an unrecovered balance
  - C. an invested capital that cannot be retrieved
  - D. All of these
13. Current assests less inventories divided by current liabilities is known as
- A. Liquidity ratio
  - B. Current ratio
  - C. Acid-Test (or Quick) ratio
  - D. Debts ratio
14. Which one of the following statements is correct?
- A. The number of years required to recover the initial cash investment in a project, is called Pay Back period (PBP).
  - B. The discount rate that equates the present value of the expected Net Cash Flows (CFs) with the Initial Cash Outflow (ICO) is known as internal rate of return.
  - C. The present value of the proposal's net cash flows, less the proposal's initial cash outflow is known as the Net Present Value (NPV)
  - D. All of these
15. The alternatives which are standalone solutions for given situations in engineering involve :
- A. a purchase cost (first cost)
  - B. the anticipated life of the assest
  - C. the yearly costs of maintaining the assest (annual maintenance and operating cost)
  - D. the anticipated resaleable value (salvage value) and the interest return (rate of return)
  - E. All of these
16. The ratio of current assests to current liabilities is known as
- A. Liquidity ratio
  - B. Current ratio
  - C. Acid-Test (or Quick) ratio

- D. Debts ratio
17. Pick up the correct statement from the following:
- A. An annuity is a series of equal payments occurring at equal period of time.
  - B. Annuity is called an equal payment or uniform payment series.
  - C. An annuity may have periods of time of any length but should always be of equal length.
  - D. All the above.
18. The construction estimate of a project is used by :
- A. the owner of the facility
  - B. the consulting architect/engineer
  - C. the contractor of the project
  - D. All of these
19. Both architect and engineer make use of the cost estimate of the project:
- A. for site selection
  - B. for designing of the project
  - C. for choosing alternatives
  - D. All of these
20. If  $a$  is the base amount expenditure,  $b$  is the increase in the operation cost each year over a period of  $n$  years, the total cost of maintenance is :
- A.  $a + (n + 1) b$
  - B.  $a + (n - 1) b$
  - C.  $a \times (n - 1) b$
  - D.  $a - (n - 1) b$
21. The more critical (or severe) test of the firm's liquidity can be judged by :
- A. Liquidity ratio
  - B. Current ratio
  - C. Acid-Test (or Quick) ratio
  - D. Debts ratio
22. Ratio analysis of a construction firm is used for analysis by :
- A. share holders
  - B. firm's management
  - C. Banks of the firm
  - D. financial analysts

- E. All of these.
23. Pick up the correct statement from the following:
- $$\text{Over head rate} = \frac{\text{total over head in rupees for period}}{\text{direct labour in rupees for period}}$$
- A.
- B. Over head cost per unit = Overhead ratio x direct labour cost/unit
- C. both (a) and (b)
- D. neither (a) nor (b)
24. Probabilistic estimating of a construction project includes:
- A. Labour      B. Productivity      C. wage scale      D. All of these
25. A construction estimate is used
- A. to judge tentatively or approximate value of the project
- B. to produce a statement of the approximate cost
- C. to decide an approximation of the value of the project and not the exact cost.
- D. None of these
26. Pick up the correct statement from the following:
- A. The capital required to get a project started, is called first cost.
- B. The costs associated with a new or existing project that remain unaffected by the changes in activity level over the normal range of operation of the project, are called fixed costs.
- C. The group of costs that vary proportionately to the changes in the activity level of a new or existing project are called variable costs.
- D. All of these
27. Present worth Annuity (PWA) is generally known as
- A. Premium annuities
- B. Income annuities
- C. Future annuities
- D. All of these
28. Pick up the ratio which gives us sufficient information by which to judge the financial condition and performance of the firm, from the following:
- A. Liquidity ratio
- B. Financial leverage ratio
- C. Activity ratio
- D. Portability
- E. None of these

29. Pick up the correct statement from the following:
- The ratios which show profitability in relation to sales and those which show profitability in relation to investment, are called profitability ratios.
  - The ratio of gross profit and net sales, is called profitability in relation to sales ratio.
  - The ratio of net profit after taxes to total assests is known as profitability in relation to investment ratio
  - All of these
30. The financial analysis helps to judge:
- The operational efficiency of the firm
  - The financial position of the firm.
  - Both (a) and (b)
  - Neither (a) nor (b)
31. If interest is paid more than once in a year,  $i$  is the rate of interest per year,  $n$  is the number of periods in years and  $m$  is a number of periods per years, compound amount factor (CAF) is :
- A.  $\left(1 + \frac{i}{m}\right)^n$       B.  $\left(1 + \frac{i}{n}\right)^m$       C.  $\left(1 + \frac{i}{n}\right)^{1/m}$       D.  $\left(1 + \frac{i}{m}\right)^{1/n}$
32. In a cash flow series :
- uniform gradient signifies that an income or disbursement changes by the same amount in each interest period.
  - Either an increase or a decrease in the amount of a cash flow is called the gradient.
  - The gradient in the cash flow may be positive or negative.
  - All of these
33. If  $P$  is principal amount,  $i$  is the rate of interest and  $n$  is the number of periods in years, then the interest factor is :
- $(1 + ni)$
  - $(ni - 1)$
  - $ni$
  - None of these
34. Pick up the correct statement from the following:
- Ratio analysis is the procedure of determining and interpreting numerical relationship of various items of the financial statement.
  - All financial ratios are obtained by relating two sets of information contained in a Single financial statement.

- C. The relationship between two accounting figures expressed mathematically, is known as a financial ratio.
- D. All of these
35. Pick up the correct statement from the following:
- A. The ability of a company to meet obligations which are likely to mature in short term, is called liquidity.
- B. The liquidity ratio may be defined as a relationship of current liabilities and current assests and advances.
- C. The liquidity ratios are used to indicate the financial position of the firm.
- D. All of these
36. The capital Recovery Factor (equal payments) of Capital Recovery Annuity is :
- A.  $\frac{i(1+i)^n}{(1+i)^n - 1}$       B.  $\frac{(1+i)^n}{(1+1)^n - 1}$       C.  $\frac{i(1+i)^n}{(1+i)^n + 1}$       D. None of these.
37. Current ratio is :
- A.  $\frac{\text{Current assests}}{\text{Current liabilities}}$
- B.  $\frac{\text{Current assests} + \text{loans}}{\text{Current liabilities}}$
- C.  $\frac{\text{Current assests} + \text{loans advances}}{\text{Current liabilities}}$
- D. None of these.
38. The interest calculated on the basis of 365 days a year, is known as :
- A. interest
- B. ordinary simple interest
- C. exact simple interest
- D. None of these
39. If S is the future capital accumulated in n years at the rate of interest i per annum, then present worth is :
- A.  $\frac{S}{(1+i)^n}$
- B.  $S(1+i)^n$
- C.  $S(1+i)^{1/n}$
- D. None of these.



40. In a cash-flow diagram :
- A. Time 0 is considered to be the present
  - B. Time 1 is considered to be the end of time period 1
  - C. A vertical arrow pointing up indicates a positive cash flow
  - D. An arrow pointing downward indicates a negative cash flow
  - E. All of these
41. Each financial ratio is generally compared by
- A. a past ratio calculated from the past financial standard of the firm.
  - B. a ratio developed by using the projected financial statement of the firm.
  - C. a ratio of some selected firms most progressive and successful at the point of consideration.
  - D. All of these
42. The key to profitable operation for project cost control, is :
- A. To keep the project cost equal to original cost estimate.
  - B. To keep the project cost equal to subsequent construction budget.
  - C. To keep the project cost within the cost budget and knowing when and where job costs are deviating.
  - D. None of these
43. The annuity which refers to a debt payment for recovering the initial amount or capital in equal periodical payments, is known as;
- A. Present Worth Annuity
  - B. Sinking fund annuity
  - C. Compound annuity
  - D. Capital recovery annuity
44. The product of CAF (S P) and PWF (S P) is:
- A.  $1/2$     B. 1    C.  $1/3$     D.  $1/4$
45. Pick up the correct reason for making conceptual (or preliminary) estimate from the following:
- A. To have a check on a definitive cost estimate.
  - B. To check quotations from contractors and/or sub contractors.
  - C. To compute target estimate for the owner while drawings and specifications are in initial stage.
  - D. All of these.
46. Pick up the correct statement from the following:
- A. A NPV profile graph shows the curvilinear relationship between the net present value of the project and discount rate employed.

- B. In a NPV profile, if discount rate is zero, then net present value is simply total cash inflows less the total cash outflows of the project.
- C. As the discount rate increases, the net present value profile slopes downward to the right.
- D. All of these
47. The project contractor relies on the cost of the estimate :
- A. for submission of a competitive bid for a lumpsum contract
- B. for a unit price contract
- C. for preparation of a definitive estimate to help negotiate contract.
- D. All of these
48. The wages of supervisors and material handlers are charged as :
- A. Over head
- B. direct labour cost
- C. indirect labour cost
- D. None of these
49. The CRF (ep) is also known as:  $[\text{CRF}(\text{EP}) - 8\% - 7]$ , where
- A. 8% is the rate of interest per year
- B. money is borrowed for  $n = 7$  years
- C. both (a) and (b)
- D. Neither (a) nor (b)
50. Annuities involve:
- A. a series of payments
- B. all payments of equal amount
- C. payment at equal time intervals
- D. payments at the end of periods.
- E. All of these

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	D	B	D	D	C	E	E	E	D	D
10	B	D	C	D	E	B	D	D	D	B
20	C	D	C	D	C	D	D	E	D	C
30	A	D	A	D	D	A	A	C	A	E
40	D	C	D	B	D	D	D	A	C	E

## Section 2

1. If a seller recovers his capital along with accumulated compensating interest not in one single lumpsum payment but in periodical equal payments, over time :
  - A. Capital Recovery Annuity is available
  - B. Present worth Annuity is available
  - C. Sinking Fund Annuity is available
  - D. Sinking Fund Annuity is available
2. Which method is adopted to develop an approximate or conceptual estimate for perimeter works for buildings from the following:
  - A. Base unit method
  - B. Cost per function method
  - C. Cost per square metre method
  - D. Cost per cubic metre method
  - E. Cost per linear metre method
3. Pick up the correct method adopted for developing the approximate or conceptual estimates from the following :
  - A. Base unit method
  - B. Cost per function method
  - C. Cost per square metre
  - D. Cost per linear unit
  - E. All of these
4. The financial analysis :
  - A. helps a share holder to compare the expected return on his investment in the firm against the expected return from other alternative investment.
  - B. helps a bank to know the financial position of the firm for granting a loan to the firm.
  - C. helps to judge the success of the firm's financial plans.
  - D. All of these.
5. Pick up the correct statement regarding financial statement analysis from the following.
  - A. Financial analysis always involves the use of various financial statements i.e., balance sheet and income statement.
  - B. The balance sheet is the summary of assets, liabilities and owner's equity of business at a point in time.
  - C. The income statement is the summary of revenues and expenses of a firm over a particular period of time.

- D. All the above
6. The owner of the construction company makes use of the estimate :
- to determine the capital investment costs.
  - to assist in financial arrangements
  - to determine economic feasibility of the project.
  - to determine the tax, insurance and evaluation purpose.
  - All of these
7. Which one of the following is not a construction estimate ?
- Initial feasibility estimate
  - Conceptual preliminary budget
  - Definite estimate
  - None of these
8. Pick up the correct statement from the following:
- Uniform series compound amount factor =  $\left[ \frac{(1+i)^n - 1}{i} \right]$
  - Uniform series present worth factor =  $\left[ \frac{(1+i)^n - 1}{i(1+i)^n} \right]$
  - Sinking fund factor =  $\left[ \frac{i}{(1+i)^n - 1} \right]$
  - Capital recovery factor =  $\left[ \frac{i}{1 - (1+i)^{-n}} \right]$  where letters carry their usual meanings.
  - All of these
9. Pick up the method used for project evaluation and selection in capital budgeting from the following:
- pay back period
  - Internal ratio of return
  - Net present worth
  - Profitability index
  - All the above
10. Pick up the correct statement from the following:
- The ratio of current assests, loans and advances, and the current liquidity is called current ratio.
  - Larger the current ratio, larger is the margin of safety.

- C. The operating profit is the difference between gross profit and operating expenses.
  - D. All of these
11. A project construction cost estimate includes:
- A. the labour and material cost
  - B. the equipment and over head cost
  - C. the profit of the contractor
  - D. All of these
12. In the cash flow diagram shown in the given figure
- A. The first disbursement occurs at the end of year 2
  - B. The second disbursement occurs at the end of year 4
  - C. The first receipt occurs at the end of year 1
  - D. The second receipt occurs at the end of year 3
  - E. All of these
13. Pick up the correct statement from the following:
- A. The receipts and disbursements in a given time interval are referred to as cash flow.
  - B. The assumptions that all cash flows occur at the end of the interest period, is known as the end of period convention.
  - C. A cash flow diagram is a graphical representation of cash flows drawn on a time scale.
  - D. The cash flow diagram represents the statement of the problem and also includes what is given and what is to be found.
  - E. All of the above.
14. The person desires to pay off the amount in 10 equal annual instalments. The amount of each instalment is :
- A. Rs 5638      B. Rs 6638      C. Rs 7738      D. None of these
15. Renu Bala deposits Rs 1200 now, Rs 800 two years from now and Rs 1000 five years from now. If the savings bank's rate of interest is 5%, she will receive an amount of Rs X 10 years from now, where X is
- A. Rs 3415      B. Rs 4225      C. Rs 4413      D. Rs 4826
16. Pick up the correct statement from the following:
- A. The capital required to get a project started is the first cost.
  - B. The first cost is a single cash flow or a series of cash flows that are made in the beginning of the activity's life span
  - C. The first cost of purchasing a car is the sum of the down payment, taxes and dealers charges.
  - D. All of these

17. Pick up the correct statement from the following:
  - A. Engineering economy is a collection of mathematical techniques which simplify economic comparisons
  - B. Engineering economy is a decision assistance tool by which one method will be chosen as the most economically one.
  - C. For understanding the engineering economy, one should be able to classify the basic terminology and fundamental concepts of economy.
  - D. All of these.
18. Keeping in view, the feasibility order of magnitude, the preliminary, conceptual or budget estimates, are prepared by :
  - A. architect/engineer
  - B. construction manager
  - C. owner himself/herself
  - D. construction manager
  - E. None of these
19. The construction manager uses the estimate of the project
  - A. to tell the owner of the project to take his/her financial decision.
  - B. to advise the architect/engineer regarding design cost parameter especially in value engineering analysis.
  - C. to develop bids on the project.
  - D. to control the project during its construction.
  - E. All of these
20. If  $P$  is principal amount,  $i$  is the rate of interest per annum and  $n$  is the number of periods in years, the compound amount factor (CAF) is :
  - A.  $(1 + i)^n$
  - B.  $(1 + i)^{(1/2n)}$
  - C.  $(n + i)$
  - D. None of these
21. Liquidity ratios are used :
  - A. to measure a firms ability to meet short-cut obligations.
  - B. to compare short term obligations to short-term resources available to meet these obligations.
  - C. to obtain much insight into the present cash solvency of the firm and the firm's ability to remain solvent in the event of adversity.
  - D. All of these
22. Earning per share is the most important ratio for

- A. share holders
  - B. banks
  - C. company's management
  - D. All of these
23. Pick up the correct statement from the following:
- A. The difference between sales revenue and cost of goods sold, is known as 'Gross Profit.'
  - B. The gross profit percentage is the average profit margin obtained on goods sold.
  - C. The relationship of contribution to sales is known as contribution ratio
  - D. The difference between sales and variable cost of sales, is called contribution.
  - E. All of these
24. Pick up the main purpose of project cost control from the following :
- A. To signal immediate warning of uneconomic operations
  - B. To provide a feed back to the estimator
  - C. To promote cost consciousness
  - D. All of these

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	E	E	D	D	E	D	E	E	D
10	D	E	E	A	C	D	D	C	E	A
20	D	D	E	D						

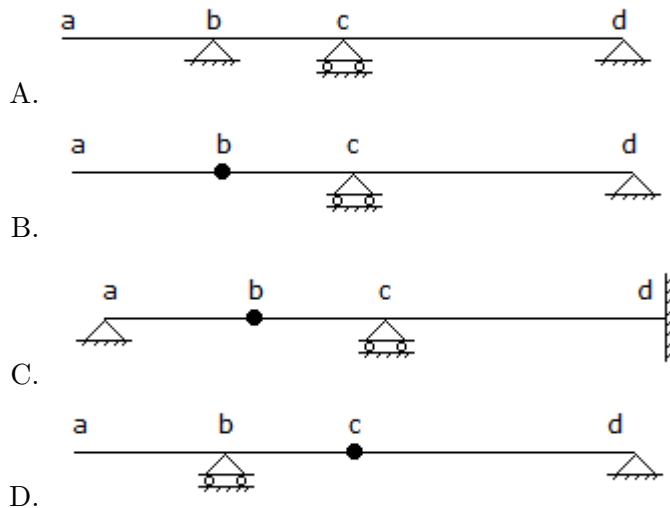
## 15 GATE Exam Questions

### Section 1

1. The number of simultaneous equations to be solved in the slope deflection method, is equal to :
  - A. the degree of statical indeterminacy
  - B. the degree of kinematic indeterminacy
  - C. the number of joints in the structure
  - D. none of the above
2. Maximum size of a fillet weld for a plate of square edge is
  - A. 1.5 mm less than the thickness of the plate
  - B. one half of the thickness of the plate
  - C. thickness of the plate itself
  - D. 1.5 mm more than the thickness of the plate
3. The treatment that should be given to the water from a deep tube well is :
  - A. pre-settling only
  - B. coagulation and flocculation only
  - C. filtration only
  - D. disinfection only
4. On sag (or valley) curves the available sight distance is determined based on :
  - A. design speed
  - B. height of obstacle
  - C. height of driver eye
  - D. night-time driving conditions
5. In a steady radial flow into an intake, the velocity is found to vary as  $(1/r^2)$ , where  $r$  is the radial distance. The acceleration of the flow is proportional to
  - A.  $1/r^5$
  - B.  $1/r^3$
  - C.  $1/r^4$
  - D.  $1/r$
6. The wall shown in the below figure has failed. The cause of failure or the error made in the design of the failed wall is :
  - A. deep slip surface failure
  - B. overturning
  - C. no proper drainage in the clay backfill
  - D. translational failure
7. The span to depth ratio limit is specified in IS : 456-1978 for the reinforced concrete beams, in order to ensure that the



- A. tensile crack width is below a limit
  - B. shear failure is avoided
  - C. stress in the tension reinforcement is less than the allowable value
  - D. deflection of the beam is below a limiting value
8. A two span beam with an internal hinge is shown below. The conjugate beam corresponding to this beam is



9. Some of the structural strength of a clayey material that is lost by remoulding is slowly recovered with time. This property of soils to undergo an isothermal gel-to-soil-to-gel transformation upon agitation and subsequent rest is termed :
- A. Isotropy
  - B. Anisotropy
  - C. Thixotropy
  - D. Allotropy
10. The capacities of "One-way 1.5 m wide sidewalk (persons per hour)" and "One-way 2-lane urban road (PCU per hour, with no frontage access, no standing vehicles and very little cross traffic)" are respectively.
- A. 1200 and 2400
  - B. 1800 and 2000
  - C. 1200 and 1500
  - D. 2000 and 1200
11. IS 459-1978 recommends to provide certain minimum steel in a RCC beam
- A. to ensure compression failure
  - B. to avoid rupture of steel in case a flexural failure occurs
  - C. to hold the stirrup steel in position
  - D. to provide enough ductility to the beam
12. Shear stress develops on a fluid element, if :
- A. the fluid is at least
  - B. the fluid-container is subject to uniform linear acceleration

- C. the fluid is inviscid
  - D. the fluid is viscous and the flow is nonuniform
13. A hydraulic turbine has a discharge of  $5 \text{ m}^3/\text{s}$ , when operating under a head of 20 m with a speed of 500 rpm. If it is to operate under a head of 15 m, for the same discharge, the rotational speed in rpm will approximately be  
A. 433    B. 403    C. 627    D. 388
  14. A nozzle discharging water under head  $H$  has an outlet area " $a$ " and discharge coefficient  $c_d = 1.0$ . A vertical plate is acted upon by the fluid force  $F_j$  when held across the free jet and by the fluid force  $F_n$  when held against the nozzle to stop the flow, the ratio  $F_j/F_n$  is  
A.  $1/2$     B. 1    C. 2    D. 2
  15. A hydraulic turbine develops a power of 104 metric horse power while running at a speed of 100 revolutions per minute, under a head of 40 m. Its specific speed is nearest to one of the following :  
A. 100    B. 628    C. 523    D. 314
  16. The Prandtl mixing length for turbulent flow through pipes is  
A. independent of shear stress  
B. a universal constant  
C. zero at the pipe wall  
D. independent of radial distance from pipe axis
  17. A  $40^\circ$  slope is excavated to a depth of 10 m in a deep layer of saturated clay of unit weight  $20 \text{ kN/m}^3$ ; the relevant shear strength parameters are  $c_u = 70 \text{ kN/m}^2$  and  $\phi_u = 0$ . The rock ledge is at a great depth. The Taylor's stability coefficient for  $\phi_u = 0$  and  $40^\circ$  slope angle is 0.18. The factor of safety of the slope is :  
A. 2.0    B. 2.1    C. 2.2    D. 2.3
  18. Lysimeter and Tensiometer are used to measure respectively, one of the following groups of quantities :  
A. Capillary potential and permeability  
B. Evapotranspiration and capillary potential  
C. Velocity in channels and vapour pressure  
D. Velocity in pipes and pressure head
  19. The ruling minimum radius of horizontal curve of a national highway in plain terrain for ruling design speed of 100 km/hour with  $e = 0.07$  and  $f = 0.15$  is close to  
A. 250 m    B. 360 m    C. 36 m    D. 300 m
  20. Principle involved in the relationship between submerged unit weight and saturated weight of a soil is based on

- A. Equilibrium of floating bodies
  - B. Archimedes' principle
  - C. Stokes' law
  - D. Darcy's law
21. The kinetic energy correction factor for a full developed laminar flow through a circular pipe is  
 A. 1.00    B. 1.33    C. 2.00    D. 1.50
22. The slope of the e-log p curve for a soil mass gives :  
 A. coefficient of permeability,  $k$   
 B. coefficient of consolidation  $C_v$   
 C. compression index,  $C_c$   
 D. coefficient of volume compressibility,  $mv$
23. The modulus of subgrade reaction is obtained from the plate bearing test in the form of load-deformation curve. The pressure corresponding to the following settlement value should be used for computing modulus of subgrade reaction  
 A. 0.375 cm    B. 0.175 cm    C. 0.125 cm    D. 0.250 cm
24. X-component of velocity in a 2-D incompressible flow is given by  $u = y^2 + 4xy$ . If Y-component of velocity ' $v$ ' equals zero at  $y = 0$ , the expression for ' $v$ ' is given by  
 A.  $4y$     B.  $2y^2$     C.  $-2y^2$     D.  $2xy$
25. Consolidation in soils  
 A. is a function of the effective stress  
 B. does not depend on the present stress  
 C. is a function of the pore water pressure  
 D. is a function of the total stress
26. A cantilever beam of length  $L$  and a cross section with shape factor  $f$  supports a concentrated load  $P$  as shown below. The length  $L_P$  of the plastic zone, when the maximum bending moment equals the plastic moment  $M_P$ , given by  
 A.  $\frac{L_P}{L} = \frac{1}{f}$     B.  $\frac{L_P}{L} = L(1 - f)$     C.  $\frac{L_P}{L} = 1 - \frac{1}{\sqrt{f}}$     D.  $\frac{L_P}{L} = 1 - \frac{1}{f}$
27. The minimum area of tension reinforcement in a beam shall be greater than  
 A.  $0.85 \frac{bd}{f_y}$   
 B.  $0.87 \frac{f_y}{bd}$   
 C.  $0.04 \frac{bd}{f_y}$   
 D.  $0.4 \frac{bd}{f_y}$

28. In an iceberg, 15% of the volume projects above the sea surface. If the specific weight of sea water is  $10.5 \text{ kN/m}^3$ , the specific weight of iceberg is  $\text{kN/m}^3$  is  
 A. 12.52    B. 9.81    C. 8.93    D. 7.83
29. A reinforced concrete column contains longitudinal steel equal to 1 percent of net cross-sectional area of the column. Assume modular ratio as 10. The loads carried (using the elastic theory) by the longitudinal steel and the net area of concrete, are  $P_s$  and  $P_c$  respectively. The ratio  $P_s/P_c$  expressed as percent is  
 A. 0.1    B. 1    C. 1.1    D. 10
30. A steady discharge of 1 cumec flows uniformly in a rectangular channel 1 m wide at a depth of 250 mm. The slope of the channel bed is :  
 A. adverse    B. steep    C. critical    D. mild
31. In reinforced concrete, pedestal is defined as compression member, whose effective length does not exceed its least dimension by  
 A. 12 times    B. 3 times    C. 16 times    D. 8 times
32. Flexible pavements derive stability primarily from :  
 A. aggregate interlock, particle friction and cohesion  
 B. cohesion alone  
 C. the binding power of bituminous materials  
 D. the flexural strength of the surface course
33. The permissible bending tensile stress in concrete for the vertical wall of an R.C. water tank made of M 25 concrete is :  
 A.  $8.5 \text{ N/mm}^2$     B.  $6.0 \text{ N/mm}^2$     C.  $2.5 \text{ N/mm}^2$     D.  $1.8 \text{ N/mm}^2$
34. The cylinder strength of the concrete is less than the cube strength because of  
 A. the difference in the shape of the cross section of the specimens  
 B. the difference in the slenderness ratio of the specimens  
 C. the friction between the concrete specimens and the steel plate of the testing machine  
 D. the cubes are tested without capping but the cylinders are tested with capping
35. A water treatment plant is required to process 28800  $\text{m}^3/\text{d}$  of raw water (density =  $1000 \text{ kg/m}^3$ , kinematic viscosity =  $10^{-6} \text{ m}^2/\text{s}$ ). The rapid mixing tank imparts tank a velocity gradient of  $900 \text{ s}^{-1}$  to blend 35 mg/l of alum with the flow for a detention time of 2 minutes. The power input (W) required for rapid mixing is  
 A. 32.4    B. 36    C. 324    D. 32400

36. The depth of tension crack in a soft clay ( $\phi_u = 0$ ) is
- A.  $\frac{4 C_u}{\gamma}$       B.  $\frac{2 C_u}{\gamma}$       C.  $\frac{C_u}{\gamma}$       D.  $\frac{C_u}{2 \gamma}$
37. A single rapid test to determine the pollutional status of river water is :
- A. biochemical oxygen demand  
B. chemical oxygen demand  
C. total organic solids  
D. dissolved oxygen
38. The vertical stress at depth  $z$ , directly below the point load  $p$  is ( $k$  is a constant)
- A.  $k \frac{p}{z}$       B.  $k \frac{p}{z^3}$       C.  $k \frac{p}{z^2}$       D.  $k \frac{p}{\sqrt{z}}$
39. Vane tester is normally used for determining in situ shear strength of :
- A. soft clays      B. sand      C. stiff clays      D. gravel
40. For the frame shown in the below figure, the maximum bending moment in the column is,
- A. zero      B. 400 kNm      C. 100 kNm      D. 200 kNm
41. In a compaction test, as the compaction effort is increased, the optimum moisture content
- A. decreases  
B. remains same  
C. increases  
D. increases first and thereafter decreases
42. The peak discharge of the instantaneous unit hydrograph of a basin, when compared to the peak discharge of a 4-hour unit hydrograph of that basin, would be
- A. greater  
B. equal  
C. equal or lesser  
D. lesser
43. The drop manholes are provided in a sewerage system when there is
- A. change in alignment of sewer line  
B. change in size of sewers  
C. change in the elevation of ground level  
D. change from gravity system to pressure system

44. The reaction time for calculation of stopping distance may be assumed as  
 A. 5 secs      B. 2.5 secs      C. 0.5 secs      D. 10.0 secs
45. The percentage error in the computed discharge over a triangular notch corresponding to an error of 1% in the measurement of the head over the notch, would be  
 A. 1.0      B. 1.5      C. 2.0      D. 2.5
46. The characteristic strength of concrete is defined as that compressive strength below which not more than  
 A. 10% of results fall  
 B. 5% of results fall  
 C. 2% of results fall  
 D. None of the above.
47. Un-factored maximum bending moments at a section of a reinforced concrete beam resulting from a frame analysis are 50, 80, 120 and 180 kNm under dead, live, wind and earthquake loads respectively. The design moment (kNm) as per IS: 456-2000 for the limit state of collapse (flexure) is  
 A. 195      B. 250      C. 345      D. 372
48. The microbial quality of treated piped water supplies is monitored by  
 A. Microscopic examination  
 B. Plate count of heterotrophic bacteria  
 C. Coliform MPN test  
 D. Identification of all pathogens
49. The 5-day BOD of a wastewater sample is obtained as 190 mg/l (with  $k = 0.01 \text{ h}^{-1}$ ). The ultimate oxygen demand (mg/l) of the sample will be  
 A. 3800      B. 475      C. 271      D. 190
50. A tube well having a capacity of 4 m<sup>3</sup>/hour operates for 20 hours each day during the irrigation season. How much area can be commanded if the irrigation interval is 20 days and depth of irrigation is 7 cm ?  
 A.  $1.71 \times 10^4 \text{ m}^2$   
 B.  $1.14 \times 10^4 \text{ m}^2$   
 C.  $22.9 \times 10^4 \text{ m}^2$   
 D.  $2.29 \times 10^4 \text{ m}^2$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	C	A	D	C	A	B	D	B	C	A
10	B	D	A	B	A	A	A	B	B	B
20	C	C	C	C	C	D	A	C	D	A
30	B	A	D	B	D	B	C	C	A	B
40	A	A	C	B	D	B	D	C	C	D

## Section 2

1. In a reinforced concrete beam-column, the increase in the flexural strength along with the increase in the axial strength occurs
  - A. beyond the elastic limit of the material
  - B. when the yield of the tension reinforcement governs the strength
  - C. when the crushing of the concrete in the compression zone governs the strength
  - D. never
2. The group efficiency of a pile group
  - A. will be always less than 100%.
  - B. will be always greater than 100%.
  - C. may be less than 100% or more than 100%.
  - D. will be more than 100% for pile groups in cohesionless soils and less than 100% for those in cohesive soils.
3. A wastewater sample contains 10-5.6 mmol/l of OH ions at 25° C. The pH of this sample is
  - A. 8.6
  - B. 8.4
  - C. 5.6
  - D. 5.4
4. At a rated capacity of 44 Cumecs, a centrifugal pump develops 36 m of head when operating at 1450 rpm. Its specific speed is :
  - A. 654
  - B. 509
  - C. 700
  - D. 90
5. Presence of fluoride in water greater than permissible level of 1.5 mg/l causes
  - A. cardiovascular disease
  - B. methemoglobinemia
  - C. hepatitis
  - D. dental fluorosis
6. The values of liquid limit and plasticity index for soils having common geological origin in a restricted locality usually define
  - A. A zone above A-line
  - B. A straight line parallel to A-line
  - C. A straight line perpendicular to A-line
  - D. Points may be anywhere in the plasticity chart
7. M -  $\theta$  relationship for a simply supported beam shown below is given by :
  - A.  $M l/EI = 2\theta$
  - B.  $M l/EI = 3\theta$
  - C.  $M l/EI = 4\theta$
  - D.  $M l/EI = 6\theta$

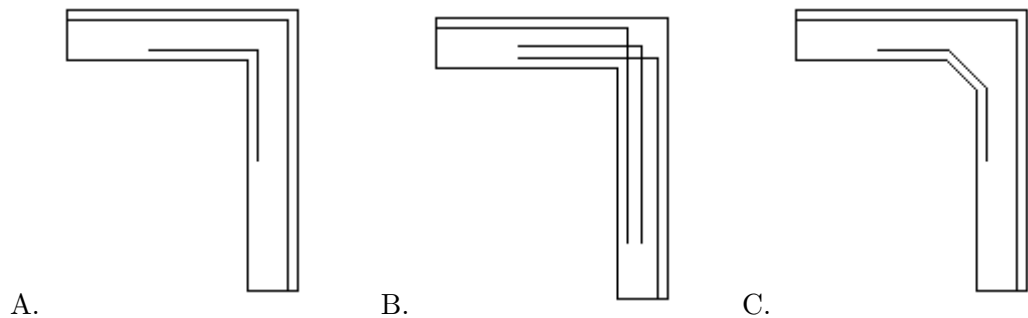
8. The number of revolutions of a current meter in 50 seconds were found to be 12 and 30 corresponding to the velocities of 0.25 and 0.46 m/s respectively. What velocity (in m/s) would be indicated by 50 revolutions of that current meter in one minute ?  
A. 0.42    B. 0.50    C. 0.60    D. 0.73
9. A lysimeter is used to measure :  
A. infiltration  
B. evaporation  
C. evapotranspiration  
D. radiation
10. In IS : 800 (1984) the permissible compressive stress in column is based on :  
A. Euler formula  
B. Secant formula  
C. Rankine-Gordan formula  
D. Rankine-Merchant formula
11. Sewage treatment in an oxidation pond is accomplished primarily by :  
A. alga-bacterial symbiosis  
B. algal photosynthesis only  
C. bacterial oxidation only  
D. chemical oxidation only
12. Presence of excess nitrates in river water indicates :  
A. recent pollution of water with sewage  
B. past pollution of water with sewage  
C. immediate pollution of water with sewage  
D. no pollution of water with sewage
13. Two steel plates each of width 150 mm and thickness 10 mm are connected with three 20 mm diameter rivets placed in a zig-zag pattern. The pitch of the rivets is 75 mm and gauge is 60 mm. If the allowable tensile stress is 150 MPa, the maximum tensile force that the joint can withstand is  
A. 195.66 kN    B. 195.00 kN    C. 192.75 kN    D. 225.00 kN
14. The relation that must hold for the flow to be irrotational is  
A.  $\frac{\partial u}{\partial y} - \frac{\partial v}{\partial x} = 0$     B.  $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$     C.  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$     D.  $\frac{\partial u}{\partial y} = - \frac{\partial v}{\partial x}$
15. A single bay single storey portal frame has hinged left support and a fixed right support. It is loaded with uniformly distributed load on the beam. Which one of the following statements is true with regard to the deformation of the frame ?

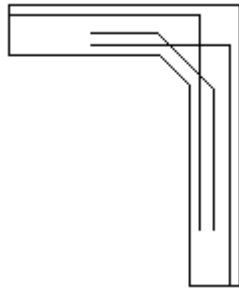


- A. It would sway to the left side  
 B. It would sway to the right side  
 C. It would not sway at all  
 D. None of the above
16. To have zero active pressure intensity at the tip of a wall in cohesive soil, one should apply a uniform surcharge intensity of  
 A.  $2c \tan \alpha$   
 B.  $2c \cot \alpha$   
 C.  $-2c \cot \alpha$   
 D.  $-2c \tan \alpha$
17. The following characteristics pertain to the sand filters used in water industry. Filtration rate is 1 to 4 m<sup>3</sup> (m<sup>2</sup> day). Typical duration of operation in one run is 24 to 72 hours. Operating cost is low. Which of the above characteristics pertain to slow sand filters ?  
 A. I, II and III      B. I and II      C. II and III      D. I and III
18. Effective length of a rafter member between two nodes at a distance L, perpendicular to the plane of the truss, is : .  
 A.  $2.00 L$       B.  $0.85$       C.  $1.50$       D.  $1.00 L$
19. Consistency Index for a clayer soil is [LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, W = natural moisture content]  
 A.  $\frac{LL - W}{PI}$   
 B.  $\frac{W - PL}{PI}$   
 C.  $LL - PL$   
 D.  $0.5 w$
20. The slope of the elastic curve at the free end of a cantilever beam of span L, and with flexural rigidity EI, subjected to uniformly distributed load of intensity w is  
 A.  $wL^3/6EI$   
 B.  $wL^3/3EI$   
 C.  $wL^4/8EI$   
 D.  $wL^3/2EI$
21. If duty (D) is 1428 hectares/cumec and base period (B) is 120 days for an irrigated crop, then delta ( $\Delta$ ) in meters is given by  
 A. 102.8      B. 0.73      C. 1.38      D. 0.01
22. The repeating variables in dimensional analysis should :  
 A. include the dependent variable

- B. have amongst themselves all the basic dimensions
  - C. be derivable from one another
  - D. exclude one of the basic dimensions
23. The minimum dissolved oxygen content (ppm) in a river necessary for the survival of aquatic life is  
A. 0     B. 2     C. 4     D. 8
24. Stopping sight distance is the minimum distance available on a highway which is the  
A. distance of sufficient length to stop the vehicle without collision.  
B. distance visible to a driver during night driving.  
C. height of the object above the road surface.  
D. distance equal to the height of the driver's eye above the road surface.
25. A body moving through still water at 6 m/sec produces a water velocity of 4 m/sec at a point 1 m ahead. The difference in pressure between the nose and the point 1 m ahead would be  
A. 2, 000 N/m<sup>2</sup>  
B. 10, 000 N/m<sup>2</sup>  
C. 19, 620 N/m<sup>2</sup>  
D. 98, 100 N/m<sup>2</sup>
26. Critical factors for the activated sludge treatment process are  
A. maximum hourly flow rate.  
B. maximum and minimum flow rate.  
C. maximum hourly flow rate and maximum daily organic load.  
D. minimum hourly flow rate and minimum daily organic load.
27. MPN index is a measure of one of the following :  
A. Coliform bacteria  
B. BOD<sub>5</sub>  
C. Dissolved Oxygen Content  
D. Hardness
28. One of the probable causes of rutting on flexible pavements is  
A. excessive stripping of binder material from the wearing course  
B. use of flaky aggregates in the wearing course  
C. inadequate compaction of pavement layers  
D. high wind speeds
29. The basic assumption of plane sections normal to the neutral axis before bending, remaining plane and normal to the neutral axis after bending, leads to :

- A. uniform strain over the beam cross section
  - B. uniform stress over the cross section
  - C. linearly varying strain over the cross section
  - D. stresses which are proportional to strains at all cross sections
30. Negative skin friction occurs when :
- A. an upward drag exists in the pile
  - B. the surrounding soil settles more than the pile
  - C. the pile passes continuously through a firm soil
  - D. the driving operation begins
31. The dimension of a pressure gradient in a fluid flow are :
- A.  $ML^{-1}T^{-2}$
  - B.  $ML^{-3}T^{-2}$
  - C.  $ML^{-2}T^{-2}$
  - D.  $M^{-1}L^{-1}T^{-2}$
32. Maximum strain at the level of compression steel for a rectangular section having effective cover to compression steel as  $d'$  and neutral axis depth from compression face as  $x_u$  is
- A.  $0.0035 (1 - d'/x_u)$
  - B.  $0.002 (1 - d'/x_u)$
  - C.  $0.0035 (1 - x_u/d')$
  - D.  $0.002 (1 - x_u/d')$
33. The correct reinforcement-details at the corner of a rectangular water tank, in horizontal plane is shown by :





D.

34. The maximum shear stress in a solid shaft of circular cross-section having diameter  $d$  subjected to a torque  $T$  is  $\tau$ . If the torque is increased by four times and the diameter of the shaft is increased by two times, the maximum shear stress in the shaft will be  
A.  $2\tau$     B.  $\tau$     C.  $\tau/2$     D.  $\tau/4$
35. In a drained triaxial compression test, a saturated specimen of a cohesionless sand fails under a deviatoric stress of  $3 \text{ kgf/cm}^2$  when the cell pressure is  $1 \text{ kgf/cm}^2$ . The effective angle of shearing resistance of sand is about  
A.  $37^\circ$     B.  $45^\circ$     C.  $53^\circ$     D.  $20^\circ$
36. The particle size distribution curves are extremely useful for the classification of  
A. fine grained soils  
B. coarse grained soils  
C. both coarse grained and fine grained soils  
D. silts and clays
37. If an element of a stressed body is in a state of pure shear with a magnitude of  $80 \text{ N/mm}^2$ , the magnitude of maximum principal stress at that location is  
A.  $80 \text{ N/mm}^2$   
B.  $113.14 \text{ N/mm}^2$   
C.  $120 \text{ N/mm}^2$   
D.  $56.57 \text{ N/mm}^2$
38. Three reservoirs A, B and C are interconnected by pipes as shown in the below figure. Water surface elevations in the reservoirs and the Piezometric Head at the junction J are indicated in the below figure. Discharges  $Q_1$ ,  $Q_2$  and  $Q_3$  are related as  
A.  $Q_1 + Q_2 = Q_3$   
B.  $Q_1 = Q_2 + Q_3$   
C.  $Q_2 = Q_1 + Q_3$   
D.  $Q_1 + Q_2 + Q_3 = 0$

39. Both Reynolds and Froude numbers assume significance in one of following examples :
- Motion of submarine at large depths
  - Motion of ship in deep seas
  - Cruising of a missile in air
  - Flow over spillways
40. A direct shear test was conducted on a cohesionless soil ( $c = 0$ ) specimen under a normal stress of 200 kN/m<sup>2</sup>. The specimen failed at a shear stress of 100 kN/m<sup>2</sup>. The angle of internal friction of the soil (degrees) is
- A. 26.6    B. 29.5    C. 30.0    D. 32.6
41. The following two statements are made with reference to a simply supported under-reinforced RCC beam : Failure takes place by crushing of concrete before the steel has yielded. The neutral axis moves up as the load is increased. With reference to the above statements, which of the following applies ?
- Both the statements are false.
  - I is true but II is false.
  - Both the statements are true.
  - I is false but II is true.
42. In deriving the equation for the hydraulic jump in a rectangular channel in terms of the conjugate depths and the initial Froude number.
- continuity equation and energy equation are used
  - continuity equation and momentum equation are used
  - equations of continuity, momentum and energy are used
  - gradually varied flow equation is used
43. An important purpose of prime coats is to:
- promote the bond between the base and the wearing courses
  - promote the adhesion between an existing wearing surface and a subsequent wearing surface
  - promote the bond between the sub-base course and the sub-grade
  - increase the stability of the sub-grade
44. A trickling filter is primarily a :
- straining process to remove suspended solids from sewage
  - biological oxidation process to remove BOD from sewage
  - straining process to remove turbidity from water
  - straining process to remove bacteria from water
45. A soil having particles of nearly the same size is known as

- A. well graded  
B. uniformly graded  
C. poorly graded  
D. gap graded
46. The ideal form of curve for the summit curve is :  
A. spiral    B. parabola    C. circle    D. lemniscate
47. A septic tank is  
A. an aerobic method of on site sewage treatment  
B. an anaerobic method of on site treatment  
C. a physical method of water treatment  
D. a physicochemical method of water treatment
48. At highway stretches where the required overtaking sight distance cannot be provided, it is necessary to incorporate :  
A. at least twice the stopping sight distance  
B. half the required overtaking sight distance  
C. one-third the required overtaking sight distance  
D. three times the stopping sight distance
49. The members EJ and IJ of steel truss shown in the figure below are subjected to a temperature rise of  $30^{\circ}\text{C}$ . The coefficient of thermal expansion of steel is  $0.000012$  per  $^{\circ}\text{C}$  per unit length. The displacement (mm) of joint E relative to joint H along the direction HE of the truss, is  
A. 0.255    B. 0.589    C. 0.764    D. 1.026
50. A-2-hour unit hydrograph can be approximated as trapezoidal as shown in the below figure. The unit hydrograph refers to catchment of area  
A.  $138.24\text{ km}^2$     B.  $0.0384\text{ km}^2$     C.  $384\text{ m}^2$     D.  $3840\text{ m}^2$

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	B	D	D	A	D	B	C	C	C	B
10	A	B	C	A	A	A	D	B	A	A
20	B	A	C	A	B	C	A	C	A	B
30	C	A	D	C	A	C	A	B	D	A
40	C	C	B	B	B	B	B	A	C	C

### Section 3

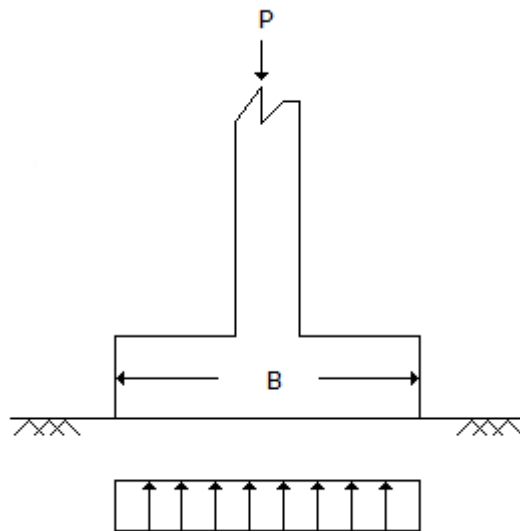
1. If the pump head is 75 m, discharge is 0.464 m<sup>3</sup>/s and the motor speed is 1440 rpm at rated condition, the specific speed of the pump is about  
A. 4      B. 26      C. 38      D. 1440
2. When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as  
A. passive earth pressure  
B. swelling pressure  
C. pore pressure  
D. active earth pressure
3. Two primary air pollutants are  
A. sulphur oxide and ozone  
B. nitrogen oxide and peroxyacetylnitrate  
C. sulphur oxide and hydrocarbon  
D. ozone and peroxyacetylnitrate
4. Flocculation is a process  
A. that removes algae from stabilization pond effluent  
B. that promotes the aggregation of small particles into larger particles to enhance their removal by gravity  
C. both (a) and (b)  
D. none of these.
5. The effective length of a circular electric pole of length  $L$  and constant diameters erected on ground is,  
A.  $0.80 L$       B.  $1.20 L$       C.  $1.50 L$       D.  $2.00 L$
6. The focal length of the object glass of a tacheometer is 200 mm, the distance between the vertical axis of the tachometer and the optical centre of the object glass is 100 mm and the spacing between the upper and lower line of the diaphragm axis is 4 mm. With the line of collimation perfectly horizontal, the staff intercepts are 1 m (top), 2 m (middle), and 3 m (bottom). The horizontal distance (m) between the staff and the instrument station is  
A. 100.3      B. 103.0      C. 150.0      D. 153.0
7. Allowable average shear stress in an un-stiffened web for beams made of steel of grade 250 N/mm<sup>2</sup> is :  
A. 250 N/mm<sup>2</sup>      B. 165 N/mm<sup>2</sup>      C. 150 N/mm<sup>2</sup>      D. 100 N/mm<sup>2</sup>
8. The superelevation needed for a vehicle travelling at a speed of 60 kmph on a curve of radius 128 m on a surface with a coefficient of friction of 0.15 is :  
A. 0.71      B. 0.81      C. 0.91      D. 0.61

9. The plastic modulus of a section is  $4.8 \times 10^{-4} \text{ m}^3$ . The shape factor is 1.2. The plastic moment capacity of the section is 120 kN.m. The yield stress of the material is  
 A. 100 MPa    B. 240 MPa    C. 250 MPa    D. 300 MPa
10. A propped cantilever beam is shown in the below figure. The plastic moment capacity of the beam is  $M_0$ . The collapse load  $P$  is  
 A.  $4 M_0/L$   
 B.  $6 M_0/L$   
 C.  $8 M_0/L$   
 D.  $12 M_0/L$
11. The removal of dissolved organic matter occurs in  
 A. slow sand filters  
 B. trickling filters  
 C. rapid sand filters  
 D. dual media filters
12. The toughness index of clayey soils is given by  
 A. Plasticity index/Flow index  
 B. Liquid limit/Plastic limit  
 C. Liquidity index/Plastic limit  
 D. Plastic limit/Liquidity index
13. A cantilever beam is shown in the below figure. The moment to be applied at free end for zero vertical deflection at that point is  
 A. 9 kN.m clock wise  
 B. 9 kN.m anti-clockwise  
 C. 12 kN.m clockwise  
 D. 12 kN.m anti-clockwise
14. The order of the flexibility matrix for a structure is,  
 A. equal to the number of redundant forces  
 B. more than the number of redundant forces  
 C. less than the number of redundant forces  
 D. equal to the number of redundant forces plus three
15. The Bowen ratio is defined as :  
 A. Ratio of heat and vapour diffusivities.  
 B. Proportionality constant between vapour heat flux and sensible heat flux.  
 C. Ratio of actual evapotranspiration and potential evapotranspiration.

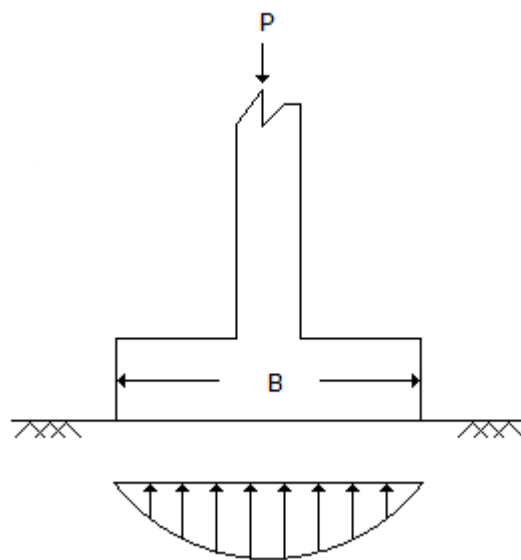


- D. Proportionality constant between heat energy used up in evaporation and the bulk radiation from a water body.
16. Water flows at a depth of 0.1 m with a velocity of 6 m/s in a rectangular channel. The alternate depth is  
 A. 0.30 m    B. 0.40 m    C. 0.86 m    D. 0.81 m
17. Two footings, one circular and the other square, are founded on the surface of a purely cohesionless soil. The diameter of the circular footing is same as that of the side of the square footing. The ratio of their ultimate bearing capacities is  
 A.  $3/4$     B.  $4/3$     C. 1.0    D. 1.3
18. An isochrone is a line on the basin map  
 A. Joining raingauge stations having equal rainfall-duration  
 B. Joining points having equal rainfall depth in a given time interval  
 C. Joining points having equal time of travel of surface runoff to the catchment outlet  
 D. Joining points which are at equal distance from the catchment outlet
19. Muskingum method for routing of flood  
 A. is used for routing floods through reservoirs  
 B. is a method of routing that uses continuity the momentum equations  
 C. is a hydrologic method of routing floods through streams  
 D. is one in which only energy equation is used
20. A frame ABCD is supported by a roller at A and is on a hinge at C as shown below The reaction at the roller end A is given by  
 A. P    B. 2P    C.  $P/2$     D. Zero.
21. On an immersed body in a flowing fluid the lift force is :  
 A. due to buoyant force  
 B. always in the opposite direction to gravity  
 C. due to Wake phenomenon  
 D. the dynamic fluid-force component normal to approach velocity
22. In a section, shear centre is a point through which, if the resultant load passes, the section will not be subjected to any  
 A. Bending    B. Tension    C. Compression    D. Torsion
23. Which one of the following conditions, both elastic and plastic methods of analysis of indeterminate structures have to satisfy ?  
 A. yield condition  
 B. mechanism condition

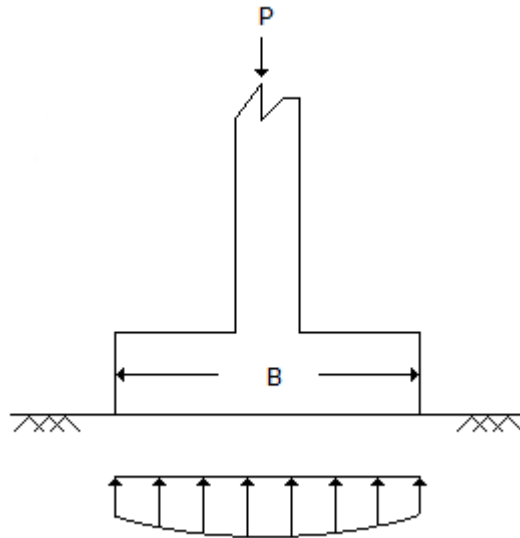
- C. equilibrium  
 D. compatibility of deformation
24. The nature of contact pressure distribution under a rigid footing resting on a sandy soil and subjected to uniformly distributed load is as shown in :



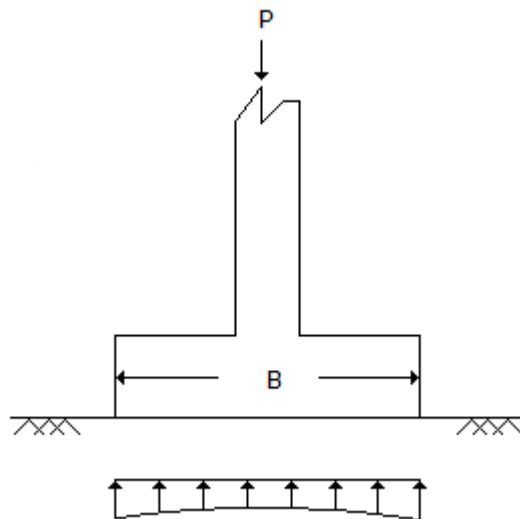
A.



B.



C.



D.

25. Bituminous materials are used in highway construction primarily because of their :
- A. cementing and water-proofing properties
  - B. load bearing capacity
  - C. high specific gravity
  - D. black colour which facilitates road markings
26. The comparison between pumps operating in series and in parallel is :
- A. Pumps operating in series boost the discharge, whereas pumps operating in parallel boost the head.

- B. Pumps operating in parallel boost the discharge, whereas pumps operating in series boost the head.
  - C. In both cases there would be a boost in discharge only.
  - D. In both cases there would be a boost in head only.
27. At highway stretches where the required overtaking sight distance cannot be provided, it is necessary to incorporate in such sections the following :
- A. at least twice the stopping sight distance
  - B. half of the required overtaking sight distance
  - C. one third of the required overtaking sight distance
  - D. three times the stopping sight distance.
28. A pile of 0.50 m diameter and of length 10 m is embedded in a deposit of clay. The un-drained strength parameters of the clay are cohesion = 60 kN/m<sup>2</sup> and the angle in internal friction = 0. The skin friction capacity (kN) of the pile for an adhesion factor of 0.6, is
- A. 671      B. 565      C. 283      D. 106
29. A roundabout is provided with an average entry width of 8.4 m, width of weaving section as 14 m, and length of the weaving section between channelizing islands as 35 m. The crossing traffic and total traffic on the weaving section are 1000 and 2000 PCU per hour respectively. The nearest rounded capacity of the roundabout (in PCU per hour) is
- A. 3300      B. 3700      C. 4500      D. 5200
30. The shape of the STOP sign according to IRC:67-2001 is
- A. circular      B. triangular      C. octagonal      D. rectangular
31. The force in the member DE of the truss shown in the below figure is,
- A. 100.0 kN      B. zero      C. 35.5 kN      D. 25.0 kN
32. The degree of static indeterminacy of the rigid frame having two internal hinges as shown in the figure below, is
- A. 8      B. 7      C. 6      D. 5
33. Excessive fluoride in drinking water causes
- A. Alzheimer's disease
  - B. Mottling of teeth and embrittlement of bones
  - C. Methemoglobinemia
  - D. Skin cancer
34. The proposed dam shown in the below figure is 90 m long and coefficient of permeability of the soil is 0.0013 mm/second. The quantity of water (m<sup>3</sup>) that will be lost per day, by seepage is (rounded to the nearest number):
- A. 55      B. 57      C. 59      D. 61

35. A 1 : 30 model of an ogee spillway crest records an acceleration of 1.3 m/s<sup>2</sup> at a certain location. The homologous value of the acceleration in the prototype in m/s<sup>2</sup> , is  
 A. 0.043      B. 0.237      C. 1.300      D. 7.120
36. The value of the camber recommended for cement concrete roads in areas of heavy rainfall is :  
 A. 1 in 25      B. 1 in 33      C. 1 in 40      D. 1 in 50
37. A waste water sample diluted to 100 times with aeration water had an initial dissolved oxygen (DO) of 7.0 mg/l and after 5 days of incubation at 20°C, the DO was zero. The BOD of waste water is :  
 A. 700 mg/l  
 B. 100 mg/l  
 C. cannot be determined  
 D. 7mg/l
38. For the strip footing on a saturated clay, for the given failure surface as shown in the below figure, the bearing capacity equation takes the form : (where  $C_u$  - undrained shear strength  $\phi_u$  - angle of internal friction  $B$  - width of strip footing  $q_c$  - ultimate bearing capacity of soil)  
 A.  $5.7 C_u$       B.  $5.14 C_u$       C.  $4\pi C_u$       D.  $2\pi C_u$
39. A soil mass has coefficients of horizontal and vertical permeability as  $9 \times 10^{-7}$  cm/s and  $4 \times 10^{-7}$  cm/s, respectively. The transformed coefficient of permeability of an equivalent isotropic soil mass is  
 A.  $9 \times 10^{-7}$  cm/s  
 B.  $4 \times 10^{-7}$  cm/s  
 C.  $13 \times 10^{-7}$  cm/s  
 D.  $6 \times 10^{-7}$  cm/s
40. A reinforced concrete wall carrying vertical loads is generally designed as per recommendations given for columns. The ratio of minimum reinforcements in the vertical and horizontal directions is  
 A. 2 : 1      B. 5 : 3      C. 1 : 1      D. 3 : 5
41. The total active thrust on a vertical wall 3m high retaining a horizontal sand backfill (unit weight  $\gamma_t = 20$  kN/m<sup>3</sup>, angle of shearing resistance  $\phi' = 30^\circ$ ) when the water table is at the bottom of the wall, will be:  
 A. 30 kN/m      B. 35 kN/m      C. 4 kN/m      D. 45 kN/m
42. Reaction at support b of the structure is  
 A.  $P$       B.  $P/2$       C.  $\frac{P}{\sqrt{2}}$       D.  $\frac{P}{2}$

43. In cohesive soils the depth of tension crack ( $Z_{cr}$ ) is likely to be

- A.  $Z_{cr} \geq \frac{2c}{\gamma} \sqrt{\tan \left( 45^\circ - \frac{\phi}{2} \right)}$       B.  $X_{cr} \geq \frac{2c}{\gamma} \sqrt{\tan \left( 45^\circ + \frac{\phi}{2} \right)}$       C.  $Z_{cr} \geq \frac{4c}{\gamma} \sqrt{\tan \left( 45^\circ - \frac{\phi}{2} \right)}$   
D.  $Z_{cr} \geq \frac{4c}{\gamma} \sqrt{\tan \left( 45^\circ + \frac{\phi}{2} \right)}$

44. A vertical rod PQ of length L is fixed at its top end P and has a flange fixed to the bottom end Q. A weight W is dropped vertically from a height h ( $< L$ ) on to the flange. The axial stress in the rod can be reduced by

- A. increasing the length of the rod  
B. decreasing the length of the rod  
C. decreasing the area of cross-section of the rod  
D. increasing the modulus of elasticity of the material

45. Compaction by vibratory roller is the best method of compaction in case of

- A. moist silty sand  
B. well graded dry sand  
C. clay of medium compressibility  
D. silt of high compressibility

46. Design rate of super elevation for horizontal highway curve of radius 450 m for a mixed traffic condition, having a speed of 125 km/hour is  
A. 1.0      B. 0.05      C. 0.07      D. 0.154

47. A mild steel specimen is under uni-axial tensile stress. Young's modulus and yield stress for mild steel are  $2 \times 10^5$  MPa and 250 MPa respectively. The maximum amount of strain energy per unit volume that can be stored in this specimen without permanent set, is

- A. 156 Nmm/mm<sup>3</sup>  
B. 15.6 Nmm/mm<sup>3</sup>  
C. 1.56 Nmm/mm<sup>3</sup>  
D. 0.156 Nmm/mm<sup>3</sup>

48. Rivets and bolts subjected to both shear stress ( $\tau_{vf}$ , cal) and axial tensile stress ( $\sigma_{tf}$ , cal) shall be so proportioned that the stresses do not exceed the respective allowable stresses  $\tau_{vf}$  and  $\sigma_{tf}$  and the value of exceed does not exceed

- A. 1.0      B. 1.2      C. 1.4      D. 1.8

49. Standard 5-day BOD of a waste water sample is nearly x% of the ultimate BOD, where x is

- A. 48      B. 58      C. 68      D. 78

50. A two lane single carriage-way is to be designed for a design life period of 15 years. Total two-way traffic intensity in the year of completion of construction is expected to be 2000 commercial vehicles per day. Vehicle damage factor = 3.0, Lane distribution factor = 0.75. Assuming an annual rate of traffic growth as 7.5%, the design traffic expressed as cumulative number of standard axles, is

A.  $42.9 \times 10^6$       B.  $22.6 \times 10^6$       C.  $10.1 \times 10^6$       D.  $5.3 \times 10^6$

**Answer Key**

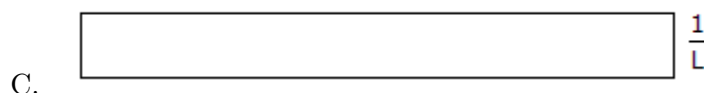
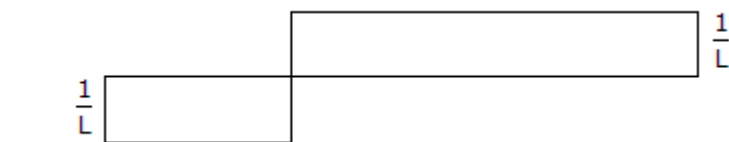
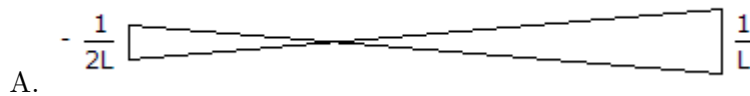
	1	2	3	4	5	6	7	8	9	0
0	C	D	C	B	D	A	D	A	C	B
10	B	A	D	A	D	D	D	C	B	D
20	B	D	D	B	A	B	A	B	B	C
30	B	D	B	D	C	D	A	B	D	A
40	A	A	B	A	B	D	D	C	C	A

## Section 4

1. At the same mean velocity, the ratio of head loss per unit length for a sewer pipe flowing full to that for the same pipe flowing half full would be :  
A. 2.0      B. 1.63      C. 1.00      D. 0.61
2. As per IS : 800-1984 the minimum pitch of rivets in a row is recommended as the diameter of the rivet times  
A. 2.0      B. 2.5      C. 3.0      D. 4.0
3. The ordinate of the Instantaneous Unit Hydrograph (IUH) of a catchment at any time  $t$ , is  
A. The slope of the 1-hour unit hydrograph at that time  
B. The slope of the direct runoff unit hydrograph at that time  
C. Difference in the slope of the  $S$ -curve and 1-hour unit hydrograph  
D. The slope of the  $S$ -curve with effective rainfall intensity of 1 cm/hr
4. Water emerges from an ogee spillway with velocity 13.72 m/s and depth = 3.0 m at its toe. The tail water depth required to form a hydraulic jump at the toe is  
A. 6.48 m      B. 5.24 m      C. 3.24 m      D. 2.24 m
5. In a BOD test, 5 ml of waste is added to 295 ml of aerated pure water. Initial dissolved oxygen (D.O) content of the diluted sample is 7.8 mg/l. After 5 days of incubation at 20°C, the D.O. content of the sample is reduced to 4.4 mg/l. The BOD of the waste water is :  
A. 196 mg/l      B. 200 mg/l      C. 204 mg/l      D. 208 mg/l
6. The lateral ties in a reinforced concrete rectangular column under axial compression are used to :  
A. avoid the buckling of the longitudinal steel under compression  
B. provide adequate shear capacity  
C. provide adequate confinement to concrete  
D. reduce the axial deformation of the column
7. The specific gravity of paving bitumen as per IS:73-1992 lies between  
A. 1.10 and 1.06      B. 1.06 and 1.02      C. 1.02 and 0.97      D. 0.97 and 0.92
8. A linear relationship is observed between speed and density on a certain section of a highway. The free flow speed is observed to be 80 km per hour and the jam density is estimated as 100 vehicles per km length. Based on the above relationship, the maximum flow expected on this section and the speed at the maximum flow will respectively be



- A. 8000 vehicles per hour and 80 km per hour  
 B. 8000 vehicles per hour and 25 km per hour  
 C. 2000 vehicles per hour and 80 km per hour  
 D. 2000 vehicles per hour and 40 km per hour
9. The ratio of unconfined compressive strength of an undisturbed sample of soil to that of a remoulded sample, at the same water content, is known as :  
 A. activity      B. damping      C. plasticity      D. sensitivity
10. The modulus of rupture of concrete gives  
 A. the direct tensile strength of the concrete  
 B. the direct compressive strength of the concrete  
 C. the tensile strength of the concrete under bending  
 D. the characteristic strength of the concrete
11. The total length (in km) of the existing National Highways in India is in the range of  
 A. 15, 000 to 25, 000  
 B. 25, 000 to 35, 000  
 C. 35, 000 to 45, 000  
 D. 45, 000 to 55, 000
12. A direct runoff hydrograph due to an isolated storm with an effective rainfall of 2 cm was trapezoidal in shape as shown in the below figure. The hydrograph corresponds to a catchment area (in sq. km) of  
 A. 790.2      B. 599.4      C. 689.5      D. 435.3
13. A simply supported beam with an overhang is traversed by a unit concentrated moment from the left to the right as shown below. The influence line for reaction at B is given by



D. zero everywhere.

14. The parameters in Horton's infiltration equation are given as,  $f_0 = 7.62$  cm/hour,  $f_c = 1.34$  cm/hour and  $k = 4.182$ /hour. For assumed continuous ponding the cumulative infiltration at the end of 2 hours is  
 A. 2.68 cm      B. 1.50 cm      C. 1.34 cm      D. 4.18 cm
15. The temporary hardness of water, is caused by:  
 A. dissolved carbondioxide  
 B. bicarbonates and carbonates of calcium and magnesium  
 C. bicarbonates of sodium and potassium  
 D. carbonates of calcium and magnesium
16. Rotational stiffness-coefficient,  $K_{11}$  for the frame having two members of equal  $EI/l$  is given by :  
 A.  $5 EI/l$   
 B.  $6 EI/l$   
 C.  $7 EI/l$   
 D.  $8 EI/l$
17. The plan of a survey plotted to a scale of 10 m to 1 cm is reduced in such a way that a line originally 10 cm long now measures 9 cm. The area of the reduced plan is measured as 81 cm<sup>2</sup>. The actual (m<sup>2</sup>) of the survey is  
 A. 10000      B. 6561      C. 1000      D. 656
18. Width of carriage way for a single lane is recommended to be  
 A. 7.5 m      B. 7.0 m      C. 3.75 m      D. 5.5 m
19. The shape of the cross-section, which has the largest shape factor, is  
 A. rectangular      B. I-section      C. diamond      D. solid circular
20. The unit of dynamic viscosity of a fluid is  
 A.  $m^2/s$   
 B.  $Ns/m^2$   
 C.  $Pa \cdot s/m^2$   
 D.  $kg \cdot s^2/m^2$
21. A point load of 700 kN is applied on the surface of thick layer of clay. Using Boussinesq's elastic analysis, the estimated vertical stress ( $\sigma_v$ ) at a depth of 2 m and a radial distance of 1.0 m from the point of application of the load, is :  
 A. 47.5 kPa      B. 47.6 kPa      C. 47.7 kPa      D. 47.8 kPa
22. The liquid limit (LL), plastic limit (PL) and shrinkage limit (SL) of a cohesive soil satisfy the relation  
 A.  $LL \geq PL \geq SL$   
 B.  $LL \geq PL \leq SL$

- C.  $LL \downarrow PL \downarrow SL$   
D.  $LL \downarrow PL \downarrow SL$
23. A propped cantilever beam of span L, is loaded with uniformly distributed load of intensity w/unit length, all through the span. Bending moment at the fixed end is,  
A.  $\frac{wL^2}{8}$       B.  $\frac{wL^2}{2}$       C.  $\frac{wL^2}{12}$       D.  $\frac{wL^2}{24}$
24. The sequent depth ratio of a hydraulic jump in a rectangular horizontal channel is 10.30. The Froude Number at the beginning of the jump is :  
A. 5.64      B. 7.63      C. 8.05      D. 13.61
25. Shear centre for an angle-purlin as shown in the below figure is located at,  
A. X      B. Y      C. Z      D. none
26. If  $\phi$  = nominal diameter of reinforcing bar,  $f_s$  = compressive stress in the bar and  $f_{bd}$  = design bond stress of concrete, the anchorage length,  $L_a$  of straight bar in compression is equal to :  
A.  $L_a = \frac{\phi f_s}{f_{bd}}$       B.  $L_a = \frac{\phi f_s}{2 f_{bd}}$       C.  $L_a = \frac{\phi f_s}{\pi f_{bd}}$       D.  $L_a = \frac{\phi f_s}{4 f_{bd}}$
27. Alligator or map cracking is the common type of failure in  
A. concrete pavements  
B. bituminous surfacing  
C. gravel roads  
D. WBM construction
28. A steel beam supporting loads from the floor slab as well as from wall is termed as  
A. Stringer beam      B. Lintel beam      C. Spandrel beam      D. Header beam
29. For an anisotropic soil, permeabilities in x and y directions are  $k_x$  and  $k_y$  respectively in a two dimensional flow. The effective permeability  $k_{eq}$  for the soil is given by  
A.  $k_x + k_y$   
B.  $k_x/k_y$   
C.  $(k_x^2 + k_y^2)^{1/2}$   
D.  $(k_x k_y)^{1/2}$
30. Chemical oxygen Demand (COD) of a sample is always greater than Biochemical Oxygen Demand (BOD) since it represents :  
A. biodegradable organic matter only

- B. biodegradable and non-biodegradable organic matter
  - C. non-biodegradable organic matter
  - D. inorganic matter
31. For the determination of earth pressure, Coulomb's wedge theory assumes that:
- A. the back of wall is smooth and vertical
  - B. the soil is non-homogeneous and anisotropic
  - C. the slip surface is circular
  - D. the wall surface is rough
32. The degree of kinematic indeterminacy of the rigid frame with clamped ends at A and D shown in the below figure is,
- A. 4      B. 3      C. 2      D. zero
33. The dimensions for the flexural rigidity of a beam element in mass (M), length (L) and time (T) is given by
- A.  $MT^{-2}$
  - B.  $ML^3T^{-2}$
  - C.  $ML^{-1}T^{-2}$
  - D.  $M^{-1}T^2$
34. The centre of pressure of a liquid on a plane surface immersed vertically in a static body of liquid, always lies below the centroid of the surface area, because
- A. in liquids the pressure acting is same in-all directions
  - B. there is no shear stress in liquids at rest
  - C. the liquid pressure is constant over depth
  - D. the liquid pressure increases linearly with depth
35. The most commonly used sampler for obtaining a disturbed sample of the soil is
- A. split spoon sampler
  - B. open drive sampler
  - C. piston sampler
  - D. thin wall shelby tube sampler
36. The two criteria for the determination of allowable bearing capacity of a foundation are
- A. tensile failure and compression failure.
  - B. tensile failure and settlement.
  - C. bond failure and shear failure.
  - D. shear failure and settlement.

37. The time for a clay layer to achieve 90% consolidation is 15 years. The time required to achieve 90% consolidation; if the layer were twice as thick, 3 times forr permeable and 4 times more compressible would be :  
 A. 70 years      B. 75 years      C. 80 years      D. 85 years
38. If soil is dried beyond its shrinkage limit, it will show :  
 A. Large volume change  
 B. Moderate volume change  
 C. Low volume change  
 D. No volume change
39. If YY is the centroidal axis of a T beam-section subjected to plastic moment,  $M_p$ , the neutral axis lies,  
 A. above the line ZZ  
 B. between the lines YY and ZZ  
 C. between the lines XX and YY  
 D. below the line XX
40. The expression for the specific speed of a pump :  
 A. does not include the diameter of the impeller  
 B. yields larger values for radial pumps than for axial flow pump  
 C. is necessarily non dimensional  
 D. includes power as one of the variables
41. A parabolic curve is used to connect a 4% upgrade with a 2% down-grade as shown in the below figure. The highest point on the summit is at a distance of (measured horizontally from the first tangent point - (FTP)  
 A. 50 m      B. 60 m      C. 75 m      D. 100 m
42. A deep cut of 7 m has to be made in a clay with unit weight 16 kN/m<sup>3</sup> and a cohesion of 25 kN/m<sup>2</sup>. What will be the factor of safety if one has to have a slope angle of 30° ? Stability number is given to be 0.178 (from Taylor's chart) for a depth factor of 3.  
 A. 0.80      B. 1.1      C. 1.25      D. 1.0
43. An inverted siphon is a  
 A. device for distributing septic tank effluent to a soil absorption system  
 B. device for preventing overflow from elevated water storage tank  
 C. device for preventing crown corrosion of sewer  
 D. section of sewer which is dropped below the hydraulic grade line in order to avoid an obstacle.

44. The main constituents of gas generated during the anaerobic digestion of sewage sludge are :
- carbon dioxide and methane
  - methane and ethane
  - carbon dioxide and carbon monoxide
  - carbon monoxide and nitrogen
45. Two samples of water A and B have pH values of 4.4 and 6.4 respectively. How many times more acidic sample A is than sample B ?  
 A. 0      B. 50      C. 100      D. 200
46. A weir on a permeable foundation with downstream sheet pile is shown in the figure below. The exit gradient as per Khosla's method is  
 A. 1 in 6.0      B. 1 in 5.0      C. 1 in 3.4      D. 1 in 2.5
47. Which one of the following set of values give the minimum clear cover (in mm) for the main reinforcements in the slab, beam, column and footing, respectively, according to IS : 456-1978 ?  
 A. 20, 25, 30, 75  
 B. 5, 15, 25, 50  
 C. 15, 25, 40, 75  
 D. none of the above
48. Two flow patterns are represented by their stream functions  $\psi_1$  and  $\psi_2$  as given below:  $\psi_1 = x^2 + y^2$ ,  $\psi_2 = 2xy$  If these two patterns are superimposed on one another, the resulting streamline pattern can be represented by one of the following :  
 A. A family of parallel straight lines  
 B. A family of circles  
 C. A family of parabolas  
 D. A family of hyperbolas
49. The forces in members 'a, b, c' in the truss shown are, respectively
- $P$ ,  $\frac{P}{2}$ , 0
  - $\frac{P}{2}$ ,  $P$ , 0
  - $P$ ,  $P$ ,  $P$
  - $\frac{P}{2}$ ,  $\frac{P}{2}$ , 0
50. The plan of stairs supported at each end by landings spanning parallel with risers is shown in the below figure. The effective span of staircase slab is  
 A. 3000 mm      B. 4600 mm      C. 4750 mm      D. 6400 mm

	1	2	3	4	5	6	7	8	9	0
0	B	B	D	C	B	A	C	D	D	C
10	B	B	A	C	B	C	A	C	C	B
20	D	B	A	B	A	D	B	A	D	B
30	D	B	D	D	A	D	C	D	B	C
40	C	C	D	A	C	C	C	B	A	B

**Answer Key**

## Section 5

- The value of bearing capacity factor for cohesion,  $N_c$ , for piles as per Meyerhof, is taken as :  
A. 6.2      B. 12.0      C. 9.0      D. 5.14
- Permissible bending tensile stress in high yield strength deformed bars of grade 415 N/mm<sup>2</sup> in a beam is :  
A. 190 N/mm<sup>2</sup>  
B. 230 N/mm<sup>2</sup>  
C. 140 N/mm<sup>2</sup>  
D. None of the above
- The equation along a stream line holds true for :  
A. steady, frictionless, compressible fluid  
B. steady, uniform, incompressible fluid  
C. steady, frictionless, incompressible fluid  
D. unsteady incompressible fluid
- An outlet irrigates an area of 20 ha. The discharge (l/s) required at this outlet to meet the evapotranspiration requirement of 20 mm occurring uniformly in 20 days neglecting other field losses is  
A. 2.52      B. 2.31      C. 2.01      D. 1.52
- A stable channel is to be designed for a discharge of  $Q$  m<sup>3</sup> /s with silt factor  $f$  as per Lacey's method. The mean flow velocity (m/s) in the channel is obtained by  
A.  $(Qf^2/140)^{1/6}$   
B.  $(Qf/140)^{1/3}$   
C.  $(Q^2f^2/140)^{1/6}$   
D.  $0.48 (Q/f)^{1/3}$
- The problem of lateral buckling can arise only in those steel beams which have  
A. Moment of inertia about the bending axis larger than the other  
B. Moment of inertia about the bending axis smaller than the other  
C. Fully supported compression flange  
D. None of the above.
- The maximum tensile stress at the section X-X shown in the figure below is  
A.  $\frac{8P}{bd}$       B.  $\frac{6P}{bd}$       C.  $\frac{4P}{bd}$       D.  $\frac{2P}{bd}$
- Mud pumping is commonly associated with  
A. bituminous penetration macadam construction



- B. cement concrete pavement on granular subgrade
  - C. premixed bituminous construction
  - D. cement concrete pavement on clay sub-grade
9. The most important water quality parameter for domestic use of water is
- A. carbonate hardness
  - B. non-carbonate hardness
  - C. coliform group of organisms
  - D. chlorides
10. Rapid curing cut back bitumen is produced by blending bitumen with
- A. Kerosene    B. Benzene    C. Diesel    D. Petrol
11. A pre-tensioned concrete member of section 200 mm x 250 mm contains tendons of area 500 mm<sup>2</sup> at centre of gravity of the section. The prestress in the tendons is 1000 N/mm<sup>2</sup>. Assuming modular ratio as 10, the stress (N/mm<sup>2</sup>) in concrete is
- A. 11    B. 9    C. 7    D. 5
12. A river 5 m deep consists of a sand bed with saturated unit weight of 20 kN/m<sup>3</sup> .  $\gamma_w = 9.81 \text{ kN/m}^3$ . The effective vertical stress at 5 m from the top of sand bed is
- A. 41 kN/m<sup>2</sup>    B. 51 kN/m<sup>2</sup>    C. 55 kN/m<sup>2</sup>    D. 53 kN/m<sup>2</sup>
13. Biochemical oxygen demand (BOD) of waste water is a measure of
- A. total concentration of a biochemicals
  - B. total concentration of organic matter
  - C. concentration of biodegradable organic matter
  - D. concentration of chemically oxidisable matter
14. The effective width of a reinforced concrete T beam flange under compression, according to IS : 456-1978, given  $I_0$  is the distance between the adjacent zero moment points,  $b$  is the breadth of the rib and  $D$  is the thickness of the flange, is
- A.  $\frac{I_0}{6} + b + 6D$     B.  $I_0 + 6D$     C.  $\frac{I_0}{6} + 6D$     D.  $\frac{I_0}{6} + b$
15. In using the data from a plate bearing test for determining the modulus of subgrade reaction, the value of settlement to be used is :
- A. 1.25 mm    B. 2.50 mm    C. 3.75 mm    D. 1.75 mm
16. The net effective cross sectional area calculated in the steel angle tension member design, accounts for:
- A. the tensile force and bolt holes
  - B. the eccentricity of the end connections and the bolt holes
  - C. the effectiveness of the tack connection along the length

- D. the effectiveness of the end connection
17. A light house of 120 m height is just visible above the horizon from a ship. The correct distance (m) between the ship and the light house considering combined correction for curvature and refraction, is  
A. 39.098      B. 42.226      C. 39098      D. 42226
18. Water distribution systems are sized to meet the  
A. maximum hourly demand  
B. average hourly demand  
C. maximum daily demand and fire demand  
D. average daily demand and fire demand.
19. Determine the correctness of otherwise of the following Assertion [A] and the Reason [R]. Assertion [A] : The crown of the outgoing larger diameter sewer is always matched with the crown of incoming smaller diameter sewer. Reason [R] : It eliminates backing up of sewage in the incoming smaller diameter sewer.  
A. Both [A] and [R] are true and [R] is the correct reason for [A]  
B. Both [A] and [R] are true and [R] is not the correct reason for [A]  
C. Both [A] and [R] are false  
D. [A] is true but [R] is false
20. For the structure shown below, the vertical deflection at point A is given by  
A.  $\frac{PL^3}{81 EI}$       B.  $\frac{2 PL^3}{81 EI}$       C. Zero      D.  $\frac{PL^3}{72 EI}$
21. In highway pavements emulsions are mainly used in :  
A. surface dressing  
B. patching and maintenance operation  
C. bitumen macadam  
D. asphaltic concrete
22. While deriving an expression for loss of head due to a sudden expansion in a pipe, in addition to the continuity and impulse-momentum equations, one of the following assumptions is made :  
A. Head loss due to friction is equal to the head loss in eddying motion  
B. The mean pressure in eddying fluid is equal to the downstream pressure  
C. The mean pressure in eddying fluid is equal to the upstream pressure

- D. Head lost in eddies is neglected
23. A three hinged arch shown in the below figure is quarter of a circle, If the vertical and horizontal components of reaction at A are equal, the value of  $\theta$  is
- $60^\circ$
  - $45^\circ$
  - $30^\circ$
  - None in  $(0^\circ, 90^\circ)$
24. The appropriate field test to determine the insitu undrained shear strength of soft clay is :
- plate load test
  - static cone penetration test
  - standard penetration test
  - vane shear test
25. Generally the maximum deflection/span ratio of a steel member should not exceed
- $\frac{1}{750}$
  - $\frac{1}{500}$
  - $\frac{1}{325}$
  - $\frac{1}{250}$
26. A continuous beam is loaded as shown in the figure below. Assuming a plastic moment capacity equal to  $M_P$ , the minimum load at which the beam would collapse is
- $\frac{4M_P}{L}$
  - $\frac{6M_P}{L}$
  - $\frac{8M_P}{L}$
  - $\frac{10M_P}{L}$
27. Delta ( $\Delta$ ) in cm. Duty (D) in hectare Cumec and Base period (B) in days are related as
- $\Delta = 864 B/D$
  - $B = 864 D/\Delta$
  - $B = 864 \Delta/D$
  - $D = 8.64 B/\Delta$
28. The penetration test for bitumen is conducted at a temperature of
- $60^\circ\text{C}$
  - $37^\circ\text{C}$
  - $25^\circ\text{C}$
  - $50^\circ\text{C}$
29. If a single pipe of length L and diameter D is to be replaced by three pipes of same material, same length and equal diameter d ( $d \leq D$ ), to convey the same total discharge under the same head loss, then d and D are related by
- $d = \frac{D}{3^{2/5}}$
  - $d = \frac{D}{2^{5/3}}$
  - $d = \frac{D}{3^{2/3}}$
  - $d = \frac{D}{2^{3/2}}$
30. According to Darcy's law for flow through porous media, the velocity is proportional to

- A. Effective stress
  - B. hydraulic gradient
  - C. cohesion
  - D. stability number
31. Storage coefficient of a compressible confined aquifer is a function of
- A. specific weight of water, thickness of the aquifer, compressibility of the aquifer and that of water
  - B. permeability, thickness and compressibility of aquifer and compressibility of water
  - C. transmissibility of the aquifer and compressibility of water
  - D. transmissibility of aquifer and specific yield of aquifer
32. Factor of safety adopted by IS : 800 - 1984 while arriving at the permissible stress in axial compression, is :
- A. 2.00      B. 1.00      C. 1.67      D. 1.50
33. Well foundations are commonly used as foundations for the following structures :
- A. Water tanks
  - B. Bridges
  - C. Buildings
  - D. Reciprocating machines
34. The consistency of a saturated cohesive soil is affected by
- A. water content
  - B. particle size distribution
  - C. density index
  - D. coefficient of permeability
35. The following two statements are made with reference to the planar truss shown below The truss is statically determinate The truss is kinematically determinate With reference to the above statements, which of the following applies ?
- A. Both statements are true.
  - B. Both statements are false.
  - C. II is true but I false.
  - D. I is true but II is false.
36. The total thickness of pavement by CBR method depends on the CBR value of
- A. base course      B. surface course      C. subgrade      D. all layers
37. The standard plate size in a plate bearing test for finding modulus of subgrade reaction (k) value is

- A. 100 cm diameter.  
 B. 50 cm diameter.  
 C. 75 cm diameter.  
 D. 25 cm diameter.
38. The strain energy stored in member AB of the pin-jointed truss shown in the below figure, when E and A are same for all members, is  
 A.  $2P^2L/AE$   
 B.  $P^2L/AE$   
 C.  $P^2L/2AE$   
 D. Zero
39. In a river, discharge is 173 m<sup>3</sup>/s; water surface slope is 1 in 6000; and stage at the gauge station is 10.0 m. If during a flood, the stage at the gauge station is same and the water surface slope is 1 in 2000, the flood discharge in m<sup>3</sup>/s, is approximately  
 A. 371      B. 100      C. 519      D. 300
40. In an area of 200 hectare, water table drops by 4 m. If the porosity is 0.35 and the specific retention is 0.15, change in volume of storage in the aquifer is  
 A. 160 m<sup>3</sup>  
 B.  $1.6 \times 10^6$  m<sup>3</sup>  
 C.  $8 \times 10^6$  m<sup>3</sup>  
 D.  $1.6 \times 10^3$  m<sup>3</sup>
41. The water surface profile resulting from flow underneath the gate in the below figure is :  
 A.  $H_1 - 3$       B.  $M_1 - 1$       C.  $H_2 - 2$       D.  $S_2 - 2$
42. A cantilever beam of span 'L' is loaded with a concentrated load 'P' at the free end. Deflection of the beam at the free end is  
 A.  $\frac{PL^3}{48 EL}$       B.  $\frac{5 PL^3}{384 EL}$       C.  $\frac{PL^3}{3 EL}$       D.  $\frac{PL^3}{6 EL}$
43. The Piezometric head at point C, in the experimental set-up shown in the below figure when the flow takes place under a constant head through the soils A and B is  
 A. 0 cm      B. 40 cm      C. 80 cm      D. 120 cm
44. If an ascending gradient of 1 in 50 meets another ascending gradient of 1 in 30 then the deviation angle is :  
 A.  $\frac{1}{50}$       B.  $\frac{1}{75}$       C.  $\frac{1}{30}$       D.  $\frac{8}{150}$
45. Bending moments at joint b and c of the portal frame are respectively :

- A.  $+ p l/2, - p l/2$   
 B.  $+ p l/2, + p l/2$   
 C.  $+ p l/4, - p l/4$   
 D.  $+ p l/4, + p l/4$
46. Generally (fatigue life of welded steel structure/fatigue life of riveted steel structure) ratio is,  
 A. smaller than 1  
 B. equal to 1  
 C. greater than 1  
 D. greater than 2.1
47. Cohesion in soil  
 A. decreases active pressure and increases passive resistance  
 B. decreases both active pressure and passive resistance  
 C. increases the active pressure and decreases the passive resistance  
 D. increases both active pressure and passive resistance.
48. The unit weight of a soil at zero air voids depends on :  
 A. specific gravity  
 B. water content  
 C. unit weight of water  
 D. all the above
49. The BOD removal efficiency, in percentage, during primary treatment under normal conditions is about  
 A. 65%    B. 85%    C. 30%    D. Zero
50. The settlement of prototype in granular material may be estimated using plate load test data from the following expression :

A.  $S_{prototype} = S_{plate} \times \left( \frac{B_{prototype}}{B_{plate}} \right)$

B.  $S_{prototype} = S_{plate} \times \left( \frac{B_{plate}}{B_{prototype}} \right)$

C.  $S_{prototype} = S_{plate} \times \left[ \frac{2B_{prototype}}{B_{prototype} + B_{plate}} \right]^2$

D.  $S_{prototype} = S_{plate} \times \left[ \frac{B_{prototype} + B_{plate}}{2B_{prototype}} \right]^2$

	1	2	3	4	5	6	7	8	9	0
0	D	B	B	B	A	B	A	A	B	D
10	B	B	C	A	A	A	D	C	A	B
20	B	C	B	D	C	B	D	C	A	B
30	D	C	B	A	C	D	C	C	D	B
40	B	C	D	B	B	A	D	D	A	A

**Answer Key**

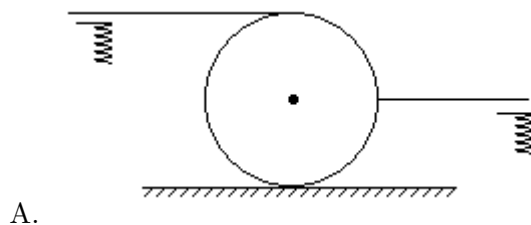
## Section 6

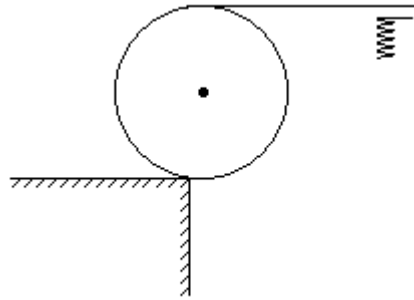
1. A prestressed concrete rectangular beam of size 300 mm x 900 mm is prestressed with an initial prestressing force of 700 kN at an eccentricity of 350 mm at midspan. Stress at top of the beam due to prestress alone, in N/mm<sup>2</sup> is
  - A. 46 (tension)
  - B. 2.59 (compression)
  - C. zero
  - D. 8.64 (compression)
2. In the plate bearing test, if the load applied is in the form of an inflated type of wheel, then this mechanism corresponds to :
  - A. rigid plate
  - B. flexible plate
  - C. semi-rigid plate
  - D. semi-elastic plate
3. Water table drops by 3 m in an irrigable land of 50 hectare. If porosity and specific retention are 0.30 and 0.10 respectively, the change in storage in hectare-meter is :
  - A. 15
  - B. 30
  - C. 45
  - D. 60
4. Horizontal stiffness coefficient,  $K_{11}$  of bar ab is given by :
  - A.  $A E / l^2$
  - B.  $A E / 2 l$
  - C.  $A E / l$
  - D.  $2 A E / l$
5. The downstream end of a long prismatic channel of mild slope, ends in a pool created by a dam. The resulting non-uniform water surface profile can be described as one of the following :
  - A.  $M_3$  profile ending in a hydraulic jump
  - B.  $M_1$  profile that lies above normal depth line
  - C.  $M_2$  profile that lies between critical and normal depth lines
  - D.  $M_3$  profile that lies between critical and normal depth lines
6. The function of ballast in railway tracks is to
  - A. facilitate drainage
  - B. serve as an elastic support for the track structure
  - C. provide the necessary resilience against the dynamic effect of the loads
  - D. all the above



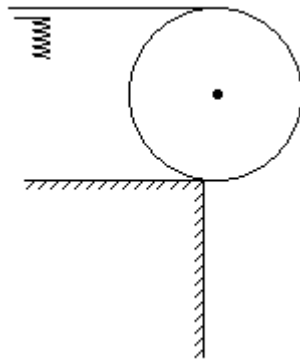
7. A soil formation through which only seepage is possible, being partly permeable and capable of giving insignificant yield, is classified as  
A. Aquifer    B. Aquitard    C. Aquifuge    D. Aquiclude
8. The return period for the annual maximum flood of a given magnitude is 8 years. The probability that this flood magnitude will be exceeded once during the next 5 years is  
A. 0.625    B. 0.966    C. 0.487    D. 0.529
9. A foundation is considered as shallow if its depth is :  
A. less than 1 metre  
B. greater than its width  
C. equal to or less than its width  
D. greater than 1 metre
10. The type of surveying in which the curvature of the earth is taken into account is called  
A. Geodetic surveying  
B. Plane surveying  
C. Preliminary surveying  
D. Topographical surveying
11. The stress-strain diagram for two materials A and B is shown below. The following statements are made based on this diagram : Material A is more brittle than material B. The ultimate strength of material B is more than that of A. With reference to the above statements, which of the following applies ?  
A. Both the statements are false.  
B. Both the statements are true.  
C. I is true but II is false.  
D. I is false but II is true.
12. Base course is used in rigid pavements for  
A. prevention of subgrade settlement  
B. prevention of slab cracking  
C. prevention of pumping  
D. prevention of thermal expansion
13. A reinforced concrete structure has to be constructed along a sea coast. The minimum grade of concrete to be used as per IS : 456-2000  
A. M 15    B. M 20    C. M 25    D. M 30
14. The relationship between the length ( $l$ ) and radius ( $r$ ) of an ideal transition curve is given by  
A.  $l \propto r$

- B.  $l \propto r^2$   
 C.  $l \propto 1/r$   
 D.  $l \propto 1/r^2$
15. The width of expansion joint gap is 2.5 cm in a cement concrete pavement. The spacing between expansion joints for a maximum rise in temperature of 25°C is, (assuming coefficient of thermal expansion of concrete as  $10 \times 10^{-6}$  per degree C),  
 A. 5 m    B. 50 m    C. 100 m    D. 25 M
16. Coulomb's theory of earth pressure is based on :  
 A. the theory of elasticity  
 B. the theory of plasticity  
 C. empirical rules  
 D. wedge theory
17. For a fixed beam with span L, having plastic moment capacity of  $M_p$ , the ultimate central concentrated load will be  
 A.  $4 M_p/L$   
 B.  $M_p/8L$   
 C.  $6 M_p/L$   
 D.  $8 M_p/L$
18. The group index of a soil subgrade is 7. The subgrade soil is rated as  
 A. poor    B. very poor    C. good    D. fair
19. Piping in soil occurs when  
 A. the soil is highly porous  
 B. sudden change in permeability occurs  
 C. effective pressure becomes zero  
 D. the soil is highly stratified
20. In which one of the following arrangements would the vertical force on the cylinder due to water be the maximum ?

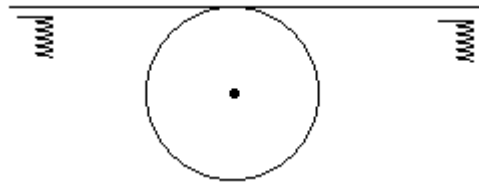




B.



C.



D.

21. The span (s) to be loaded uniformly for maximum positive (upward) reaction at support P, as shown in the figure below, is (are)
- $PQ$  only
  - $PQ$  and  $QR$
  - $QR$  and  $RS$
  - $PQ$  and  $RS$
22. Mechanical stabilization requires :
- mixing of two or more types of natural soils
  - addition of chemicals to soils
  - addition of lime to soils
  - addition of cementing material to soils
23. The disinfection efficiency of chlorine in water treatment
- is not dependent on pH value.

- B. is increased by increased pH values.
  - C. remains constant at all pH values.
  - D. is reduced by increased pH value.
24. Chlorine is some times used in sewage treatment
- A. to avoid flocculation
  - B. to increase biological activity of bacteria
  - C. to avoid bulking of activated sludge
  - D. to help in grease separation
25. The deflection of a cantilever beam at free end b applied with a moment M at the same point is :
- A.  $M l^2/EI$
  - B.  $M l^2/2 EI$
  - C.  $M l^2/3 EI$
  - D.  $M l^2/4 EI$
26. A saturated clay stratum draining both at the top and bottom undergoes 50 percent consolidation in 16 years under an applied load. If an additional drainage layer were present at the middle of the clay stratum, 50 percent consolidation would occur in
- A. 2 years      B. 4 years      C. 8 years      D. 16 years
27. Water flows at a rate of 10 m<sup>3</sup>/s in a rectangular channel 3 m wide. The critical depth of flow is
- A. 1.13 m      B. 2 m      C. 1.45 m      D. 1.04 m
28. Coagulation-flocculation with alum is performed :
- A. immediately before chlorination
  - B. immediately after chlorination
  - C. after rapid sand filtration
  - D. before rapid sand filtration
29. Blue baby disease (methaemoglobinemia) in children is caused by the presence of excess
- A. Chlorides      B. Nitrates      C. Fluoride      D. Lead
30. Breakpoint chlorination of water involves addition of chlorine in an amount sufficient to:
- A. react with any ammonia and readily oxidisable organic matter
  - B. kill Giardia cysts
  - C. react with inorganic matter
  - D. reduce bacterial growth in filters
31. A borrow pit soil has a dry density of 17 kN/m<sup>3</sup>. How many cubic meters of this soil will be required to construct an embankment of 100

- m<sup>3</sup> volume with a dry density of 16 kN/m<sup>3</sup>.  
 A. 94 m<sup>3</sup>      B. 106 m<sup>3</sup>      C. 100 m<sup>3</sup>      D. 90 m<sup>3</sup>
32. The ultimate bearing capacity of a soil is 300 kN/m<sup>2</sup>. The depth of foundation is 1 m and unit weight of soil is 20 kN/m<sup>3</sup>. Choosing a factor of safety of 2.5, the net safe bearing capacity is  
 A. 100 kN/m<sup>2</sup>  
 B. 112 kN/m<sup>2</sup>  
 C. 800 kN/m<sup>2</sup>  
 D. 100.5 kN/m<sup>2</sup>
33. One of the following statements is true with regards to bodies that float or are submerged in liquids :  
 A. For a body wholly submerged in a liquid the stability is ensured if the centre of buoyancy is below the centre of gravity of the body  
 B. For a body floating in a liquid the stability is ensured if the centre of buoyancy is below the centre of gravity of the body  
 C. For a body floating in a liquid the stability is ensured if the centre of buoyancy and the centre of gravity, regardless of the relative positions of the centre of buoyancy and gravity  
 D. For a body floating in a liquid the stability is ensured if the centre of buoyancy is below the centre of gravity and the metacentre is above both the centres of gravity and buoyancy.
34. Transition curves are provided on the approach to horizontal curves in order to :  
 A. increase jerk to allowable levels  
 B. minimize the length of the horizontal curve  
 C. simplify the laying-out and construction of the horizontal curve  
 D. reduce jerk to allowable levels
35. The flow of water (mass density = 1000 kg/m<sup>3</sup> and kinematic viscosity = 10<sup>-6</sup> m<sup>2</sup>/s) in a commercial pipe, having equivalent roughness  $k_s$  as 0.12 mm, yields an average shear stress at the pipe boundary = 600 N/m<sup>2</sup>. The value of  $k_s/\delta'$  ( $\delta'$  being the thickness of laminar sub-layer) for this pipe is  
 A. 0.25      B. 0.50      C. 6.0      D. 8.0
36. The unconfined compressive strength of a 'stiff clay' falls in the range  
 A. less than 50 kN/m<sup>2</sup>  
 B. 50 to 100 kN/m<sup>2</sup>  
 C. 100 to 200 kN/m<sup>2</sup>  
 D. above 200 kN/m<sup>2</sup>

37. What is the equivalent single wheel load of a dual wheel assembly carrying 20, 440 N each for pavement thickness of 20 cm ? Centre to centre spacing of tyres is 27 cm and the distance between the walls of tyres is 11 cm  
 A. 27, 600 N    B. 32, 300 N    C. 40, 880 N    D. 30, 190 N
38. A person standing on the bank of a canal drops a stone on the water surface. He notices that the disturbance on the water surface is not travelling upstream. This is because the flow in the canal is  
 A. sub-critical    B. super-critical    C. steady    D. uniform
39. A circular sewer 2 m diameter has to carry a discharge of 2 m<sup>3</sup>/s when flowing nearly full. What is the minimum required slope to initiate the flow ? (Assume Manning's  $n = 0.015$ )  
 A. 0.00023    B. 0.000036    C. 0.000091    D. 0.000014
40. The material that exhibits the same elastic properties in all the directions at a point, is said to be  
 A. homogeneous    B. orthotropic    C. visco-elastic    D. isotropic
41. If the porosity of a soil sample is 20%, the void ratio is  
 A. 0.20    B. 0.80    C. 1.00    D. 0.25
42. The magnitude of the bending moment at the fixed support of the beam is equal to :  
 A.  $P.a$   
 B.  $\frac{P.a}{2}$   
 C.  $P.b$   
 D.  $P.(a + b)$
43. A soil sample has a void ratio of 0.5 and its porosity will be close to  
 A. 50%    B. 66%    C. 100%    D. 33%
44. Which one of the following statements is true with regard to the flexibility method of analysis?  
 A. The method is used to analyse determinate structures  
 B. The method is used only for manual analysis of indeterminate structures  
 C. The method is used for analysis of flexible structures  
 D. The method is used for analysis of indeterminate structures with lesser degree of static indeterminacy.
45. An isolated T beam is used as a walkway. The beam is simply supported with an effective span of 6 m. The effective width of flange, for the cross-section shown in the below figure is  
 A. 900 mm    B. 1000 mm    C. 1259 mm    D. 2200 mm

46. For a highway with design speed of 100 kmph, the safe overtaking sight distance is (assume accelerations as  $0.53 \text{ m/sec}^2$ )  
 A. 300 m      B. 750 m      C. 320 m      D. 470 m
47. For a flow of 5.7 MLD (million litres per day) and a detention time of 2 hours, the surface area of a rectangular sedimentation tank to remove all particles having settling velocity of  $0.33 \text{ mm/s}$  is  
 A.  $20 \text{ m}^2$       B.  $100 \text{ m}^2$       C.  $200 \text{ m}^2$       D.  $400 \text{ m}^2$
48. If the deformations of the truss-members are as shown in parentheses, the rotation of the member bd is :  
 A.  $0.5 \times 10^{-2}$  radian  
 B.  $1.0 \times 10^{-2}$  radian  
 C.  $1.5 \times 10^{-2}$  radian  
 D.  $2.0 \times 10^{-2}$  radian
49. The shape of clay particle is usually  
 A. angular      B. flaky      C. tubular      D. rounde
50. As per IS : 800-1984 the maximum allowable slenderness ratio of compression members carrying forces resulting from dead load and super-imposed load is  
 A. 180      B. 250      C. 300      D. 400

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	C	B	A	D	D	B	C	C	A
10	D	C	D	C	A	D	D	A	C	B
20	D	A	D	C	B	B	D	D	B	A
30	A	D	D	D	D	A	D	B	C	D
40	D	B	D	D	A	B	C	D	B	A

## Section 7

1. The unit for coefficient of subgrade modulus is  
A.  $\text{kN/m}^3$     B.  $\text{kN/m}^2$     C.  $\text{kN/m}$     D.  $\text{kN.m}$
2. Plate bearing test with 20 cm diameter plate on soil subgrade yielded a pressure of  $1.25 \times 10^5 \text{ N/m}^2$  at 0.5 cm deflection. What is the elastic modulus of subgrade ?  
A.  $56.18 \times 10^5 \text{ N/m}^2$   
B.  $22.10 \times 10^5 \text{ N/m}^2$   
C.  $44.25 \times 10^5 \text{ N/m}^2$   
D.  $50.19 \times 10^5 \text{ N/m}^2$   
E. None.
3. Use of coagulants such as alum  
A. results in reduction of pH of the treated water.  
B. results in increase of pH of the treated water.  
C. results in no change in pH of the treated water.  
D. may cause an increase or decrease of pH of the treated water.
4. The maximum permissible deflection for a gantry girder, spanning over 6 m, on which an EOT (electric overhead travelling) crane of capacity 200 kN is operating, is  
A. 8 mm    B. 10 mm    C. 12 mm    D. 18 mm
5. A hyetograph is a graph representing  
A. rainfall volume with time  
B. rainfall intensity with time  
C. rainfall intensity with duration  
D. rainfall intensity over an area
6. If, for a fluid in motion, pressure at a point is same in all directions, then the fluid is :  
A. a real fluid  
B. a Newtonian fluid  
C. an ideal fluid  
D. a non-Newtonian fluid
7. It is proposed to widen and strengthen an existing 2-lane NH section as a divided highway. The existing traffic in one direction is 2500 commercial vehicles (CV) per day. The construction will take 1 year. The design CBR of soil subgrade is found to be 5 percent, Given: traffic growth rate for CV = 8 percent, vehicle damage factor = 3.5 (standard axles per CV), design life = 10 years and traffic distribution



factor = 0.75. The cumulative standard axes (msa) computed are  
 A. 35      B. 37      C. 65      D. 70

8. If the shear force at a section of beam under bending is equal to zero then the bending moment at the section is
  - A. zero
  - B. maximum
  - C. minimum
  - D. minimum or maximum
9. In network of pipes
  - A. the algebraic sum of discharges around each circuit is zero
  - B. the algebraic sum of (pressure + datum) head drops around each circuit is zero
  - C. the elevation of hydraulic grade line is assumed for each junction point
  - D. elementary circuits are replaced by equivalent pipes
10. A volume of  $3.0 \times 10^6$  m<sup>3</sup> of ground water was pumped out from an unconfined aquifer, uniformly from an area of 5 km<sup>2</sup>. The pumping lowered the water table from initial level of 102 m to 99 m. The specific yield of the aquifer is
  - A. 0.20      B. 0.30      C. 0.40      D. 0.50
11. The stress-strain behaviour of soils as shown in the following figure corresponds to :
  - A. Curve 1 : Loose sand and normally consolidated clay  
 Curve 2 : Loose sand and over consolidated clay
  - B. Curve 1 : Dense sand and normally consolidated clay  
 Curve 2 : Loose sand and over consolidated clay
  - C. Curve 1: Dense sand and over consolidated clay  
 Curve 2: Loose sand and normally consolidated clay
  - D. Curve 1: Loose sand and over consolidated clay  
 Curve 2: Dense sand and normally consolidated clay
12. The maximum allowable compressive stress corresponding to lateral buckling in a discretely laterally supported symmetrical I beam does not depend upon :
  - A. the modulus of elasticity
  - B. the radius of gyration about the minor axis
  - C. the span length of the beam
  - D. the ratio of overall depth of thickness of the flange
13. The soils most susceptible to liquefaction are :
  - A. saturated dense sands

- B. saturated fine and medium sands of uniform particle size
  - C. saturated clays of uniform size
  - D. saturated gravels and cobbles
14. The following general statement may be made about the penetration value and softening point of bitumen
- A. higher the penetration value, higher is the softening point
  - B. higher the penetration value, lower is the softening point
  - C. for very high and very low penetration value the softening point is very low
  - D. absolutely no correlation can be drawn between penetration value and softening point of bitumen
15. Sand drains are used to :
- A. reduce the settlement
  - B. accelerate the consolidation
  - C. increase the permeability
  - D. transfer the load
16. For a 'best' symmetrical trapezoidal section of an open channel with a given area of section and side slopes, one of the following statements holds true :
- A. Half the top width is equal to one of the side slopes
  - B. Half the top width plus the bottom width is equal to both the side slopes put together
  - C. Water depth is equal to half bottom width
  - D. Hydraulic mean depth is equal to half the top width
17. Temporary hardness in water is caused by the presence of
- A. Bicarbonates of Ca and Mg
  - B. Sulphates of Ca and Mg
  - C. Chlorides of Ca and Mg
  - D. Nitrates of Ca and Mg.
18. Bituminous materials are commonly use in highway construction because of their good
- A. tensile and compression properties.
  - B. binding and water proofing properties.
  - C. shear strength and tensile properties.
  - D. bond and tensile properties.
19. The stepped cantilever is subjected to moments,  $M$  as shown in the figure below. The vertical deflection at the free end (neglecting the

self weight) is

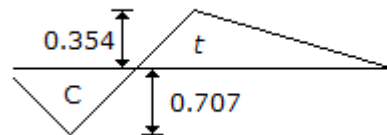
- A.  $\frac{ML^2}{8EI}$       B.  $\frac{ML^2}{4EI}$       C.  $\frac{ML^2}{2EI}$       D. Zero

20. A road is provided with a horizontal circular curve having deflection angle of  $55^\circ$  and centre line radius of 250 m. A transition curve is to be provided at each end of the circular curve of such a length that the rate of gain of radial acceleration is  $0.3 \text{ m/s}^3$  at a speed of 50 km per hour. Length of the transition curve required at each of the ends is  
A. 2.57 m      B. 33.33 m      C. 35.73 m      D. 1666.67 m
21. A test plate 30 cm x 30 cm resting on a sand deposit settles by 10 mm under a certain loading intensity. A footing 150 cm x 200 cm resting on the same sand deposit and loaded to the same load intensity settles by  
A. 2.0 mm      B. 27.8 mm      C. 3.02 mm      D. 50.0 mm
22. Cavitation is caused by  
A. high velocity  
B. low pressure  
C. high pressure  
D. high temperature
23. Flow at critical depth takes place in an open channel When  
A. for a given specific energy, discharge is maximum  
B. for a given discharge, specific energy is maximum  
C. discharge is minimum for a given specific energy  
D. discharge is maximum for a given specific force
24. Two completely penetrating wells are located  $L$  (in metres) apart, in homogeneous confined aquifer. The drawdown measured at the mid point between the two wells (at a distance of  $0.5 L$  from both the wells) is 2.0 m when only the first well is being pumped at the steady rate of  $Q_1 \text{ m}^3/\text{sec}$ . When both the wells are being pumped at identical steady rate of  $Q_2 \text{ m}^3/\text{sec}$ , the drawdown measured at the same location is 8, 0 m. It may be assumed that the drawdown at the wells always remains at 10.0 m when being pumped and the radius of influence is larger than  $0.5 L$ .  $Q_1/Q_2$  is equal to  
A.  $8/5$   
B.  $4/3$   
C.  $5/8$   
D.  $\ln (L/2)$
25. A footing 2 m x 1 m exerts a uniform pressure of  $150 \text{ kN/m}^2$  on the soil. Assuming a load dispersion of 2 vertical to 1 horizontal the

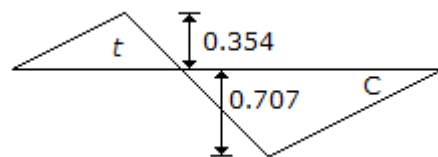
average vertical stress (kN/m<sup>2</sup>) at 1.0 m below the footing is

- A. 50    B. 75    C. 80    D. 100

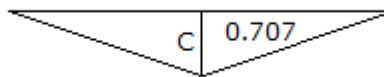
26. The influence line diagram for the force in member 'a' of the truss shown below is given by



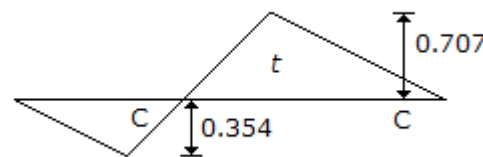
A.



B.



C.



D.

27. In a BOD test using 5% dilution of the sample (15 mL of sample and 285 mL of dilution water), dissolved oxygen values for the sample and dilution water blank bottles after five days incubation at 20°C were 3.80 and 8.80 mg/L. respectively. Dissolved oxygen originally present in the undiluted sample was 0.80 mg/L. The 5-day 20°C BOD of the sample is

- A. 116 mg/L    B. 108 mg/L    C. 100 mg/L    D. 92 Mg/L

28. Group symbols assigned to silty sand and clayey sand are respectively  
A. SS and CS    B. SM and CS    C. SM and SC    D. MS and CS

29. The shape factor of the section shown in the below figure is

- A. 1.5    B. 1.12    C. 2    D. 1.7

**Answer Key**

	1	2	3	4	5	6	7	8	9	0
0	A	E	A	A	B	C	B	B	B	A
10	C	A	B	B	A	A	A	B	C	C
20	B	B	B	D	A	A	D	C	C	