1. When plates are exposed to weather, tacking rivets are provided at a pitch in line not exceeding, where t is the thickness of the outside plate
   [A] $8t$
   [B] $16t$
   [C] $24t$
   [D] $32t$

2. If the depth of the section of an upper column is smaller than the lower column
   [A] filler plates are provided with column splice
   [B] bearing plates are provided with column splice
   [C] neither filler plates nor bearing plates are provided with column splice
   [D] filler plates and bearing plates are provided with column splice

3. If the characteristic strength of concrete f_{ck} is defined as the strength below which not more than 50% of the test results are expected to fall, the expression for f_{ck} in terms of mean strength f_m and standard deviation σ would be
   [A] $f_m - 0{\cdot}1645\sigma$
   [B] $f_m - 1{\cdot}645\sigma$
   [C] f_m
   [D] $f_m + 1{\cdot}645\sigma$

4. The permissible stress in axial tension σ_{st} in steel member on the net effective area of the section shall not exceed (f_y is the yield stress)
   [A] $0{\cdot}8f_y$
   [B] $0{\cdot}75f_y$
   [C] $0{\cdot}6f_y$
   [D] $0{\cdot}5f_y$

5. Two bars of different materials and same size are subjected to the same tensile force. If the bars have unit elongation in the ratio of 2 : 5, then the ratio of modulus of elasticity of the two materials will be
   [A] 2 : 5
   [B] 5 : 2
   [C] 4 : 3
   [D] 3 : 4

6. For limit state of collapse, the partial safety factors recommended by IS : 456-2000 for estimating the design strength of concrete and reinforcing steel are respectively
   [A] 1·15 and 1·5
   [B] 1·0 and 1·0
   [C] 1·5 and 1·15
   [D] 1·5 and 1·0

7. 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

8. 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

9. Maximum strains in an extreme fibre in concrete and in the tension reinforcement (Fe-415 grade and E_s = 200 kN/mm^2) in a balanced section at limit state of flexure are respectively
   [A] 0·0035 and 0·0038
   [B] 0·002 and 0·0018
   [C] Both [A] and [B]
   [D] None of the above

10. The shape of recession limb of a hydrograph depends on

[A] basin characteristic as well as storm characteristics

[B] storm characteristics only

[C] basin characteristics only

[D] base flow only

11. A uniform flow takes place in a steep channel of large slope. The hydraulic gradient line

[A] coincides with the bed

[B] essentially coincides with the free surface

[C] is above the free surface

[D] is below the free surface

12. There is a free over fall at the end of a long open channel. For a given flow rate, the critical depth is less than the normal depth. What gradually varied flow profile will occur in the channel for this flow rate?

[A] M_1

[B] S_1

[C] M_3

[D] M_2

13. The rainfall during three successive 2-hour periods are 0·5 cm, 2·8 cm, and 1·6 cm. The surface runoff resulting from this storm is 3·2 cm. The ϕ index value of this storm is

[A] 0·2 cm/h

[B] 0·28 cm/h

[C] 0·3 cm/h

[D] 0·8 cm/h

14. If the BOD_3 of a waste water sample is 75 mg/litre and reaction rate constant k (base e) is 0·345 per day, the amount of BOD remaining in the given sample after 10 days is

[A] 3·12 mg/litre

[B] 3·45 mg/litre

[C] 3·69 mg/litre

[D] 3·92 mg/litre

15. An aerobic reactor receives waste water at flow rate of 5000 m^3/day, having a COD of 2000 mg/litre. the effluent COD is 400 mg/litre. Assuming that waste water contains 80% biodegradable waste, the daily volume of methane produced by the reactor is

[A] 0·224 m^3

[B] 0·28 m^3

[C] 224 m^3

[D] 280 m^3

16. For a 2-D flow field, the stream function ψ is given as $\psi = \frac{3}{2}(y^2 - x^2)$. The magnitude of discharge occurring between the stream line passing through points (0, 3) and (3, 4) is

[A] 6 units

[B] 3 units

[C] 1·5 units

[D] 2 units

17. The function of an expansion joint in rigid pavements is to

[A] relieve warping stresses

[B] relieve shrinkage stresses

[C] resist stresses due to expansion

[D] allow free expansion

18. The first moment of area about the axis of bending for a beam cross-section is

[A] moment of inertia

[B] section modulus

[C] shape factor

[D] polar moment of inertia

19. An isolated 3-h rainfall event on a small catchment produces a hydrograph peak and point of inflection on the falling limb of the hydrograph at 7 hours and 8·5 hours respectively, after the start of the rainfall. Assuming no losses and no base flow contribution, the time of concentration (in hours) for this catchment is approximately

[A] 8·5

[B] 7·0

[C] 6·5

[D] 5·5

20. A waste water stream (flow = 2 m^3/s, ultimate BOD = 90 mg/litre) is joining a small river (flow = 12 m^3/s, ultimate BOD = 5 mg/litre). Both water streams get mixed up instantaneously. Cross-sectional area of the river is 50 m^2. Assuming the de-oxygenation rate constant, $k' = 0{\cdot}25$/day, the BOD (in mg/litre) of the river water, 10 km downstream of the mixing point is

[A] 1·68

[B] 12·63

[C] 15·46

[D] 1·37

21. While designing, for a steel column of Fe-250 grade, a base plate resting on a concrete pedestal of M-20 grade, the bearing strength of concrete (in N/mm^2) in limit state method of design as per IS : 456-2000 is

[A] 9 N/mm^2

[B] 10 N/mm^2

[C] 11 N/mm^2

[D] 12 N/mm^2

22. A steel section is subjected to a combination of shear and bending actions. The applied shear force is V and the shear capacity of the section is V_s. For such a section, high shear force (as per IS : 800-2007) is defined as

[A] $V > 0{\cdot}6\ V_s$

[B] $V > 0{\cdot}7\ V_s$

[C] $V > 0{\cdot}8\ V_s$

[D] $V > 0{\cdot}9\ V_s$

23. Some of the nontoxic metals normally found in natural water are

[A] arsenic, lead and mercury

[B] calcium, sodium and silver

[C] cadmium, chromium and copper

[D] iron, manganese and magnesium

24. Length of vehicles ***does not*** affect

[A] extra widening

[B] minimum radius of turning

[C] passing sight distance

[D] width of shoulders

25. Failure of the stability of slopes generally occurs along

[A] slip plane

[B] a horizontal surface

[C] a curved surface

[D] all the surfaces

26. A horizontal jet of water with its cross-sectional area of 0·0028 m^2 hits a fixed vertical plate with a velocity of 5 m/s. After impact the jet splits symmetrically in a plane parallel to the plane of the plate. The force of impact (in N) of the jet on the plate is

[A] 90

[B] 80

[C] 70

[D] 60

27. The quantity of seepage of water through soils is proportional to

[A] coefficient of permeability of soil

[B] total head loss through the soil

[C] Neither [A] nor [B]

[D] Both [A] and [B]

28. As per IS : 456-2000, for the design of reinforced concrete beam, the maximum allowable shear stress (τ_{cmax}) depends on the

[A] grade of concrete and grade of steel

[B] grade of concrete only

[C] grade of steel only

[D] grade of concrete and percentage of reinforcement

29. As per Indian standards for bricks, minimum acceptable compressive strength of any class of burnt clay bricks in dry state is

[A] 10·0 MPa

[B] 7·5 MPa

[C] 5·0 MPa

[D] 3·5 MPa

30. A strip footing is resting on the surface of a purely clayey soil deposit. If the width of the footing is doubled, the ultimate bearing capacity of the soil

[A] becomes double

[B] becomes half

[C] becomes four-times

[D] remains the same

31. The relationship between the specific gravity of sand (G) and the hydraulic gradient (i) to initiate quick condition in the sand layer having porosity of 30% is

[A] $G = 0{\cdot}7i + 1$

[B] $G = 1{\cdot}43i - 1$

[C] $G = 1{\cdot}43i + 1$

[D] $G = 0{\cdot}7i - 1$

32. In shear design of an RC beam, other than the allowable shear strength of concrete (τ_c), there is also an additional check suggested in IS : 456-2000 with respect to the maximum permissible shear stress (τ_{cmax}). The check for τ_{cmax} is required to take care of

[A] additional shear resistance from reinforcing steel

[B] additional shear stress that comes from accidental loading

[C] possibility of failure of concrete by diagonal tension

[D] possibility of crushing of concrete by diagonal compression

33. The staff reading taken on a workshop floor using a level is 0·645 m. The inverted staff reading taken to the bottom of a beam is 2·960 m. The reduced level of the floor is 40·500 m. The reduced level (expressed in m) of the bottom of the beam is

[A] 44·105

[B] 43·460

[C] 42·815

[D] 41·145

34. A reinforced concrete (RC) beam with width of 250 mm and effective depth of 400 mm is reinforced with Fe-415 steel. As per the provisions of IS : 456-2000, the minimum and maximum amount of tensile reinforcement (expressed in mm^2) for the section are respectively

[A] 250 and 3500

[B] 205 and 4000

[C] 270 and 2000

[D] 300 and 2500

35. A propped cantilever of span L carries a vertical concentrated load at the mid-span. If the plastic moment capacity of the section is M_p, the magnitude of the collapse load is

[A] $8M_p/L$

[B] $6M_p/L$

[C] $4M_p/L$

[D] $2M_p/L$

36. A 4 m wide rectangular channel, having bed slope of 0·001 carries a discharge of 16 m^3/s. Considering Manning's roughness coefficient = 0·012 and $g = 10\ m/s^2$, the category of the channel slope is

[A] horizontal

[B] mild

[C] critical

[D] steep

37. The deformation in concrete due to sustained loading is

[A] creep

[B] hydration

[C] segregation

[D] shrinkage

38. A bitumen sample has been graded as VG30 as per IS : 73-2013. The '30' in the grade means that

[A] penetration of bitumen at 25 °C is between 20 and 40

[B] viscosity of bitumen at 60 °C is between 2400 and 3600 poise

[C] ductility of bitumen at 27 °C is more than 30 cm

[D] elastic recovery of bitumen at 15 °C is more than 30%

39. In a shrinkage limit test, the volume and mass of a dry soil pat are found to be 50 cm^3 and 88 g respectively. The specific gravity of the soil solids is 2·71 and the density of water is 1 g/cc. The shrinkage limit is

[A] 20

[B] 21

[C] 22

[D] 23

40. The clay mineral whose structural units are held together by potassium bond is

[A] halloysite

[B] illite

[C] kaolinite

[D] smectite

41. As per IRC : 37-2012, in order to control subgrade rutting in flexible pavements, the parameter to be considered is

[A] horizontal tensile strain at the bottom of bituminous layer

[B] vertical compressive strain on top of subgrade

[C] vertical compressive stress on top of granular layer

[D] vertical deflection at the surface of the pavement

42. The initial concavity in the load-penetration curve of a CBR test is ***not*** due to

[A] uneven top surface

[B] high impact at start of loading

[C] inclined penetration plunger

[D] soft top layer of soaked soil

43. A 7·5 m wide two-lane road on a plain terrain is to be laid along a horizontal curve of radius 510 m. For a design speed of 100 kmph, superelevation is provided as per IRC : 73-1980. Consider acceleration due to gravity as 9·81 m/s^2. The level difference between the inner and outer edges of the road (in m) is

[A] 0·525

[B] 0·535

[C] 0·545

[D] 0·555

44. Gypsum is typically added in cement to

[A] prevent quick setting

[B] enhance hardening

[C] increase workability

[D] decrease heat of hydration

45. A partially saturated soil sample has natural moisture content of 25% and bulk unit weight of 18·5 kN/m^3. The specific gravity of soil solids is 2·65 and unit weight of water is 9·81 kN/m^3. The unit weight of the soil sample on full saturation is

[A] 21·12 kN/m^3

[B] 19·03 kN/m^3

[C] 20·12 kN/m^3

[D] 18·50 kN/m^3

46. If water is flowing at the same depth in most hydraulically efficient triangular and rectangular channel sections, then the ratio of hydraulic radius of triangular section to that of rectangular section is

[A] $1\sqrt{2}$

[B] $\sqrt{2}$

[C] 1

[D] 2

47. The liquid forms of particulate air pollutants are

[A] dust and mist

[B] mist and spray

[C] smoke and spray

[D] fly ash and fumes

48. A highway designed for 80 km/h speed has a horizontal curve section with radius 250 m. If the design of lateral friction is assumed to develop fully, the required superelevation is

[A] 0·02

[B] 0·05

[C] 0·07

[D] 0·09

49. Strain hardening of structural steel means

[A] experiencing higher stress than yield stress with increased deformation

[B] strengthening steel member externally for reducing strain experienced

[C] strain occurring before plastic flow of steel material

[D] decrease in the stress experienced with increasing strain

50. The most appropriate triaxial test to assess the long-term stability of an excavated clay slope is

[A] consolidated drained test

[B] unconsolidated undrained test

[C] consolidated undrained test

[D] unconfined compression test

51. As per the Unified Soil Classification System (USCS), the type of soil represented by 'MH' is

[A] inorganic silts of high plasticity with liquid limit more than 50%

[B] inorganic silts of low plasticity with liquid limit less than 50%

[C] inorganic clays of high plasticity with liquid limit less than 50%

[D] inorganic clays of low plasticity with liquid limit more than 50%

52. The ratio of the momentum correction factor to the energy correction factor for a laminar flow in a pipe is

[A] 1/2

[B] 2/3

[C] 1

[D] 3/2

53. Relationship between traffic speed and density is described using a negatively sloped straight line. If v_f is the free-flow speed, then the speed at which the maximum flow occurs, is

[A] 0

[B] $v_f/4$

[C] $v_f/2$

[D] v_f

54. A rectangular open channel of 6 m width is carrying a discharge of 20 m^3/s. Consider the acceleration due to gravity as 9·81 m/s^2 and assume water as incompressible. The depth of flow in the channel at which the specific energy of the flowing water is minimum for the given discharge, will be

[A] 0·82 m

[B] 1·04 m

[C] 2·56 m

[D] 3·18 m

55. From laboratory investigations, the liquid limit, plastic limit, natural moisture content and flow index of a soil specimen are obtained as 60%, 27%, 32% and 27 respectively. The corresponding toughness index and liquidity index of the soil specimen, respectively, are

[A] 0·15 and 1·22

[B] 0·19 and 6·60

[C] 1·22 and 0·15

[D] 6·60 and 0·19

56. An element is subjected to biaxial normal tensile strains of 0·0030 and 0·0020. The normal strain in the plane of maximum shear strain is

[A] zero

[B] 0·0010

[C] 0·0025

[D] 0·0050

57. Assuming that there is no possibility of shear buckling in the web, the maximum reduction permitted by IS 800-2007 in the (low-shear) design bending strength of a semi-compact steel section due to high shear is

[A] zero

[B] 25%

[C] 50%

[D] governed by the area of the flange

58. For a given loading on a rectangular plain concrete beam with an overall depth of 500 mm, the compressive strain and tensile strain developed at the extreme fibres are of the same magnitude of $2{\cdot}5 \times 10^{-4}$. The curvature in the beam cross-section is

[A] 0·001

[B] 0·002

[C] 0·003

[D] 0·004

59. The probability that the annual maximum flood discharge will exceed 25000 m^3/s, at least once in next 5 years is found to be 0·25. The return period of this flood event is

[A] 17·9

[B] 16·9

[C] 18·9

[D] 15·9

60. A concentrated load of 500 kN is applied on an elastic half space. The ratio of the increase in vertical normal stress at depths of 2 m and 4 m along the point of the loading, as per Boussinesq's theory, would be

[A] 4

[B] 5

[C] 6

[D] 7

61. If the fineness modulus of a sample of fine aggregates is 4·3, the mean size of the particles in the sample is between

[A] 1·5 mm and 3 mm

[B] 3 mm and 6 mm

[C] 1·18 mm and 2·36 mm

[D] 2·36 mm and 4·75 mm

62. Which one of the following options contains only primary air pollutants?

[A] Hydrocarbons and nitrogen oxides

[B] Hydrocarbons and ozone

[C] Ozone and peroxyacetyl nitrate

[D] Nitrogen oxides and peroxyacetyl nitrate

63. Structural failures considered in the mechanistic method of bituminous pavement design are

[A] fatigue and rutting

[B] fatigue and shear

[C] rutting and shear

[D] shear and slippage

64. Chlorine is used as the disinfectant in a municipal water treatment plant. It achieves 50 percent of disinfection efficiency measured in terms of killing the indicator microorganisms (*Ecoli*) in 3 minutes. The minimum time required to achieve 99 percent disinfection efficiency would be

[A] 9·93 minutes

[B] 11·93 minutes

[C] 19·93 minutes

[D] 21·93 minutes

65. A camera with a focal length of 20 cm fitted in an aircraft is used for taking vertical aerial photographs of a terrain. The average elevation of the terrain is 1200 m above mean sea level (MSL). What is the height above MSL at which an aircraft must fly in order to get the aerial photographs at a scale of 1 : 8000?

[A] 2600 m

[B] 2800 m

[C] 3000 m

[D] 3200 m

66. A column of height h with a rectangular cross-section of size $a \times 2a$ has a buckling load of P. If the cross-section is changed to $0{\cdot}5a \times 3a$ and its height changed to $1{\cdot}5h$, the buckling load of the redesigned column will be

[A] $P/12$

[B] $P/4$

[C] $P/2$

[D] $3P/4$

67. A cantilever beam of length 2 m with a square section of side length 0·1 m is loaded vertically at the free end. The vertical displacement at the free end is 5 mm. The beam is made of steel with Young's modulus of $2{\cdot}0 \times 10^{11}$ N/m^2. The maximum bending stress at the fixed end of the cantilever is

[A] 20·0 MPa

[B] 37·5 MPa

[C] 60·0 MPa

[D] 75·0 MPa

68. A flow net below a dam consists of 24 equipotential drops and 7 flow channels. The difference between the upstream and downstream water levels is 6 m. The length of the flow line adjacent to the toe of the dam at exit is 1 m. The specific gravity and void ratio of the soil below the dam are 2·70 and 0·70 respectively. The factor of safety against piping is

[A] 1·67

[B] 2·5

[C] 3·4

[D] 4

69. In a wide rectangular channel, if the normal depth is increased by 20 %, the discharge would increase by

[A] 20%

[B] 15·5%

[C] 35·5%

[D] 41·3%

70. A 6-hour rainfall of 6 cm at a place A was found to have a return period of 40 years. The probability that at A, a 6-hour rainfall of this or large magnitude will occur at least once in 20 successive years is

[A] 0·397

[B] 0·603

[C] 0·309

[D] 0·025

71. A triangular direct runoff hydrograph due to a storm has a time base of 90 hours. The peak flow of 60 m^3/s occurs at 20 hours from the start of the storm. The area of catchment is 300 km^2. The rainfall excess of the storm (in cm), is

[A] 2·00

[B] 3·24

[C] 5·40

[D] 6·48

72. Remote sensing techniques make use of the properties of _____ emitted, reflected or diffracted by the sensed objects.

[A] electric waves

[B] sound waves

[C] electromagnetic waves

[D] wind waves

73. A body is subjected to a tensile stress of 1200 MPa on one plane and another tensile stress of 600 MPa on a plane at right angles to the former. It is also subjected to a shear stress of 400 MPa on the same planes. The maximum normal stress will be

[A] 400 MPa

[B] 500 MPa

[C] 900 MPa

[D] 1400 MPa

74. A body floating in a liquid is in a stable state of equilibrium if its

[A] metacentre lies above its centre of gravity

[B] metacentre lies below its centre of gravity

[C] metacentre coincides with its centre of gravity

[D] centre of gravity is below its centre of buoyancy

75. In CPM analysis

[A] emphasis is given to activities

[B] uncertainties are not allowed

[C] activities are represented by arrows

[D] All of the above

76. PERT is

[A] analytic in concept

[B] limited of event oriented diagrams

[C] used for research and development projects

[D] All of the above

77. For the economical design of a combined footing to support two equal column loads, the projections of beams in lower tier are kept such that bending moment under column is equal to

[A] bending moment at the centre of the beam

[B] half the bending moment at the centre of the beam

[C] twice the bending moment at the centre of the beam

[D] None of the above

78. In rolled steel beams, shear force is mostly resisted by

[A] web only

[B] flanges only

[C] web and flanges together

[D] None of the above

79. If the length of an intermediate span of a continuous slab is 5 m, the length of the end span is kept at

[A] 4·5 m

[B] 4·0 m

[C] 3·5 m

[D] 3·0 m

80. 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 with the geometrical centre of the beam

[D] None of the above

PART—II

(General Knowledge, General English & Islamic History and Culture)

81. Hadrat Umer was Caliph for

[A] 2 years

[B] 4 years

[C] 10 years

[D] None of the above

82. Which country is called the "Land of Prophets"?

[A] Saudi Arabia

[B] Syria

[C] Palestine

[D] Iraq

83. Hadrat Ali's (R.A.) wife was

[A] Ruqayyah (R.A.)

[B] Fatima (R.A.)

[C] Umm Kulthum (R.A.)

[D] Hadrat Aisha (R.A.)

84. The Pre-Islamic Era is known as

[A] Modern Age

[B] Age of Ignorance

[C] Golden Age

[D] None of the above

85. Which prayer is not obligatory for women?

[A] Maghrib Prayer

[B] Isha Prayer

[C] Juma Prayer

[D] Fajar Prayer

86. The first Masjid that was built by the Holy Prophet (PBUH) was

[A] Masjid ul Haram

[B] Masjid ul Aqsa

[C] Masjid e Quba

[D] Masjid e Nabavi

87. What does Zam Zam mean?

[A] Water

[B] Water well

[C] Stop

[D] Drink

88. What is Abu Bakr's (R.A.) full name?

[A] Abdul Rahman ibn Uthman

[B] Uthman ibn Abdullah

[C] Abdullah ibn Abdur Rahman

[D] Abdullah ibn Uthman

89. In which battle did some Muslim archers disobey the order of Prophet Muhammad (PBUH)?

[A] Battle of Badr

[B] Battle of Uhud

[C] Battle of Khaybar

[D] Battle of Khandaq

90. Which is ***not*** one of the five pillars of Islam?

[A] Roza

[B] Namaz

[C] Zakat

[D] Paradise

91. Big Bang theory explains

[A] origin of Universe

[B] origin of Sun

[C] origin of gravitation

[D] origin of bacteria

92. Visva-Bharati is situated in the district of

[A] Purulia

[B] Bankura

[C] Birbhum

[D] Medinipur

93. Dhyan Chand was associated with the sports

[A] Running

[B] Football

[C] Boxing

[D] Hockey

94. Gatidhara Prakalpa is introduced by the Government of

[A] West Bengal

[B] Odisha

[C] Maharashtra

[D] Gujarat

95. The founder of the organisation Bengal Chemical was

[A] Nil Ratan Sarkar

[B] Prafulla Chandra Roy

[C] Dwarakanath Tagore

[D] Alamohan Das

96. Fill in, with relative pronoun, the blank space below :

The man, _____ briefcase was lost, reported to the police.

[A] that

[B] whose

[C] which

[D] whom

97. Select the option that is the indirect form of the given sentence :

Rupa said, "I am very busy now".

[A] Rupa told that she might be very busy then.

[B] Rupa said that she is very busy now.

[C] Rupa said that she was very busy then.

[D] Rupa said that she will be very busy then.

98. Fill in the blank with the most appropriate option :

_____ you like to drink milk twice daily?

[A] When

[B] Does

[C] Do

[D] What

99. Fill in the blank with the most appropriate option :

_____ has taken my new red pen?

[A] Who

[B] Why

[C] Where

[D] What

100. Fill in the blank with the most appropriate option :

_____ she get good marks in the Bengali test?

[A] Has

[B] Don't

[C] Hasn't

[D] Didn't