**114.** Maximum factor of safety against sliding of the retaining wall should not be more than

(*a*) 1.5 (*b*) 2

(*c*) 3 (*d*) none of the above

**115.** Main reinforcement in the heel of cantilever retaining wall is placed

(*a*) near the lower face

(*b*) near the upper face

(*c*) at the centre of cross-section

(*d*) at 2/3rd of depth of heel

**116.** Which of the following is not considered in the design of isolated footings

(*a*) bending moment (*b*) shear

(*c*) punching stress (*d*) torsion

**117.** In a footing where reinforcement is not needed as per structural calculations

(*a*) no reinforcement be provided

(*b*) nominal reinforcement be provided

(*c*) reinforcement be extended from column

(*d*) none of the above

**118.** In a counterfort retaining wall the Umain reinforcement is provided on

(*a*) bottom face in front counterfort and inclined face in back counterfort

(*b*) bottom face in back counterfort and inclined face in front counterfort

(*c*) bottom face in front counterfort only

(*d*) None of the above

**119.** Temperature reinforcement in the vertical slab of T-shaped R.C retaining wall is

(*a*) provided more on inner face than on outer face

(*b*) provided equally on both sides

(*c*) provided more on outer face than on inner face

(*d*) not needed

**120.** The toe projection of foundation slab is taken

(*a*) $\frac{1}{3}$ rd of the base

(*b*) $\frac{1}{3}$ th of the overall height of the wall

(*c*) equal to heel slab

(*d*) least of the above

**121.** A T-shaped retaining wall mainly consists of

(*a*) one cantilever

(*b*) two cantilever

(*c*) three cantilever

(*d*) four cantilever

**122.** Main reinforcement is provided in the design affront counterfort, on

(*a*) bottom face near counterfort

(*b*) top face near centre of span

(*c*) top face near centre counterfort

(*d*) both (*a*) and (*b*) above

**123.** In a cantilever retaining wall without a heel slab

(*a*) thickness of the stem is kept same

(*b*) base slab is made 10cm thicker than stem

(*c*) width of the base slab is kept 0.7 times the total weight of the wall

(*d*) all of the above

**124.** The design of heel slab of a retaining wall, is based on the maximum bending moment due to

(*a*) its own weight or weight of the soil above it

(*b*) load of the surcharge

(*c*) upward soil reaction

(*d*) All of the above

**125.** The spacing of counterforts depends upon

(*a*) the height of the wall

(*b*) relative cost of steel and concrete

(*c*) allowable unit pressure on soil

(*d*) all of the above

**126.** Ultimate load acting on an R.C.C structure is obtained

(*a*) from the collapse load

(*b*) by multiplying the working loads with factors of safety

(*c*) by multiplying the working loads with appropriate load factor

(*d*) none of the above

**127.** The ultimate strength design in R.C.C beams may be considered the same as

(*a*) Load factor design

(*b*) Plastic design

(*c*) Limit state design

(*d*) None of the above

**128.** A column designed by ultimate strength design is considered to be long if

(*a*) height is more than 8 m

(*b*) slenderness ratio is more than 12

(*c*) slenderness ratio is more than 18

(*d*) ratio of the effective length to least lateral dimension is more than 12

**129.** Method of designing structures based on a statical concept of safety and the associated statical probability of fair is called

(*a*) working stress design

(*b*) ultimate stress design

(*c*) limit stare design

(*d*) none of the above

**130.** According to Whitney's theory ultimate strain of concrete is assumed to be

(*a*) 0.03% (*b*) 0.3%

(*c*) 3% (*d*) none of the above

**131.** The design yield stress of steel according to IS:456 is

(*a*) 0.57 $f_y$ (*b*) 0.67 $f_y$

(*c*) 0.78 $f_y$ (*d*) none of the above

where $f_y$ is the characteristic yield strength of steel.

**132.** Maximum strain in concrete at the outermost compression fibre in bending is taken as

(*a*) 0.25% (*b*) 0.30%

(*c*) 0.35% (*d*) 0.40%

**133.** Maximum compressive stress in concrete is equal to

(*a*) 0.37 $\sigma_{ck}$ (*b*) 0.4 $\sigma_{ck}$

(*c*) 0.44 $\sigma_{ck}$ (*d*) none of the above

**134.** The partial safety factor of steel is

(*a*) 1.5 (*b*) 1.15

(*c*) 2.0 (*d*) 2.5

**135.** As per IS 456-1978 the idealized stress strain curve has the following shape

(*a*) rectangular

(*b*) parabolic

(*c*) rectangular parabolic

(*d*) triangular

**136.** Design strength of concrete for Limit state of collapse is taken as

(*a*) $0.67 f_{ck}/r$ (*b*) $0.67 f_{ck}$

(*c*) $r f_{ck}$ (*d*) $f_{ck}$

where $f_{ck}$ is the characteristic compressive strength of concrete $r$ is the partial safety factor of concrete

**137.** In combined footing, if the projections in two directions are fixed, the shape of footing usually provided is

(*a*) trapezoidal

(*b*) rectangular

(*c*) square

(*d*) circular

**138.** In a combined footing if the centre of gravity of footing coincides with resultant of loads, the stresses at the base of footing from the soil will be

(*a*) purely tensile

(*b*) purely compressive

(*c*) both tensile and compressive

(*d*) None of the above

**139.** Tilts and shifts in the wells can be rectified

(*a*) by cutting more the higher side by regulating dredging

(*b*) by applying more load on the tilted and shifted side

(*c*) by reducing load on the tilted side

(*d*) None of the above methods is adequate

**140.** Shifts in the well foundation are limited to

(*a*) one per cent of depth sunk

(*b*) one per cent of diameter of the well

(*c*) two per cent of depth sunk

(*d*) None of the above

**141.** Well foundations are more suitable for

(*a*) deep foundations below water table

(*b*) for expansive soils having low bearing capacity

(*c*) foundation in rocky regions having very high penetration resistance

(*d*) for tall building in seismic zones

**142.** Timber as a material is not suitable for the construction of

(*a*) fender piles (*b*) friction piles

(*c*) tension piles (*d*) None of the above

**143.** Pile foundation is preferred than other type of foundations to transmit loads to the soil mass due to the fact that

(*a*) it controls the settlement when spread footing or a mat is on a marginal soil or is underlain by highly compressible stratum

(*b*) it is cheaper than spread footing and raft foundation for the same load and soil type

(*c*) uplift forces are not encountered in any type of soil

(*d*) minimum factor of safety is required using pile foundation

**144.** Precast concrete piles are usually

(*a*) plain or reinforced concrete type

(*b*) reinforced or prestressed concrete type

(*c*) plain reinforced or prestressed type

(*d*) only for very light load and temporary jobs

**145.** Settlement of a group of friction piles when compared with that of single pile

(*a*) increases with the decrease in the number of piles

(*b*) increases with the increase in the number of piles

(*c*) is affected by the number of piles

(*d*) None of the above

**146.** Negative skin friction on a pile foundation is caused by

(*a*) downward movement of the pile

(*b*) downward movement of the soil

(*c*) relative settlement of the soil

(*d*) relative settlement of the piles

**147.** When the bearing capacity of soil is very low, the most suitable foundation is

(*a*) Independent footing

(*b*) Combined footing

(*c*) Pile foundation

(*d*) Raft foundation

**148.** A prestressed concrete beam is loaded with two point loads. If the profile of the cable is laid based on the load balancing concept, the shape of profile is

(*a*) parabolic (*b*) rectangular

(*c*) trapezoidal (*d*) circular

**149.** In pretensioned beam, the maximum ultimate moment of resistance is obtained by

(*a*) distributing wires evenly paralled to axis

(*b*) distributing wires at the centre

(*c*) putting large group of wires near the bottom and smaller group near the top

(*d*) putting smaller group of wires near the bottom and large group near the top

**150.** The main purpose of reinforcement in prestress concrete is

(*a*) to provide adequate bond stress

(*b*) to resist tensile stresses

(*c*) to impart initial compressive stress in concrete

(*d*) All of the above

**151.** Mild or HYSD (high yield strength Deformed) bars cannot be used in prestressing bars in prestressed concrete because

(*a*) loss of prestress is high

(*b*) loss of prestress is high when compared to yield stress

(*c*) it is not economical

(*d*) of low percentage of elongation

**152.** In prestress concrete, generally steel wires used are of

(*a*) very low tensile strength

(*b*) low tensile strength

(*c*) high yield strength

(*d*) high tensile strength

**153.** A concordant cable in prestressed concrete is

(*a*) one which causes no secondary moments

(*b*) one which causes secondary moments

(*c*) parallel to the axis of beam

(*d*) coincides with centroidal axis of beam

**154.** Prestress loss due to friction occurs only in

(*a*) post tensioned beams

(*b*) pretensioned beams

(*c*) does not occur in either

(*d*) occurs in both

**155.** The main advantage of prestressed concrete is

(*a*) It is free of cracks under service loads

(*b*) It enables the entire section to take part in resisting moment

(*c*) It eliminates corrosion of steel when the structure is exposed to weather

(*d*) All of the above

**156.** Ducts are required in the following type of prestressed construction

(*a*) post tensioning

(*b*) pre tensioning

(*c*) partial prestressing

(*d*) In all types

**157.** Normally prestressing wires are arranged in the

(*a*) lower part of the beam

(*b*) upper part of the beam

(*c*) center part of the beam

(*d*) Any part of the beam

**158.** In case of post tensioning members, prestress takes place

(*a*) after the completion of tensioning process

(*b*) before the completion of tensioning process

(*c*) at the release of prestress from bulkhead

(*d*) None of the above

**159.** Coefficient of shrinkage for high grade concrete for pretensioned work is

(*a*) $3 \times 15^{-6}$ (*b*) $3 \times 10^{-4}$

(*c*) $3 \times 10^{-2}$ (*d*) $3 \times 10^{-6}$

**160.** The system is which anchorage is provided by a pair of wires, held by flat steel wedges in sandwich plates bearing on distributions plates is

(*a*) Mangel-Baltone system
(*b*) Freyssinet system
(*c*) Lee-McCall system
(*d*) Freyssinet system

**161.** The loss of prestress due to the slippage of anchorage in long span prestressed concrete is generally in the range

(*a*) 1–3% (*b*) 3–5%
(*c*) 5–8% (*d*) 8–12%

**162.** The system in which all the wires are tensioned simultaneously is

(*a*) Mangel-BIaton system
(*b*) Freyssinet system
(*c*) Lee-McCall system
(*d*) Billner system

**163.** If the loading on a prestressed rectangular beam, is uniformaly 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

**164.** 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

(*a*) $\frac{WL}{P}$ (*b*) $\frac{WL}{4P}$
(*c*) $\frac{WL}{3P}$ (*d*) $\frac{WP}{L}$

**165.** Net shear force on concrete in case of prestressed concrete members is less when compared with that in R.C.C because of

(*a*) anchorage force
(*b*) transverse component of the cable force
(*c*) precompression
(*d*) None of the above

**166.** The bending moment at which visible cracks develop in prestressed beam is called

(*a*) cracking moment
(*b*) plastic moment
(*c*) collapse moment
(*d*) ultimate moment

**167.** For pretensioned members, the minimum strength as per IS code is

(*a*) 20 $N/mm^2$ (*b*) 30 $N/mm^2$
(*c*) 40 $N/mm^2$ (*d*) 50 $N/mm^2$

**168.** Loss of prestress due to creep will be found more in

(*a*) pretensioned beams
(*b*) post tensioned beams
(*c*) same in both
(*d*) cannot say

**169.** Shrinkage of concrete does not depend upon

(*a*) humidity in atmosphere
(*b*) time lapse
(*c*) application of load
(*d*) All of the above

**170.** The ultimate tensile strength of steel wires commonly used for prestressing should be around

(*a*) 250 MPa (*b*) 415 MPa
(*c*) 1500 MPa (*d*) 4000 MPa

**171.** Factor which affect the loss of prestress due to creep is

(*a*) ultimate creep strain
(*b*) characteristic concrete strength
(*c*) modulus of elasticity of steel
(*d*) All of the above

**172.** The statement that the prestressed concrete beam carries its self weight is based on the

(*a*) requirement of no tension section
(*b*) concept of load balancing
(*c*) strength of prestressing cables
(*d*) none of the above

**173.** Which of the following system of prestressing is applicable for pretensioning

(*a*) Freyssinet system
(*b*) Manual Blaton system
(*c*) Lee-McCall system
(*d*) None of the above

**174.** According to IS: 456-1978, the maximum compressive stress in concrete for design purpose is taken is

(*a*) 0.370 (*b*) 0.416 $f_{ck}$
(*c*) 0.446 $f_{ck}$ (*d*) 0.670 $f_{ck}$

**175.** The partial safety factor for steel as per IS: 456-1978 is taken as

(*a*) 1.15 (*b*) 1.35
(*c*) 1.50 (*d*) 1.65

**176.** The limits of percentage p of the longitudinal reinforcement in a column is given by

(*a*) 0.15% to 2%
(*b*) 0.8% to 4%
(*c*) 0.8% to 6%
(*d*) 0.8% to 8%

**177.** The purpose of lateral ties in short RC columns is to

(*a*) avoid buckling of longitudinal bars.

(*b*) facilitate construction

(*c*) facilitate compaction of concrete.

(*d*) increase the load carrying capacity of the columns

**178.** In a double reinforced rectangular beam, the allowable stress in compression steel is

(*a*) equal to the permissible stress in tension in stell

(*b*) more than the permissible stress in tension in steel

(*c*) less than the permissible stress in ten sion in steel

(*d*) not related the permissible concrete compression stress.

**179.** Loss of stress with time at constant strain in steel is called

(*a*) relaxation (*b*) creep

(c) shrinkage (*d*) ductility

**180.** Deep beams are designed for

(*a*) shear force only

(*b*) bending moment only

(*c*) both shear force and bending moment

(*d*) bearing

**181.** In the limit state design of concrete structures the strain distribution is assumed to be

(*a*) Linear

(*b*) non-linear

(*c*) parabolic

(*d*) parabolic and rectangular

**182.** $M_{ult}$ singly reinforced balanced RC rectangular beam section is

(*a*) $0.115 f_{ck} bd^2$

(*b*) $0.135 f_{ck} bd^2$

(*c*) $0.185 f_{ck} bd^2$

(*d*) $0.225 f_{ck} bd^2$

**183.** At limit state of collapse in shear, the case ofseb shear cracks, it is assumed that the concrete cracks when the maximum principal tensile stress exceeds a value of $f_t$ equal to

(*a*) $0.24 \sqrt{f_{ck}}$ (*b*) $0.20 \sqrt{f_{ck}}$

(*c*) $0.16 \sqrt{f_{ck}}$ (*d*) $0.30 \sqrt{f_{ck}}$

**184.** The loads to be taken corresponding to limit states of strength, deflection and crack width are respectively

(*a*) working load, working load and working load

(*b*) ultimate load, working load and ultimate load

(*c*) ultimate load, ultimate load and working load

(*d*) ultimate load, working load and working load

**185.** The bending moment at the edges of square vertical bunker due to a laternal pressure '*p*' per unit area is

(*a*) $\frac{pl^2}{12}$ (*b*) $\frac{pl^2}{10}$

(*c*) $\frac{pl^2}{16}$ (*d*) $\frac{pl^2}{11}$

**186.** In concrete bridge design, the impact factor

(*a*) can be ignored for a pedestrain bridge

(*b*) can be ignored for deal load when the bridge is of 8 lane width

(*c*) is the same for both dead and live load

(*d*) is the same for IRC class A and IRC class AA (wheeled) loadings when the span is large

**187.** Concordant profile represents, for a certain set of external loads to some scale, the

(*a*) bending moment diagram

(*b*) Williot-Mohr diagram

(*c*) shear force diagram

(*d*) influence line diagram

**188.** While applying the Winter and Pei's method of analysis to folded plates

(*a*) moment distribution method is used to correct the stresses at the junction of adjacent plates

(*b*) span to depth ratio is not restricted

(*c*) individual plates are assumed to bend transversally

(*d*) displacement of the junction of hipped plate can be ignored if the span/depth ratio is less than 4.

**189.** Yield line theory results, in

(*a*) elastic solution

(*b*) lower bound solution

(*c*) upper bound solution

(*d*) unique solution

**190.** Prestressed concrete is more desirable in case of
(*a*) cylindrical pipe subjected to internal fluid pressure
(*b*) cylindrical pipe subjected to external fluid pressure
(*c*) cylindrical oipe subjected to equal in ternal and external fluid pressure
(*d*) cylindrical pipe subjected to end pressures

**191.** Shrinkage deflections in case of rectangular beams and slabs can be eliminated by putting
(*a*) compression steel equal to tensile steel
(*b*) compression steel more than tensile steel
(*c*) compression steel less than tensile steel
(*d*) compression steel 25% greater than tensile steel

**192.** In case of 2-way slab, the limiting deflection of the slab is
(*a*) primarily a function of the long span
(*b*) primarily a function of the short span
(*c*) independent of long or short span
(*d*) dependent on both long and short spans

**193.** In a load balanced prestressed concrete beam under self load the cross-section is subjected to
(*a*) axial stress
(*b*) bending stress
(*c*) axial and shear stress
(*d*) axial and bending stress

**194.** Shear span is defined as the zone where
(*a*) bending moment is zero
(*b*) shear force is zero
(*c*) shear force is constant
(*d*) bending moment is constant

**195.** Deflection can be controlled by using the appropriate
(*a*) aspect ratio (*b*) modular ratio
(*c*) span/depth ratio (*d*) water/cement ratio

**196.** In limit state approach, spacing of main reinforcement controls primarily.
(*a*) collapse (*b*) cracking
(*c*) deflection (*d*) durability

**197.** Design of foundation for a large generator is guided primarily, by
(*a*) frequency (*b*) deformation
(*c*) strength (*d*) stiffness

**198.** Drops are provided in flat slab to resist
(*a*) bending moment
(*b*) thrust
(*c*) shear
(*d*) torsion

**199.** Flexural collapse in over reinforced beams is due to
(*a*) primary compression failure
(*b*) secondary compression failure
(*c*) primary tension failure
(*d*) bond failure

**200.** In an RCC beam, side face reinforcement is provided if its depth exceeds
(*a*) 300 mm
(*b*) 500 mm
(*c*) 700 mm
(*d*) 750 mm

**201.** The maximum spacing of vertical reinforcement in RCC wall should not exceed
(*a*) the thickness of wall
(*b*) 1.5 times the thickness of wall
(*c*) 2 times the thickness of wall
(*d*) 3 times the thickness of wall

**202.** In a reinforcement concrete retaining wall, a shear key is provided, if the
(*a*) shear stress in the vertical stem is ex cessive
(*b*) shear force in the toe slab is more than that in the heel slab
(*c*) retaining wall is not safe against slid ing
(*d*) retaining wall is not safe against over turning

**203.** In the limit state method of design, the failure criterion for reinforced concrete beams and columns is
(*a*) Maximum principal stress theory
(*b*) Maximum principal strain theory
(*c*) Maximum shear stress theory
(*d*) Maximum strain energy theory

**204.** The sum of nodal forces at any yield line intersection in a slab is
(*a*) zero
(*b*) infinity
(*c*) independent of the reinforcement
(*d*) indeterminate

# EXERCISE - II

## (Questions From Previous SSC CPWD Exams)

### 2008

1. If d and n are the effective depth and depth of neutral axis respectively of a singly reinforced beam, the lever arm of the beam is

(a) d (b) n

(c) $d+\frac{n}{3}$ (d) $d-\frac{n}{3}$

### 2009

2. Minimum thickness of load bearing RCC wall should be

(a) 5 cm (b) 10 cm

(c) 15 cm (d) 20 cm

3. The minimum cover of a slab should neither be less than the diameter of bar nor less than

(a) 10 mm

(b) 15 mm

(c) 25 mm

(d) 13 mm

4. According to IS : 456-2000, the maximum reinforcement in a column is

(a) 4% (b) 2%

(c) 6% (d) 8%

### 2010

5. A reinforced concrete beam, supported on columns at ends, has a clear span 5m, and 0.5 m effective depth. It carries a total uniformly distributed load 100 KN/m. The design shear force for the beam is :

(a) 250 KN (b) 200 KN

(c) 175 KN (d) 150 KN

6. Shear reinforcement is provided in the form of

(a) Vertical bars

(b) Inclined bars

(c) Combination of vertical & inclined bars

(d) Any one of the above

### 2011

7. The deflection of a beam may be reduced by

(a) increasing depth of the section

(b) increasing degree of end restraint

(c) increasing width of the section

(d) any one or all of the above

8. In limit state of collapse against flexure, the maximum strain in tension reinforcement at failure shall **not** be less than

(a) 0.002 (b) $0.002+\frac{f_y}{E_s}$

(c) $0.002+\frac{f_y}{0.87E_s}$ (d) $0.002+\frac{f_y}{1.15E_s}$

9. A slab is designed as a two-way slab if the ratio of long span to short span is greater than

(a) 1.0 (b) 1.2

(c) 1.5 (d) 2.0

10. According to IS 456 : 2000, the maximum depth of stress block for balanced section of beam of effective depth $d$ using steel with $f_y$ = 250, is given by

(a) 0.43 $d$ (b) 0.53 $d$

(c) 0.68 $d$ (d) 0.73 $d$

11. The HYSD reinforcement in RC slab shall not be less than

(a) 0.12 (bd)/100

(b) 0.12 (bD)/100

(c) 0.15 (bd)/100

(d) 0.15 (bD)/100

### 2012

12. The horizontal distance between parallel main reinforcements in RC slab shall not be more than

(a) 4 times effective depth of slab

(b) 5 times effective depth of slab

(c) 3 times effective depth of slab

(d) 2 times effective depth of slab

13. The factored loads at the limit state of collapse for DL + LL, DL + WL and DL + LL + WL combinations, according to IS : 456 - 2000 are respectively

(a) 1.2 DL + 1.2 LL, 1.5 DL + 1.5 WL, 1.5 DL + 1.5 LL + 1.5 WL

(b) 1.5 DL + 1.5 LL, (0.9 or 1.5) DL + 1.5 WL, 1.2 DL + 1.2 LL + 1.2 WL

(c) 1.5 DL + 1.5 LL, 1.2 DL + 1.2 WL, 1.5 DL + 1.5 LL + 1.5 WL

(d) (0.9 or 1.5) DL + 1.5 LL, 1.5 DL + 1.5 WL, 1.2 DL + 1.2 LL + 1.2 WL

14. A compression member is termed as column or strut if the ratio of its effective length to the least lateral dimension is more than
   (*a*) 3 (*b*) 5
   (*c*) 1 (*d*) 2

15. Minimum percentage of tension steel in and RCC beam for Fe 500 steel is
   (*a*) 0.22 (*b*) 0.80
   (*c*) 0.12 (*d*) 0.17

16. In reinforced and plain concrete footing resting on soils, the thickness at edge shall not be less than
   (*a*) 30 cm (*b*) 50 cm
   (*c*) 15 cm (*d*) 25 cm

17. Bending moment co-efficients and shear co-efficient for continous beams of uniform cross-section as per IS 456 (tab-12 and 13) may be used only when spans do not differ to the longest span by
   (*a*) 15% (*b*) 20%
   (*c*) 10% (*d*) 12%

## 2013

18. Minimum percentage of tension steel in an RCC beam for Fe 500 steel is
   (*a*) 0.12 (*b*) 0.17
   (*c*) 0.22 (*d*) 0.80

19. As per IS 456, the effective length of cantilever shall be taken as
   (*a*) clear span
   (*b*) clear span + effective depth/2
   (*c*) clear span + effective depth
   (*d*) clear span + effective width

20. The minimum horizontal distance between two main reinforcement bars should be
   (*a*) diameter of larger bar or 5 mm more than the nominal maximum size of coarse aggregate, whichever is higher
   (*b*) 5 mm more than the nomial size of the aggregate only
   (*c*) 5 mm more than the diameter of the bar
   (*d*) None of the above

21. As per IS 456, splitting tensile strength ($f_{cr}$) of concrete may be estimated from compressive strength as
   (*a*) $f_{cr} = 0.65\sqrt{f_{ck}}$ (*b*) $f_{cr} = 0.7\sqrt{f_{ck}}$
   (*c*) $f_{cr} = 0.75\sqrt{f_{ck}}$ (*d*) $f_{cr} = 0.8\sqrt{f_{ck}}$

22. For simply supported beams, the allowable deflection shall ***not*** exceed
   (*a*) 1/325 of span
   (*b*) 1/350 of span
   (*c*) 1/375 of span
   (*d*) 1/400 of span

23. The beams supporting the stair steps, are generally known as
   (*a*) headers
   (*b*) trimmers
   (*c*) stringers
   (*d*) spandrel beam

24. In a singly reinforced beam, if the permissible stress in concrete reaches earlier than the permissible stress in steel, the beam section is called
   (*a*) Under reinforced section
   (*b*) Over reinforced section
   (*c*) Balanced section
   (*d*) Economic section

25. Side face reinforcement shall be provided in the reinforced concrete beam when depth of web in the beam exceeds
   (*a*) 500 mm (*b*) 750 mm
   (*c*) 1000 mm (*d*) 1200 mm

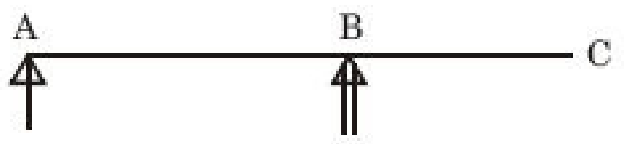
26. A cantilever retaining wall should ***not*** be used for heights more than
   (*a*) 4 m (*b*) 6 m
   (*c*) 8 m (*d*) 10 m

27. Diagonal tension in a reinforced concrete beam
   (*a*) is maximum at neutral axis
   (*b*) decreases below neutral axis and increases above netural axis
   (*c*) increases below netural axis and decreases above neutral axis
   (*d*) remains constant throughout the depth

## 2014

28. Spacing of stirrups in a rectangular beam is :
   (*a*) increased at the ends
   (*b*) kept constant throughout the length
   (*c*) decreased towards the centre of the beam
   (*d*) increased at the centre of the beam

29. The minimum percentage of longitudinal reinforcement in RCC coloumn is :
   (*a*) 12 (*b*) 0.6
   (*c*) 0.8 (*d*) 1.0

**30.** 


The beam shown in Fig. is :

(*a*) Free cantilever beam

(*b*) Single overhanging beam

(*c*) Doubel overhanging beam

(*d*) Proper cantilever beam

**31.** In a singly reinforced beam if the stress in concrete reaches its allowable limit earlier than the steel reaches its permissible limit, the beam section is called:

(*a*) critical section

(*b*) under reinforced section

(*c*) over feinforced section

(*d*) economic section

**32.** The minimum diameter of longitudinal reinforcement in RCC column should not be less than :

(*a*) 16 mm (*b*) 6 mm

(*c*) 8 mm (*d*) 12 mm

**33.** A RCC column is regarded as long column if the ratio of its unsupported length between end restraints to least lateral dimension is more than :

(*a*) 25 (*b*) 150

(*c*) 125 (*d*) 60

**34.** Mild steel used in RCC structures conforms to

(*a*) IS : 432 (*b*) IS : 1566

(*c*) IS : 1786 (*d*) IS : 2062

**35.** The effective slenderness ratio of a cantilever column is

(*a*) 0.5 L/r (*b*) L/r

(*c*) $\sqrt{2}\,L/r$ (*d*) 2 L/r

**36.** If the area of tension reinforcement provided is less than that required for a balanced section, then the RCC beam is called

(*a*) over reinforced

(*b*) neutral reinforced

(*c*) under reinforced

(*d*) bottom reinforced

**37.** In limit state of collapse for direct compression, the maximum axial compressive strain in concrete is

(*a*) 0.002 (*b*) 0.003

(*c*) 0.0035 (*d*) 0.004

**38.** A reduction factor $C_r$ to load carrying capacity for a long column of effective length $L_e$ and width b is applied as obtained from following expression:

(*a*) $1-\frac{L_e}{24b}$ (*b*) $1.25-\frac{L_e}{36b}$

(*c*) $1.25-\frac{L_e}{48b}$ (*d*) $1.5-\frac{L_e}{60b}$

**39.** A T-beam behaves are rectangular beam of a width equal to its flange if its neutral axis

(*a*) falls within the flange

(*b*) falls below the flange

(*c*) coincides with the geometrical centre of the beam

(*d*) falls below the centroidal axis of the beam

**40.** The minimum clear cover (in mm) for the main reinforcement in column, according to IS : 456-2000 is

(*a*) 20 (*b*) 25

(*c*) 40 (*d*) 50

**41.** The diameter of longitudinal bars of a RCC column should never be less than

(*a*) 6 mm (*b*) 8 mm

(*c*) 10 mm (*d*) 12 mm

**42.** In an RCC section of effective depth 'd', if vertical stirrups are provided to resist shear, their maximum spacing measured along the axis of the member as per IS : 456-2000 should **not** exceed

(*a*) 0.25 d (*b*) 0.50 d

(*c*) 0.75 d (*d*) 1.00 d

**43.** For a continuous slab of 3 m × 3.5 m size, the minimum overall depth of slab to satisfy vertical deflection limit is

(*a*) 5 cm (*b*) 7.5 cm

(*c*) 10 cm (*d*) 15 cm

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**44.** The thickness of the flange of a tee beam of a ribbed slab is assumed as

(*a*) half the thickness of the rib

(*b*) thickness of the concrete topping

(*c*) depth of the rib

(*d*) width of the rib

**45.** A beam is supported over three rollers lying in the same plane. The beam is stable for

(*a*) loading with no component perpendicular to the direction of beam

(*b*) only when no load except self weight acts

(*c*) loading with no component in the direction of the beam

(*d*) any general loading

**46.** In a singly reinforced beam, if the concrete is stressed to its allowable limit earlier than steel, the section is said to be

(*a*) economical section

(*b*) over reinforced section

(*c*) balanced section

(*d*) under reinforced section

**47.** The span to depth ratio limit is specified in IS : 456-2000 for the reinforced concreted beams, in order to ensure that the

(*a*) shear failure is avoided

(*b*) tensile crack width is below a limit

(*c*) deflection of the beam is below a limiting value

(*d*) stress in the tension reinforcement is less than the allowable value

**48.** A 300 × 300 mm R.C. column in reinforced with 8 bars, four bars are of 12 mm diameter. The diameter of lateral ties is 6 mm. The pitch of lateral ties shall be kept as

(*a*) 288 mm (*b*) 160 mm

(*c*) 192 mm (*d*) 300 mm

**49.** When R.C.C. footing is not to extend in the plot of the neighbouring house, the type of footing preferred is

(*a*) cellular flat not footing

(*b*) inverted flat not footing

(*c*) strap footing

(*d*) both (*a*) and (*b*) above

# ANSWERS

## EXERCISE - I

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*c*) | **2.** (*b*) | **3.** (*b*) | **4.** (*d*) | **5.** (*d*) | **6.** (*c*) | **7.** (*d*) | **8.** (*a*) | **9.** (*b*) | **10.** (*b*) |
| **11.** (*c*) | **12.** (*d*) | **13.** (*c*) | **14.** (*a*) | **15.** (*a*) | **16.** (*b*) | **17.** (*c*) | **18.** (*a*) | **19.** (*d*) | **20.** (*d*) |
| **21.** (*d*) | **22.** (*a*) | **23.** (*b*) | **24.** (*b*) | **25.** (*b*) | **26.** (*c*) | **27.** (*b*) | **28.** (*c*) | **29.** (*a*) | **30.** (*d*) |
| **31.** (*c*) | **32.** (*a*) | **33.** (*b*) | **34.** (*b*) | **35.** (*b*) | **36.** (*c*) | **37.** (*c*) | **38.** (*b*) | **39.** (*b*) | **40.** (*d*) |
| **41.** (*a*) | **42.** (*d*) | **43.** (*d*) | **44.** (*c*) | **45.** (*c*) | **46.** (*b*) | **47.** (*c*) | **48.** (*a*) | **49.** (*d*) | **50.** (*a*) |
| **51.** (*d*) | **52.** (*a*) | **53.** (*d*) | **54.** (*b*) | **55.** (*b*) | **56.** (*c*) | **57.** (*a*) | **58.** (*c*) | **59.** (*b*) | **60.** (*a*) |
| **61.** (*d*) | **62.** (*b*) | **63.** (*a*) | **64.** (*d*) | **65.** (*c*) | **66.** (*a*) | **67.** (*d*) | **68.** (*c*) | **69.** (*b*) | **70.** (*d*) |
| **71.** (*b*) | **72.** (*b*) | **73.** (*b*) | **74.** (*b*) | **75.** (*a*) | **76.** (*a*) | **77.** (*c*) | **78.** (*b*) | **79.** (*a*) | **80.** (*b*) |
| **81.** (*a*) | **82.** (*b*) | **83.** (*a*) | **84.** (*a*) | **85.** (*a*) | **86.** (*d*) | **87.** (*b*) | **88.** (*d*) | **89.** (*c*) | **90.** (*c*) |
| **91.** (*a*) | **92.** (*c*) | **93.** (*a*) | **94.** (*a*) | **95.** (*b*) | **96.** (*c*) | **97.** (*c*) | **98.** (*a*) | **99.** (*d*) | **100.** (*d*) |
| **101.** (*d*) | **102.** (*c*) | **103.** (*b*) | **104.** (*d*) | **105.** (*b*) | **106.** (*c*) | **107.** (*d*) | **108.** (*b*) | **109.** (*a*) | **110.** (*d*) |
| **111.** (*d*) | **112.** (*b*) | **113.** (*a*) | **114.** (*b*) | **115.** (*b*) | **116.** (*d*) | **117.** (*d*) | **118.** (*c*) | **119.** (*c*) | **120.** (*a*) |
| **121.** (*a*) | **122.** (*a*) | **123.** (*c*) | **124.** (*d*) | **125.** (*d*) | **126.** (*d*) | **127.** (*a*) | **128.** (*c*) | **129.** (*c*) | **130.** (*a*) |
| **131.** (*b*) | **132.** (*b*) | **133.** (*c*) | **134.** (*b*) | **135.** (*b*) | **136.** (*c*) | **137.** (*a*) | **138.** (*b*) | **139.** (*a*) | **140.** (*a*) |
| **141.** (*a*) | **142.** (*c*) | **143.** (*a*) | **144.** (*b*) | **145.** (*b*) | **146.** (*c*) | **147.** (*d*) | **148.** (*c*) | **149.** (*c*) | **150.** (*a*) |
| **151.** (*a*) | **152.** (*c*) | **153.** (*d*) | **154.** (*b*) | **155.** (*a*) | **156.** (*a*) | **157.** (*b*) | **158.** (*a*) | **159.** (*a*) | **160.** (*b*) |
| **161.** (*a*) | **162.** (*b*) | **163.** (*b*) | **164.** (*b*) | **165.** (*d*) | **166.** (*a*) | **167.** (*b*) | **168.** (*b*) | **169.** (*c*) | **170.** (*c*) |
| **171.** (*d*) | **172.** (*b*) | **173.** (*d*) | **174.** (*c*) | **175.** (*a*) | **176.** (*c*) | **177.** (*a*) | **178.** (*c*) | **179.** (*a*) | **180.** (*b*) |
| **181.** (*a*) | **182.** (*b*) | **183.** (*c*) | **184.** (*d*) | **185.** (*a*) | **186.** (*d*) | **187.** (*a*) | **188.** (*d*) | **189.** (*c*) | **190.** (*a*) |
| **191.** (*a*) | **192.** (*b*) | **193.** (*c*) | **194.** (*c*) | **195.** (*c*) | **196.** (*b*) | **197.** (*a*) | **198.** (*c*) | **199.** (*a*) | **200.** (*d*) |
| **201.** (*d*) | **202.** (*c*) | **203.** (*b*) | **204.** (*a*) | | | | | | |

## EXERCISE - II

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*d*) | **2.** (*b*) | **3.** (*b*) | **4.** (*c*) | **5.** (*b*) | **6.** (*d*) | **7.** (*a*) | **8.** (*d*) | **9.** (*) | **10.** (*b*) |
| **11.** (*b*) | **12.** (*c*) | **13.** (*b*) | **14.** (*a*) | **15.** (*d*) | **16.** (*c*) | **17.** (*a*) | **18.** (*b*) | **19.** (*b*) | **20.** (*a*) |
| **21.** (*b*) | **22.** (*a*) | **23.** (*c*) | **24.** (*b*) | **25.** (*b*) | **26.** (*b*) | **27.** (*c*) | **28.** (*d*) | **29.** (*c*) | **30.** (*b*) |
| **31.** (*c*) | **32.** (*d*) | **33.** (*d*) | **34.** (*a*) | **35.** (*d*) | **36.** (*c*) | **37.** (*a*) | **38.** (*c*) | **39.** (*a*) | **40.** (*c*) |
| **41.** (*d*) | **42.** (*c*) | **43.** (*b*) | **44.** (*b*) | **45.** (*c*) | **46.** (*b*) | **47.** (*c*) | **48.** (*c*) | **49.** (*c*) | |

# EXPLANATIONS

**Exercises II**

**1.** lever arm of the beam (LA) = $\left(d - \frac{n}{3}\right)$

**2.** The minimum thickness of walls shall be 100 mm.

**3. CLEAR COVER TO MAIN REINFORCEMENT**

| | |
|---|---|
| Footings | 50 mm |
| Column | 40 mm (d >12 mm) 25 mm (d = 12 mm) |
| Beams | 25 mm |
| Slabs | 15mm or not less than diameter of the bar |
| Flat Slab | 20 mm |
| Staircase | 15 mm |
| Sunshade (Chajja) | 25 mm |

**4.** Cross-sectional area of longitudinal reinforcement shall be not less than 0.8 % and not more than 6% of the gross cross-sectional area of the column.

**5.** For a udl load applied on a simply supported beam, shear force = $\frac{wL}{2}$

here L = 5m

$$S.F = \frac{100 \times 5}{2} = 250\text{kN}$$

The effective depth of the beam is 0.5m, hence critical section for shear occurs at a distance 0.5m from face of the column.

Therefore, design shear force

$$= 250 - 100 \times 0.5 = 200\text{kN}$$

**18.** Min $\frac{R}{F}$ $As = \frac{0.85}{fy} \cdot bd = \frac{0.85}{500} \times 100 = 0.17$

**19.** $\frac{\text{clear span} + \text{Effective depth}}{2}$

The effective length of a contilever shall be taken as its length to the face of support plus half the effective depth. See code is 456:2000 page No. 35.

**20.** Diameter of larger bar or 5 mm more than the nominal maximum size or coarse aggregate, whichever is higher, see code 456:2000

**21.** $F_{Cr} = 0.7\sqrt{f_{ck}}$ [By code] and 456 : 2000

$f_{ck}$ = characteristic cube compressibe strength of concrete.

**22.** Maximum deflection $\Rightarrow \frac{l}{325}$(span)

**23.** Stringer [is a wooden slop on which step rest]

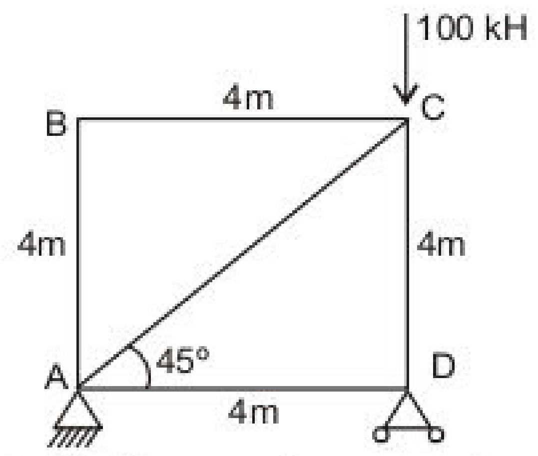
**24.** Over reinfored section

**25.** 750 mm see code 15456 : 2000 P No. 47

**26.** 6 m

**27.** Increase below the N-As.

Find the force in member CA




**28.** Spacing of stirrup in a rectangular beam increased at the centre of the beam.

**30.** An overhanging beam is one in which the supports are not situated at ends i.e. one or both the ends project beyond the supports. Thus it is single overhanging beam.

**31.** In a singly reinforced beam, if the stress in concrete reaches its allowable limit earlier than the steel reaches its permissible limit, the beam section is called over reinforced section.

**32.** The minimum diameter of longitudinal reinforcement in RCC column should not be less than 12 mm.

**33.** The unsupported length between end restraints shall not exceed 60 times the least lateral dimension of a column.

**43.** $\frac{l_y}{l_x} \leq 2$, this is a two way slab

Deflection limit for continuous slab = 40

$$\frac{\text{Span}}{40} \leq \text{overall depth}$$

Therefore, minimum overall depth

$$\geq \frac{300\,cm}{40} = 7.5\text{cm}$$

**44.** Thickness of flange ($d_f$). This is equal to the overall depth of the slab forming the flange of the T-Beam.