

- 1 A soil sample with specific gravity of solids 2.70 has a mass specific gravity of 1.84. Assuming soil to be perfectly dry, the liquid ratio of soil will be
 - (a) 0.47
 - (b) 0.57
 - (c) 0.28
 - (d) 0.70

- 2 The compactive energy used in IS modified proctor test is times the compactive energy used in case of IS standard proctor test.
 - (a) 4.56
 - (b) 1.0
 - (c) 2.5
 - (d) 3.14

- 3 Maximum permissible upward gradient in a pervious sand of porosity $n = 45\%$, specific gravity $G_s = 2.65$ with a factor of safety 4 will be
 - (a) 0.425
 - (b) 0.225
 - (c) 0.375
 - (d) 0.275

- 4 Which is not a method of obtaining flownets?
 - (a) Electrical flow analogy
 - (b) Capillary flow analogy
 - (c) Sand model
 - (d) Flow model

- 5 A silty soil of high compressibility is represented by the symbol
 - (a) SM
 - (b) ML
 - (c) OL
 - (d) MH

- 6 In a triaxial shear test a sample of $c - \phi$ soil fails making an angle of α_c° with horizontal, then value of ϕ can be determined as
 - (a) $2(\alpha_c^\circ - 45^\circ)$
 - (b) $(\alpha_c^\circ + 45^\circ)$
 - (c) $2(45^\circ - \alpha_c^\circ)$
 - (d) $2\alpha_c^\circ$

- 7 Depth below the ground surface is $c - \phi$ soil, where active earth pressure intensity is zero, is given by
 - (a) $\frac{2c\sqrt{K_A}}{\gamma}$
 - (b) $\frac{2c\gamma}{\sqrt{K_A}}$
 - (c) $\frac{2c}{\gamma\sqrt{K_A}}$
 - (d) $\frac{2c\gamma}{K_A}$

Where, γ is the effective unit weight of soil.

K_A = coefficient of active earth pressure by the soil.

- 8 For 6 m deep excavation in soft clay, $\gamma = 18\text{kN/m}^3$, $c = 26\text{kN/m}^2$, Taylor's stability number, $S_n = 0.172$, factor of safety (F_c) against sliding will be
- (f) -1.2
 - (b) 1.3
 - (c) 1.4
 - (d) 1.5
- 9 Given that Plasticity Index (PI) of local soil is 15 and PI of sand is zero. For a desired PI of 6, the percentage of sand in the mix should be
- (a) 70
 - (b) 60
 - (c) 40
 - (d) 30
- 10 The natural void ratio of a saturated clay strata, 3 m thick is 0.90. The final void ratio of the clay at the end of the consolidation is expected to be 0.71. The total consolidation settlement of the clay strata is
- (a) 30 cm
 - (b) 25 cm
 - (c) 20 cm
 - (d) 15 cm
- 11 A 30 cm diameter friction pile is embedded 10 m into a homogeneous consolidated deposit. Unit cohesion developed between clay and pile shaft is 4t/m^2 and adhesion factor is 0.7. The safe load for factor of safety 2.5 will be
- (a) 21.50t
 - (b) 11.57t
 - (c) 70.55t
 - (d) 6.85t
- 12 In Newmark's influence chart for stress distribution, there are ten concentric circles and ten radial lines. The influence factor of the chart is
- (a) 0.1
 - (b) 0.01
 - (c) 0.001
 - (d) 0.0001
- 13 Ultimate bearing capacity (q_f) of a square footing 2.5 m wide resting at 1.5 m depth in a sandy soil having unit weight $\gamma = 18\text{kN/m}^3$, $N_q = 33$, $N_r = 48$, using factor of safety as 3, will be
- (a) 487kN/m^2
 - (c) 741kN/m^2
 - (b) 585kN/m^2
 - (d) 512kN/m^2
- 14 Using Engineering News formula, the allowable load (Q_a) of a wooden pile hammered with a drop hammer ($W = 30\text{ kN}$), having free fall (H) 1.5 m, penetration in last blow (S) 5 mm, using empirical constant (C) as 2.5 and factor of safety as 6, will be
- (a) 185kN
 - (b) 250kN

- (c) 212kN
(d) 231kN
- 15 The ratio of average permeability in horizontal direction (k_n) to that in vertical direction (k_v) of a 3 layer soil deposit with thickness ratio 1: 2: 3. The permeability of second layer is twice that of first and third is twice that of second, $k_n: k_v$ will be
(a) 1: 0.51
(b) 1: 0.67
(c) 1: 0.59
(d) 1: 0.77
- 16 If undisturbed undrained strength of clay is 40.5kN/m^2 and its remoulded undrained strength is 26.6kN/m^2 , the sensitivity of clay will be
(a) 1.42
(b) 1.52
(c) 1.62
(d) 1.72
- 17 Vertical point load (Q) on the surface is 500kN, σ_z (pressure increment) at 10 m depth ($Z = 10\text{ m}$, directly under the axis of load) will be
(a) 1.68kN/m^2
(b) 2.38kN/m^2
(c) 9.54kN/m^2
(d) 4.636kN/m^2
- 18 A soil has discharge velocity of $6 \times 10^{-7}\text{ m/s}$ and void ratio of 0.5. Its seepage velocity is
(a) $18 \times 10^{-7}\text{ m/s}$
(b) $12 \times 10^{-7}\text{ m/s}$
(c) $6 \times 10^{-7}\text{ m/s}$
(d) $3 \times 10^{-7}\text{ m/s}$
- 19 In a fully saturated soil, Skempton's pore pressure parameter 'B' becomes equal to
(a) 0
(b) 0.5
(c) 0.75
(d) 1.0
- 20 In order to minimize sampling disturbance the area ratio A_r ($A_r = \frac{D_e^2 - D_i^2}{D_i^2}$) should be
(a) zero
(b) as high as possible
(c) as low as possible
(d) equal to unity
- 21 Four vertical columns of the same material, height and weight have the same end conditions. The buckling load will be the largest for column having the cross-section of
(a) solid square
(b) thin hollow circle
(c) solid circle
(d) H-section

- 22 Effective length of steel column effectively held at both ends in position but not restrained in directions is ' x ' times its length between two ends, where ' x ' is equal to
- (a) 0.65
 - (b) 0.85
 - (c) 1.00
 - (d) 2.00
- 23 Effective length of a column is the length between the points of
- (a) support
 - (b) maximum moment
 - (c) zero moment
 - (d) zero shear
- 24 A steel plate is 300 mm wide and 10 mm thick. It has one rivet of nominal diameter 18 mm. The net sectional area of the plate is
- (a) 1800 mm²
 - (b) 2805 mm²
 - (c) 2820 mm²
 - (d) 3242 mm²
- 25 Vertical web stiffeners are used in plate girder to
- (a) Avoid buckling of web plate.
 - (b) Improve the aesthetic of girder.
 - (c) Increase the moment capacity of girder.
 - (d) None of the above.
- 26 In case of I-section steel beam
- (a) Shear capacity of flange is neglected.
 - (b) Shear capacity of web is neglected.
 - (c) Shear capacity of both flange and web is neglected.
 - (d) None of the above.
- 27 The weakest plane in a filled web is
- (a) a side parallel to the force
 - (b) a side normal to the force
 - (c) along the throat
 - (d) normal to the throat
- 28 The strength at which steel fails under repeated load applications is known as
- (a) impact strength
 - (b) tensile strength
 - (c) yield strength
 - (d) fatigue strength
- 29 If the angle between fusion faces of a fillet weld is 60° – 90°, the effective throat thickness as per Indian Standard is equal to
- (a) $\frac{1}{\sqrt{2}}$ size of weld
 - (b) $\frac{1}{\sqrt{3}}$ size of weld
 - (c) $\sqrt{2}$ size of weld
 - (d) $\sqrt{3}$ size of weld

- 30 The junction between flange and web of an I-section is called
- Lap joint
 - Butt joint
 - Fillet joint
 - Shear joint
- 31 Which one of the following method does not fall under the category of force method?
- Method of consistent deformation
 - Cotamn analogy method.
 - Equilibrium method
 - Three moment equation
- 32 In a triangular section placed with its base horizontal, ratio of max. shear stress to average shear stress is
- 1.25
 - 1.33
 - 1.43
 - 1.53
- 33 The effective slenderness ratio of a cantilever column is
- $\frac{0.5 L}{R}$
 - $\frac{L}{R}$
 - $\frac{\sqrt{2} L}{r}$
 - $\frac{2L}{r}$
- 34 A horizontal semi-circular beam of radius 'R' is fixed at the ends and carries a uniformly distributed load 'W' over the entire length. The bending moment at the fixed supports is
- $\frac{WR^2}{4}$
 - $\frac{WR^2}{3}$
 - $\frac{WR^2}{2}$
 - WR^2
- 35 The deflection is ' δ ', strain energy ' U ' and load ' W '. on a truss. These are related by
- $\delta = \frac{\partial U}{\partial W}$
 - $\delta = \frac{\partial^2 U}{\partial W^2}$
 - $\delta = \frac{\partial^3 U}{\partial W^3}$
 - $\delta = \left(\frac{\partial U}{\partial W}\right)^2$
- 36 Eccentricity of connections introduces
- Primary stresses
 - Yibrating stresses
 - Secondary stresses →
 - None of the above

- 37 A point load 'W' is acting at a distance 'a' from the left support of a three hinged arch of span 2l and rise 'h' hinged at the crown. The horizontal reaction at the support is
- Wa/h
 - Wa/2 h
 - 2 W/ha.
 - 2 h/Wa
- 38 As per IS code, the reinforcement in a column should not be less than
- 0.5% and not more than 5% of gross sectional area.
 - 0.6% and not more than 6% of gross sectional area.
 - 0.7% and not more than 7% of gross sectional area.
 - 0.8% and not more than 8% of gross sectional area.
- 39 As per IS 456: 2000, the development length is given by
- $\frac{\phi \sigma_s}{8\tau bd}$
 - $\frac{\phi \sigma_s}{4\tau bd}$
 - $\frac{\phi \sigma_s}{8\tau bd}$
 - $\frac{\phi \sigma_s}{4\tau bd}$
- 40 The target mean strength of concrete mix should be
- The characteristic strength +1.65 times standard deviation.
 - The characteristic strength +1.45 times standard deviation.
 - The ultimate strength +1.65 times standard deviation.
 - The ultimate strength +1.45 times standard deviation
- 41 A stationary hydraulic jump occurs in a rectangular channel with the initial and sequent depths being equal to 0.20 m and 1.20 m respectively. The energy loss will be equal to
- 1.042 m
 - 0.521 m
 - 1.563 m
 - 0.265 m
- 42 In a rectangular channel, the depth of flow, is 1.6 m and the specific energy at that section is 2.7 m, the flow is
- Sub critical
 - Super critical
 - Critical
 - Not possible
- 43 For a triangular channel having side slope of a 2 horizontal to 1 vertical, the Froude number, F is given by
- $\frac{V}{\sqrt{gy}}$
 - $\frac{2V}{\sqrt{gy}}$
 - $\frac{V}{\sqrt{2gy}}$
 - $y = \frac{2Q^2}{gm^2}$
 - $\frac{N}{\sqrt{g(y/2)}}$

44 Lacey's regime scour depth, D is expressed by equation, $D =$

(a) $1.35\left(\frac{q^2}{f}\right)^{\frac{1}{6}}$

(b) $1.35\left(\frac{q^2}{f}\right)^{\frac{1}{3}}$

(c) $1.35\left(\frac{q}{f}\right)^{\frac{1}{3}}$

(d) $1.35\left(\frac{q}{f}\right)^{\frac{1}{6}}$

Where $q =$ Discharge

$f =$ silt factor

45 Neglecting uplift pressure, the base width of an elementary profile of a gravity dam shall be taken as

(a) $\frac{H}{\mu G}$

(b) $\frac{H}{\sqrt{G}}$

(c) greater of $\frac{H}{\sqrt{G}}$ & $\frac{H}{\mu G}$

(d) lesser of $\frac{H}{\sqrt{G}}$ & $\frac{H}{\mu G}$

46 The graphical solution of Kennedy's equation and Kutter's equation is given by

(a) Garret's diagram

(b) Mohr's diagram

(c) Kennedy's diagram

(d) Kutter's diagram

47 Which of the following conditions is the chief Characteristics of critical flow?

(a) $\frac{Q^2 T}{g A^3} = 1$

(b) $\frac{Q T^2}{g A^2} = 1$

(c) $\frac{Q^2 R}{g A^3} = 1$

(d) $\frac{Q^2 T^2}{g A^3} = 1$

48 The velocity of pressure wave in a rigid pipe carrying a fluid of density ' ρ ', viscosity $\cdot \mu$ varies as

(a) ρ

(b) $\sqrt{\rho}$

(c) $\frac{\rho}{\mu}$

(d) $\frac{1}{\sqrt{\rho}}$

49 The flow will be in super critical state in the following profile :

(a) M_3, S_3 and M_1

(b) M_2, S_1 and M_3

(c) S_2, S_3 and M_3

(d) S_1, S_2 and S_3

- 50 The critical velocity $V_0 = 0.55my^{0.64}$ as suggested by Kennedy for design of trapezoidal irrigation channel is
- the maximum permissible velocity.
 - the minimum permissible velocity.
 - both (a) and (b)
 - None of these
- 51 If $\psi = 2xy$, the magnitude of velocity vector at $(2, -2)$ is
- $4\sqrt{2}$
 - 4
 - 8
 - $\sqrt{2}$
- 52 The velocity potential function for a line source varies with radial distance, r as
- $\frac{1}{r}$
 - $\frac{1}{r^2}$
 - r
 - $\ln r$
- 53 In a pipeline the hydraulic grade line is above the pipe centre line in the longitudinal section at point A and below the pipe centre line at another point B. From this it can be inferred that
- Vacuum pressure prevails at B
 - Vacuum pressure prevails at A
 - the flow is from A to B
 - the flow is from B to A.
- 54 In a steady incompressible fluid flow with uniform velocity distribution, the momentum flux in a given x -direction past a given section is expressed as $M_x =$
- ρQV
 - $\frac{\rho V^2}{2}$
 - ρQv_x
 - $\frac{Q^2}{A}$
- 55 In a tidal model, the horizontal scale ratio is $1/500$. The vertical scale ratio is $1/50$. The model period corresponding to a prototype period of 12 hours will be
- 10 minutes 10 second
 - 1 minute 10 second
 - 5 minutes 5 second
 - 10 minutes
- 56 The equation of motion for laminar flow of a real fluid are known as
- Euler's equation
 - Bernoulli's equation
 - Navier-Stokes' equation
 - Hagen-Poiseuille equation
- 57 In turbulent pipe flow, inside the laminar boundary, the velocity distribution is
- Parabolic

- (b) Linear
(c) Logarithmic
(d) Exponential decay type
- 58 The friction factor ' f ' in a laminar pipe flow was found to be 0.04. The Reynold number of the flow is
(a) 2000
(b) 1000
(c) 800
(d) 1600
- 59 In a turbulent flow through a pipe of radius r_0 , the radial distance at which the local velocity is equal to the mean velocity
(a) $0.1r_0$
(b) $0.223r_0$
(c) $0.777r_0$
(d) $0.5r_0$
- 60 In the Moody diagram the values of ' f ' for turbulent flow are based on
(a) Nikuradse's uniform sand grain. data.
(b) Data on non-uniform sand grains coated in pipe.
(c) Colebook-white data on commercial pipe.
(d) Hazen-William pipe flow formula.
- 61 The head loss in a sudden expansion from 6 cm diameter pipe to 12 cm diameter pipe, in terms of velocity V_1 , in the 6 cm dia pipe is
(a) $\frac{15}{16} \cdot \frac{V_1^2}{2g}$
(b) $\frac{3}{4} \cdot \frac{V_1^2}{2g}$
(c) $\frac{1}{4} \cdot \frac{V_1^2}{2g}$
(d) $\frac{9}{16} + \frac{V_1^2}{2g}$
- 62 For maximum transmission of power through a pipeline with total head, H , the head loss due to friction, (h_f) is given by $b_f f =$
(a) $H/3$
(b) $H/2$
(c) $\frac{2}{3}H$
(d) $0.1H$
- 63 Two identical pipes of length L , diameter D and friction factor f , are connected in parallel between two points. The length of a single pipe of diameter D and the same friction factor f , equivalent to the above pair is
(a) $\sqrt{2L}$
(b) $L/2$
(c) $L/\sqrt{2}$
(d) $L/4$
- 64 Which one of the following is analogous to normal shock wave ?
(a) An elementary wave in a still liquid.

- (b) Flow of liquid in an expanding nozzle.
 (c) Hydraulic jump
 (d) Subcritical flow in a rough channel.
- 65 The Mach number, M of a compressible fluid flow is $0.3 < M < 0.8$. The fluid flow is usually classified as
 (a) Incompressible (b) Subsonic
 (c) Supersonic
 (d) Hypersonic
- 66 With increasing aging of pipes, the proportion between maximum velocity and the mean velocity in turbulent flow
 (a) initially decreases and then increases.
 (b) initially increases and then decreases.
 (c) decreases
 (d) increases.
- 67 In a laminar flow between two fixed parallel plates, the shear stress is
 (a) constant across the passage.
 (b) maximum at centre and zero at boundary.
 (c) zero all through the passage.
 (d) maximum at the boundary and zero at the centre.
- 68 The Blasius equation for friction factor ' f ' in a turbulent flow through pipes relates ' P ' to the Reynold's number ' Re ' as, $f =$
 (a) $\frac{64}{Re}$
 (b) $\frac{0.316}{Re^4}$
 (c) $\frac{1.328}{Re^2}$
 (d) $\frac{0.316}{Re^5}$
- 69 According to Lacy, regime theory is applicable to channel in
 (a) Initial regime
 (b) True regime
 (c) Final regime
 (d) both (b) and (c)
- 70 For a hydraulically efficient triangular section the hydraulic radius, $R =$
 (a) $2\sqrt{2}y$
 (b) $\frac{y}{2\sqrt{2}}$
 (c) $\frac{y}{2}$
 (d) y
- 71 The effect of sinking of supports by ' δ ' is to create a bending moment equal to
 (a) $\frac{2EI\delta}{\rho}$
 (b) $\frac{6EI\delta}{\rho^2}$

(c) $\frac{3EI\delta}{\rho^2}$
 (d) $\frac{EI\delta}{\rho^2}$

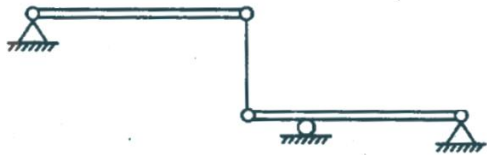
72 Column Analogy method may be used to analysis

- (a) Fixed beam
- (b) Portal frame
- (c) Box frame
- (d) All of the above

73 Which of the followings are indeterminate structure?

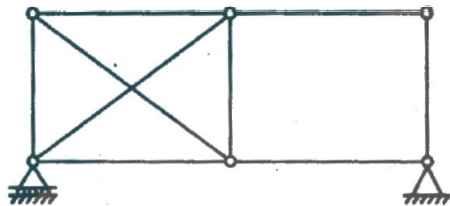
- (a) 3-hinged arch
- (b) continuous beam
- (c) Redundant frame
- (d) both (b) and (c)

74 No. of degree of static indeterminacy for the beam shown below is



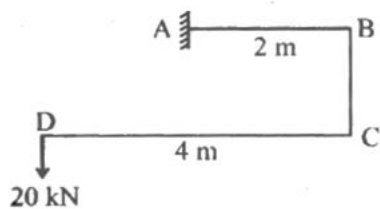
- (a) -1
- (b) 0
- (c) 1
- (d) 2

75 In the truss shown below which statement is correct?



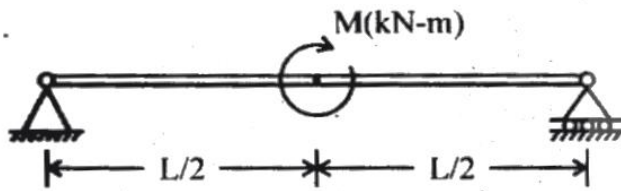
- (a). Externally unstable
- (b) Internally unstable
- (c) Statically determinate structure
- (d) Statically indeterminate structure

76 The fixed end moment at A for the structure shown below is :



- (a) 40kN – m
- (b) 80kN – m
- (c) 100kN – m
- (d) 120kN – m

77 For the beam shown below, correct BMD is:

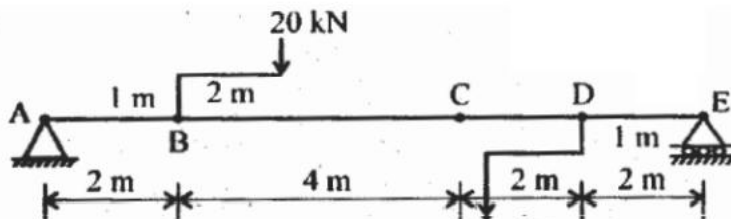


- (a)
- (b)
- (c)
- (d)

78 The line of thrust in a parabolic arch is

- (a) Parabolic
 (b) Circular
 (c) Triangular
 (d) Funicular Polygon

79 The reaction at support A for the beam shown below is

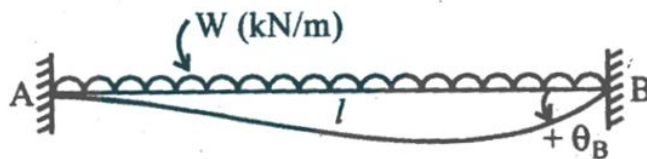


- (a) 15kN
 (b) 16kN
 (c) 17kN
 (d) 18kN

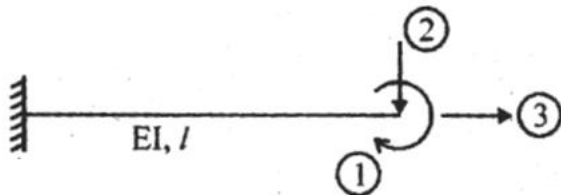
80 The point of contraflexure is the point where

- (a) bending moment changes sign
 (b) bending moment is maximum

- (c) bending moment is minimum
 (d) shear force is zero
- 81 A two hinged arch/ is statically indeterminate by
 (a) 0 degree
 (b) 1 degree
 (c) 2 degree
 (d) 3 degree
- 82 In three hinged arch, maximum hogging moment occurs when, the point load is at
 (a) springing
 (b) crown
 (c) quarter span
 (d) the section itself
- 83 Deflections in a truss depends upon
 (a) axial rigidity
 (b) flexural rigidity
 (c) axial and flexural rigidity
 (d) None of these
- 84 Influence line diagram for bending moment in a simply supported beam is a
 (a) straight line
 (b) parabola
 (c) triangle
 (d) None of these
- 85 For a fixed beam loaded as shown below, if the support, B rotates $+\theta_B$ radian anticlockwise, the fixed end moment at ' B ' is



- (a) $-\frac{Wl^2}{12} + \frac{2Ei\theta_B}{l}$
 (b) $-\frac{Wl^2}{12} + \frac{4Ei\theta_B}{l}$
 (c) $+\frac{Wl^2}{12} - \frac{2Ei\theta_B}{l}$
 (d) $+\frac{Wl^2}{12} - \frac{4Ei\theta_B}{l}$
- 86 Stiffness matrix with reference to coordinates 1,2 and 3 as shown in Fig. below is :



$$(a) [K] = \begin{bmatrix} 4EI/I & -6EI/I^2 & 0 \\ -6EI/R & 12EI/R & 0 \\ 0 & 0 & AE/I \end{bmatrix}$$

$$(b) [K] = \begin{bmatrix} -6EI/R & 4EI/I & 0 \\ 4EI/I & 12EI/I^3 & 0 \\ 0 & 0 & AE/I \end{bmatrix}$$

$$(c) [K] = \begin{bmatrix} 0 & 4EI/I & -6EI/R^2 \\ 4EI/I & 0 & 12EI/I^3 \\ 0 & 0 & AE/I \end{bmatrix}$$

$$(d) [K] = \begin{bmatrix} 0 & 4EI/I & -6EI/R \\ 4EI/I & 0 & 12EI/I\beta \\ AE/I & 0 & 0 \end{bmatrix}$$

- 87 The plastic theory is generally used for
- Column
 - Beams
 - Rigid frame structures
 - Roofs
- 88 The reversible nature of loads are
- Earthquake loads
 - Wind loads
 - Both (a) and(b)
 - None of the above
- 89 An under reinforced section means
- reinforcing steel reaches its yield stress first.
 - concrete reaches its maximum stress first.
 - reinforcement provided is equal to maximum reinforcement.
 - None of the above,
- 90 The live load to be considered for an inaccessible roof is
- 0
 - 75 kg/m²
 - 150 kg/m²
 - 250 kg/m²
- 91 Spacing of shear stirrups in a rectangular RC simply supported beam is
- kept constant throughout the span.
 - decreased towards the centre of beam.
 - increased towards the ends of beam.
 - increased towards the centre of beam.
- 92 The minimum grade of concrete that can be used for pre-tensioned beam system is
- M20
 - M25
 - M30
 - M40
- 93 The strength of compression member with helical reinforcement shall be taken as the no. of times the strength of similar member with lateral ties

- (a) 1.03
 - (b) 1.05
 - (c) 1.10
 - (d) 1.15
- 94 Partial safety factor concrete and steel respectively may be taken as
- (a) 1.5 and 1.15
 - (b) 1.5 and 1.5
 - (c) 1.5 and 1.75
 - (d) 1.75 and 1.5
- 95 In case of cantilever beam, the vertical deflection limits may generally be assumed to be satisfied provided that the span to depth ratio are not greater than
- (a) 7
 - (b) 20
 - (c) 26
 - (d) 30
- 96 The diameter of longitudinal bars of an RC column should not be less than
- (a) 6 mm
 - (b) 8 mm
 - (c) 10 mm
 - (d) 12 mm
- 97 Enlarged head of a supporting column of an RC-flat slab is called
- (a) capital
 - (b) drop panel
 - (c) column head
 - (d) None of these
- 98 An RC column is reported as long column if the ratio of its effective length and least lateral dimension exceeds
- (a) 10
 - (b) 12
 - (c) 15
 - (d) 20
- 99 Distribution reinforcement in a simply supported RC slab is provided to distribute
- (a) load
 - (b) temperature stresses
 - (c) shrinkage stresses
 - (d) All of these
- 100 As per IS 456: 2000, the tensile strength of concrete can be obtained from
- (a) $0.67\sqrt{f_{ck}}$
 - (b) $0.7\sqrt{f_{ck}}$
 - (c) $0.75\sqrt{f_{ck}}$
 - (d) $0.87\sqrt{f_{ck}}$