1. The cross section of prestressed concrete beam is given by following properties.

Area A=46450 mm^2

$I = 76 \times 10^7 mm^4$

$y_{bottom} = 244$ mm $y_{Top} = 158$ mm

It is subjected to prestressing force at aneccentricity e so as to have a zero stress at top fibre. The value of e is given by.

(a) 103.55 mm

(b) 102.30 mm

(c) 104.72 mm

(d) 105.32 mm

2. The percentage loss of prestress due to anchorage slip of 6 mm in a concrete beam of length 50 m which is post tensioned by a tendon with an initial stress of 1250 N/mm^2 and modulus of elasticity equal to 2×10^5 N/mm^2 is.

(a) 1.92 % (b) 2.5%

(c) 1.75% (d) 12%

3. The cross-sectional area of prestressing steel is 200 m^2. Modulus of elasticity of steel and concrete is 2×10^5 MPa and 3×10^4 MPa respectively. The rectangular beam of dimension 145 mm width and 230 mm depth is pretensioned by prestressing force of 150 KN at an eccentricity of 25 mm. The percentage loss of stress in the prestressing steel due to elastic deformation of concrete is.

(a) 8.750 (b) 6.125

(c) 4.564 (d) 2.190

4. Spalling stresses are produced in post tensioned pre-stressed concrete members at.

(a) Location of maximum bending moment only

(b) Location of maximum shear zone

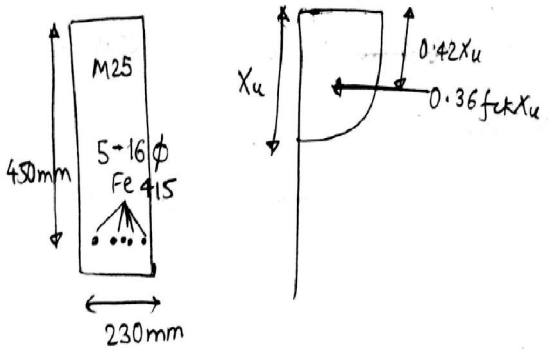
(c) Anchorage zone

(d) Bond developing zone

5. Consider the singly reinforced beam section given below. The stress block parameters for the cross section for 1S-456:2000 are also given below. The moment of

resistance for the given section by limit state method is ----------kNm.

The stress block is given below



6. A column of size 500 × 600 mm^2 has unsupported length of 3500 mm and is braced against side sway in both directions. According to IS - 456 : 2000, the minimum eccentricity (in mm)

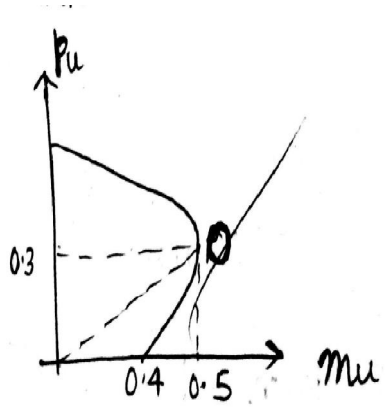
(a) 27 and 27

(b) 27 and 23.67

(c) 23.67 and 23.67

(d) 20 and 20

7. An RCC column of square cross-section (450 mm × 450 mm) has its column load moment interaction diagram as shown below.



What is the maximum uniaxial eccentricity for balanced failure of column (grade of concrete M20)

(a) 350 mm (b) 480 mm

(c) 667 mm (d) 750 mm

8. Calculate the ultimate load carrying capacity of column of a circular section of 500 mm diameter with helical reinforcement using 6 bars of 20 mm diameter. Grade of concrete used is M25 and grade of steel isFe 415.

(a) 1852 kN (b) 2590 kN

(c) 2468 kN (d) 3050 kN

9. A reinforced concrete member is subjected to combined bending

moment and axial compressive load. If E_c is the least compressive strain in the member, fy is the yield stress of steel and ε_c is the modulus of elasticity of steel, then maximum strain in concrete member will be.

(a) 0.035 - 0.75 ε_c

(b) 0.0031

(c) $0.002 + \frac{0.87\,fy}{E_S}$

(d) 0.0035 + 0.75 ε_c

10. For a bar of diameter 12 mm, the anchorage value of hook is.

(a) 24 mm (b) 96 mm

(c) 12 mm (d) 192 mm

11. The length of bars beyond theoretical cut off points shall be.

(a) Dowell length

(b) Bond length

(c) Development length

(d) Anchorage length

12. A bar of 16 mm diameter is embedded in concrete for a distance of 150 mm. What is the maximum load that can be taken by the bar if the maximum bond stress is taken as 0.8 MPa?

(a) 4.5 kN (b) 6 kN

(c) 7.5 kN (d) 9 kN

13. A rectangular beam of size 230 mm × 450 mm is subjected to shear force of 80 kN. The effective cover to the beam is 50 mm. Permissible shear stress is 0.25 N/mm^2. The design shear force (in kN) is?

(a) 57 kN (b) 23 kN

(c) 80 kN (d) 34 kN

14. Transverse shear reinforcement is provided in the form of 2 legged closed stirrups of 8 mm diameter. Find the spacing between stirrups if M2O grade of concrete is used and Fe 415 grade is used as main reinforcement and Fe 250 is used for shear stirrups. The section of RCC beam is given by 350 mm × 650 mm having $\tau_{c\max}$=2.8N/mm^2. Take τ_c=1.2N/mm^2 and design shear force for beam as 500 kN. (Effective cover -50 mm)

15. A beam is designed for udl causing compression in the supporting

column. Where is the critical section for shear?

(a) At the centre of support

(b) At a distance d from the face of support.

(c) At the face of support

(d) At a distance of d/2 from the face of support.

16. Following are the bending moments (unfactored) acting in the case of RCC beam.

BM Due to	
Dead Load	50 kNm
Live Load	80 kNm
Earth quake Load	120 kNm
Wind Load	180 kNm

Find the design moment as per 15456 : 2000 for limit state of collapse.

(a) 345 kNm (b) 195 kNm

(c) 372 kNm (d) 465 kNm

17. For a balanced. RCC rectangular section having width of 230 mm and effective depth of 400 mm, allowable moment capcity is 35 kNm. If permissible tensile stress is 230 MPa, then the area of reinforcing steel is.

(a) 421 mm^2 (b) 520 mm^2

(c) 1149 mm^2 (d) 752 mm^2

18. Flexure collapse in over reinforced beam is due to.

(a) Primary compression failure

(b) Secondary compression failure

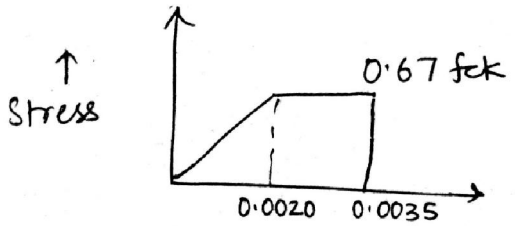
(c) Primary tension failure

(d) Bond failure.

Linked Answer Question 19 and 20

Assume a straight line instead of parabola for stress strain curve of concrete as follows and partial factor of safety of 2 for concrete.

A rectangular under reinforced concrete section of 300 mm width and 550 mm effective depth is reinforced with 4 bars of 20 mm diameter. Grade of concrete is M-25, and grade of steel Fe 415.



19. ı the compression fibre is ----------.

20. Moment of resistance of the RCC beam is ----------.

21. Which of the following is categorised as a long term loss of prestress in PSC member?

(a) Loss of elastic shortening

(b) Loss due to friction

(c) Loss due to relaxation of strands

(d) Loss due to anchorage slip

22. What is the tendon profile, in which eccentricity is proportional to bending moment caused by a loading on a rigidly supported indeterminate structure at all cross sections?

(a) Cable profile

(b) Resultant profile

(c) Concordant profile

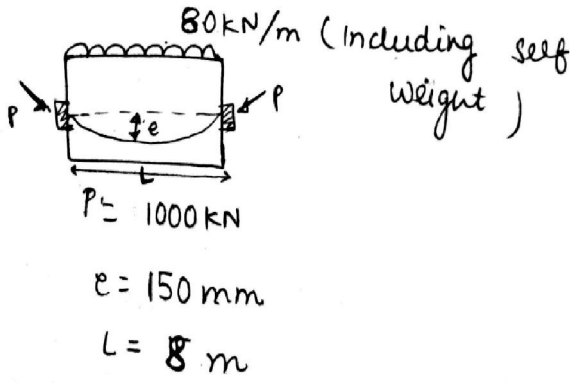
(d) Reduced profile

23. The maximum upward deflection of a PSC member is limited to

(a) Span/300 (b) Span/250

(c) Span/200 (d) Span/350

24. What is the net downward load to be considered for the analysis of the pre-stressed concrete beam provided with parabolic cable as shown in the figure below?



(c) 61.25 kN/m(d) 18.75 kN/m

25. A pedestal is defined as compression member, whose effective length does not exceeds its dimension by.

(a) 12 times (b) 3 times

(c) 16 times (d) 8 times

26. Minimum area of tension reinforment in a beam shall be greater than

(a) $\frac{0.87fy}{bd}$ (b) $\frac{0.85bd}{fy}$

(c) 0.04 bd (d) $\frac{0.4bd}{fy}$

27. 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 Xu is.

(a) $0.0035\left(1-\frac{d}{Xu}\right)$

(b) $0.002\left(1-\frac{d}{Xu}\right)$

(c) $0.0035\left(1-\frac{Xu}{d}\right)$

(d) $0.002\left(1-\frac{Xu}{d}\right)$

28. A beam whose effective span is 'l' and effecitve depth is 'd' and overall depth is 'D' shall be deemed to be a deep beam when the ratio of.

(i) $\frac{l}{d}$ is less than 2 for a simply supported beam.

(ii) $\frac{l}{d}$ is less than 2.5 for a continuous beam.

(iii) $\frac{l}{D}$ is less than 2 for a simply supported beam

(iv) $\frac{l}{D}$ is less than 2.5 for a continuous beam.

Continuous beam of these statements.

(a) (i) and (iii) are correct

(b) (i) and (iv) are correct

(c) (ii) and (iii) are correct

(d) (iii) and (iv) are correct

29. A rectangular RCC beam of size b = 350 mm and D = 550 mm is subjected to torsional moment of 15 kNm. The side face reinforcement should be provided ---------- (in mm^2)

Linked Question No.30 and 31.

An RCC beam of size 350 mm (width) and 550 mm (overall depth) is subjected to a shear force of 100 kN, Bending moment of 150 kNm and twisting moment of 50 kNm. Effective cover to reinforcement is 30 mm.

30. Find the equivalent shear force in the beam.

31. Find the equivalent bending moment in the beam?

32. The modulus of rupture of concrete in terms of its characteristic cube compressive strength (fck) in MPa according to IS - 456 : 2000 is

(a) 5000 fck (b) $0.7\sqrt{fck}$

(c) $5000\sqrt{fck}$ (d) $5000\ (fck)^{3/2}$

33. In limit state design, permissible bond stress in case of deformed bars is more than that in plain bars by.

(a) 60 % (b) 25 %

(c) 40 % (d) 30 %

34. Limit state of serviceability for deflection including the effects due to creep, shrinkage and temperature occuring after erection of partitions and application of finishes as applicable to floors and roofs is.

(a) Span/150 (b) Span/200

(c) Span/250 (d) Span/350

35. As the value of $\frac{d'}{d}$ increases, the stress in compression steel for Fe 415 bar (d' $\rightarrow$ effective cover to compression Reinforcement and d is effective depth).

(a) Increase

(b) Decrease

(c) Remain same

(d) None of the above

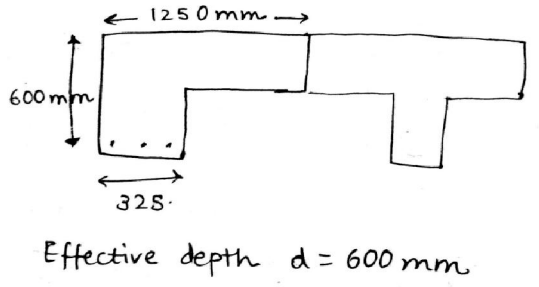
36. For M25 grade of concrete and Fe 415 grade of steel the development length in tension is K times the bar diameter, where K is given by.

$\left(\tau_{bd} = 1.6\ N/mm^2\right)$

(a) 86.46 (b) 64.84

(c) 75.22 (d) 56.41

37. Calculate the effective width of flange for a simply supported L-beam section shown in the figure. Length of beam is 6 mm.



Effective depth d = 600 mm

b_w = 325 mm

B_f = 1250 mm

D_f = 150 mm

(a) 1250 mm (b) 1275 mm

(c) 1175 mm (d) 1025 mm

38. In limit state design method of concrete structures, the recomended partial material safety factor (γ_m) for steel according to IS 456 : 2000 is.

(a) 1.0 (b) 1.15

(c) 1.5 (d) 0.87

39. An RCC square footing of side length 3 m and uniform effective depth of 200 mm is provided for 300 mm ×300 mm column. The line of action of vertical compressive load passes through the centroid of the footing as well as the column. If the magnitdue of the load is 420 kN, the nominal transverse (one way) shear stress in footing is given by.

(a) 0.221 N/mm^2

(b) 0.268 N/mm^2

(c) 0.242 N/mm^2

(d) 0.310 N/mm^2

40. An axially loaded column of 600 × 450 mm has unsupported length of 3m. The design criteria for the column (IS 456:2000) is.

(a) Short column

(b) Pedestal

(c) Slender column

(d) None of these

41. On the average wheat requires about 8.5 cm depths of water after every 35 days. If the base period for wheat is 140 days. What is the delta .....cm.

42 An irrigation channel has G.C.A. = 10^5

hac out of which 30% C.C.A. the average duty at the head of the channel for kharif season is 775 hac/cumes and for rabi season is 1800 hac/cumes. If the intensity of irrigation for kharif and rabi are 40% and 50% respectively. Compute the discharge required at the head of the channel.

(a) 15.48 m^3/s

(b) 23.81 m^3/s

(c) 8.33 m^3/s

(d) 9.4 m^3/s

Common Data for question 43 and 44

The transplantation of rice usually tax 16 days & delta of water required is 60 cm on field. Due to rain about 15 cm demand is fulfilled taking 12% losses from the distributing head to water course head and 20% losses in water course, compute

43. Duty of water at the head of the water course

(a) 230.4 hac/cumes

(b) 184.32 hac/cumes

(c) 307.2 hac/cumes

(d) 245.76 hac/cumes

44. Duty of water at the head of Distributary

(a) 245.76 hac/cumes

(b) 216.268 hac/cumes

(c) 270.336 hac/cumes

(d) 202.752 hac/cumes

45. Water course has culler able commanded area of 2600 hac. Out of which the intensities of irrigation for sugarcane and rice crop are 20% and 40% respectively. The duty for those crops at the head of water course is 750 hac/cumes and 1800 hac/cumes respectively. Find the discharge required at the head of water course if the peak demand is 120% if the average requirement.

(a) 0.694 cumes

(b) 0.678 cumes

(c) 1.272 cumes

(d) 1.53 cumes

46. A certain crop is grown in an area of 3000 hac which is fed by a canal system. The data pertaining to irrigation are as follows.

Fe = 26%

Optimum moisture = 12%

Permanent wiltering point = 10%

Effective depth of root zone = 80 cm

Relative density of soil = 1.4

If the frequency of irrigation is 10 days and the overall efficiency is 28%. Find the daily consumption use.

(a) 15.68 cm

(b) 15.68 mm

(c) 1.568 m

(d) 156.8 mm

47. Delta of a crop is defined as

(a) Total depth of water required by a crop to come in maturity

(b) Total water requirement including evaporation and percolation loss

(c) The area irrigated per m^3/s of discharge running for base period B

(d) None of the above

48. Find the field capacity of a soil for the following data

Root zone depth = 2 m

Existing water content = 5%

Dry density of soil = 15 kN/m^3

Water applied to the = 500 m^3

Water loss due to evaporation and deep percolation = 10%

Area of plot = 1000 sq. Meters

(a) 14.72%

(b) 19.72%

(c) 16.35%

(d) 21.35%

49. Assertion (A)

Leaching requirement is defined as the fraction of irrigation water that must be leached through the root zone of the plant in order to prevent soil salinity exceeding specified levels.

Reason (R)

The concept of leaching requirement can be used to compute the quantity of drainage water that must be removed from an identified land spread.

(a) Both A & R are true and R is the correct explanation of A.

(b) Both A & 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

50. The following data were recorded from an irrigated field.

1. Field capacity : 20%
2. Permanent wilting point : 10%
3. Permissible depletion of available soil moisture : 50 %
4. Dry unit weight of soil : 1500 kgf/m^3
5. Effective rainfall : 25 mm

(a) 75 mm (b) 125 mm

(c) 50 mm (d) 25 mm

51. The spacing of the tile drains to relive 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.

52. 10 m^3/s of water is diverted to a 32 hac field for 4 hr soil probing after irrigation showed that 0.3 m of water had been stored in this case would be

(a) 96% (b) 66.67%

(c)48% (d) 24%

53. A canal was designed to supply the irrigation needs of 1000 hac of land growing rice of 140 days base period having a delta of 130 cm. If the canal water is used to irrigate wheat of base period 119 days and having a delta of 50 cm, the area that can be irrigate is.

(a) 452 hac (b)904 hac

(c)1105 hac (d) 2210 hac

54. For a culturable command area of 1000 hac with intensity of irrigation of 50% the duty on field for a certain crop is 2000 hac/cumecs. What is discharge required at head of water course with 25% losses of water.

(a) 3/16 cumec

(b) 1/4 cumec

(c) 1/3 cumec

(d) 1/2 cumec

55. The base width of a solid 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 appropriate allowable height of the dam.

(a) 64 m (b) 40 m

(c) 164 m (d) 80 m

56. If the discharge required for different crops is 0.4 cumecs in the field and the capacity factor and time factors are 0.8 and 0.5 respectively then what is the design discharge of the distributary at its head.

(a) 0.80 cumecs

(b) 0.16 cumecs

(c) 1.0 cumecs

(d) 1.24 cumecs

57. During a particular stage of the growth of a crop, consumptive use of water is 2.8 mm/day. If the amount of water available in the soil is 25% of 80 mm depth of water, what is the frequency of irrigation?

(a) 9 days (b) 13 days

(c) 21 days (d) 25 days

58. Three distributaries are used for irrigation. The details are given below. Find which one is most efficient.

Distributary	**1**	**2**	**3**
Discharge (m^3/s)	15	20	25
C.C.A. (Hac)	15000	25000	30000
Intensity of irrigation (%)	60	80	50`
Base period (Days)	200 (Cotton crop)	120 (Wheat crop)	360 (Sugar cane crop)

(a) Distributary,1 (b) Distributary, 2

(c) Distributary, 3 (d) All are equally efficient

59. For the given data compute the design discharge

C.C.A (hac)	**Intensity of Irrigation**	**Duty of head (hac/cums)**	**Time taken**	**Capacity factor**
2500	Rice = 30%	775	0.80	0.65
	Sugarcane = 25%	730		

Note:- Capacity factor is defined as the ratio of the mean supply to the full supply of a canal.

(a) 0.9677 m^3/s (b) 0.856 m^3/s

(c) 1.82 m^3/s (d) 3.50 m^3/s

60. The following data pertain to a natural drain crossing an irrigation canal.

Item	Canal Data	Drainage Data
Flow (m^3/s)	5	500
Bed level (m)	120	116
Depth of flow (m)	0.8	10

Which of the following types of cross-drainage should be recommended in the case?

(a) Aqueduct (b) Syphone aqueduct
(c) Syphone (d) Super-passage