Code : 011617

B.Tech 6th Semester Examination, 2017

Design of Concrete Structure-1

Time : 3 hours *Full Marks : 70*

Instructions :

(i) *There are **Nine** Questions in this Paper.*

(ii) *Attempt **Five** questions in all.*

(iii) ***Question No. 1 is Compulsory.'***

(iv) *The marks are indicated in the right-hand margin.*

1. Answer any seven questions from the following: 14

(i) Limit state of serviceability for deflection including the effects due to creep, shrinkage and temperature occurring after erection of partitions and application of finishes as applicable to floors and roofs is restricted to

(a) Span/150

(b) Span/200

(c) Span/250

(d) Span/350

(ii) Shrinkage deflection in case of rectangular bearing 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.

(iii) Deflection can be controlled by using the appropriate

(a) aspect ratio

(b) modular ratio

(c) span/depth ratio

(d) water/cement ratio

(iv) As compared to working stress method of design, limit state method takes concrete to

(a) a higher stress level

(b) a lower stress level

(c) the same stress level

(d) sometimes higher but generally lower stress level

(v) The limiting compressive strain of concrete in bending is

(a) 0.0035

(b) 0.0015

(c) 0.0025

(d) 0.015

(vi) What is the value of flexural strength of M 25 grade concrete (in MPa)

(a) 4.0

(b) 3.5

(c) 3.0

(d) 1.75

(vii) The probability of failure implied in limit state design is of the order of

(a) 10^{-2}

(b) 10^{-3}

(c) 10^{-4}

(d) 10^{-5}

(viii) What is the modular ratio to be used in the analysis of RC beams using working stress method if the grade of concrete is M 20?

(a) 18.6

(b) 13.3

(c) 9.9

(d) 6.6

(ix) Grade of steel is designated as Fe 415, if

(a) the upper yield stress of the steel is 415 N/mm²

(b) the ultimate stress of the steel is 415 N/mm²

(c) the partial safety factor is 1.15

(d) the characteristic strength is 415 N/mm²

(x) What is the minimum area of tension reinforcement in beams when Fe 415 is used?

(a) 0.8%

(b) 0.12%

(c) 0.15%

(d) 0.2%

2. What are the three assumptions made for design of reinforced concrete section for limiting state of collapse in flexure that lead to the limiting value of depth of neutral axis? Calculate the limiting values of depth of neutral axis in terms of effective depth of section for two grades of steel having yield strength f_y=250 and 415 N/mm². E_s=2×105N/mm². 14

3. Design a square section column using M15 concrete and mild steel bars to carry and axial load (P) of 30,000 kg. Effective length of column (left)=4 m. Assume permissible stresses in direct compression in M15 concrete (σ_{cc}) and in mild steel bars (σ_{sc}) as 40 and 1300 kg/cm², respectively, as per IS code $P = CR(\sigma_{cc} A_c + \sigma_{sc} A_s)$ where Ac and As are areas of cross-section of concrete and steel respectively. CR= reduction factor coefficient = 1.25 – Leff/48B <= 1.0, B = lateral dimension of column. 14

4. A rectangular RC section 25 cm wide and 50 cm overall deep is reinforced with 3-16 mm diameter HYSD bars at an effective cover of 4 cm from bottom face. If permissible stresses in concrete in bending compression and steel are 50 kg/cm² and 2300 kg/cm² respectively, modular ratio m = 19, calculate the moment of resistance of the section using WSM. 14

5. Use limit state method to design a RC rectangular beam having an effective simply supported span of 6 m. The beam is required to support live survive and super imposed (dead) loads of 14 kN/m and 9.5 kN/m, respectively. The materials to be used are M20 grade concrete and HYSD bars of grade Fe 415. The unit weight of concrete is 25 kN/m³. Adopt d/b ratio as 2. For the given materials P_t, lim = 0.955%. 14

6. A RC column of size 460 mm × 600 mm having effective length of 3.6 m is to be designed using LSM to support an axial service load of 25000 kN. Use M20 grade concrete and HYSD steel of Fe 415 grade. 14

7. Determine the moment of resistance of a T-section having the following properties: Flange width = 2000 mm, Flange depth = 100 mm, Web width = 250 mm, Effective depth = 750 mm, Area of steel = 8 bars of 20 mm diameter, material used = M 25 grade of concrete and Fe 415 HYSD bars. 14

8. A brick wall 300 mm thick carries a load of 180 kN/m length. Design a R.C.C. footing, if the safe bearing capacity of soil is 120 kN/m². Use M 20 concrete and Fe 415 steel. Constants are: For M 20, $c = \sigma_{cbc} = 7$ N/mm², $\sigma = \sigma_{st}$ 230 N/mm², m = 13.33., $k_c = 0.289$, $j_c = 0.904$, and R_c 0.914. Use τ_c =0.28 N/mm² and k=1.1. 14

9. A rectangular RC slab 2 m × 3 m is simply supported along shorter edges such that clear distance between the supporting wall is 2.7 m. The slab is 15 cm thick and reinforced with 16 mm diameter mild steel bars spaced at 25 cm c/c at effective cover of 25 mm along longer edges and with 10 mm diameter bars along shorter edges spaced at 25 cm c/c. Concrete used is M 15 grade for which permissible stresses in bending, shear

(nominal) and bond are 50, 3 and 6 kg/cm^2 respectively. Permissible tensile stresses in mild steel = 1400 kg/cm^2, m=19. Calculate maximum safe intensity of load that the slab can carry in addition to its self-weight. 14

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