

Question Set

Sub - Structural Design - I

Sem - 4th Sem, Civil Engg^{Sc}

FM. - 80

Chapter-1 : Working Stress Method

2 marks questions

1. What do you mean by structural design?
2. What is serviceability?
3. What are various methods of design of concrete structures?
4. What is Hooke's Law?
5. Draw stress-strain diagram of mild steel?
6. Draw stress-strain diagram of concrete?
7. What is PCC?
8. What is RCC?
9. What is rebar?
10. What is characteristic compressive strength?
11. What is Young's modulus (E)?
12. What is Tensile strength of concrete (f_{ct})?
13. What is M20?
14. What is Fe415?
15. In 1:3:6 mix proportion, what is the value of aggregate if cement is 2kg?
16. What is yield stress?
17. What is deformed bars?
18. What is TMT bar?

19. Write full form of HYSD base?
20. What is nominal cover?
21. What is effective cover?
22. What is modular ratio (m)?
23. What is MOR?
24. What is neutral axis (NA)?
25. What is neutral axis constant (k)?
26. What is lever arm (LA)?
27. What is partial safety factor?

5 marks questions

1. Briefly explain the concept of UR, OR & balanced section.
2. Write the assumptions in WSM.
3. Write the advantages & disadvantages of WSM.
4. Differentiate between nominal & design mix?

10 marks questions

1. Analyze a section (single reinforced) with stress-strain diagram. Find out formulation for neutral axis, lever arm and moment of resistance.
2. Explain LSM, WSM & ULM.

3. A R.C. beam of $300\text{mm} \times 600\text{mm}$ is acted by compressive stress of 5 N/mm^2 and tensile stress of $140\frac{\text{N}}{\text{mm}^2}$. Find the depth of neutral axis, area of steel, % of steel and moment of resistance?

Chapter 2: Philosophy of LSM

2 marks questions

1. Define LSM.
2. What is limit state of safety?
3. What is limit state of serviceability?
4. What is factor of safety & partial safety factor?
5. What is partial safety factor for concrete and steel?
6. What is design load?

5 marks questions

1. Why LSM is preferred over WSM?

10 marks questions

1. Briefly explain various IS specifications.
 - minimum reinforcement
 - spacing of rebar in slab
 - cover to reinforcement

- lapping
- anchorage
- effective span

Chapter 3: Analysis & Design of Single and double Reinforced Section (WSM)

2 marks question

1. What is limit state of serviceability?
2. What is max. strain at outermost compression & tension fibre?
3. Draw stress-strain diagram high strength deformed bars.
4. Draw stress-strain diagram for concrete.
5. What is Neutral axis?
6. What is percentage of steel (P_t)?
7. What is 'C' & 'T'?
8. What is limiting neutral axis distance ($x_{u, max}$)?
9. What is limiting moment co-efficient (K)?

5 marks question

10. Why double reinforced section is needed?

5 marks questions

1. Write assumptions in flexure ?
2. Differentiate between balanced section, under-reinforced section & over reinforced section.
3. Write steps for design of singly reinforced system ?
4. Write steps for design of doubly reinforced system.
5. Determine the moment of resistance of a beam of 250×400 mm. The area of steel consists of 3 bars of 12 mm dia placed at a distance of 40 mm from bottom of beam. Use M20 & Fe415.

10 marks question

1. Analyse a beam section (single reinforced) with stress-strain diagram. Use LSM.
2. Analyse a beam section (double reinforced) with stress-strain diagram. Use LSM.
3. A rectangular beam of 200×400 mm deep upto the centre of reinforcement. Find the area of reinforcement & no. of rebar if it has to resist a moment of 30 kNm . Use M25, Fe415.
4. Find the M_u of an RCC beam 300×500 mm. The beam is reinforced with 4-25 mm ϕ bars in tension zone. 2-20 ϕ bars are placed at a distance of 50 mm from top compression zone. Use M25, Fe415.

Chapter: 4 ▸ Shear, Bond & Development Length

2 marks question

1. What is shear stress?
2. What is nominal shear stress?
3. What is design shear strength of concrete?
4. What is max. shear strength of concrete?

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5 marks question

1. Explain the design^{steps} of shear reinforcement for vertical stirrups & inclined stirrups & bent up bars.

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10 marks question

1. A reinforced concrete beam 400×600 mm effective is simply supported and carries a udl of 60 kN/m including self weight over a span of 6 m . The section is reinforced with $05-20 \phi$ bars. Use $M20$ & $Fe415$.
Design shear reinforcement for the beam for.

↳ vertical stirrups are used.

↳ Two bars are bent up at 45° at supports.

2 marks question

- * 5. What is bond?
6. What is anchorage length?
7. What is development length?
8. What is bond stress?
9. What are the anchorage values for 90° , 45° & U-bend bar?
10. What is the equation for check for development length?

5 mark question

2. Derive the equation for development length & write the formula for following cases
 - ① deformed bars
 - ② bars in tension
 - ③ bars in compression
3. An RCC beam $250\text{ mm} \times 500\text{ mm}$ has a clear span of 5.5 m . The beam has 2-20 ϕ bars going into the support. $V_u = 140\text{ kN}$. Check for l_d . Use M20, Fe415.

Chapter 5: Analysis & Design of T-beam

2 mark question

1. What are the advantages of T-beam?
2. What is the effective width of flange as per IS-456:2000 codal provision?
(for T-beam, L-beam)
3. Where T-beams are used? Give real ^{life} examples.

5 mark question

1. Design steps of a T-beam with stress-strain diagram where NA lies within the flange.
2. Find the moment of resistance of a T-beam having a web width of 240 mm, effective depth of 400 mm, flange width of 740 mm and flange thickness of 100 mm. The beam is reinforced with 05-16 ϕ , Use M20, Fe415.

10 mark question

- 1/ An isolated sfs T-beam has flange width of 2400 mm & flange thickness 120 mm $l_{eff} = 3.6m$, $d = 560mm$ & $b_w = 300mm$. It is reinforced with 8-20 ϕ , Use M20, Fe415. Find out M_u ?

chapter 6: Analysis & design of slab & staircase

2 marks question

1. What is one way slab?
2. What is two way slab?
3. What do you mean by restrained & unrestrained slab?
4. What do you mean by staircase?
5. What is dog-legged staircase?
6. What is value of rise & tread?
7. What do you mean by going, flight & riser?
8. Write the formula for calculation of A_{st} .

5 mark question

1. Differentiate between one way slab & two way slab?
2. Write design steps for s/s and cantilever one way slab?
3. Write design steps of unrestrained two way slab?
4. What are the various types of stairs staircase? Explain with neat diagram?
5. Draw neat diagram of staircase showing its various parts.
6. Diff. between stair slab spanning longitudinally and horizontally:

10 mark question

1/ Design a s/s roof slab for a room $7.5\text{m} \times 3.5\text{m}$ clear in size. The slab is carrying an imposed load of 5 kN/m^2 . Use M20, Fe415.

2/ Design a cantilever slab for an overhang of 1.25m . The imposed load on slab consists of 1 kN/m^2 of line load and weight of finishing 800 N/m^2 . Use M20, Fe415.

3/ Design a RCC slab for a room measuring $4\text{m} \times 5\text{m}$. The slab carries $L_h = 2\text{ kN/m}^2$ and is finished with 20mm thick granolithic finishing with $\gamma = 25\text{ kN/m}^2$. Use M20, Fe415. The four ~~are~~ edges ~~are~~ of slabs are of corner free do lift. Width of supporting wall is 300mm .

4/ Design a dog-legged staircase for an office building in a room measuring $3.0\text{m} \times 6\text{m}$. Floor to floor height is 3.5m . The building is a public building liable to over crowding. Stairs are supported on brick walls 230mm thick at the end of ~~lan~~ landing. Use M20, Fe415.

Chapter 7: Design of axially loaded column & footing

2 mark question

1. Write the assumptions in limit state of collapse.
2. What is column?
3. What is ~~slab~~ pedestal?
4. What is footing?
5. What is strut?
6. What is slenderness ratio?
7. What is long & short column?
8. What is effective length of column?
9. How many main rebars are allowed in rectangular, square and circular column?
10. What is minimum eccentricity?
11. What is the codal provision for dia. & pitch of lateral ties used in column?

5 mark question

1. Explain various types of column?
2. Classify various footings with diagrams?
3. A RCC short column of 400×400 mm with 4-20 mm of is there. Determine P_u if M20, Fe415 is used. Assume $e_{min} < 0.05 D$.

10 mark question

- 1/ A RCC short column of size 400×500 is carrying factored load of 3000 kN . Design the column assuming $e_{\text{min}} < 0.05 D$. Use M25, Fe415.
- 2/ Design a circular column of diameter 400 mm subjected to axial load of 1200 kN . The col. is having lateral ties. The col. is 3 m long & is effectively held in posⁿ at both ends but not restrained against rotation. Use M20, Fe415.
- 3/ Design a square footing of uniform thickness for an axially loaded column of 450×450 size. The safe bearing capacity of soil is 190 kN/m^2 . Load on the column is 850 kN . Use M20, Fe415.

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