

B.E. in Civil Engineering 3rd Year 1st semester Examinations, 2024-25**SUBJECT: Design of Structures - I****PART-I**

Time: Three hours

Full Marks 100
(50 marks for this part)

No. of Q	Assume any reasonable values to data not given. Use of IS 456:2000 and SP-16 is allowed.	
1.a)	What is meant by partial safety factor for materials in limit state method? Mention its values for steel and concrete for different limit states.	5
b) i.	Design (for flexure only) a simply supported doubly reinforced rectangular RC beam having effective span 5.5m, subjected to a uniformly distributed load of 40kN/m. Assume the beam width of 250mm and effective cover of 50mm both for tension and compression reinforcement. Use M20 concrete and Fe500 steel. Show all necessary checks.	16
ii.	Show detail labelled diagram of beam cross-section. COI	4
	OR	
2. a)	Design a One-way slab, with clear span of 4m, simply supported on 250mm wide beams and subjected to a live load of 4kN/m ² and surface finish of 1kN/m ² . Use M20 concrete and Fe500 steel. Show all necessary checks.	10
b)	Show detail labelled diagram of the designed slab.	5
c)	Compute the maximum short-term deflection due to DL+LL assuming cracked section as specified in IS456:2000. COI	10
3. a)	Distinguish between unsupported length and effective length of a column.	2
b)	Explain the function of transverse reinforcement in a reinforced concrete column.	3
c)	Design a column of size 300mm X 500mm subjected to a factored axial load of 1400kN and biaxial moments of 130kN-m and 60kNm with respect to the major axis and minor axis respectively. The column has an unsupported length of 3.0m and is braced against sideway in both directions. Use M25 concrete and Fe500 steel. Use Limit State Method. Show all necessary checks.	16
d)	Show detail labelled diagram of column cross-section. CO4	4
	OR	
4. a)	Define 'bond stress'.	3
b)	Design an isolated footing for a column (400mm x 400mm) reinforced with 8-20Φ bar and carrying a service load of 2000kN. Assume safe bearing capacity of soil 250kN/m ² at a depth of 1.5m below the ground. Assume M25 concrete and Fe500 steel both for column and footing. Use Limit State Method. Show all necessary checks.	16
c)	Show detail labelled diagram of the isolated footing. CO4	6

.....B.E. Civil Engineering 3rd Year 1st Semester..... EXAMINATION, 2025

SUBJECTDesign of Structures - I.....

PAPER--.....

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Use a separate Answer-Script for each part

No. of
Questions

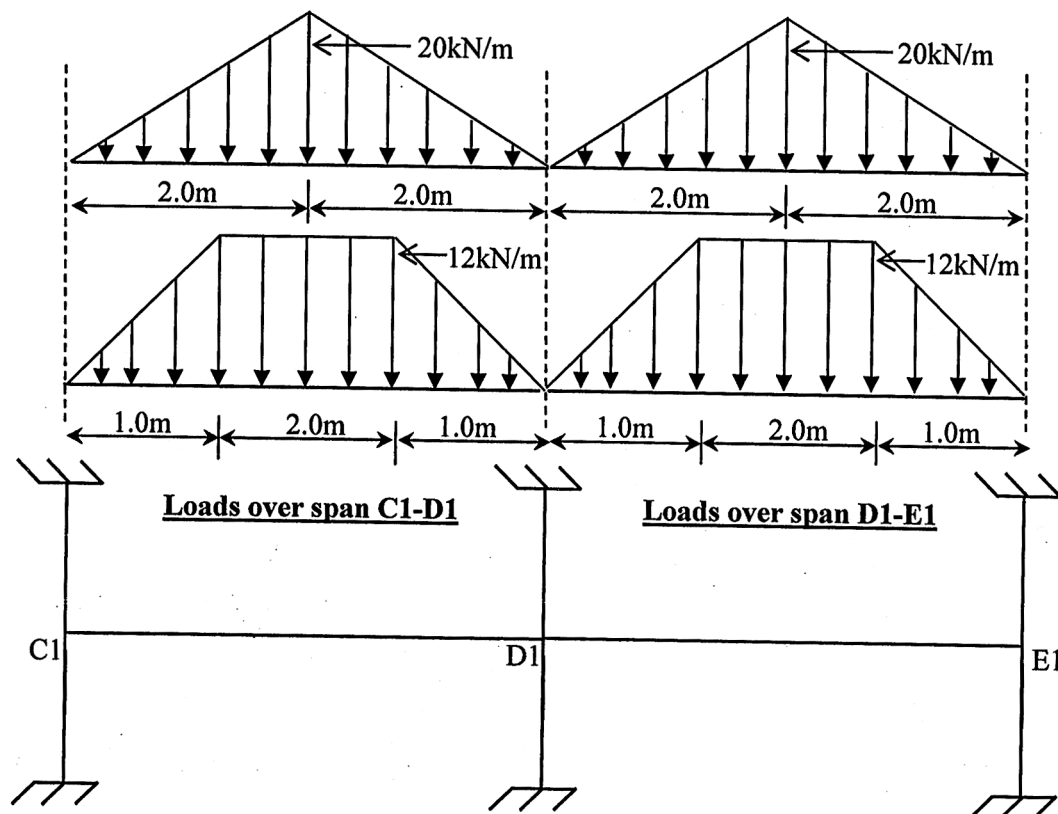
PART II

Marks

(Use of IS:456-2000 and SP:16 are allowed in the examination hall)

Answer Q.1 and ANY ONE questions from the rest

- Q1. [CO:3] Beam C1-D1-E1 of a R.C. framed building is subjected to the loads (Dead & Live combined) as shown in Fig.1 in addition to its self-weight. Calculate the bending moment and shear force at the critical sections of the beam by 'substitute frame method of analysis'. Design the flexural and shear reinforcement of the beam. Apply 'Limit state method of design'. Floor-to-floor height is 3.3m. The cross-sectional dimensions may be assumed as 250mmx350mm for beam and 350mmx350mm for column. The grade of concrete is M25 and grade of steel is Fe500. Show the reinforcement details in neat sketch. [30]

Fig. 1: Substitute Frame C1-D1-E1

[20]

[20]

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No. of
Questions

PART II

Marks

(contd. from page I)

- Q2. Design and detail a ('waist slab' type) dog-legged staircase for an office building based on the [20]
[CO:2] data given below:
- Height between floors = 3.6 m;
 - Width of flight = landing width = 1.4 m;
 - Load due to finishes = 1.0 kN/m².
 - Riser = 150 mm, Tread = 260 mm;
 - Live load = 3.0 kN/m²;
- Assume the stairs to be supported on 250 mm thick masonry walls at the outer edges of the landing. Grade of concrete is M20 and grade of steel is Fe500. Assume mild exposure conditions. Apply 'Limit state method' of design.
- Q3. A T-beam roof consists of 140mm thick reinforced concrete slab cast monolithically with [20]
[CO:2] 300mm wide beams spaced 2.1m centre to centre. The super imposed load (including floor finish, ceiling plaster and live load) over the slab is 4.0kN/m² and the effective span of each beam is 4.5m. Design the overall depth, longitudinal reinforcement of any intermediate beam. Grade of concrete is M20 and grade of steel is Fe415. Apply 'Working stress method of design'.

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