

**B.E. Civil Engineering 3<sup>rd</sup> Year 1<sup>st</sup> Semester Supplementary..... EXAMINATION, 2024****SUBJECT .....Design of Structures - I****Full Marks 100  
(50 marks for this part)**

Time: Three hours

Use a separate Answer-Script for each part

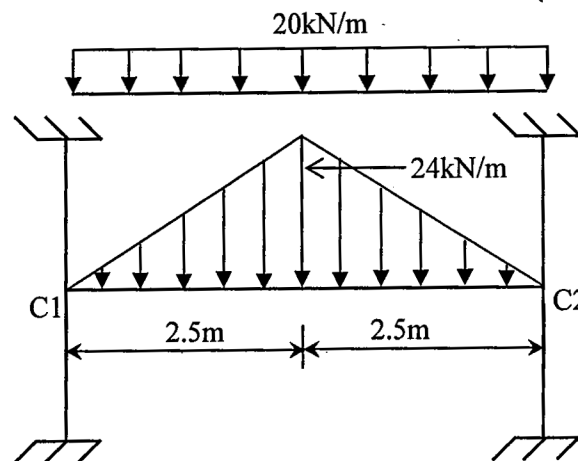
No. of  
Questions**PART I**

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. Beam C1-C2 of a R.C. framed building is subjected to the loads (Dead & Live combined) as shown in Fig.1. 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 3.4m. The cross-sectional dimensions may be assumed as 350mmx450mm for beam and 400mmx400mm for column. The grade of concrete is M25 and grade of steel is Fe500. Show the reinforcement details in neat sketch. [30]  
[CO:3]

**Fig. 1**

- Q2. Design and detail a ('waist slab' type) dog-legged staircase for an office building based on the data given below: [20]  
[CO:2]
- Height between floors = 3.6 m;
  - Width of flight = landing width = 1.25 m;
  - Load due to finishes = 1.0 kN/m<sup>2</sup>.
  - Riser = 150 mm, Tread = 260 mm;
  - Live load = 3.0 kN/m<sup>2</sup>;
- 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 Fe415. Assume mild exposure conditions. Apply 'Limit state method' of design.
- Q3. A T-beam roof consists of 175mm thick reinforced concrete slab cast monolithically with 350mm wide beams spaced 3.0m centre to centre. The super imposed load (including floor finish, ceiling plaster and live load) over the slab is 5.25kN/m<sup>2</sup> and the effective span of each beam is 6.2m. 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'. [20]  
[CO:2]

=== END ===

[ Turn over

## B.E. in Civil Engineering 3rd Year 1st semester Supplementary Examinations, 2024

## SUBJECT: Design of Structures - I

## PART-II

Time: 3 Hr.

( 50 Marks)

Full Marks: 100

No. of Q	Assume any reasonable values to data not given. Use of IS 456:2000 and SP-16 is allowed.	
<b>CO1</b>		
1.a)	What is limit state method of design? Discuss difference between limit state and working stress method of design.	2+3
b)	A beam (400mm X 600mm) of effective length 6m, is provided with reinforcement of 3-25 $\Phi$ bar at tension side and 2-25 $\Phi$ bar at compression side.	
i.	Find ultimate moment of resistance of the <i>doubly reinforced beam</i> by Limit State Method. Assume M25 concrete and Fe500 steel.	15
ii.	Hence find maximum uniformly distributed load that the beam can carry apart from self-weight taking partial safety factor 1.5.	5
<b>CO1</b>	<b>OR</b>	
2. a)	Explain <i>shrinkage</i> and <i>creep</i> . How these are taken care of in RC design?	4+3
b)	An interior floor slab panel of dimension 4m x 4.5m is supported on 250mm thick reinforced concrete beam. Assume a floor finish of 1kN/m <sup>2</sup> and live load 2kN/m <sup>2</sup> . Design the slab showing all necessary checks. Use M20 concrete and Fe 415 steel. Assume mild exposure condition. Use Limit State method.	12
c)	Draw labelled detail of top and bottom reinforcement in the slab.	6
<b>CO4</b>		3
3. a)	Explain classification of Columns Based on Slenderness Ratios.	
b)	Design the reinforcement in a column of size 300mm X 450mm, subjected to a factored axial load of 1500kN and biaxial moments of 130kN-m and 90kNm with respect to the major axis and minor axis respectively. The column has an unsupported length of 3.5m and is braced against sideway in both directions. Use M25 concrete and Fe500 steel. Use Limit State Method. Show all necessary checks.	17
c)	Draw labelled detail of the reinforcement in the column.	5
<b>CO4</b>	<b>OR</b>	
4. a)	Explain bond stress?	3
b)	Design an isolated footing for a column (400mm x 500mm) reinforced with 8-20 $\Phi$ bar and carrying a service load of 3000kN. Assume safe bearing capacity of soil 280kN/m <sup>2</sup> at a depth of 1.4m below the ground. Assume M25 concrete and Fe500 steel both for column and footing. Use Limit State Method. Show all necessary checks.	17
c)	Draw labelled detail (of the reinforcement in the isolated footing.	5