

**B E Civil Engineering Fourth Year First Semester Examination – 2024****Subject: Design of structures –III**

Time : Three hours

Full Marks: 100

Use separate answer script for each part

Part – I (full marks = 60)

Assume reasonable values of any data if required. The notations have their usual meaning.  
IS-875 part-II, IS 1893, IS 456 and SP-16 are allowed in the examination hall.

CO1 [20]	<p>Q.1 A G+9 storey RCC Hospital building (24m x 24m in plan) is to be constructed at Mumbai. Columns are placed 6m c/c along both direction. Floor to floor height is 3.4m except ground floor which is 3.0 m for parking. The building is located on a site with Soft soil. The service block is separated structurally from the main building by expansion joint. The lumped weights due to dead load at each floor are as follows - 2800 KN (roof level), 3800KN (typical intermediate floor level), 2900KN (1st floor level) and 600KN (pile cap level). Live load is 4.0 KN/m<sup>2</sup> on floor including light partitions and 1.5 KN/m<sup>2</sup> on roof. Determine the seismic load at each floor level and calculate the bending moment and shear fore (with diagram) of an internal at 7<sup>th</sup> floor level only. Take the plinth level is 100 mm above ground level and top of the pile cap is 500mm below Ground level. Assume that ductile detailing as per IS13920 will be incorporated.</p> <p><b>Or</b></p> <p>A G+9 storey RCC Hospital building (24m x 24m in plan) is to be constructed at Mumbai. Columns are placed 6m c/c along both direction. Floor to floor height is 3.4m except ground floor which is 3.0 m for parking. The service block is separated structurally from the main building by expansion joint. Analyse the internal frame at 6<sup>th</sup> floor level under the dead load and live load ( all spans) and draw the bending moment and shear force diagram of the beam and the adjoining column. Assume a load of 1KN/m<sup>2</sup> on the floor for partition wall.</p>
CO2 [5]	Q2 Show a typical detailing ( as per IS 13920) of a column ( long section). Assume column and beam sections are 400mm x 400 mm and 300x500 mm respectively. The rebar dia and spacing are to be assumed suitably.
CO3 [15]	Q3 A pre-stressed concrete beam of cross-section 300 mm x 600 mm deep is simply supported over a span of 12 m. The beam is pre-tensioned by 4 tendons. Each tendon consists of 4nos 5mm dia wires. The tendons are located at 150 mm from bottom. The Initial pre-stress in the tendons is 1500 MPa. Assume 12% loss of pre-stress. The live load on the beam is 25 KN/m. Determine the stresses at the center and support for both initial and service condition.
CO4 [20]	Design and detail a pile cap having four piles of diameter 500 mm and length 20m. The unfactored axial load and the two moments acting on a column of size 500mm x500mm for the critical load case are 1500 KN ,225 KNm and 30 KNm respectively. The vertical load capacity of the pile is 500 KN. Use M25 and Fe500.

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B.E. Civil Engineering, Fourth Year First Semester Examination, 2024

DESIGN OF STRUCTURES – III

Part - II

Marks – 40

(Answer any two questions)

**(IS 800 and SP 6 (1) are allowed in the hall)**

1. Suggest a 20 m span gantry girder section supporting a crane of 16 m span .The electrically operated crane has a weight of 450 kN and has two wheels on each gantry girder with a wheel base distance of 4 m on which a 250 kN crab moves carrying a lifting load of 500 kN. Check the section for plastic shear and shear buckling only. 20
2. Design and detail a stepped column fixed at base and hinged at top .The crane and roof legs are 9 m and 2.5 m respectively .The column carries 75 kN and 600 kN vertical loads at roof and crane levels respectively and a udl due to wind load of 3.5 kN/m throughout the column height. 20
3. Consider the data of problem 2. Assuming 2 - ISMB 600 @900 mm c/c as the crane leg,design and detail the base connection. 20