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**Question Paper Code: U1601**

M.E. DEGREE EXAMINATION, MAY 2024

First Semester

Structural Engineering

21PSE101– DESIGN OF ADVANCED CONCRETE STRUCTURES

(Regulations 2021)

(Note: Use of IS 13920:2016, IS 456:2000 and SP16 are permitted)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) Calculate the total deflection of a cantilever beam with a span of 4m and a width of 300mm, a depth of 550mm, and characteristic dead and live loads of 210kNm, of which 60% are permanent. The cover to center of the steel is 37.5mm, the creep factor is 1.6, and the shrinkage strain is 0.0003. Assume that tension steel is 1.117%, compression steel is 0.418%. Adopt the grades M15 and Fe415. CO1-App (20)
- Or
- (b) Design a two way slab for an office floor of size 3.5m x 4.5m with discontinuous and simply supported edges on all the sides with corners prevented from lifting and supporting a service live load of 4kN/m<sup>2</sup>. Adopt M20 and Fe415 grades. CO1-App (20)
2. (a) Design a shear wall of length 4.16m and thickness is 250mm subject to the following forces. Adopt M25 and Fe415grades. Assume the wall is high wall. CO2-App (20)

Loading	Axial Forces (kN)	Moment (kNm)	Shear (kN)
DL + LL	1950	600	20
Seismic load	250	4800	700

Or

- (b) The ultimate moments of  $M_y$  (top) and  $M_y$  (bottom) are 70kNm and 10kNm, respectively. If the column is bent in double curvature, determine the design moments using YY as the minor axis. The axial ultimate load is 1700kN. Accept the grades M40 and Fe415. Design R.C braced column of 300 x 500mm,  $L_o = 9m$ ,  $L_e = 6.75m$ . CO2-U (20)
3. (a) A flat plate with 7.5 x 6m panels on 500 x 500 mm columns has a slab thickness of 185mm, designed for a total characteristics of load (DL+LL) of  $9.3 \text{ kN/m}^2$ . Check the safety of the slab in shear if grade M25 concrete and Fe415 steel are used for its construction. How can we increase the shear capacity of the slab? CO3-App (20)
- Or
- (b) Design a simply supported square slab of 4.5m side length to support a service live load of  $4\text{kN/m}^2$ . Adopt M30 and Fe415 grades. Assume load factors according to IS456:2000 code standards. CO3-App (20)
4. (a) A reinforced concrete slab is 105mm thick with 20mm cover to center of steel. If the positive steel reinforcement is  $424\text{mm}^2/\text{m}$ . Determine the approximate moment curvature. Determine the ductility factor assuming M25 concrete and Fe250 steel for reinforcements. CO4-App (20)
- Or
- (b) Determine the salient points on the stress – strain curve of concrete in bending of an unconfined concrete member if cylinder strength of concrete used  $f_c'$  is  $25\text{N/mm}^2$ . If such a concrete is confined in a section of breadth 300mm, total depth 500mm and clear cover of 50mm with 10mm ( $78 \text{ mm}^2$ ) stirrups at 100mm centers, determine the stress – strain curve for inelastic analysis of the structures. Use the relation  $f_c' = 0.8 f_{ck}$ . CO4-App (20)

5. (a) A block of ten storeyed flats in Chennai has its lowermost columns 500mm x 700mm in size. In order to use the ground floor for car parking, the lower columns are made free standing. Comment on the considerations to be given for detailing of these freestanding columns. Assume M20 grade of concrete and Fe415 grade of steel and height of free bay is 4m. CO5- U (20)

Or

- (b) The diameter of a circular column is 300mm. Determine the hoop's diameter and spacing for confinement. What will be the lateral ties if the column has a 500mm x 650mm cross section? Concrete of M20 grade and steel of Fe 415 grade should be used. CO5- U (20)

