MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. MAKEUP EXAMINATIONS

2023

SUBJECT: BASIC REINFORCED CONCRETE DESIGN

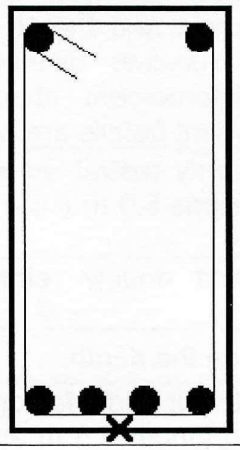
[CIE 2251]

Date of Exam: Time of Exam:— Max. Marks: **50**

Instructions to Candidates:

- Answer all the questions.
- Any missing data may be suitably assumed.
- Use of IS 456:2000 and SP-16 handbooks are permitted.
- Consider limit state approach unless specified otherwise.

Q. No.	Questions	Marks	CO	BL
1A	Differentiate between working stress method and limit state method.	2	1	2
1B	Illustrate the design of a cantilever beam having an effective span of 3.0 m carrying a factored load of 20 kN/m. Carry out all the necessary checks as per IS: 456 2000. The grade of concrete is M25 and grade of steel is Fe415, the beam is located in moderate exposure condition. Assume breadth of the beam as 230 mm. Also assume the span to depth ratio as 5 for initial calculation. Take the diameter of main reinforcement as 16 mm and 2LVS as 8mm diameter. Sketch of reinforcement details is not required.	8	2	3
2A	Illustrate the design of a simply supported one-way slab of clear span 4.0 m resting on a masonry wall of 230 mm width. The working live load on slab is 2.0 kN/m^2. Adopt M20 grade concrete and Fe415 grade steel. Consider moderate exposure condition. Assume diameter of main reinforcement as 10 mm. (Distribution reinforcement, check for shear, check for deflection and sketch of reinforcement details are not required)	5	3	3
2B	Calculate the bending moments for a two-way restrained slab with two adjacent edges are discontinuous of dimensions 5.0 m × 6.0 m carrying a total factored load of 8.0 kN/m^2.	3	3	3
2C	Differentiate between singly reinforced and doubly reinforced beam sections.	2	1	2
3A	Explain the foundation classification based on the depth.	3	4	2
3B	A column of size 600 mm × 450 mm needs to support a factored axial load of 3000kN.The column has an unsupported length 3.5 m and effectively held in position at both ends but restrained against rotation against rotation at one end. Calculate the longitudinal reinforcement only. Assume M25 grade concrete and Fe415 grade steel and an effective cover of 50 mm.	3	4	3
3C	A reinforced concrete beam of 250 mm wide and an effective depth of 550 mm is reinforced with 4 bars of 20 mm diameter on tension side. Using M25 grade concrete and Fe415 grade steel, calculate the moment of resistance of the section. (Use working stress method)	4	2	3
4A	A column of size 450 mm × 450 mm is subjected to factored axial load of 1700kN and factored moment of 120 kN-m about one of its axes. The unsupported length is 3 m with both ends hinged. Consider M25 grade concrete, Fe415 grade steel and effective cover 58 mm. Calculate the longitudinal reinforcement only.	5	4	3

4B	A short column of size 250 mm × 500 mm is subjected to factored axial load of 1000 kN and factored moment of 125 kN-m about major axis and 35 kN-m about minor axis. Taking effective cover as 55 mm, M35 grade concrete and Fe415 grade steel, calculate the longitudinal reinforcement by considering bars equally on four sides. Also check the adequacy of design by assuming α_n = 1.4. Check for spacing of longitudinal bars and lateral tie design need not be carried out.	**5**	**4**	**3**
5A	Calculate the initial plus creep deflection due to permanent loads only ($\alpha_{i,cc}$ (perm)) for a simply supported beam of span 4 m of size 300 mm × 600 mm. Permanent load on the beam is 35 kN/m, the beam is reinforced with 3 bars of 16 mm diameter on tension side. The depth of neutral axis is 175.74 mm and cracking moment is 63 × 10^6 N.mm. Use M25 grade concrete and Fe 415 steel. Assume an effective cover of 55 mm. Also assume the age of concrete at loading is 28 days. [Use working stress approach]	**5**	**5**	**3**
5B	Determine the crack width at the location as indicated for a beam of size 300 mm × 600 mm as shown in the Fig. The beam is reinforced with 4 bars of 25 mm diameter on tension side and 2 bars of 12 mm diameter on compression side with 8 mm diameter stirrups. The beam is subjected to a bending moment of 250 kN.m due to service loads. The depth of neutral axis is 187.86 mm. Use M25 grade concrete and Fe 415 steel. Assume a clear cover of 25 mm for both tension and compression reinforcements. [Use working stress approach] 	**5**	**5**	**3**