MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. END SEMESTER EXAMINATIONS

May 2023

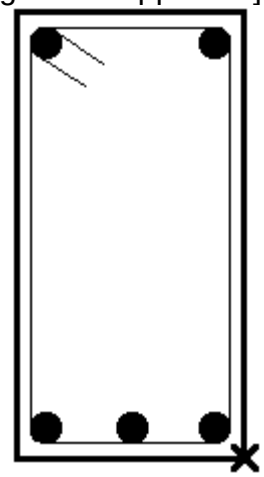
SUBJECT: BASIC REINFORCED CONCRETE DESIGN [CIE 2251]

Date of Exam: **26-05-2023** Time of Exam: **2.30 PM to 5.30 PM** Max. Marks: **50**

Instructions to Candidates:

- Answer all 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 under reinforced and over reinforced beam sections.	**2**	**1**	**2**
1B.	Illustrate the design of a simply supported beam having an effective span of 4.5 m carrying a working load of 40 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 250 mm. Also assume span to depth ratio as 10 for the initial calculation of effective depth. Consider diameter of main reinforcement as 20 mm and 2LVS as 8 mm. Sketch of reinforcement details is not required.	**8**	**2**	**3**
2A.	Illustrate the design of a cantilever one-way slab of span 1.5 m resting on a masonry wall of 250 mm width. The working live load on slab is 1.5 kN/m^2. Adopt M20 grade concrete and Fe415 grade steel. Consider a 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 simply supported two-way slab of dimensions 3.0 m × 2.0 m discontinuous on all four sides carrying a total ultimate (factored) load of 9.0 kN/m^2. Use the method of coefficients given in IS 456:2000. The corners of slab do not have adequate provision to resist torsion and lifting at corners.	**3**	**3**	**3**
2C.	Explain the role of reinforcements in RCC.	**2**	**1**	**2**
3A	A reinforced concrete footing for a column of size 230 mm × 500 mm supports an axial service load of 1600 kN. The safe bearing capacity (SBC) of soil is 190 kN/m^2. The angle of internal friction of soil is 30^o and density is 19 kN/m^3. Determine the minimum depth required, proportion the footing dimensions and check the soil pressure at base.	**3**	**4**	**3**
3B	A short square column of unsupported length 3.0 m needs to support a factored axial load of 1650 kN. Assume M25 grade concrete and Fe415 grade steel Consider an effective cover of 50 mm. Assume both the ends of the column as fixed. Calculate the longitudinal reinforcement only. Check for spacing need not be carried out.	**3**	**4**	**3**

3C.	A reinforced concrete beam of 230 mm wide and an effective depth of 450 mm is reinforced with 3 bars of 16 mm diameter. Using M25 grade concrete and Fe415 grade steel, calculate the moment of resistance of the section.	**4**	**2**	**3**
4A	Calculate the longitudinal reinforcement required for a short column of size 230 mm × 450 mm subjected to a factored axial load of 1800 kN and factored moment of 60 kN-m about major axis. The unsupported length of the column is 3.8 m with both ends effectively held in position and restrained against rotation at both the ends. Assume M20 grade concrete, Fe415 grade steel with an effective cover of 50 mm to the longitudinal reinforcement.	**5**	**4**	**3**
4B	A short column of size 300 mm × 500 mm is subjected to a factored axial load of 1550 kN and factored moment of 90kN.m about major axis and 100 kN.m about minor axis. Adopt an effective cover of 60 mm, M30 grade concrete, and Fe415 grade steel. Calculate the longitudinal reinforcement by assuming distribution of bars equally on all sides. Also examine the column for adequacy by considering $\alpha_n = 1$. Check for min. eccentricity, spacing of longitudinal bars and lateral tie design need not be carried out.	**5**	**4**	**3**
5A	A simply supported beam of size of 230 mm × 450 mm is supported over a span of 4.5 m. The beam is reinforced with 3 bars of 25 mm diameter on the tension side and carries a service load of 20 kN/m. The beam is made of M30 grade concrete and Fe 415 steel. The depth of neutral axis is 153.37 mm and moment of inertia of the cracked section (I_r) is 0.957×10^9 mm^4. Assuming an effective cover of 45 mm calculate the short-term deflection at mid span of the beam [Use working stress approach]	**5**	**5**	**3**
5B	Calculate the strain 'ε_1'at the level as indicated for a beam of size 250 mm × 450 mm as shown in the Fig. The beam is reinforced with 3 bars of 16 mm diameter on tension side and 2 bars of 10 mm diameter on compression side with 8 mm diameter stirrups. The beam is subjected to a bending moment of 190 kN.m due to service loads. Use M30 grade concrete and Fe 415 steel. Assume a clear cover of 30 mm for both tension and compression reinforcements. [Use working stress approach] 	**5**	**5**	**3**