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

IV SEMESTER B.TECH (CIVIL ENGINEERING)
END SEMESTER EXAMINATIONS, JUNE 2022
SUBJECT: **BASIC REINFORCED CONCRETE DESIGN [CIE 2251]**
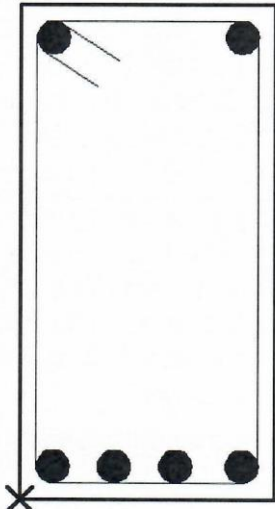**REVISED CREDIT SYSTEM**
(_ / 06 / 2022)

Time: 3 Hours   Max. Marks: **50**

Instructions to Candidates:

❖ Answer ALL the questions
❖ 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		Marks	CO
1.	A rectangular beam of size 230 mm wide and 525 mm effective depth is reinforced with 4 no.'s of 16 mm diameter bars on the tension side. State the type of the beam, if the materials are M25 grade concrete and Fe415 grade steel. (Use working stress method)	3	2
2.	Design a simply supported beam to carry a uniformly distributed load of 25 kN/m at working including the self-weight. The beam has a clear span of 6 m and supported over masonry wall of 230 mm wide. The width of the beam is restricted to 230 mm. The beam is exposed to mild exposure condition. Assume M20 grade concrete and Fe 415 steel. Check for deflection and development length calculations are **not** reauired.	7	2
3.	Differentiate between working stress method and limit state method.	2	1
4.	Design one-way simply supported slab having a clear span of 5 m and support width of 250 mm. The working live load on slab is 2.5 kN/m^2. Adopt M20 grade concrete and Fe415 grade steel. Consider moderate exposure condition, do all the necessary checks as per IS: 456 2000. (Sketch of reinforcement details not required)	8	3
5.	A beam has 230 mm x 500 mm overall cross section. Calculate the area of steel required, if the bending moment induced for a working load is 195 kN-m. Consider an effective cover of 40 mm for both tension and compression reinforcements. Use M30 grade concrete and Fe415 steel	5	2
6.	Design a square short column of effective length of 3.6 m supports a factored axial load of 1800 kN. Assume M25 grade concrete and Fe415 grade steel. Consider an effective cover of 50 mm. The column is hinged at both the ends.	5	4
7.	A 3m long column of size 300 mm x 500 mm is subjected to a factored axial load of 1360kN and factored moment of 190kN-m about major axis and 80kN-m about minor axis. Adopt an effective cover of 50 mm, M30 grade concrete, and Fe415 grade steel. Assuming distribution of bars equally on all sides check the column for adequacy.	5	4

8.	Calculate the longitudinal reinforcement required for a column of size 250 mm x 500 mm subjected to a factored axial load of 1600kN and factored moment of 20kN-m about major axis. The unsupported length of the column is 2.8 m with both ends hinged. Assume M20 grade concrete, Fe415 grade steel with an effective cover of 50 mm to the longitudinal reinforcement	3	4
9.	A reinforced concrete footing for a column of size 250 mm x 500 mm supports an axial load of 1200 kN. The safe bearing capacity (SBC) of soil is 200 kN/m^2. Pro portion the footing dimensions and check the soil pressure at base.	2	4
10.	A simply supported beam of size of 250 mm x 550 mm is supported over a span 5 m. The beam is reinforced with 4 bars of 20 mm diameter on tension side and carries a service load of 30 kN/m. The beam is made of M25 grade concrete and Fe 415 steel. The depth of neutral axis is 165.35 mm and moment of inertia of the cracked section (Ir) is 1.53×10^9 mm^4. Assuming an effective cover of 45 mm determine the short-term deflection at mid span of the beam [Use working stress approach]	5	5
11.	Determine the crack width at the location as indicated for a beam of size 250 mm x 500 mm as shown in the Fig. The beam is reinforced with 4 bars of 12 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 150 kN.m due to service loads. The depth of neutral axis is 96.71 mm. Use M25 grade concrete and Fe 415 steel. Assume a clear cover of 30 mm for both tension and compression reinforcements.	5	5