BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH/B.ARCH **SEMESTER : V**
BRANCH: CIVIL/ARCHITECTURE **SESSION : MO/2022**

SUBJECT: CE301 STRUCTURAL DESIGN I

TIME: 3:00 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a)	Mention various loads which are required to be considered in design of structures.	[2]
Q.1(b)	What do you mean by limit state of serviceability?	[3]
Q.1(c)	What are balanced sections, under-reinforced sections and over-reinforced sections in Limit State Method of design? Explain with strain diagram.	[5]
Q.2(a)	A 250 mm wide rectangular singly reinforced concrete beam is subjected to a maximum factored bending moment of 300 kNm. Grade of concrete is M20 and grade of steel is Fe415. Clear cover is 25 mm. Determine the depth of the beam.	[2]
Q.2(b)	Design the longitudinal reinforcement for the beam mentioned in Q.2(a).	[3]
Q.2(c)	The beam mentioned in Q.2(a) is subjected to a factored shear force of 150 kN. Design the shear reinforcement for the beam.	[5]
Q.3(a)	An interior panel of size 4m x 6m of a concrete slab is carrying an imposed load of 3 kN/m2 and load due to finishes of 1.0 kN/m2. Calculate the factored load for design of the slab assuming 150mm thick slab.	[2]
Q.3(b)	Calculate factored bending moments at mid-span and continuous edges of the slab mentioned in Q.3(a).	[3]
Q.3(c)	Check the adequacy of the assumed thickness of 150mm for bending moments. Design the reinforcements for the slab in Q.3(a). Assume M20 concrete and Fe415 steel. Consider clear cover as 20mm.	[5]
Q.4(a)	A rectangular RCC column is having the following data: Size of column: 500mm x 650mm, Unsupported length, lo = 9m Effective length in both the direction = 8.5m, Factored Axial Load, Pu = 1500 kN Factored Moment about major axis, Mux = 225 kNm, Factored Moment about minor axis, Muy = 80 kNm, Grade of Concrete: M25, Grade of Steel: Fe415, Clear cover: 40mm Check whether the column is to be designed as short column or as long column.	[2]
Q.4(b)	Calculate the moments for design of the column mentioned in Q.4(a).	[3]
Q.4(c)	Design the longitudinal reinforcement using design chart and lateral ties for the column mentioned in Q.4(a).	[5]
Q.5(a)	Check for bearing pressure on soil from a concentrically loaded footing for a square column of size 500mm x 500mm, supporting a service load of 2000 kN with the following data: Size of the footing: 3.5m x 3.5m, Depth of footing below ground level: 2m, Gross Safe Bearing Capacity of soil: 250 kN/m2, Thickness of footing: 700mm, Unit weight of soil: 18 kN/m3.	[2]
Q.5(b)	Check the footing of Q.5(a) for two-way shear. Use M25 concrete and Fe415 steel. Consider 40mm clear cover.	[3]
Q.5(c)	Check for one-way shear and design the reinforcement of footing of Q.5(a).	[5]

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Chart 44 COMPRESSION WITH BENDING—Rectangular Section—Reinforcement Distributed Equally on Four Sides