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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Feb. - 2021

Design of RC Structural Elements

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of engineering fundamentals and understand different method of design and terms terminology in design methods.

CO2: Identify Analyse and Design using limit state methods for beam elements using relevant codes.

CO3: Identify Analyse and Design using limit state methods for Slab and stair elements using relevant codes.

CO4: Identify, Analyse and Design using limit state methods for column and Footing elements using relevant codes.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*
II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for Maximum of* ***18 marks*** *from each unit.*
III) *Use of IS456:2000 and SP-16 is permitted.* ***IV)*** *Assume any missing data suitably.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
1 a.	Explain partial safety factor.	2	L2	CO1	PO1,12
b.	Calculate the depth of neutral axis of a singly reinforced beam 230 × 450 mm effective reinforced with 4 bars of 16 mm diameter. Use M20 concrete and Fe415 steel and also comment on type of beam.	2	L3	CO2	PO1,2,12
c.	A simply supported RCC beam 250 × 600 mm effective is subjected to a design shear force of 180 kN and it is reinforced with 4 bars of 20 mm diameter. Use M20 concrete and Fe415 steel. Design for shear.	2	L3	CO3	PO1,2,12
d.	List out any two differences between one-way and two-way slab.	2	L1	CO4	PO1,12
e.	Calculate the ultimate load carrying capacity of RC circular column of 400 mm diameter reinforced with 6 bars of 16 mm diameter. Use M20 concrete and Fe415 steel.	2	L3	CO4	PO1,2,12
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	i) Develop an expression for depth of neutral axis from stress block parameters.	6	L2	CO2	PO1,12
	ii) A rectangular beam of 300 × 500 mm section is used as a simply supported beam for an effective span of 6.5 m. Determine the superimposed load on the beam, if the maximum percentage of steel is provided, only on tension side. Use M20 concrete and Fe415 steel. Determine the amount of steel to be provided.	12	L3	CO1	PO1,12
b.	i) Explain balanced, under reinforced and over reinforced section with a neat sketch.	6	L2	CO2	PO1,12
	ii) A doubly reinforced beam 250 mm wide and 450 mm effective depth is provided with 2 bars of 16 mm diameter as compression reinforcement at an effective cover of 50 mm and 4 bars of 25 mm diameter as tensile steel. Use M20 concrete and Fe250 steel. Calculate the ultimate moment of resistance of the beam.	12	L3	CO2	PO1,12

Contd…2

UNIT - II **18**

2 a.	i) Describe different modes of shear failure of beam with a neat sketch.	12	L2	CO3	PO1,12
	ii) A simply supported RCC beam 250 mm wide and 500 mm effective depth is reinforced with 4 bars of 22 mm diameter as tensile steel. If the beam is subjected to a factored shear force of 65 kN at the support, design the shear reinforcement by using M20 concrete and Fe250 steel.	6	L3	CO3	PO1,2,3,12
b.	A rectangular beam 230 × 550 mm deep is subjected to an ultimate bending moment of 40 kN-m, shear force of 30 kN and torsional moment of 11.5 kN-m at a given section. Design the reinforcement, if M20 grade concrete and Fe415 grade steel is used. Sketch the details.	18	L3	CO3	PO1,2,3,12

UNIT - III **18**

3 a.	Design a cantilever beam of clear span 3.25 m to carry a service load of 15 kN/m. Use M20 grade concrete and Fe415 steel. Sketch the reinforcement details.	18	L3	CO4	PO1,2,3,8,12
b.	A floor of hall measures 16 m × 10 m to the faces of the supporting walls. The floor consists of three beams spaced at 4 m c/c and slab thickness is of 150 mm. The floor carries a live load of 4 kN/m^2. Design the intermediate T-beam. Use M20 grade concrete and Fe415 Steel. The support width may be assumed as 300 mm.	18	L3	CO4	PO1,2,3,8,12

UNIT - IV **18**

4 a.	Design a slab over a room of internal dimensions 4 m × 5 m supported on 230 mm thick brick wall. Live load on the slab is 2 kN/m^2 and floor finish is of 1 kN/m^2. Use M20 grade concrete and Fe415 steel. Assume all the edges are simply supported. Sketch the reinforcement details.	18	L3	CO4	PO1,2,3,8,12
b.	Design a dog-legged staircase for a building in which the vertical distance between the floor is 3.6 m. The stair hall measures 3 m × 6 m. Take live load on the stair as 4 kN/m^2. The flights are supported on 230 mm thick walls at the ends of outer edge. Adopt M20 grade concrete and Fe415 steel. Sketch the reinforcement details. Take; Riser = 150 mm and Tread = 300 mm.	18	L3	CO4	PO1,2,3,12

UNIT - V **18**

5 a.	i) Enumerate the differences between long and short columns.	4	L2	CO4	PO1,12
	ii) Design necessary reinforcement for RC column 400 mm × 600 mm to carry an axial load of 2000 kN. The length of the column is 3 m. Use M20 grade concrete and Fe415 steel. Sketch the reinforcement details.	14	L3	CO4	PO1,2,3,8,12
b.	Design a square footing to carry a column load of 1200 kN from a 400 mm side square column. The bearing capacity of soil is 120 kN/m^2. Use M20 grade concrete and Fe415 steel. Sketch the reinforcement details.	18	L3	CO4	PO1,2,3,8,12

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