Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Summer 2018- 19Examination

Semester: 5 **Date: 18/05/2019**
Subject Code: 03104303 **Time: 10:30am to 1:00pm**
Subject Name: Structural Design - I **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.
5. IS 456 : 2000 is allowed.

Q.1 Objective Type Questions: **(15)**

A) Answer the most appropriate option from the multiple choices.

1. What is the minimum length of torsion reinforcement in case of two way restrained slabs? (Where l_x = Shorter span)
   (a) $l_x/2$ (b) $l_x/5$ (c) $l_x/7$ (d) $l_x/10$
2. What is the maximum spacing of longitudinal bars measured along the periphery of the column?
   (a) 300 mm (b) 280 mm (c) 250 mm (d) 180 mm
3. What is the limiting value of the depth of neutral axis ($X_{U, max}$) for Fe500 grade of steel?
   (a) 0.53d (b) 0.48d (c) 0.46d (d) 0.42d
4. What is the minimum % cross-sectional area of longitudinal reinforcement for columns? (Where A_g = Gross cross-sectional area of the column)
   (a) 0.12% of A_g (b) 0.3% of A_g (c) 0.6% of A_g (d) 0.8% of A_g
5. What is the basic value of span to effective depth ratio of continuous beam for spans up to 10 m?
   (a) 7 (b) 20 (c) 22 (d) 26

B) Fill in the blanks.

6. The longitudinal bars in columns shall not be less than ___ mm in diameter.
7. In case of two way restrained slabs, torsion reinforcement shall be provided in _____ numbers of layers.
8. Limiting moment of resistance for Fe415 grade of steel in terms of f_{ck}, b and d is given by $M_{U, lim}$ = _____.
9. Minimum reinforcement in slab is __ % of the total cross-sectional area for Fe250 grade of steel.
10. Design shear strength of concrete (τ_c) depends upon % steel and _____.
11. In no case the spacing of shear reinforcement shall exceed _____ mm.
12. In case of two way simply supported slabs, the moment co-efficients α_x and α_y depends upon _____ ratio.
13. In Limit State Method of design, factor of safety for concrete is __ and factor of safety for steel is __ .
14. The minimum number of longitudinal bars provided in column shall be ___ in circular columns.
15. Compressive strength of concrete for design purpose is taken at age of __ days.

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Write a short note on the concept of limit state method of structural design.

B) Explain design stress-strain curve concrete.

C) A beam of rectangular section 230 mm × 500 mm deep is reinforced with tensile reinforcement of 4 numbers of 20 mm diameter bars and compressive reinforcement of 2 numbers of 16 mm diameter bars at effective cover of 40 mm on both the sides. Find moment of resistance of the beam in M20 grade of concrete and Fe250 grade of steel is used.

D) A simply supported beam 230 mm × 550 mm effective is reinforced with 4 numbers of 16 mm diameter bars of Fe415 grade steel. Find safe load carried by a beam if span is 4 m effective. Use M20 grade of concrete.

Q.3 A) Design a R.C.C. square column subjected to axial service compressive load of 600 kN. Use M20 grade of concrete and Fe500 grade of steel. Provide steel 1% of gross cross-sectional area of the column. Also draw reinforcement details. **(07)**

B) Design a square pad footing for an isolated column 500 mm × 500 mm size carrying axial load of 1600 kN. Safe bearing capacity of soil is 200 kN/m^2. Use M20 grade of concrete and Fe415 grade of steel. Also check for cracking. **(08)**

OR

B) A 1 m wide, single flight R.C.C. staircase is to be provided for 2.7 m height residential building. It is supported at top and bottom by beams of 300 mm width. Waist slab is 150 mm thick, Risers are of 180 mm and Treads are of 300 mm. Design the reinforcement in waist slab. Use M20 grade of concrete and Fe250 grade of steel. **(08)**

Q.4 A) A column of size 300 mm × 400 mm has effective length of 3.3 m is subjected to axial factored load of 100 kN and factored moment of 150 kN*m. Design the column for M25 grade of concrete and Fe415 grade of steel. Take effective cover of 60 mm and provide steel on two faces of column. **(07)**

OR

A) Design a rectangular beam having width 250 mm, simply supported with effective span of 4.5 m. It is loaded with dead load of 15 kN/m including self-weight & live load of 5 kN/m. Use M20 grade of concrete and Fe415 grade of steel. Also check for minimum reinforcement and deflection. **(07)**

B) Design a simply supported two way slab of 3 m × 4 m clear span supported on 230 mm thick walls on all four sides. Take live load of 4 kN/m^2 and floor finishing of 0.5 kN/m^2. Use M20 grade of concrete and Fe250 grade of steel. Corners are not held down. Checks are not required. **(08)**

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