Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Winter Examination-2021

Subject Name : Structural Design-I

Subject Code : 4TE07STD1 **Branch: B.Tech (Civil)**

Semester: 7 **Date: 13/12/2021** **Time: 02:30 To 05:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.
(5) IS 456:2000 and IS 800:2007 are allowed in the examination hall.

Q-1 **a)** **Give the definition of the following terms.** **08**

(i) Limit state of serviceability,
(ii) Effective cover,
(iii) Neutral axis,
(iv) Bundled bar,
(v) Tied column,
(vi) Development length,
(vii) Shape factor,
(viii) Plastic hinge.

b) Where gusset plate is provided? **01**

c) Where splices are provided? **01**

d) When lug angels are required? **01**

e) For one way slab, In which direction distribution steel is provided? **01**

f) Calculate the design strength of Fe 415. **01**

g) Give the nominal cover for extreme exposure condition. **01**

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

(a) Explain the steel beam behavior, with reference to Flexure, Elasticity, Yielding and Plastic behavior. **10**

(b) What are the assumptions considered in the design of concrete compression member? **04**

Q-3 **Attempt all questions** **(14)**

(a) Determine the plastic section modulus, shape factor about minor axis (y-y) and the moment capacity of channel section given in Fig-1. Take f_y = 250 MPa. **08**

(b) Determine the Plastic section moduli about the z-z axis and shape factor of channel section given in Fig-1. Take f_y = 250 MPa. **06**

Q-4		**Attempt all questions**	**(14)**
	(a)	Determine the plan dimensions of combined footing for two axially loaded column with the following data. Both the columns A and B are interior column with dimension 400 mm × 400 mm. Column A and B have 1000 kN and 1200 kN loading respectively. Center to center spacing of both the column id 3 m and soil bearing capacity is 150 kN/m^2. Condition 1. If width is not restricted Condition 2. Width is restricted 2.3 m Draw the sketch for both conditions.	**10**
	(b)	Draw the stress block diagram for doubly reinforced beam.	**04**
Q-5		**Attempt all questions**	**(14)**
	(a)	A simply supported rectangular beam 230 × 415 mm effective is subjected to factored sheer force of 150 kN. Find spacing of 8 mm ϕ-2 legged fe 415 grade vertical stirups if beam is reinforced with 0.85% P_t. M20 grade of concrete is used.	**08**
	(b)	Find the maximum load inclined at 60° to the horizontal, which the bracket shown in the Fig-2 can transmit if five grade 8.8 bolts with a diameter of 20 mm are used and plates connected are 10-mm thick. Determine the load (1) if the joint is considered a slip joint and if (2) joint is considered as non-slip joints.	**06**
Q-6		**Attempt all questions**	**(14)**
	(a)	Determine the design axial load on the column section ISMB 350. The height of the column is 3.0 m and that it is pin-ended. Also assume the yield strength 250 MPa, ultimate strength 410 MPa and modulus of elasticity is 2×10^5 MPa.	**10**
	(b)	Find the numbers of 16 mm diameter bars for a reinforced concrete beam of size 230 mm × 415 mm effective to resist factored bending moment 90 kNm. Use M20 and Fe 415.	**04**
Q-7		**Attempt all questions**	**(14)**
	(a)	Design a circular column to carry an axial load of 1600 kN by using helical reinforcement. M-25 grade of concrete and fe 415 is used.	**10**
	(b)	What is Under reinforced section (URS) and Over reinforced section (ORS)?	**04**
Q-8		**Attempt all questions**	**(14)**
		Design a two way simply supported slab 3 m × 3.5 m clear span, supported on 300 mm wide wall on four sides. Live load is 5 kN/m^2 and floor finish 1 kN/m^2. Corners are held down and draw the cross section of slab.	**14**

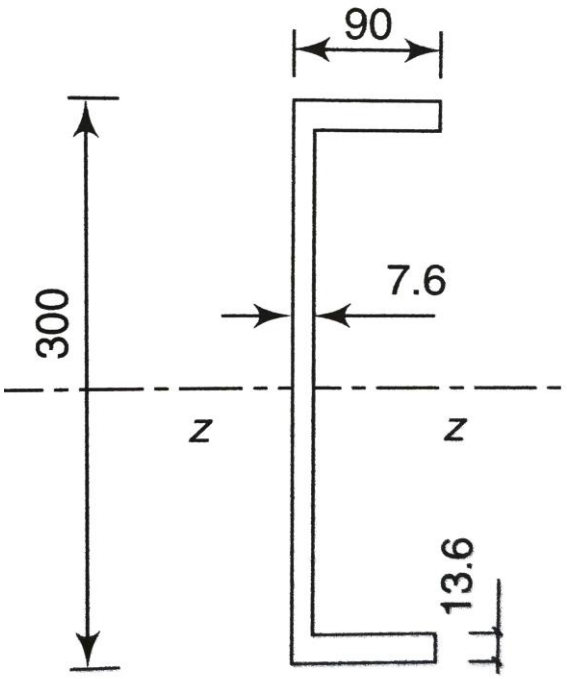

Fig-1 (Q-3)

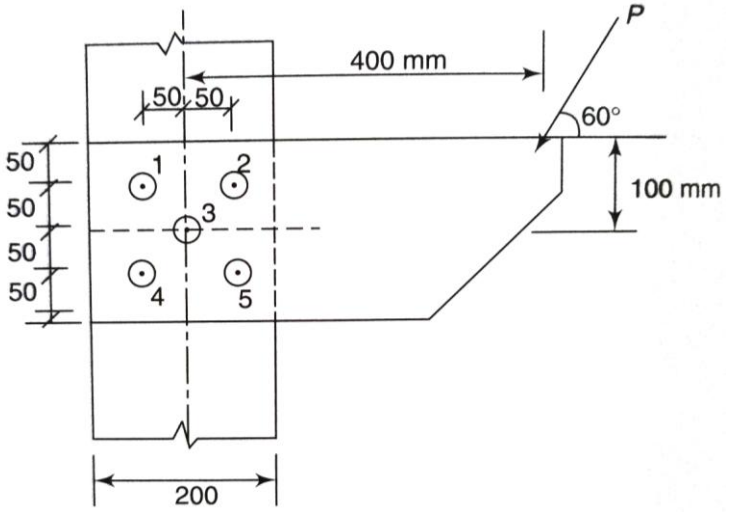

Fig-2 (Q-5 (b))