Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2160607   Date:17/05/2016
Subject Name: Elementary Structural Design
Time: 10:30 AM to 01:30 PM   Total Marks: 70

Instructions:
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of IS- 456-2000, IS: 800-2007 and Steel Table is permitted.
5. Use of SP-16(Design Aids) is NOT permitted.

Q.1 (a) Find the Moment of Resistance of a singly reinforced concrete beam of 200mm width and 410 mm effective depth, reinforced with 4 bars of 12 mm diameter of Fe415 and M20 concrete. **07**

(b) Design a short rectangular R.C.C. column to carry an axial load of 1500 kN. Use M20 grade concrete and Fe-415 grade steel. Show the reinforcement details with neat sketches. **07**

Q.2 (a) Two plates 80 mm wide and 12 mm and 20 mm thick are connected by lap joint to resist design tensile load of 70 kN. Design a lap joint using M16 bolts of grade 4.6 and grade 410 plates. **07**

(b) Discuss advantages and disadvantages of structural steel. **07**

OR

(b) Write the design steps for the RC combined footing. **07**

Q.3 (a) A singly reinforced slab 120 mm thick is supported by T-beam spaced 3.2 m centre to centre. The effective depth and width of web are 560 mm and 450 mm respectively. 8 nos. of Tor steel of 20 mm diameter are provided in 2 layers. The effective cover to the bars in lower layer is 50 mm. The effective span of simply supported beam is 3.60 m. Determine the depth of Neutral Axis and the Moment of resistance of T-beam section. Use M20 grade concrete and Fe-415 grade steel. **07**

(b) A RC Beam 250 x 500 mm effective is reinforced with 4 Nos-20 mm diameter of Fe 415. The beam carries factored shear force of 200 kN. Find spacing of 8 mm diameter-2 legged-Fe 250 stirrups. Use M 20. **07**

OR

Q.3 (a) An ISA 125 x 75 x 8 mm is to be connected with 8 mm thick gusset plate with its longer leg connected by 4 mm size weld to transfer an axial pull of 120 kN. Design the welded connection and show the details by sketch. Assume steel grade Fe 410. **07**

(b) Design a tension member to carry a factored load of 230 kN. Use single unequal angle with 4 mm fillet weld for the connection to gusset plate. Length of member is 3 m. Take f_y 250 MPa and f_u 410 MPa. **07**

Q.4 (a) A beam 250 mm x 500 mm effective deep is doubly reinforced with 2 Nos. 16 mm diameter compression steel and 4 Nos. 25 mm diameter tension steel. Effective cover is 50 mm. Find moment of resistance of doubly reinforced beam section. Use M20 grade concrete and Fe-415 grade steel. **07**

(b) Design a two way Simply supported slab for a room of 3.3 m x 3.3 m. The slab is resting on 230 mm thick wall. Take L.L = 2.5 kN/m², F.F= 1.0 kN/ m². Use M-20 and Fe-415. Corners are not held down. Show reinforcement details with neat sketches. **07**

OR

Q.4 (a) Calculate compressive strength of 2 ISA 80 x 80 x 8 mm placed on either side of **07**

gusset plate 8 mm thick with effective held in position at both ends but restrained against rotation at one end. The length of member is 3 m and f_y is 250 MPa.

(b) Design a simply supported beam of span 6m carrying working loads of Dead Load 15 kN/m and Live Load 10 kN/m. Assume that the compression flange of the beam is laterally restrained throughout.   **07**

Q.5 **(a)** Explain one way shear check and two way shear check for footing design.   **07**

(b) Draw the neat sketches of Lacing systems, Battening systems and slab base foundation for steel columns.   **07**

OR

Q.5 **(a)** Design a one way simply supported slab for a room of 3.3 m x 9.6 m. The slab is resting on 230 mm thick wall. Take L.L = 2.5 kN/m². Use M-20 grade concrete and Fe-415 steel. Check the slab for deflection. Show reinforcement details with a neat sketch.   **07**

(b) Design an isolated sloped Footing for a square R.C.C. column of size 450 mm carrying an axial load of 1800 kN. Safe bearing capacity of soil is 220 kN/ m². Use M-20 concrete and Fe-415 steel. Check for bearing pressure is not required. Show the details with neat sketches.   **07**