

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-VII EXAMINATION – WINTER 2015**

**Subject Code: 170603****Date: 09/12/2015****Subject Name: Structural Design -I****Time: 10:30am to 1:30pm****Total Marks: 70****Instructions:**

1. Use of SP-16(Design Aids) is NOT permitted.
2. Use of IS- 456-2000, IS: 800-2007 and Steel Table is permitted.
3. Attempt all questions.
4. Make suitable assumptions wherever necessary.
5. Draw neat sketches where necessary .

- Q.1** (a) 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**
- (b) Design a steel column to carry an axial load of 1300 kN. The length of column is 4.0 m and fixed at both ends. Take  $f_y = 250 \text{ N/mm}^2$ . **07**
- Q.2** (a) Explain briefly, the various Limit States of design. **07**
- (b) Design a Doubly R.C. beam of 300 mm X 600 mm overall size to resist a factored moment 310 kNm. The effective cover is 50 mm for tensile and compression steel. Use M-20 concrete and Fe- 415 steel. **07**
- OR**
- (b) Design a tension member to carry a tensile load of 150 kN. Select suitable single angle assuming a single row of M20 bolt of 4.6 grade. Take  $f_y = 250 \text{ N/mm}^2$ . **07**
- Q.3** (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/m<sup>2</sup>. 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/mm<sup>2</sup>. Use M-20 concrete and Fe-415 steel. Check for bearing pressure is not required. Show the details with neat sketches. **07**
- OR**
- Q.3** (a) 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/m<sup>2</sup>, F.F= 1.0 kN/mm<sup>2</sup>. Use M-20 and Fe-415. Corners are not held down. Show reinforcement details with neat sketches. **07**
- (b) A Simply R.C.C. beam of 300 mm X 500 mm overall size has 4 nos. 20 mm diameter bars of Fe-415 at an effective cover of 30 mm. The beam is subjected to Shear Force of 150 kN. Design the shear reinforcement. Use M-20 grade concrete & 8 mm diameter stirrups of Fe-250. **07**
- Q.4** (a) Design a lap joint for connecting two plates, 180 mm wide and 12 mm thick, subjected to design tensile load of 220 kN. Use Fe 410 grade of plate and 8.8 grade HSFG bolt of 20 mm diameter. **07**
- (b) Design a simply supported steel beam of 5 m span carrying factored load of 40 kN/m. The compression flange of the beam is laterally restrained throughout. Check for web crippling is not required. Take  $f_y = 250 \text{ N/mm}^2$ . **07**

**OR**

- Q.4 (a)** Design the welded connection for an ISA 90x90x8 mm which is to be connected with 10 mm thick gusset plate by 6 mm fillet weld on sides and at the end of the member to transfer tensile load of 150 kN. Take Fe 410 grade steel and field welding. Draw neat sketch of connections. **07**
- (b)** Design a single angle discontinuous strut to carry a factored load of 85 kN. The c/c distance between its joint is 3.3 m. Assume two bolts at each end and fixed conditions take  $f_y=250 \text{ N/mm}^2$ . **07**
- Q.5 (a)** Draw the neat sketches of Lacing systems, Battening systems and slab base foundation for steel columns. **07**
- (b)** Discuss the procedure for design of R.C.C. beam subjected to combined Shear Force, Bending Moment and Torsion Moment. **07**
- OR**
- Q.5 (a)** Discuss the procedure for the design of steel member subjected to both axial compressive force and bending moment. **07**
- (b)** Explain various elements of Flat slab with neat sketches. Mention advantages & Disadvantages of Flat slab. **07**

\*\*\*\*\*