Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – SUMMER • 2014

Subject Code: 141301 **Date: 16-06-2014**

Subject Name: Design of Environmental Structure

Time: 10:30 am - 01:00 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, IS-800, IS-875: Part-I, II, III, SP-6 & SP-16 is permitted.**
5. **For analysis and design purpose, take concrete grade: M_{20}, steel grade: Fe_{415} in RCC design and yield stress of steel: f_y = 250 MPa in steel design if not given in the data.**
6. **Take shear stress in fillet weld as 108 MPa, wherever necessary.**

Q.1 **(a)** Design a simply supported beam to carry a live load of 25 kN/m. The span of the beam is 4.2 m and the support width is 300 mm. The grade of concrete is M20 and the grade of steel is Fe415. Also take the width of beam as 230 mm. **07**

(b) Determine the moment carrying capacity of RCC beam reinforced with 6 bars of 16 mm diameter in tension zone. The width of beam is 250 mm and total depth is 500 mm. The grade of steel is Fe415 and the grade of concrete is M20. **07**

Q.2 **(a)** A tension member of a roof truss carries an axial tension of 260 kN. Design the section composed of two unequal ISA placed on either side of 10 mm thick gusset plate. Take diameter of rivet 20mm and grade of steel Fe250. Also find number of rivets required. **07**

(b) State the advantages and disadvantages of welded connections. **07**

OR

(b) Design a riveted connection for a tension member carrying an axial force of 268 kN. The member is composed of 2 ISA80X80X8 mm connected on both side of 10 mm thick gusset plate. The rivets are 18 mm diameter power driven shop rivets. Draw the connection details. **07**

Q.3 **(a)** Design a slab base for a steel column ISHB 350 weighing 67.4 kg/m carrying a total load of 1200kN. Take the bearing strength of concrete as 4 N/mm^2. **07**

(b) Design an ISHB section for a column taking compressive force of 1000 kN. The unsupported length of column is 5.5 m with both ends fixed. **07**

OR

Q.3 **(a)** Design a simply supported steel beam to carry a udl of 50 kN/m on entire span of 5.5m. Check the beam for shear and deflection. **07**

(b) Design the welded joint for tension member given in Q. No.2(b) OR. Use 6 mm fillet weld. Permissible shear stress in the welds = 110 N/mm^2. **07**

Q.4 **(a)** A doubly reinforced rectangular section is 250 mm wide and 500 mm deep. It is reinforced with 2 bars of 12 mm diameter as compression steel and four bars of 25 mm diameter as tension steel. The cover to compression steel is 40 mm. Determine the ultimate moment of resistance of the beam .The grade of steel is Fe415 & the grade of concrete is M20. **07**

(b) Design a simply supported slab resting on 300 mm thick wall. The clear span is 3.5 m and live load on slab is 3 kN/m^2. The grade of steel is Fe415 and grade of concrete is M20. Check the slab for deflection. **07**

OR

Q.4 **(a)** A reinforced concrete beam 250 mm wide and 400 mm effective depth and 5 m span is subjected to a factored shear force of 150 kN near supports. The percentage of tension reinforcement near support is 0.5 percent. Design the vertical stirrups as shear reinforcement near support and in mid span. Assume the grade of steel and concrete as Fe415 and M20 respectively. **07**

(b) Design the Slab for a room of internal size 5 m x 6 m. the slab is simply supported on all four edges and all corners are held down. It carries a superimposed load of 3 kN/m^2 excluding floor finish. Use M20 grade of concrete and Fe 415 grade of steel. **07**

Q.5 **(a)** Design a built up column of two channels back to back to carry an axial load of 1400kN. The length of the column is 6m and it is effectively held in position at both ends and restrained against rotation at one end. Assume a yield stress of 250MPa. **07**

(b) Design the single lacing system for built up column designed in Q. No. 5(a). **07**

OR

Q.5 **(a)** A square RCC column is carrying a characteristic load of 1000 kN. The size of column is 350 mm X 350 mm. The safe bearing capacity at 1.5 m depth is 150 kN/m^2. Design the square pad footing. Assume the grade of concrete as M20 and grade of steel as Fe415. **07**

(b) Design a circular column to support an axial load of 700 kN with lateral ties. The column has unsupported length of 3 m. Use the grade of concrete and steel as M20 and Fe415 respectively. **07**

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