Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – SUMMER 2014

Subject Code: 170603 **Date: 05-06-2014**

Subject Name: Structural Design - I

Time: 02.30 pm - 05.30 pm **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. **Non-programmable calculator is permitted.**
4. **Attempt all questions.**
5. **Make suitable assumptions wherever necessary.**
6. **Figures to the right indicate full marks.**

Q-1. **(a)** Sketch neatly the Design Stress and Strain Block Parameters and derive equation for Depth of Neutral Axis and Moment of Resistance for a balanced beam section. **07**

(b) 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 Fe_{415} and M_{20} concrete. **07**

Q-2. **(a)** Find the Moment of Resistance of a T beam of M_{15} Concrete grade with following details: Df = 110mm; bf = 730mm; d = 410mm; bw = 230mm; Ast = 4-20mm dia Fe415 bars **07**

(b) A simply supported RCC beam 250mm wide, 400mm effective depth is subjected to Ultimate Shear Vu of 150kN at supports. Tensile reinforcement at supports is 0.5%. Design shear stirrups near supports and also design nominal shear reinforcement at mid span for M15 concrete and Fe250 steel for stirrups. **07**

OR

(b) An RCC beam 200mm wide, 500 mm deep is reinforced with 2-12mm dia bars at top and 2-16mm dia bars at bottom, with an effective cover of 40mm. Using M20 concrete and Fe415 steel, determine resistance of the beam in pure torsion. **07**

Q-3. **(a)** Design a simply supported one way slab 3m x 7m supported on 200 mm wide beams. The slab carries a 2 kN/m^2 live load and 1.2 kN/m^2 finish load. Use M_{20} concrete and Fe_{415} steel. Check criteria for deflection and development length. **10**

(b) Enumerate the difference between short and slender columns. State the code specifications for: a) minimum eccentricity for design of columns; b) longitudinal reinforcement; c) lateral ties. **04**

OR

Q-3. **(a)** Discuss advantages and disadvantages of structural steel? **04**

(b) Describe what you understand by class 4.6 and class 8.8 bolts? **03**

(c) Two plates of width 200 mm and thickness 10 mm are required to be designed, using welded connection for 100 percent efficiency. Use slot welds if required. **07**

Q-4. **(a)** A single unequal angle 100 × 75 × 6 mm is connected to an 8 mm thick gusset plate at the ends with six 18 mm diameter bolts to transfer tension. Determine the design tensile strength of the angle assuming that the yield and ultimate stress of steel used are 250 MPa and 410 MPa. Assume that the longer leg is connected to the gusset plate. **07**

(b) What do you mean by "LUG ANGLE"? Design a tension member of a roof truss to carry a factored axial tension of 350 kN using lug angle. **07**

OR

Q-4. **(a)** A laterally supported simply supported beam of 5.0 m span carries uniformly distributed load of 36 kN/m with a central point load of 40 kN. Design the section and check for shear and deflection. **07**

(b) Explain: 1) Plastic Bending of Beams; 2)Types of Torsion **07**

Q-5. **(a)** Explain drawing neat sketches the terms: "LACING" and "BATTENING". **07**

(b) A built up column with 2 ISMC 350, back to back, at spacing of 150 mm, is carrying an axial load of 1000 kN. Length of column is 9 m. It is held in position at both ends but not restrained in direction. Design a suitable double lacing system. **07**

OR

Q-5. **(a)** Design a slab base footing for built up column consisting of two ISLC 350 back to back separated by a distance of 180 mm and carrying factored load of 1400 kN. Concrete grade M15 and steel Fe410, Bearing capacity of soil 250 kN/m^2. **07**

(b) Design a double angle discontinuous strut to carry a factored load of 300 kN. The length (between intersections) of the member is 3.0 m. The two angles are placed back to back on the same side of gusset plate. Use grade Fe 410 steel. **07**

****