Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (NEW).EXAMINATION – WINTER 2016

Subject Code: 2160607 **Date: 26/10/2016**

Subject Name: Elementary Structural Design

Time: 2:30 PM to 05:30 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, Steel table is permitted.**
5. **If not specified, consider M20 & Fe415 for RCC and yield stress 250 MPa for steel structures.**

Q.1 **(a)** State and explain in brief types of limit states and assumptions made in theory of limit state of collapse. **07**

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

Q.2 **(a)** A simply supported normal tee beam of 4.5 m clear span is loaded with characteristic load of 40kN/m. It is reinforced with 4 no. 20mm diameter bars at support. The section of the beam is 230mm wide and 560mm effective depth. Design the shear reinforcement at support. Use M20 and Fe415. **07**

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

OR

(b) Design a doubly reinforced section for a rectangular beam having an effective span of 4.0m. The superimposed load is 40kN/m and size of beam is 230mm × 450mm.Assume the suitable data. Design for the M25 and Fe 415 grades of materials. **07**

Q.3 **(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) Design a short RCC column square in section, to resist a factored axial load of 2500 KN. Provide all necessary checks and detailed sketch. Use M25 and Fe 415. **07**

OR

Q.3 **(a)** Design a RCC slab continuous over all four sides having span of 3 m× 4m subjected to live load of 3kN/m^2 and floor finish 1.2 kN/m^2. Use M25 and Fe 415. **07**

(b) Design a simply supported one way RCC slab with clear span of 3 m× 7m. Assume the live (imposed) load as 4kN/m^2 and floor finish load as 1kN/m^2. **07**

Q.4 **(a)** Design the bolted connection to transmit an axial force equals to the strength of the plate. Here, two plates of size 200×12 mm of grade 410 are to be connected by 22 mm diameter bolt by using butt joint. **07**

(b) A member of steel roof truss consist of two angle sections ISA 90×90×6 mm placed back to back on either side of 8 mm thick gusset plate. The member carries an ultimate tensile load of 190 KN. Design the connection if diameter of bolts provided is 20 mm of product grade 5.6. Ultimate tensile stress in the plate is 410Mpa. **07**

OR

Q.4 **(a)** A tension member comprises of the single angle ISA8080 × 8mm is connected **07**

by 7 nos. of 16mm dia. Bolt to the 10mm thick gusset plate. Calculate the tensile load capacity of the member. Take edge distance as 30mm and pitch as 50mm for bolt connection.

(b) A double angle discontinuous strut consists of 2- ISA 75×75×8 mm placed on the same side of the gusset plate of 10 mm thickness and tack bolted. The length of the member is 3.2 m between the intersections. Determine the compressive strength of the member. Assume F_u 410Mpa and f_y 250Mpa. Strut is hinged at both the ends. **07**

Q.5 **(a)** Two plates of width 200 mm and thickness 10 mm are required to be designed, using welded connection for 100% efficiency. Use slot's welds if required. **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)** 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 250Mpa and 410Mpa. Assume that the longer leg is connected to the gusset plate. **07**

(b) Explain drawing neat sketches the terms: "LACING" and "BATTENING". **07**

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