

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VII • EXAMINATION – WINTER • 2014****Subject Code: 170603****Date: 04-12-2014****Subject Name: Structure Design - I****Time: 10:30 am - 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, SP-16 and 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) Derive the expression for depth of neutral axis and moment of resistance for a balanced RCC beam section. **07**
- (b) A concrete beam has 350 mm width and 700 mm effective depth. Design the beam if it is subjected to a super imposed bending moment of 400 KN-m. Use M20 and Fe415. **07**
- OR**
- (b) A simply supported normal tee beam of 4.5 m clear span is loaded with characteristic load of 40 KN/m. it is reinforced with 4 no. 20 mm diameter bars at support. The section of the beam is 230 mm wide and 560 mm effective depth. Design the shear reinforcement at the support. Use M20 and Fe415. **07**
- Q.3** (a) Design a RCC slab continuous over all four sides having span of 3 m x 4 m subjected to live load of 3 KN/m<sup>2</sup> and floor finish 1.2 KN/m<sup>2</sup>. Use M25 and Fe415. **07**
- (b) A member of steel roof truss consist of two angle sections ISA 90 x 90 x 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 410 Mpa. **07**
- OR**
- Q.3** (a) 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**
- (b) Design a suitable fillet weld to connect a tie plate 100 mm x 8 mm to a 12 mm thick gusset plate. The plate is subjected to load equal to tension capacity of the member. Assume shop welding. Provide only side fillets. Assume  $F_u$  410 MPa and  $f_y$  250 Mpa. **07**
- Q.4** (a) A double angle discontinuous strut consists of 2- ISA 75 x 75 x 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  $F_u$  410 MPa and  $f_y$  250 Mpa. Strut is hinged at both the ends. **07**

- (b) Design rectangular isolated sloped footing for a column of size 250 mm x 600 mm carrying an axial characteristic load of 1600 KN and reinforced with 8 nos. 25 mm diameter bars. The bearing capacity of soil is 200 KN/m<sup>2</sup>. Grade of concrete M30 and grade of steel used is Fe 415. **07**
- OR**
- Q.4** (a) Calculate the compressive strength of a compound column consist of ISHB 350 with one cover plate of 400 x 20 mm on each flange and having length of 4 m. assume that the bottom of column is fixed and top is pinned. Take  $f_y = 250$  Mpa. **07**
- (b) A steel column ISMB 600 is loaded by the factored axial compressive load 550 KN. Design the suitable slab base for the column if it is resting on the concrete of grade M30. **07**
- Q.5** (a) Design a simply supported beam of span 7 m carrying RCC slab capable of providing later restraint to the top compression flange. The beam is subjected to total UDL of 120 KN dead load excluding self weight plus 100 KN imposed load. In addition beam carries a point load at mid span made of 50 KN dead load and 75 KN imposed load. Use grade of steel 410. **07**
- (b) A short concrete column of size 500 mm x 500 mm is subjected to factored axial load of 1500 KN,  $M_{ux} = 200$  kN.m,  $M_{uy} = 110$  kN.m. Design the reinforcement in the column. Use M 25 and Fe 415. **07**
- OR**
- Q.5** (a) Explain in brief : i) shear lag effect **04**  
ii) plastic hinge **03**
- (b) Design a tension member to carry a factored load of 260 KN. Use single unequal angle section with 6 mm fillet weld used to connect to the gusset plate of thickness 8 mm. Assume length of the member 3.5 m and  $f_u$  for plate is 410 Mpa. **07**

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