

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII • EXAMINATION – SUMMER 2013****Subject Code: 170603****Date: 28-05-2013****Subject Name: Structural Design I****Time: 02.30 pm - 05.30 pm****Total Marks: 70****Instructions:**

1. Make suitable assumptions wherever necessary.
2. Figures to the right indicate full marks.
3. Draw neat and clean sketches with pencil only.
4. Use of IS 456-2000, IS 800-2007, IS 875 Part I, II and III and steel table is permitted.
5. Adopt M20 grade of concrete & Fe 415 grade of reinforcement for RC design and $f_y = 250$ grade for steel design unless otherwise stated.

Q.1 (a) (i) What is the difference between Mild steel and HYSD steel. Also state the few characteristics of both types of steel. **07**

(ii) Explain the purpose of Binding wires, Spacers, Chairs and Dowels from detailing point of view.

(b) (i) State the types of Limit State **07**

(ii) Give the full forms of the following acronyms: RCC, HYSD, TMT

Q.2 (a) (i) List a few Indian standard codes that are followed while designing structures made of steel. **07**

(ii) What are the advantages of bolted connections over riveted or welded connections?

(b) Design a rectangular beam having 3.5 m simply supported clear span. Assume support width to be 230 mm. Beam is subjected to a dead load of 25 kN/m and live load of 20.0 kN/m. Design the beam for M20 and Fe 415 grade of materials. **07**

OR

(b) Design a lap joint and butt joint between two plates having thickness 12 mm and 16 mm are connected by a single bolted joint with 20 mm diameter bolts at 75mm pitch. Calculate the efficiency of the joint. Take f_u of plate as 410 MPa and assume 4.6 grade bolts. **07**

Q.3 (a) A singly reinforced slab 120 mm thick is supported by T-beam spaced 3.2 m centre to centre. The effective depth and width of web are 560 mm and 450 mm respectively. 8 nos. of Tor steel of 20 mm dia are provided in 2 layers. The effective cover to the bars in lower layer is 50 mm. The effective span of simply supported beam is 3.60 m. Determine the depth of Neutral Axis and the Moment of resistance of T-beam section. **07**

(b) Design a doubly reinforced section for a rectangular beam having an effective span of 4.0 m. The superimposed load is 40 kN/m and size of beam is 230 mm x 450 mm. Assume the suitable data. Design for the M25 and Fe415 grades of materials. **07**

OR

Q.3 (a) (i) What is meant by Aspect Ratio. State the limits of the same for One way and two way slabs. Also show the sharing of the loads on the adjacent beams of both the slabs by sketch. **07**

(ii) List down the criterion for the following along with the relevant Clause numbers in IS 456:2000 : Maximum diameter of reinforcement bars, Maximum spacing of the bars and Minimum reinforcement.

(b) A simply supported reinforced concrete beam of size 300 x 500 mm effective is reinforced with 4 bars of 16 mm dia HYSD steel of grade Fe-415. Determine the anchorage length of the bars at the simply supported end if it is subjected to a factored shear force of 350 kN at the centre of 300 mm wide masonry support. Concrete mix M20 is used. **07**

Q.4 (a) Design a tie member of roof truss subjected to working loads of 80 kN(DL) and 120 **07**

kN(LL). Use double angle section connected back o back on either side of gusset 8 mm thick. Use bolted connection. $F_y=250\text{MPa}$ and $f_u = 410\text{ MPa}$ for both member and bolt material. What will be the capacity if the angles are connected on the same side of the gusset plate.

- (b) Calculate compressive strength of 2 ISA 80 x 80 x 8 mm placed on either side of gusset plate 8 mm thick with effective held in position at both ends but restrained against rotation at one end. The length of member is 3 m and f_y is 250 MPa. **07**

OR

- Q.4** (a) Design a simply supported beam of span 5m carrying a reinforced concrete floor Capable of providing lateral restraint to the top compression flange. The UDL is made up of 25 kN/m including dead load. Assume Fe 410 grade steel. **07**

- (b) A two span continuous beam is fixed at A and simply supported at B and C. $AB=6\text{m}$ and $BC=4\text{m}$. It carries factored UDL of 10kN/m over entire length. Design uniform section. Compare the design if the section for span AB and BC have their plastic moment of resistance in the ratio of their plastic moments M_p developed due to their individual mechanisms. **07**

- Q.5** (a) (i)List down the assumptions made in the Limit state of collapse in Flexure. **07**
(ii)Explain the modes of failure for Under- reinforced and Over- reinforced beam.

- (b) Design a short rectangular column to carry an axial load of 455KN. Take M20 grade of concrete and Fe415 grade of steel. Apply the check for the eccentricity. Unsupported length of column is 3m. **07**

OR

- Q.5** (a) Design a built up column with two channels toe-to-toe to carry a factored load of 1700 kN. Take the effective length as 5.2 m. Design it as a laced column and also design the lacing. **07**

- (b) (i) Explain different end conditions of columns with their effective length. **07**
(ii) What is difference in behavior of short and long compression members ?.
