Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 170603   **Date: 01/01/2013**
Subject Name: Structural Design - I
Time: 10.30 am - 01.00 pm   **Total Marks: 70**
Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of IS:456, IS:800 and Steel Tables is permitted.**
5. **Assume yield stress of steel as 250 MPa and ultimate stress as 410 MPa unless mentioned other wise for Steel Design.**
6. **Use concrete of grade M20 and steel of grade fe415 unless mentioned other wise for R. C. C. Design.**

Q.1 **(a)** Discuss the various philosophies of the design in R. C. C. and steel structures. Also discuss the merits and demerits of each. **07**

    (b) A square R. C. C. column of size 450 x 450mm has concrete grade of M25 and main steel of 12 nos. of 20mm dia. bars (Fe 500). It carries a factored axial load of 1600kN and factored bending moments of 120kN-m and 60kN-m about two axes. Check the safety of the column if Uniaxial Bending Moment capacity about each axis is 180kN-m. **07**

Q.2 **(a)** An ISMB500 is loaded by a factored compressive load of 500kN at the midpoint of the flange. Check the safety of the column if the effective length for both axial and bending is 2.8.m **07**

    (b) A steel column ISMB600 is loaded by the factored axial compressive load 600kN. Design the suitable slab base for the column if it is resting on the concrete of the grade M25. **07**

OR

    (b) An R. C. C. column of the size 300x300 mm is loaded by a working axial compressive load of 700kN. If the Safe Bearing capacity of the soil is 150kN/m², design the suitable square slopped individual footing for the same giving check for the shear. **07**

Q.3 **(a)** A truss member is analyzed and found that following loads are acting on it. 1) Dead Load = 100kN (compression) and 2) Live Load = 75kN (compression). If the length of the member is 2.25m between the connections and is connected to the 10mm thick gusset plate, design the member comprising of 2 equal angle sections. Assume that the member is connected to gusset plate by more than 2 nos. of bolts. **07**

Q.3 **(b)** A steel column is loaded by a working load of 600kN. The length of the column is 3.4m and is restrained against both at the one end and is restrained against translation only at the other end. Design suitable I section for the same. **07**

OR

Q.3 **(a)** A tension member comprises of the single angle ISA9060 x 6mm is connected by 7 nos. of 16mm dia. Bolt to the 10mm thick gusset plate. Calculate the capacity of the member if shorter leg is connected. Take edge distance as 40mm and pitch as 50mm. **07**

Q.3 **(b)** A column restrained against rotation and translation both at both the ends **07**

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has length of 6.0m. It is fabricated form 2ISMC350 face to face forming a rectangle of 500x350. It is loaded by an axial compressive factored load of 1600kN. Design the suitable Lacing **OR** Battening system for the same.

Q.4 **(a)** A simply supported R. C. C. beam of span 6m carries working udl of 30kN/m throughout the span. Design the beam assuming the width of the beam as 300m, effective cover as 45mm and main steel bars of dia. 20mm. **07**

(b) A simply supported R. C. C. beam with clear span of 5m, support width 230mm, size of 230 wide and 420mm deep, tension bars as 4nos. of 16mm dia. bars and clear cover of 25mm. If it is loaded by an all inclusive factored udl of 60kN/m, design the shear reinforcement near support only using 2 legged 6mm. mild steel stirrups. **07**

OR

Q.4 **(a)** An R. C. C. beam of size 300 wide and 500mm deep is reinforced by tension bars as 4nos. of 25mm dia. and compression bars as 2nos. of 16mm dia. Calculate the moment of resistance of beam if the clear cover is 30mm on both the sides. **07**

Q.4 **(b)** A short R. C. C. column of size 300 wide and 600mm deep carries working axial compressive load of 800kN. Design the column using 20mm main steel bars and 8mm tie bars. Assume the grade of the concrete as M25. **07**

Q.5 **(a)** A simple support beam is laterally supported over the span of 8m and loaded by a super imposed load of 30kN/m over the entire span and 100kN and centre. Design the beam using ISMB section and check for all the safety. **07**

(b) An R. C. C. slab of spans 4mx6m has only one long edge continuous and all other edges discontinuous. The slab is 130mm thick. It is loaded by live load of $4kN/m^2$ and floor finish load of $1kN/m^2$. Design main steel at bottom of 4m span and check for deflection assuming support width of 230mm. **07**

OR

Q.5 **(a)** A beam of ISMB550 has simple support span of 9m and is laterally supported at centre only. Calculate the maximum all inclusive factored udl it can support. **07**

(b) A 180mm thick R. C. C. flat slab is loaded by live load of 4kN/m2 and floor finish load of 1kN/m2. It is supported by 4 columns of size 450x450 mm. The column head is changing the size of 600x600 mm bottom to 1500x1500mm at top over the depth 500mm. The columns are placed at 4.5mx6m centre to centre. Check the slab for shear only. **07**

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