

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-IV • EXAMINATION – SUMMER 2013

Subject Code: 140603**Date: 14-06-2013****Subject Name: Structural Design - I****Time: 10:30am – 01:00pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q-1. (a)** Describe in detail with neat sketches Design Stress Block Parameters for members in flexure and derive the equation for depth of neutral axis for balanced section **03**
- (b)** Find the Moment of Resistance of a singly reinforced concrete beam of 200mm width and 400 mm effective depth, reinforced with 3 bars of diameter of Fe₄₁₅ and M₂₀ concrete. **04**
- Q-2. (a)** Find the Moment of Resistance of a T beam for following data: D_f = 100mm; **07**
 b_f = 730mm; d = 410mm; b_w = 240mm; A_{st} = 4-20mm dia HYSD bars; M15 concrete
- (b)** A simply supported RCC beam 250mm wide, 400mm effective depth is subjected to V_u of 150kN at critical section near supports. Tensile re at supports is 0.5%. Design shear stirrups near supports and also design no shear reinforcement at mid span for M20 concrete and Fe250 steel. **07**
- OR**
- (b)** An RCC beam 300mm wide, 400 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 for a room with inner dimensions of 3m x 7m and 300mm supporting walls. The slab carries a 2kN/m² live load and 1.5kN/m² finish load, using M₂₀ concrete and Fe₄₁₅ steel. Check for deflection and development length **10**
- (b)** Enumerate the difference between short and slender columns. State the codal 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 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 400 kN using lug angle. **07**

OR

- Q-4. (a)** Design a double angle discontinuous strut to carry a factored load of 2 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. Take grade Fe 410 steel with $f_y = 250$ MPa. **07**
- (b)** Explain:
1. Plastic Bending of Beams **03**
 2. Types of Torsion **04**
- Q-5. (a)** What do you mean by “LACING” and “BATTENING”? Give your answer with appropriate sketches. **06**
- (b)** A built up column with 2 ISMC 350, back to back, at spacing of 200 mm, is carrying an axial load of 1200 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. **08**

OR

- Q-5. (a)** Design the 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 1600 kN. Concrete grade M15 and steel Fe410, Bearing capacity of soil 280 kN/m^2 . **07**
- (b)** A laterally supported simply supported beam of 5.5 m span carries uniformly distributed load of 36 kN/m with a central point load of 45 kN. Design the section and check the section for shear and deflection. **07**

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