

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-IV • EXAMINATION – WINTER • 2014****Subject Code:141301****Date: 22-12-2014****Subject Name: Design of Environmental Structure****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary and mention the assumed data clearly in your answers.
3. Figures to the right indicate full marks.
4. Use of IS-456, IS-800(1984), IS-875: Part-I, II, III, and Steel Table is permitted.
5. For analysis and design of R.C.C. structures consider concrete grade: M20, steel of grade Fe415 HYSD and For analysis and design Steel structures consider yield stress of steel:  $f_y = 250$  MPa, unless specified otherwise.
6. Take shear stress in fillet weld as 108 Mpa, wherever necessary.
7. Figures to the right indicate full marks to the question.
8. Assume suitable data, if necessary

- Q.1** (a) Explain Under- reinforced, Over- reinforced and balanced beam and discuss their failure modes. **07**
- (b) A singly reinforced beam section of size 230 mm x 500 mm effective is to carry a factored moment of 100 kNm. Calculate and provide the area of steel required and show reinforcement details. **07**

- Q.2** (a) Calculate the moment of resistance of a doubly reinforced beam of 300mm X 600mm effective depth reinforced with 2 bars of 16 mm dia. as compression reinforcement and 4 bars. of 25mm dia. as tensile reinforcement. **07**
- (b) Calculate limiting moment of resistance and shear capacity of beam section 200mmX450 mm effective depth reinforced with 3 bars of 16mm diameter and 8 mm dia. stirrups at 200mm c/c. **07**

**OR**

- (b) Design a simply supported beam resting on 230 mm thick wall for the following data : (i) Live load 8 kN/m, Dead load 10 kN/m. Consider concrete M20 and steel Fe415. Assume that the beam is simply supported over the walls. Design the beam for flexure and Shear only. **07**
- Q.3** (a) Determine moment of resistance and shear capacity for a 125mm effective depth slab reinforced with 12 mm bars spaced at 110mm c/c. **07**
- (b) A column of 400mm x 600mm size carries a factored load an axial load of 1600kN. The column is short and having a minimum eccentricity  $< 0.05D$ . Design the column with longitudinal steel and transverse steel. Also show reinforcement details. **07**

**OR**

- Q.3** (a) Determine the load carrying capacity of the short braced column of size 400mm x 400mm reinforced with 6 no. of 16mm diameter bars. Minimum eccentricity  $< 0.05D$ . Consider grade of concrete M20 and HYSD steel of grade Fe 415. **07**

- (b) Design an isolated slopped footing subjected to axial working load of 1500kN. The allowable bearing pressure on soil is  $180 \text{ kN/m}^2$ . Consider grade of concrete M20 and HYSD steel of grade Fe 415. **07**
- Q.4** (a) An ISA 100x100x8 mm is carrying an axial tensile force of 120kN with one leg connected to gusset plate 10 mm thickness. Design the joint using M20 bolts of 4.6 grade and Fe 410 plate. **07**
- (b) Determine the tensile strength of an angle ISA 100x75x8 mm connected to the gusset plate by 6 mm welds toe and back. Take  $f_y=250\text{Mpa}$ . **07**
- OR**
- Q.4** (a) 1] Discuss merits and demerits of R.C.C and Steel structures. **04**  
2] Explain Bond and development length in R.C.C. structures . **03**
- (b) Determine the compressive strength of a single angle strut ISA 90x90x8 mm with centre to centre length of 3 m. The angle is loaded through one leg and ends are fixed. Consider only one bolt at each end. **07**
- Q.5** (a) Design suitable slab base for column ISHB 300 @63 kg/m carrying axial load of 2700 kN. The safe bearing capacity of soil is  $200 \text{ kN/m}^2$  and grade of concrete is M20. Draw two views of your design details. **07**
- (b) Design column using I-section, subjected to an axial load of 1200 kN. The length of the member is 4.2 m with one end fixed other hinged. **07**
- OR**
- Q.5** (a) Design a simply supported beam of span 5m carrying working loads of dead load  $20 \text{ kN/m}$  and imposed load  $15 \text{ kN/m}$ . Assume that the compression flange of the beam is laterally restrained throughout. Provide only deflection check. **07**
- (b) 1] What are the advantages of riveted connections over welded connections? **03**  
2] List the failure modes that may control the strength of a riveted joint. **04**

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