

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- VIIth SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 170603****Date: 09/06/2012****Subject Name: Structural Design-I****Time: 02:30 pm – 05:00 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: 800 (2007), IS: 456 (2000) and Steel Table (IS Hand book-No:1) is permitted.
5. Assume the Ultimate and Yield stress of steel as 410N/mm^2 and 250N/mm^2 respectively unless it is mentioned.

- Q.1** (a) Explain Working stress method and Limit state method of structural Design Philosophy. **06**
- (b) A single equal-leg angle $100 \times 100 \times 10\text{mm}$ is connected to a gusset plate of 10mm thick at the ends with 6 bolts of 20mm diameter in a single line at a gauge distance of 60mm to transfer tensile force. Determine the design tensile strength of the angle. Assume edge distance as 40mm & pitch for the bolts as 50mm . **08**
- Q.2** (a) Distinguish clearly between **06**
1. One way and Two way slab
 2. Lacing and Battening.
- (b) Design and detail a slab base plate for a column ISHB450 @ 87.24kg/m of 4m length. The factored load on column is 1250kN . The grade of concrete used for pedestal is M20. **08**
- OR**
- (b) Design an isolated sloped footing for the column of size $300\text{mm} \times 500\text{mm}$ reinforced with 6 bars of 20mm diameter carrying an ultimate load of 900kN . The bearing capacity of soil is 260kN/m^2 . Use M20 and Fe415. Effective cover for bottom steel is 60mm . **07**
- Q.3** (a) Design a Reinforced Concrete slab for a room $6\text{m} \times 5\text{m}$. The slab is to be cast monolithically over beams with corners held down. The width of supporting beams 230mm . Slab carries superimposed load of 3kN/m^2 . Use M20 and Fe415. **07**
- (b) Design a column of I- section in a building subjected to axial factored compressive load of 900kN . The height of column is 4.5m with both ends fixed. It is braced in order to prevent buckling about the weaker axis at a half the length of the column. **07**
- OR**
- Q.3** (a) Determine axial compressive load carrying capacity of a 2.3m long single angle strut ISA75x50x8mm. The longer leg is connected to the gusset plate with two bolts at each end. Assume hinged condition. **07**
- (b) A reinforced concrete rectangular beam $300\text{mm} \times 600\text{mm}$ deep is subjected to a uniformly distributed load 40kN/m over a simply supported span of 6m . Design the beam for flexure using M20 and Fe415. **07**

- Q.4** (a) Design a uniform section for Moment and shear capacity of two spans simply supported continuous beam ABC. Span AB is of 4m length and carries a central concentrated load of 150kN and span BC is of 6m length and carries a central concentrated load of 200kN. Assume the beam is to be laterally supported. Adopt plastic design procedure. **07**
- (b) A doubly reinforced beam of size 250mmx600mm is required to resist a moment of 300kN.m. Using concrete of grade M20 and Fe415, calculate the amount of steel required. Assume effective cover as 50mm. **07**

OR

- Q.4** (a) Explain various structural members with neat sketches, which will be designed as a beam-column (Combination of Bending with axial compression). Mention the design steps involved for beam-column as per IS: 800, 2007. **07**
- (b) A Reinforced Concrete beam of rectangular cross section 350mmx450mm effective depth is subjected to bending moment of 40kN.m, shear force of 25kN and torsion 15kN.m at the section. Design the beam assuming effective cover as 50mm. **07**
- Q.5** (a) Design and detail a connection for a truss member 2-ISA60x60x8mm connected back-to-back on both the sides of a 10mm thick gusset plate using M20 bolts of property class 4.6 grade. The axial factored load in the member is 150kN. **07**
- (b) Calculate the area of steel required for a short RCC column 400mmx450mm to carry an axial load of 1100kN. Use $f_{ck}=20\text{MPa}$ and Fe415 grade of steel. **07**

OR

- Q.5** (a) Explain various elements of FLAT SLAB. **07**
- (b) Determine the maximum uniformly distributed load that can be carried by a laterally unrestrained ISMB300 simply supported beam of 2.5m effective length. **07**
