

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (Old) EXAMINATION – WINTER 2019****Subject Code: 170603****Date: 28/11/2019****Subject Name: Structural Design-I****Time: 10:30 AM TO 01:30 PM****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)** Explain Working stress method and Limit state method of structural Design Philosophy. **07**
- (b)** Discuss the procedure for the design the steel member subjected to combined axial and bending loading. **07**
- Q.2 (a)** Calculate area of steel required for a short RCC column 400mm × 450mm to carry an axial load of 1100 kN. Use $f_{ck} = 20\text{MPa}$ and Fe 415 grade of steel with neat sketch. **07**
- (b)** A Singly reinforced beam 250 mm × 500 mm is reinforced with 3 Nos. 20mm dia bars at an effective cover of 30 mm. Effective span of the beam is 4m. Find allowable superimposed load on the beam. **07**
- OR**
- (b)** Explain the limit state of collapse and limit state of serviceability in flexure. **07**
- Q.3 (a)** Determine bolt value of 20 mm diameter bolt connecting 10 mm plate in **07**
- a) Single shear
b) Double shear
- Grade of bolt is 4.6 and grade of plate is 410 Mpa.
- (b)** A tie plate of 75 × 8 mm is connected to the gusset plate to transmit a factored load of 120 kN. Determine the size and length of the fillet weld, assuming site welds, Fe 410 steel and E 41 electrode. **07**
- OR**
- Q.3 (a)** Calculate compressive strength of 2 ISA 80 × 80 × 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 3m and f_y is 250 MPa. **07**
- (b)** Determine the design axial load on the column section ISMB 350 having height 3.0 m. hinged at both ends. Take $f_y = 250\text{ MPa}$. **07**
- Q.4 (a)** A reinforced concrete beam of rectangular section 300 mm wide and 600 mm deep is reinforced with tensile and compression reinforcement 4 Nos of 25 mm dia and 4 Nos of 16 mm dia at an effective cover of 50 mm on both sides respectively. Calculate the factored moment assuming concrete mix M 20 and steel as Fe-415. **07**
- (b)** A RCC T-beam section reinforced for tension has the following data: **07**
- a) Flange width = 2000 mm
b) Thickness of flange = 130 mm
c) Effective depth = 800 mm
d) Breadth of rib = 400 mm

Determine the limiting moment of resistance of the section. Take $f_y = 415 \text{ N/mm}^2$ and $f_{ck} = 20 \text{ Nmm}^2$.

OR

Q.4 (a) Determine in limit state method development length for 20 mm diameter, Fe-415 grade steel bar in compression. Concrete grade as M-20. **07**

(b) A singly R.C beam $230 \text{ mm} \times 460 \text{ mm}$ effective is reinforced with 5 nos. – 16Φ bars as tension reinforcement. The beam is subjected to a factored shear force of 60 kN. Design for shear reinforcement use M20 concrete and Fe 415 steel. **07**

Q.5 (a) A simply supported beam is laterally supported over the span of 6 m and loaded by an all-inclusive factored udl of 30 kN/m over the entire span and 100 kN and center. Design the beam using ISMB section and check for all safety. **07**

(b) Design a simply supported one way slab for an effective span of 3.0 m to carry total factored load of 9 kN/m^2 . Use M-20 concrete and Fe-250 steel. Draw sketch with all required details. Check not required. **07**

OR

Q.5 (a) A rectangular beam 300 mm wide and 400 mm deep is reinforced with 2-12 mm dia. Bars at top and 2-16 mm dia. Bars at the bottom, each provided with an effective cover of 40 mm. Assuming concrete grade M20 and steel of Fe 415 grade, determine the resistance of beam in pure tension. Check not required. **07**

(b) A short concrete column of size $400 \text{ mm} \times 400 \text{ mm}$ is subjected to factored axial load 1300 kN, $M_{ux} = 190 \text{ kN.m}$ $M_{uy} = 110 \text{ kN.m}$. Design the reinforcement in column assuming M 25 concrete and Fe 415 steel and effective cover 60 mm. **07**
