Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2018

Subject Code:2160607 Date:08/05/2018

Subject Name:Elementary Structural Design

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.**
4. **Use of IS:456, IS:800 and steel table is permitted.**
5. **Assume M20 grade concrete and Fe415 steel for RCC element and f_y of 250 MPa and f_u of 410 MPa for the structural steel if not given.**

Q.1	**(a)**	Define (i) Limit State (ii) Characteristic strength (iii) Partial Safety Factor	**03**
	(b)	Write Advantages and Disadvantages of Steel and R.C.C. Structures.	**04**
	(c)	Discuss different kinds of loads to be taken into account for the the design.	**07**
Q.2	**(a)**	Explain different modes of failure for R.C.C beam in flexure.	**03**
	(b)	A singly reinforced rectangular beam of width 230 mm and 460 mm effective depth is reinforced with 3 no. 20 mm diameter bars. Find out the factored moment of resistance of the section.	**04**
	(c)	A simply supported rectangular beam of size 230 mm wide and 500 mm effective depth is subjected to a factored load of 64 kN/m. Beam length is 5 m. Find the reinforcement for flexure. Effective cover to compression reinforcement is 50 mm.	**07**
		OR	
	(c)	A simply supported rectangular beam of 6 m span carries a characteristic load of 24 kN/m including self-weight. The beam section is 230 mm x 560 mm effective. 2 nos. 20 mm diameter and 2 nos. 16 mm diameter bars are provided as tension reinforcement in mid span. 2 nos. 16 mm diameter are curtailed at a distance 750 mm from the face of the R.C.C. column support. Check the beam section for shear and deflection. Ends of the reinforcement are confined with compressive reaction. Take $f_s = 219$ N/mm^2.	**07**
Q.3	**(a)**	Classify slabs according to the system of supports used. Explain any one in detail.	**03**
	(b)	An R.C.C. short column of size 400 mm x 500 mm is carrying a factored load of 3000 kN. Design the column assuming $e_{min} < 0.05D$. Use M25 concrete and Fe415 steel.	**04**
	(c)	A simply supported one-way slab of effective span 4 m is supported on masonry walls of 230 mm thickness. Live load acting on slab is 3.0 kN/m^2 and floor finish is equal to 1.0 kN/m^2. Design the slab.	**07**
		OR	
Q.3	**(a)**	Sketch reinforcement detail of a rectangular combined footing to be provided for two columns. Draw plan, longitudinal and cross section.	**03**
	(b)	Design a circular column of diameter 400 mm subjected to a load of 1150 kN. The column is 3 m long and is effectively held in position at both ends but not restrained against rotation. Use M25 concrete and Fe415 steel.	**04**
	(c)	Design a square footing of uniform thickness for an axially loaded column of 500 mm x 500 mm size. The safe bearing capacity of soil is 180 kN/m^2. Load on column is 900 kN.	**07**
Q.4	**(a)**	A member of steel roof truss consists of two angles ISA 75x75x6 mm placed back to back on either side of 8mm thick gusset plate. The member carries ultimate tensile load of 200 kN. Determine no. of 16mm diameter, 4.6 grade ordinary bolts required for the joint. Take F_u as 410 MPa.	**07**

	(b)	Design a tension member to carry a factored load of 300 kN. Use single unequal angle with 6 mm fillet weld for the connection to gusset plate. Length of member is 3.0 m.	**07**

OR

Q.4	**(a)**	Write short note on "Lug Angle"	**03**
	(b)	Explain term (i) Lateral – torsional buckling (ii) Web crippling	**04**
	(c)	A simply supported steel joist of 5.0 m span has to support a load of 60 kN/m inclusive of self weight. The beam compression flange is restrained against buckling. Design an appropriate section using steel of grade Fe 410.	**07**
Q.5	**(a)**	Explain single lacing system and double lacing system with neat sketches.	**03**
	(b)	Two plates of 12 mm and 20 mm thickness have width of 100 mm. These plates are connected by lap joint to resist design tensile load of 70 kN. Find bolt value if 16 mm bolts of grade 4.6 is used for connection.	**04**
	(c)	Calculate the design load carrying capacity of a compound column consisting of ISHB 250 @ 51 kg/m with one cover plate of 320 x 20 mm on each flange. The length of column is 4 m. Assume that its one end is fixed and other end is hinged.	**07**

OR

Q.5	**(a)**	Sketch the details of gusseted base footing.	**03**
	(b)	Discuss IS code provisions for design of beam-column.	**04**
	(c)	Design the base plate for an ISHB 300 @ 63 kg/m column to carry a factored load of 1000 kN. Take Fe 410 grade steel and M25 grade concrete. Also design welded connection of base plate to Column.	**07**

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