Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2160607 Date:21/05/2019

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 fy of 250 MPa and fu of 410 MPa for the structural steel if not given.**

			MARKS
Q.1	**(a)**	Discuss the suitability of steel as reinforcement material.	**03**
	(b)	Why are drilled holes preferred over punched holes? When Punched holes are allowed?	**04**
	(c)	Explain different methods of designing R.C.C structures.	**07**
Q.2	**(a)**	Draw detailed stress and strain diagrams for singly under-reinforced section & Over reinforced section.	**03**
	(b)	What are the values of factor of safety for concrete and steel? Why do we use less factor of safety for steel as compared to concrete?	**04**
	(c)	A R.C beam of rectangular section 230 mm wide and 600 mm deep is reinforced on tension side by 4 bars of 20 mm diameter. The characteristic strength of concrete and steel used are 25 N/mm^2 and 500 N/mm^2. Take nominal cover 20 mm. Calculate a) Ultimate moment of resistance of the section b) Determine the maximum uniformly distributed load a simply supported beam of this section can carry over a span of 6m.	**07**
		OR	
	(c)	A reinforced concrete slab 150 mm thick is reinforced with 10 mm bars @ 180 mm c/c. the reinforcement is located at an effective depth of 125 mm from top. Calculate the moment of resistance of the section. Use M-20 concrete and Fe 415 steel.	**07**
Q.3	**(a)**	Explain the difference between one way and two way slab.	**03**
	(b)	Find the ultimate load carrying capacity and allowable load for a short column of size 500 mm * 500 mm. the column is reinforced with 4-25 mm diameter bars. Use M20 concrete and HYSD grade Fe 415 steel. Assume $e_{min} < 0.05D$.	**04**
	(c)	A Simply supported beam 300 mm * 600 mm (effective) is reinforced with 5 bars of 25 mm diameter. It carries a uniformly distributed load of 80 kN/m (Including self-weight) over an effective span of 6m. Out of 5 main bars, two bars can be bentup safely near the supports. Design the shear reinforcement for the beam. Use M20 grade of concrete and Fe 415 steel.	**07**
		OR	
Q.3	**(a)**	What is the function of providing distribution steel in slab?	**03**
	(b)	Write design steps for isolated rectangular column footing.	**04**
	(c)	Determine the ultimate moment of resistance of the tee beam having the following properties: - 1. Width of flange = 900 mm 2. Thickness of Flange = 150 mm	**07**

3. Width of rib = 300 mm
4. Effective depth = 600 mm
5. Area of tension reinforcement = 3966 mm^2

Use M-20 Grade of Concrete and Fe-415 HYSD bars.

Q.4 **(a)** Describe failure modes of steel beam. **03**

(b) Write short notes on block shear failure in plates and angles. **04**

(c) Select a suitable angle section to carry a factored tensile force of 290 kN assuming a single row of M20 bolts and assuming design strength f_y = 250 N/mm2 **07**

OR

Q.4 **(a)** How can the effects of shear lag be considered in the design calculation? **03**

(b) Discuss cross section classification. **04**

(c) Two plates of thickness 12 mm and 10 mm are to be jointed by a groove or butt weld as shown in fig.1 The joint is subjected to a factored tensile force of 300 kN. Assuming an effective length of 150mm, Check the safety of joint for single groove weld joint and double V groove weld joint. Assume Fe410 grate steel plate and welds are shop welded. **07**

Q.5 **(a)** Write design steps of lacing column. **03**

(b) Draw a neat sketch of gusseted steel footing. **04**

(c) Design simply supported beam of span 3.5 m subjected to a factored bending moment of 300 kNm and factored shear of 140 kN. The beam is laterally unsupported. Steel grade of Fe 410. **07**

OR

Q.5 **(a)** Write design steps of battening column. **03**

(b) Compare welded joint vs bolted joints. **04**

(c) A beam of ISMB550 has simple support span of 9m and is laterally supported at center only. Calculate the maximum all inclusive factored udl it can support. **07**

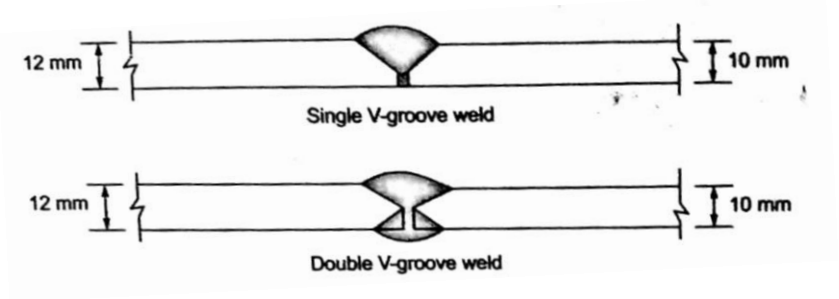

Figure -1

****