Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (New) EXAMINATION – WINTER 2019

Subject Code: 2160607 **Date: 12/12/2019**

Subject Name: Elementary Structural Design

Time: 02:30 PM TO 05:30 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary and state clearly.**
3. **Figures to the right indicate full marks.**
4. **IS:456(2000) and IS:800(2007) design codes are allowed.**
5. **Steel table is allowed.**

Q.1	**(a)**	Explain the concept of limit state design methodology.	**03**
	(b)	Write the importance of lacing and battening	**04**
	(c)	A reinforced concrete rectangular beam 230mmx600mm 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. Also check for deflection criteria as per IS:456.	**07**
Q.2	**(a)**	Explain under Reinforced, Over Reinforced and Balance section design.	**03**
	(b)	Identify the section as under reinforced, balanced or over reinforced section and determine its moment of resistance. Find the moment of resistance of a singly reinforced concrete beam 230mm width and 410mm effective depth, reinforced with 4 bars of 16mm diameters of Fe415 and M20 concrete.	**04**
	(c)	Design and detail shear reinforcement at supports and centre only for RC beam 5m long carrying udl of 40kN/m having section of 250X500mm size with M20 grade of concrete and singly reinforced with 4-16 diameter bars of FE415 grade of steel.	**07**
		OR	
	(c)	Design a simply supported one way RCC slab with clear span of 3m x 8m. Assume the live load as 4kN/m^2 and floor finish 1kN/m^2. Also show check for deflection and reinforcement details as per IS:456.	**07**
Q.3	**(a)**	Enlist the reasons when the provisions of doubly reinforced sections are required.	**03**
	(b)	Find the moment of resistance of a beam section 250 mm wide x 550 mm effective depth, reinforced with 3-20# diameters of Fe415 with M20 concrete.	**04**
	(c)	A tee-beam with 1200mm wide flange and 120 mm deep slab. The effective depth of beam is 600 mm width of web is 230 mm. Find the area of steel required for an ultimate moment of 550 kN-m. Consider concrete of M20, Grade of steel Fe 415.	**07**
		OR	
Q.3	**(a)**	What are the reasons for providing combined footing.	**03**
	(b)	A short column of 450mm x 600mm size carries a factored load axial load of 1600kN. The column is short and having a minimum eccentricity < 0.05D. Design the column for axial and transverse reinforcement. Also sketch reinforcement details.	**04**
	(c)	Design and detail isolated footing for an axially loaded column 400 x 400 mm in c/s and carrying 1500 kN working load. Take SBC of soil as 200 kN/m^2.	**07**

Q.4	**(a)**	Describe the different types of connections	**03**
	(b)	Write the characteristics of Plastic, Compact and Slender sections	**04**
	(c)	Two plates of thickness 20 mm are to be joined by groove weld. Butt joint is formed by the groove welds, which is subjected to factored tensile force of 350 kN. Effective length of the joint is 150 mm. Welds are shop welded and plates are Fe410 grade. Check the safety of joint for (i) Single V-groove (ii) Double V-groove.	**07**

OR

Q.4	**(a)**	Sketch reinforcement detail of a rectangular combined R.C.C. footing to be provided for two columns. Sketch plan, longitudinal and cross section.	**03**
	(b)	Deign lap joint to connect two plates 100x16 mm and 100x12mm to transfer 100 kN axial factored load. Use single row of 4.6 grade bolts. Plates are of steel grade 410.	**04**
	(c)	Design a double angle section to carry a tension of 300 kN working load. The end connection is to be made using M20 bolts of property class 4.6. Assume that the angles are provided on both sides of gusset. Also design the bolt connection.	**07**

Q.5	**(a)**	Sketch the details of gusseted base footing.	**03**
	(b)	Determine axial compressive load carrying capacity of a 2.3m long discontinuous single angle strut ISA75x50x8mm. The longer leg is connected to the gusset plate with two bolts at each end.	**04**
	(c)	Determine working imposed uniformly distributed load acting on a laterally unrestrained simply supported beam of section ISMB 350 @ 52.4 kg/m. Span of the beam is 5 m.	**07**

OR

Q.5	**(a)**	Explain beam-column design with illustrative sketches.	**03**
	(b)	Sketch the details of slab base footing.	**04**
	(c)	Design a simply supported steel beam of span 5m carrying working dead load of 15kN/m and working live load of 15kN/m. The compression flange of the beam is laterally restrained throughout. Assume steel grade Fe 410.	**07**

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