

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– V EXAMINATION – SUMMER 2026

Subject Code:3150612

Date:09-06-2026

Subject Name:Design of Structures

Time:02:30 PM TO 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. Simple and non-programmable scientific calculators are allowed.
5. Use of IS : 456-2000, IS : 800-2007 and Steel Table or SP 6 is permitted
6. 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.

		Marks
Q.1	(a) Define (1) Characteristic load (2) Characteristic strength (3) Clear cover	03
	(b) Explain limit state of collapse & limit state of serviceability in flexure.	04
	(c) A singly reinforced beam 200 mm width and 410 mm effective depth reinforced with 4 bars of 12 mm diameter on tension side. State the type of section and calculate moment of resistance of the section. Use M20 grade concrete and Fe415 steel.	07
Q.2	(a) Explain the different types of failures observed in bolted connection with neat sketches.	03
	(b) Enlist advantages and disadvantages of structural steel.	04
	(c) Find the area of reinforcement in tension and compression zones of rectangular R.C. beam of limited size 250 mm wide and 400 mm deep effective. The effective cover of compression and tensile reinforcement is 40 mm. The beam has to resist factored B.M. 180 kN.m. Use M-20 concrete and fe-250 steel.	07
OR		
	(c) An ISA 125 x 75 x 8 mm is to be connected with 8 mm thick gusset plate with its longer leg connected by 4 mm size weld to transfer an axial pull of 120 kN. Design the welded connection and show the details by sketch. Assume steel grade fe 410	07
Q.3	(a) Differentiate the limit state method and working stress method of design for RCC structures.	03
	(b) Write design steps for isolated rectangular column footing.	04
	(c) Design a simply supported slab on 300 mm wide brick masonry walls for a clear room dimension 3 m x 8 m. Assume floor finish 0.75 kN/m ² and live load 3 kN/m ² . Check for limit state of serviceability. Use M: 20 grade of concrete and Fe: 250 grade of steel	07
OR		
Q.3	(a) Why the balanced sections are most preferred over Under-reinforced section and Over-reinforced section. Also mention which type of section is avoided in design of singly reinforced beam with suitable reason.	03
	(b) Why are four different buckling curves prescribed to evaluate column strength?	04
	(c) Design a short R.C. square column for an axial compressive factored load of 1500 kN. Consider minimum percentage of steel as longitudinal reinforcement. Also, design lateral ties. Use M: 20 grade of concrete and Fe:	07

415 grade of steel.

- Q.4** (a) Differentiate between one-way slab and two-way slab. **03**
(b) Plot neat sketch of stress-strain curve of concrete and stress block parameters adopted by IS:456(2000). **04**
(c) A singly reinforced rectangular beam is subjected to factored shear force of 180 kN. The effective size of beam is 300 mm x 500 mm. the beam is reinforced with 1.2% tension steel. Find spacing of 2 legged-8 mm dia.-Fe 415 grade vertical stirrups. Use M-20. **07**

OR

- Q.4** (a) Describe what you understand by class 4.6 and class 8.8 bolts? **03**
(b) Explain shear lag effect and lug angle with neat sketch? **04**
(c) A member of a steel roof truss consists of two angles ISA 75 x 75x 6 mm placed back-to-back on either side of 8 mm thick gusset plate. The member carries an ultimate tensile load of 150 kN. Determine the number of 16 mm dia. 4.6 grade ordinary bolts required for the joint. Assume f_u of plate as 410 MPa. **07**

- Q.5** (a) Draw neat sketch of battening system. **03**
(b) Draw a neat sketch with all details of gusseted base footing. **04**
(c) Design a tension member to carry a factored load of 230 kN. Use single unequal angle with 4 mm fillet weld for the connection to gusset plate. Length of member is 3.0 m. Take $f_y = 250$ MPa and $f_u = 410$ MPa **07**

OR

- Q.5** (a) Draw neat sketch of lacing system. **03**
(b) Draw a neat sketch with all details of slab base footing. **04**
(c) Calculate compressive strength of a compound column consisting of ISHB 300 @ 0.58 kN/m with one cover plate of 350 x 20 mm on each flange and having a length of 5.0 m. assume that the bottom of column is fixed and top in pinned. Take $f_y = 250$ MPa **07**
