

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2023

Subject Code: 2160607

Date: 14-07-2023

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. Simple and non-programmable scientific calculators are allowed.
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.

		MARKS
Q.1	(a) Where do we use combined footing? explain various types of combined footing	03
	(b) Explain limit state of collapse & limit state of serviceability.	04
	(c) Discuss different kinds of loads to be taken into account for the design	07
Q.2	(a) Explain “various modes of failure” of bolted joint. With neat sketch	03
	(b) Write the characteristics of Plastic, Compact and Slender sections	04
	(c) Write advantage and disadvantages of steel structure and RCC structure.	07
	OR	
	(c) A rectangular beam of size 230 mm wide x 500 mm effective depth is subjected to a factored moment 200 KN. Find the reinforcement for flexure. The material M 20 grade of concrete and HYSD reinforcement of Fe grade 415.	07
Q.3	(a) Write short note on “Lug Angle”	03
	(b) Explain term (i) Lateral – Torsional buckling (ii) Web crippling	04
	(c) A simply supported one way slab of effective span 4 m supported on masonry walls of 230 mm thick . Design the slab. Take the live load equal to 2.5 kN/m ² and floor finish equal to 1 kN/m ² . The materials are M20 grade of concrete and HYSD reinforcement of Grade Fe 415. Do check for shear only.	07
	OR	
Q.3	(a) Give the assumption As per IS 456 for limit state of flexure.	03
	(b) Why are drilled holes preferred over punched holes? When Punched holes are allowed?	04
	(c) An RCC column of size 350 mm x 350 mm reinforced with 8 No 16 mm diameter bars carries a characteristic load 800kN. The allowable bearing pressure on soil is 200 kN /m ² . Design an isolated square pad footing . The materials grade M 20 concrete and HYSD reinforcement of grade Fe 415 for both, the column and footing. Check for one-way shear only.	07

Q.4	(a) Discuss IS code provisions for design of beam-column	03
	(b) Determine the size of end fillets to connect two plates with cross section of 125mm x 8 mm and 12 mm x 12 mm are subjected to a tension of 100 kN at working load .The ultimate strength of plates $f_u = 410$ Mpa.	04
	(c) A tie member of roof Truss consists of 2 ISA 100 x75x8 mm . The angles are connected to either side of 10 mm gusset plates and the member is subjected to working pull of 300 kN. Design the welded connection . Assume connections are made in the workshop.	07
OR		
Q.4	(a) Explain under Reinforced, Over Reinforced and Balance section design	03
	(b) Determine the load carrying capacity of the column section made from ISWB 400 fitted with one cover plate 300 mm x 20 mm on each flange top and bottom. Actual length of column is 4.5 m. Its one end may be assumed fixed and the other end hinged. The grade of steel is Fe 415.	04
	(c) An ISMB 500 section is used as beam over span 6 m, with simply supported end . Determine the maximum factored load UDL that beam can carry if the ends are restrained against torsion but compression flange is laterally unsupported.	07
Q.5	(a) What is meant by shear lag and how it is accounted for in design?	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) Design a gusseted base for a column ISHB350 @710 N/m with two plates 450mm x 20 mm carrying a factored load of 3600 kN . The column is to be supported on concrete pedestal to built with M20 grade of concrete.	07
OR		
Q.5	(a) What is the function of transverse & longitudinal reinforcement in a column	03
	(b) Draw sketch slab base foundation for steel column	04
	(c) A column section ISHB @577 N/m is Carrying a factored axial load of 600 kN ,a factored moment of 30 kN-m and factored shear force of 60 kN. Design suitable column splice . Assume ends are milled	07