

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI EXAMINATION – SUMMER 2025

Subject Code:2160607

Date:30-05-2025

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. Use of IS:456, IS:800 and steel table is permitted.
6. Assume M20 grade concrete and Fe415 steel for RCC element, if not provided

- Q.1**
- (a) Describe Advantages and Disadvantages of Steel and Reinforced Concrete. **03**
- (b) Distinguish between One-way slab and Two-way slab. **04**
- (c) Discuss different kinds of loads to be taken into account for the design. **07**

- Q.2**
- (a) How singly RC beam is differing from doubly RC beam? **03**
- (b) Identify the section as under reinforced, balanced or over reinforced section for a given data and also find the moment of resistance of a singly reinforced concrete beam 230mm width and 450mm effective depth, reinforced with 4 bars of 16mm diameter of Fe415 and M20 concrete. **04**
- (c) Find Area of tensile & compressive steel required for a rectangular beam 250mm x 500 mm for the factored moment of 190 KN.m, the effective cover for tensile and compressive steel are 50 mm & 40 mm respectively. **07**

OR

- (c) Discuss Under reinforced, Over Reinforced and Balance sections design with equations. **07**

- Q.3**
- (a) Where do we use combined footing? Explain various types of combined footing. **03**
- (b) Determine develop length for 20 mm diameter, fe415 grade steel bar in compression Take M20 grade of concrete **04**
- (c) A short column of 400mm x 450mm size carries an axial load of 1100kN. Design the column for axial and transverse reinforcement. Also sketch reinforcement details. Use M: 20 grade of concrete and Fe: 415 grade of steel **07**

OR

- Q.3**
- (a) i] Compare the advantages and disadvantages of welded connections over bolted connections in structural applications. **07**
- ii] Write design steps for RCC one-way slab with IS codal provisions.
- (b) Design and detail isolated footing for an axially loaded column 400 x 400 mm in c/s and carrying 1600 kN load. Take SBC of soil as 210 kN/m². Check for shear is not required. Consider M20 and Fe 415. **07**

- Q.4**
- (a) Write ultimate tensile strength[f_u] and yield strength[f_y] for 4.6 and 8.8 class bolts. **03**
- (b) Design lap joint to connect two plates 100x16 mm and 100x12mm to transfer 100 **04**

kN axial factored load. Use single row of 4.6 grade bolts. Plates are of steel grade 410. Consider M20 Bolts

- (c) Design a tension member to carry a factored load of 230 kN. Use single angle assuming single row of M20 bolts. Take f_y 250 MPa and f_u 410 MPa **07**

OR

- Q.4** (a) Write the characteristics of Plastic, Compact and Semi-Compact sections **03**
- (b) Design suitable fillet weld to connect a tie plate 80mm x 6mm to a 12 mm thick gusset plate. The plate is subjected to load equal full strength of member. Assume shop welding & Fe-410 **04**
- (c) Determine the design axial load on the column section ISMB 350 having height 3.1m, hinged at both ends. Take f_y = 250 MPa. **07**
- Q.5** (a) Discuss in brief the term “lacing” OR “battening” with neat sketch. **03**
- (b) Draw a neat sketch with all details of slab base footing. **04**
- (c) Design a simply supported steel beam of 5m effective span to carry 17 kN/m working dead load and 12 kN/m working live load. Compression flanges are restrained laterally throughout the span. **07**

OR

- Q.5** (a) Write formulae for Pitch, Shear capacity of bolt and Bearing capacity of Bolt using IS 800:2007 **03**
- (b) Explain beam-column design with illustrative sketches. **04**
- (c) A column section ISHB 250@ 500.3 N/m is carrying a factored load of 500 kN. design a suitable column splice. use 20 Φ 4.6 grade bolts and steel of grade Fe 410 **07**
