

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026

Subject Code: 2160607

Date: 01/06/2026

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.

- Q.1**
- (a) State advantages and disadvantages of welded connections. **03**
 - (b) Discuss different kinds of loads to be taken into account for the design. **04**
 - (c) Explain under Reinforced, Over Reinforced and Balance section design with equations. **07**
- Q.2**
- (a) Write limiting Value for $X_{u,max}/d$ for Fe250, Fe415, Fe500 using IS 456: 2000. **03**
 - (b) Write IS codal provisions longitudinal reinforcement for RC Column. **04**
 - (c) A reinforced concrete beam of rectangular section 300 mm wide and 600 mm deep is reinforced with tensile and compression reinforcement 4 Nos - 25 mm dia. and 4 Nos - 16 mm dia at an effective cover on both sides respectively. Calculate the factored moment assuming concrete M20 and Fe 415. **07**
- OR
- (c) Described Advantages and Disadvantages of Steel and Reinforced Concrete. **07**
- Q.3**
- (a) What is Footing ? Enlist Various Types of footing. **03**
 - (b) Determine development length for 20 mm diameter, Fe250 grade steel bar in compression Take M20 grade of concrete. **04**
 - (c) Design and detail isolated footing for an axially loaded column 500 x 500 mm in c/s and carrying 1600 kN load. Take SBC of soil as 200 kN/m². Check for shear is not required. Consider M20 and Fe 415 **07**
- OR
- Q.3**
- (a) Discuss types of connection for steel structures. **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 RC Short Column square in section has to resist a factored axial load of 2000 kN. Use M20 and Fe415 grades. Assuming 2 % of longitudinal steel reinforcement. Determine : **07**
 - a) Size of square column
 - b) Area of longitudinal reinforcement
 - c) Pitch and dia of lateral ties. Draw Sketches of reinforcement.
- Q.4**
- (a) Define Pitch, Edge distance, Gauge distance for steel design. **03**
 - (b) Two plates of thickness 8 mm and 10 mm are joined together by 16 mm diameter bolts of grade 4.6. Calculate nominal bearing strength of bolt. Consider Fe 410 grade steel and $k_b = 1$. **04**

- (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) What is difference between bending and buckling occur? **03**
(b) Design suitable fillet weld to connect a tie plate 70mm x 8mm to a 10 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 3.0m, hinged at both ends. Take f_y = 250 MPa. **07**

- Q.5** (a) What is design strength of tension member based on (i) yielding of gross section, and (ii) rupture of critical section? Using IS 800: 2007 **03**
(b) Draw neat sketch of gusseted base foundation. **04**
(c) Discuss in brief the term “lacing” OR “battening” with neat sketch. **07**

OR

- Q.5** (a) What is meant by shear lag and how it is accounted for in design? **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**
