

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3174018

Date:14-12-2023

Subject Name: Analysis and Design of Steel Structures

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. Draw neat and clean sketches with pencil only.
6. Use of IS 800-2007, IS 875-1987 and Steel Table is allowed.

	MARKS
Q.1	
(a) Enlist hot rolled steel sections used in steel structures.	03
(b) What is limit state? Explain limit state of strength.	04
(c) A tie bar 100 mm × 8 mm is to carry a load of 100 kN. A specimen of the same quality steel of cross-sectional area 250 mm ² was tested in laboratory. The maximum load carried by the specimen was 125 kN. Find factor of safety in the design.	07
Q.2	
(a) Write a note on HSFG bolt.	03
(b) Explain “Shear Lag Effect”.	04
(c) Design a suitable longitudinal fillet weld to connect the plates (150 mm × 12 mm) to transmit a pull equal to the full strength. Assume Gusset plate having width of 200 mm and thickness 14 mm. Grade of plates is Fe 410 and welding is to be made in workshop.	07
OR	
(c) Design a tie member roof truss consist of double angle section connected back-to-back on either side of gusset 12 mm thick using bolted connection subjected to factored load of 450 kN. The grade of steel Fe 410 for both member and bolt material.	07
Q.3	
(a) Explain cross section classification used in limit state.	03
(b) What are the design requirements for lacing used in compression member?	04
(c) Design a brattening system for a column composed of 2 ISLC 300 @ 66.2 Kg/m placed back-to-back at clear spacing of 220 mm. Axial designed load on column is 1000 kN. Effective length of column is 3.5 m.	07
OR	
Q.3	
(a) Write short note on “Column Splices”	03
(b) Calculate the design compressive strength of a compound column consist of ISHB 450 @ 87.2 Kg/m with one cover plate of 600 mm × 20 mm provided on each flange. The length of the column is 4.5 m effectively held at both ends and restrained in directions at one of the ends. Assuming the yield and ultimate stress of steel are 250 MPa and 410 MPa respectively.	04

- (c) Design a slab base foundation for a column ISLC 300 Kg/m @ 66.2 Kg placed back-to-back at clear spacing of 240 mm to carry a factored axial load of 1500 kN. Take safe bearing capacity of soil as 200 kN/m². Assume Fe 410 of steel and M 25 of concrete. **07**
- Q.4** (a) Write a short note on “Web Crippling” in flexural members. **03**
 (b) Enumerate design steps for gantry girder. **04**
 (c) Design a welded plate girder for 24 m span to support a uniformly distributed load of 80 kN/m over full span along with two moving loads 150 kN each spaced at 4 m apart. The girder is laterally supported throughout. Use steel grade of Fe 410 both for Flange as well as web. (Note: Design of weld connection for flange plate and web plate is not required). **07**
- OR**
- Q.4** (a) What are the factors affecting lateral stability of a beam? **03**
 (b) Enumerate design steps for plate girder. **04**
 (c) Design a simply supported beam of span 4 m carrying design load of 35 kN/m. Assume the compression flange of the beam is laterally restrained throughout. [Note: Check for shear lag effect, deflection, web crippling are not required] **07**
- Q.5** (a) Give advantages of cold formed corrugated sheets. **03**
 (b) Differentiate between Pre-Engineered Building (PEB) and Conventional Steel Building (CSB). **04**
 (c) Design suitable beam-column. If a column in industrial building frame is subjected to the design axial load of 500 kN along with design moment about z-z axis at top and bottom of 40 kN.m and 60 kN.m respectively (same nature). Height of column is 3.5 m and supported with hinged at top and fixed at bottom. **07**
- OR**
- Q.5** (a) Enlist elements of an Industrial Building. **03**
 (b) Explain any one components of Pre-Engineered Steel Building in detail. **04**
 (c) Discuss in detail various types of loads and its combination acting on Pre-Engineered Building. **07**
