

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: CIVIL ENGINEERING
SUBJECT NAME: DESIGN OF STEEL STRUCTURES
SUBJECT CODE: 2180610
B.E. SEMESTER-VIII

Type of course: Applied Mechanics

Prerequisite: Mechanics of Solids, Structural Analysis-I & II, Elementary Structural Design

Rationale: Many civil engineering structures are made up of steel. Knowledge of designing and detailing of steel structures is very important for civil engineers in order to make structures safe and serviceable during its life span. Limit State design philosophy is currently used worldwide for design of steel structures and its various components. Also precise and correct detailing of structural drawing is necessary in order to get the correct behavior of structures and leads to smooth construction of structures. This course will provide detailed knowledge of design and detailing of steel structures as per Indian standards.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
PA	ALA	ESE		OEP						
3	2	0	5	70	20	10	30	0	20	150

ESE-End Semester Exam, PA-Progressive Assessment, E-External, M-Mid semester, V-Viva (External) , I-Internal, ALA-Active Learning Assignment, OEP-Open Ended Problem

Note: IS:800(2007), IS:1893, IS:875, Steel table are permitted in the examination.

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Loads & Load Combinations: Appraisal of loading standards such as I.S, I.R.C., Effect of wind and earthquake on structure.	03	20
2	Connections: Stiffened and unstiffened, moment & shear resisting structural connections, design and detailing of various connection - roof truss to column, column to beam, beam to beam and truss to bed block.	06	
3	Design of Industrial Building: Structural layout of industrial building, Various types of trusses and their selection, effect of wind loads on purlin and trusses, bracing systems, columns, foundations, gantry girder – static and moving loads, selection & design of section.	10	25
4	Design of plate girders: Modes of failure : Elastic buckling, Bending in the plane of web, Local buckling, Buckling in the plane of web, Vertical buckling of the compression flange, Shear buckling Design of bolted, welded plate girder by Tension field Method & Simple Post Critical Method including design of vertical & horizontal stiffeners, Splices, Curtailment	09	20

5	Design of foot-over bridges: Structural system of through & deck type bridges, design of foot-over bridge & its Supporting system.	06	15
6	Plastic Design: Introduction to plastic method of analysis, Design of continuous beams and portal frame using plastic design approach.	08	20

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	15	25	25	25	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. N. Subramaniam, Design of Steel Structures, Oxford University Press
2. S. S. Bhavikatti, Design of Steel Structures: By Limit State Method as Per IS: 800-2007, I K International Publishing House Pvt. Ltd
3. P. Dayaratnam, "Design of Steel Structures", S. Chand Group
4. IS 800:2007, General Construction In Steel - Code of Practice, Bureau of Indian Standards, New Delhi.
5. IS 875 (Part 1): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 1 Dead Loads - Unit Weights of Building Materials and Stored Materials, Bureau of Indian Standards, New Delhi.
6. IS 875 (Part 2): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 2 Imposed Loads, Bureau of Indian Standards, New Delhi.
7. IS 875 (Part 3): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 3 Wind Loads, Bureau of Indian Standards, New Delhi.
8. IS 875 (Part 4): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 4 Snow Loads, Bureau of Indian Standards, New Delhi.
9. IS 875 (Part 5): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 5 Special Loads and Combinations, Bureau of Indian Standards, New Delhi.

Course Outcome:

After learning the course, the students should be able to:

1. prepare structural layout of Industrial steel structures, plate girder, foot-over bridge.
2. determine the loads acting on it and identify the typical failure modes.

3. apply the principles, procedures and current Indian codal provisions to the analysis and design of Industrial structures, plate girder & foot-over bridges.
4. apply the principles of plastic design in steel beams & portal frames

Term-Work:

The students will have to

- (1) Carry out full design of Industrial structure/ plate girder/ foot-over bridge and prepare design report & detailed drawings in A2 size drawing sheet
- (2) Solve at least five design examples from remaining topics (not covered in full design) and draw sketches of various structural components with proper detailing in sketch book/A3 size sheet.

Practical examinations shall consist of oral based on term work and above course.

Design based problem/ Open ended problem may also considered as a part of Term-work.

Design based Problems (DP)/Open Ended Problem:

(Below mentioned problems are for reference only. Similar problems may be designed by the concerned faculty.)

1. Prepare model of any one steel structure of the syllabus.
2. Development of spread sheets for design of various structural components of steel structure.
3. Design of any steel structure from the course using any open-source / professional software and/or self-developed spread sheet/programs.
4. Site visit related to construction stages and report preparation
5. Failure study : during and/or after construction

Major Equipment:

List of Open Source Software/learning website:

1. <http://nptel.ac.in/>
2. elearning.vtu.ac.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.