GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3174018
Semester –VII
Subject Name: Analysis and Design of Steel Structures

Type of course: Professional Core Course

Prerequisite: Mechanics of solid, Structural Analysis.

Rationale:
Many civil engineering structures are made up of steel. Knowledge of designing and detailing of steel structures is very important for civil engineers 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. Precise and correct detailing of structural drawing is necessary 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 and conceptual understanding and applications of design of steel structures.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Steel:** Introduction of Steel as construction material. Properties of Structural Steel, Steel Sections, I.S. Specifications	02
2	**Design Approach:** Design requirements: Strength, Stiffness, Stability, Serviceability Design philosophy: Elastic method, Plastic method and Limit state method.	03
3	**Connections:** Introduction to type of connections in steel structures i.e. rivet connections, bolted connections and welded connections. Types of joints and its design for strength, efficiency. Mode of failure of connections. Design of rivet connection, bolted connection, and welded connection. Design of eccentric connection.	08
4	**Tension Members:** Introduction, Types of tension members, Permissible stress in member, Slenderness ratio, Net sectional area, Lug angle, Gusset plate, Basic of current codal provision for tension member design. Design of tension member subjected to axial load, Design of tension member subjected to combine action of axial tension and bending. Concept of shear lags effect.	07

5	**Compression Members:** Introduction to theory associated with columns i.e. Euler's Theory, Rankine's Theory etc., and Types of compression members. Mode of failure of column member, Effective length, Slenderness Ratio, Basic of current codal provision for compression member design. Design of axially loaded compression member, of built-up compression members: Laced and Battened Columns, Design of eccentric loaded compression members. Design of Column Bases. Design of Column Splices.	**08**
6	**Flexural Members:** Introduction, types of section used in flexural member. Lateral stability of beam, Concept of web buckling, web crippling diagonal buckling. Design of laterally supported and unsupported beams, built up beams, beams subjected to uniaxial and biaxial bending, Design of flange and web splices, Design of plate girder, Design of gantry girder.	**08**
7	**Roof Truss and Pre-Engineered Steel Structures:** Introduction to types of roof truss, bracings, purlins, sheeting. Loads and load combinations, Analysis and design of roof members, end bearing. Introduction to Pre-Engineered Steel Structures, Applications, Advantages of PEB over conventional steel buildings.	**06**
	Total	**42**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
05	**20**	**20**	**20**	**25**	**10**

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. Subramanian, Design of Steel Structures, Oxford University Press, 2008.
[2] Bhavikatti S. S., Design of Steel Structures, Oxford University Press.
[3] Segui W T, Design of Steel Structures, Cengage Learning.
[4] S K Duggal, Design of Steel Structures, Tata McGraw Hill
[5] S. A. Raz, Structural Design in Steel, New Age International Publisher, 2002.
[6] M. Edwin, J. Gaylord and J. E. Stallmeyer, Design of Steel Structures, McGraw-Hill, 1991.
[7] P. Dayaratnam, Design of Steel Structures, S. Chand & Co., 2003.
[8] S. M. A. Kazimi and R. S. Jindal, Design of Steel Structures, Prentice Hall of India Pvt Ltd, 1988.

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Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the behavior and properties of structural steel, various design philosophy to be used in the design of structural steel elements and Use of the relevant codes of practice for design.	10 %
CO-2	Understand the structural behaviour of structural steel elements in tension, compression, flexure, and torsion based on limit state method under various loads and load combinations.	10 %
CO-3	Able to design of various steel structure elements such as Connections, Tension members, Compression members and its base, Flexural members etc. as per IS codal provisions and guidelines.	60 %
CO-4	Able to design a various type of roof trusses and procedure for designing of PEB structures.	20 %

Term-Work:

The students will have to

- Carry out full design of any steel structures and prepare design report & detailed drawings in A2 size drawing sheet
- 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.

Software based Design problem/ Open ended problem

A group of students must undertake one open ended problem/design problem. Few examples of the same are given below:

1. Development of spread sheets for design of various structural steel elements like connections, tension member, compression member, flexural member, column base etc.
2. Design of any one steel structure from the course using any open-source / professional software and/or self-developed spread sheet/programs.
3. Site visit related to construction stages and report preparation.

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

List of Open Source Software/learning website:

1.http://nptel.ac.in
2. www.steel-insdag.org
3. www.ocw.mit.edu