

MOHAMED SATHAK A J COLLEGE OF ENGINEERING							
Siruseri IT park, OMR, Chennai - 603103							
LESSON PLAN							
Department of Civil Engineering							
Name of the Subject	DESIGN OF STEEL STRUCTURAL ELEMENTS			Name of the handling Faculty	C.Navaneetha Krishnan		
Subject Code	CE8601			Year / Sem	III / VI		
Acad Year	2022- 2023			Batch	2019-2024		
Course Objective							
To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections. Design of structural systems such as roof trusses, gantry girders as per provisions of current code (IS 800 - 2007) of practice for working stress and Limit state Method.							
Course Outcome							
1. Understand the concepts of various design philosophies							
2. Design common bolted and welded connections for steel structures							
3. Design tension members and understand the effect of shear lag.							
4. Design axially loaded columns and column base connections							
5. Design of laterally restrained and unrestrained steel beams							
Lesson Plan							
Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc )	Blooms Level (L1-L6)	CO	PO
		Book					
UNIT I - INTRODUCTION AND ALLOWABLE STRESS DESIGN							
1	Structural steel types, Mechanical Properties of structural steel, Indian structural steel products	T1, T2	1	BB, PPT	L1	CO1	PO1
2	Steps involved in the Deign Process, Steel Structural systems and their Elements, Type of Loads on Structures and Load combinations	T1, T2	1	BB, PPT	L1	CO1	PO1, PO8
3	Code of practices, Loading standards and Specifications, Concept of Allowable Stress Method, and Limit State Design Methods for Steel structures	T1, T2	1	BB, PPT	L1	CO2	PO1, PO8
4	Relative advantages and Limitations- Strengths and Serviceability Limit states	T1, T2	2	BB, PPT	L2	CO1	PO1
5	Allowable stresses as per IS 800 section 11, Concepts of Allowable stress design for bending and Shear	T1, T2	2	BB, PPT	L1	CO1	PO1, PO8

6	Check for Elastic deflection, Calculation of moment carrying capacity	T1, T2	2	BB, PPT	L3	CO1	PO1-PO3,
7	Design of Laterally supported Solid Hot Rolled section beams	T1, T2	3	BB, PPT	L3	CO1	PO2,PO3
8	Allowable stress design of Angle Tension and Compression Members and estimation of axial load carrying capacity.	T1, T2	3	BB, PPT	L3	CO1	PO3

**Suggested Activity: Assignment - Structural Loads**

**Evaluation method : Paper Based**

## UNIT II - CONNECTIONS IN STEEL STRUCTURES

9	Type of Fasteners, Bolts Pins and welds and types of simple bolted and welded connections,	T1, T2	1	BB, PPT	L1	CO2	PO1
10	Relative advantages and Limitations	T1, T2	1	BB, PPT	L2	CO2	PO2, PO8
12	Modes of failure and the concept of Shear lag	T1, T2	1	BB, PPT	L3	CO2	PO1-PO2
13	Efficiency of joints, Axially loaded bolted connections for Plates and Angle Members using bearing type bolts	T1, T2	1	BB, PPT	L2	CO2	PO3, PO8
14	Prying forces and Hanger connection, Design of Slip critical connections with High strength Friction Grip bolts	T1, T2	2	BB, PPT	L3	CO2	PO1-PO3
15	Design of joints for combined shear and Tension, Eccentrically Loaded Bolted Bracket Connections	T1, T2	2	BB, PPT	L3	CO2	PO3, PO8
16	Welds-symbols, specifications and effective area of welds	T1, T2	2	BB, PPT	L3	CO2	PO3,
17	Fillet and but Welded connections	T1, T2	2	BB, PPT	L3	CO2	PO3, PO8
18	Axially Loaded connections for Plate and angle truss members and eccentrically Loaded bracket connections.	T1, T2	3	BB, PPT	L3	CO2	PO3, PO8

**Suggested Activity: Case study on failures of connections**

**Evaluation method: Group Discussions**

## UNIT III - TENSION MEMBERS

19	Tension Members, Types of Tension members and sections	T1, T2	1	BB, PPT	L1	CO3	PO1
20	Behaviour of Tension Members, modes of failure and slenderness ratio	T1, T2	1	BB, PPT	L1	CO3	PO2, PO8
21	Net area, Net effective sections for Plates ,Angles and Tee in tension	T1, T2	2	BB, PPT	L1	CO3	PO8
22	Design of single section and compound section compression members	T1, T2	2	BB, PPT	L2	CO3	PO1-PO3, PO8

23	Concepts of Shear Lag, Design of plate and angle tension members	T1, T2	3	BB,NPTEL	L3	CO3	PO1-PO3
34	Design of built up tension Members and Connections in tension members	T1, T2	3	BB,NPTEL	L3	CO3	PO1-PO3, PO8
25	Use of lug angles and design of tension splice	T1, T2	3	BB,NPTEL	L3	CO3	PO1-PO3

**Suggested Activity: Quiz**

**Evaluation method : MCQ**

#### UNIT IV - COMPRESSION MEMBERS

26	Types of compression members and sections–Behaviour and types of failures	T1, T2	1	BB, PPT	L1	CO4	PO1
27	Short and slender columns and Current code provisions for compression members	T1, T2	1	BB, PPT	L2	CO4	PO2, PO8
28	Beams subjected to uniaxial and biaxial bending	T1, T2	1	BB, PPT	L3	CO4	PO1-PO3
29	Effective Length, Slenderness ratio and Column formula and column curves	T1, T2	2	BB, PPT	L3	CO4	PO1-PO3
30	Design of single section and compound Angles, Axially Loaded solid section Columns	T1, T2	2	BB, PPT	L3	CO4	PO1-PO3, PO8
31	Design of Built up Laced and Battened type columns	T1, T2	3	BB, PPT	L3	CO4	PO1-PO3, PO8
32	Design of column bases, Plate and Gusseted bases for Axially loaded columns	T1, T2	3	BB, PPT	L3	CO4	PO1-PO3, PO8
33	Splices for columns	T1, T2	2	BB, PPT	L3	CO4	PO1-PO3, PO8

**Suggested Activity: Assignment - Design splice for columns**

**Evaluation method : Paper Based**

#### UNIT V - DESIGN OF FLEXURAL MEMBERS

34	Types of steel Beam sections- Behaviour of Beams in flexure- Code Provisions	T1, T2	1	BB, PPT	L1	CO5	PO1, PO8
35	Classification of cross sections- Flexural Strength and Lateral stability of Beams	T1, T2	2	BB, PPT	L2	CO5	PO1-PO3
36	Shear Strength-Web Buckling, Crippling and deflection of Beams- Design of laterally supported Beams	T1, T2	3	BB, PPT	L2	CO5	PO1-PO3
37	Design of solid rolled section Beams and design of Plated beams with cover plates	T1, T2	3	BB, PPT	L3	CO5	PO1-PO3, PO8
38	Design Strength of Laterally unsupported Beams and design of laterally unsupported rolled section Beams	T1, T2	3	BB, PPT	L3	CO5	PO1-PO3, PO8

39	Purlin in Roof Trusses, Design of Channel and I section Purlins.	T1, T2	3	BB, PPT	L3	CO5	PO1-PO3, PO8		
Suggested Activity: Quiz									
Evaluation method: MCQ									
Content Beyond the Syllabus Planned									
1	Prying Forces								
2	Bolted Beam Connection								
Text Books									
1	Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.								
2	Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013								
3	Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005								
Reference Books									
1	Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002								
2	Sai Ram. K.S. “Design of Steel Structures “ Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2nd Edition, 2015, www.pearsoned.co.in/kssairam								
3	Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013								
4	Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800– 2007, IK International Publishing House Pvt. Ltd., 2009								
5	Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007, Structures Publications, 2009.								
6	SP 6(1) Hand book on structural Steel Sections								
8	IS800 :2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007								
Website / URL References									
1	<a href="https://nptel.ac.in/courses/105/105/105105162/">https://nptel.ac.in/courses/105/105/105105162/</a>								
2	<a href="http://www.steel-insdag.org/teachingmaterial/chapter27.pdf">http://www.steel-insdag.org/teachingmaterial/chapter27.pdf</a>								
Blooms Level									
Level 1 ( L1 ) : Remembering		Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analysing				Higher Order Thinking	Projects / Mini Projects
Level 2 (L2) : Understanding				Level 5 (L5) : Evaluating					
Level 3 (L3) : Applying				Level 6 (L6) : Creating					
Mapping syllabus with Bloom’s Taxonomy LOT and HOT									
Unit No	Unit Name	L1	L2	L3	L4	L5	L6	HOT	Total
Unit 1	INTRODUCTION AND ALLOWABLE STRESS DESIGN	4	1	3				0	8

Unit 2	CONNECTIONS IN STEEL STRUCTURES				1	2	6				0	9
Unit 3	TENSION MEMBERS				3	1	3				0	7
Unit 4	COMPRESSION MEMBERS				1	1	6				0	8
Unit 5	DESIGN OF FLEXURAL MEMBERS				1	2	3				0	6
<b>Total</b>					<b>10</b>	<b>7</b>	<b>21</b>				<b>0</b>	<b>38</b>
<b>Total Percentage</b>					<b>26.32</b>	<b>18.42</b>	<b>55</b>				<b>0</b>	<b>100</b>
<b>CO PO Mapping</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	2	2	3				2				2	2
<b>CO2</b>	3	3	3				2				2	2
<b>CO3</b>	3	2	2				2				2	2
<b>CO4</b>	3	3	3				2				2	2
<b>CO5</b>	3	3	3				2				2	2
<b>Avg</b>	<b>2.8</b>	<b>2.6</b>	<b>2.8</b>				<b>2</b>				<b>2</b>	<b>2</b>
<b>Justification for CO-PO mapping</b>												
<b>CO1</b>	PO1 : Knowledge in properties of steel, PO2 : formulate structural steel sections, PO3 : Design structural elements using working stress method, PO8 : Ethics in designing structural elements, PSO1 : Designing structural members for sustainable solution, PSO2 : Design cost effective structural components											
<b>CO2</b>	PO1 : Knowledge in bolt and weld connections, PO2 : Problem analysis of connections, PO3 : Design connections, PO8 : Ethics in designing connections for sustainable development, PSO1 : Designing connections for sustainability, PSO2 : Design cost effective connection solutions in structures											
<b>CO3</b>	PO1 : Knowledge in theory of tension members, PO2 : Analysing in tension member, PO3 : Designing tension member, PO8 : Ethics in designing sustainable members, PSO1 : Designing structural members for sustainable solution , PSO2 : Design cost effective structural components											
<b>CO4</b>	PO1 : Knowledge in compression members, PO2 : Problem analysis in columns, PO3 : Designing beams, plate girders, flange and web splice, PO8 : Ethics in designing slenderness ratio for sustainable member, PSO1 : Designing structural members for sustainable solution , PSO2 : Design cost effective structural components											
<b>CO5</b>	PO1 : Knowledge in flexural members, PO2 : Problem analysis in roof, side coverings and built up beams , PO3 : Designing flexural members, PO8 : Ethics in designing and flexural members, PSO1 : Designing structural members for sustainable solution , PSO2 : Design cost effective structural components											
<b>3</b>		<b>High level</b>		<b>2</b>		<b>Moderate level</b>			<b>1</b>		Low level	
Name & Sign of Faculty Incharge :												
Name & Sign of Subject Expert :												
Head of the Department :												