

## COURSE CONTENT

<b>ADVANCED STRUCTURAL STEEL DESIGN (Professional Elective – III)</b>								
<b>II Semester: SE</b>								
Course Code	Category	Hours/ Week			Credits	Maximum Marks		
2522047	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
<b>Contact Classes: 45</b>		<b>Tutorial Classes: Nil</b>		<b>Practical Classes: Nil</b>		<b>Total Classes: 45</b>		
<b>Prerequisites:</b> Design of Steel Structures & Structural Analysis								

### Course Overview:

This course covers the analysis and design of steel structures, focusing on connections, plastic behavior, and structural systems. Unit I deals with bolted and welded connections, including load transfer, failure modes, slip-critical joints, and weld design. Unit II introduces plastic analysis, plastic hinges, collapse mechanisms, and structural behavior beyond elastic limits. Unit III focuses on eccentric and moment connections in beams and columns. Unit IV covers industrial buildings, roof trusses, wind loads, purlins, and bracing systems. Unit V addresses steel truss girder bridges, including member design, load effects, and stability bracing.

### Course Objectives:

1. To introduce advanced concepts in steel design including load-resistance factor design (LRFD), stability criteria, and connection detailing.
2. To analyze and design beams, columns, plate girders, built-up members, and industrial steel components under combined loading.
3. To apply buckling, fatigue, fire-resistant design, and ductile detailing requirements based on national and international codes.
4. To integrate software tools and analytical methods for designing steel structures with efficiency and safety.
5. To enable students to handle real-world steel design projects including industrial buildings, bridges, and high-rise applications.

**Course Outcomes:** After completion of the course, students should be able to

1. Describe the behaviour and failure modes of bolted and welded connections, including load transfer, slip-critical connections, and design of fillet and groove welds.
2. Perform plastic analysis of beams and frames to determine collapse loads and plastic hinge formations for various structural systems.
3. Examine different types of eccentric and moment-resisting connections, including bolted and welded framed, bracket, and seat connections.
4. Assess the design requirements for industrial buildings under dead, live, and wind loads, and evaluate the design of trusses, purlins, bracings, and related components.
5. Apply design principles to steel truss girder bridges including members under compression and tension, and wind effects on bracings.

## SYLLABUS:

### UNIT - I

**Simple Connections – Bolted Pinned And Welded Connections:** Bolted Connections – Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

### UNIT - II

#### Plastic Analysis:

Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

### UNIT - III

**Eccentric and Moment Connections:** Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections – Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

### UNIT - IV

#### Analysis and Design of Industrial Buildings:

Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform, Design of purlins for roofs, design of built-up purlins, design of knee braced trusses and stanchions, Design of bracings.

### UNIT - V

#### Design of Steel Truss Girder Bridges:

Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self-weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder. Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.



## REFERENCES:

1. Limitstate Design of Steel Structures by N. Subramanian
2. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
3. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.
4. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientific Publishes Journals Department.
5. Design of Steel Structures Galyord & Gaylord, Publisher: Tata Mc Graw Hill, Education. Edition 2012.
6. Indian Standard Code – IS – 800-2007.
7. Indian Standard Code – IS – 875 – Part III – 2015

## ELECTRONIC RESOURCES:

<https://nptel.ac.in/courses/114106047>

## MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Definitions and terminology
4. Assignments
5. Model question paper–I
6. Model question paper–II
7. Lecture notes
8. E-Learning Readiness Videos(ELRV)