



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ADVANCED STEEL DESIGN								
II Semester: ST								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTE19	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil			Total Classes: 45			
Prerequisite: Steel Structures Design and Drawing								

I. COURSE OVERVIEW:

This course is designed for postgraduate students in the Structural Engineering program who seek to advance their knowledge in the analysis and design of steel structures. It introduces the mechanical properties and specifications of structural steels, along with the design considerations governing their use. The course emphasizes the behavior and design of key structural components, including tension members, compression members, beams (laterally restrained and unrestrained), beam-columns, and steel connections. Both bolted and welded connections are covered, with attention to their design procedures, performance, and failure modes. Students will develop a comprehensive understanding of the iterative nature of structural design, integrating material behavior, analysis principles, and codal provisions. By the end of the course, students are expected to demonstrate competence in designing simple and complex steel structural members and connections, as well as in recognizing potential failure mechanisms.

II. COURSE OBJECTIVES:

The student will be able to:

- Design and evaluate steel connections such as riveted, bolted, pinned, and welded joints by applying codal provisions, considering load transfer, efficiency, and possible modes of failure.
- Analyze and design structural steel elements including gantry girders and roof trusses, along with secondary components such as purlins, knee-braced systems, and bracings, under various loading conditions.
- Develop safe and economical designs for industrial steel structures and truss girder bridges by applying codal methodologies to ensure strength, stability, and serviceability.
- Analyze and design steel bunkers and silos for safe storage applications, considering relevant loading conditions, codal provisions, and structural integrity.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- Analyze the load transfer mechanisms in riveted and bolted connections, and design joints considering strength, efficiency, and possible modes of failure.
- Design welded connections including groove welds, fillet welds, and intermittent welds, and evaluate their performance against different modes of failure.
- Analyze the loads acting on gantry girders due to electrically operated cranes, determine maximum moments and shears, and design gantry girders using codal provisions.
- Analyze dead loads, live loads, and wind loads on industrial buildings, and design structural components such as roof trusses, purlins, knee-braced trusses, stanchions, and bracing systems to ensure stability and serviceability.
- Apply codal provisions and design methodologies to analyze and design steel truss girder bridges, satisfying strength, stability, and serviceability requirements for road bridges.
- Analyze the behavior of steel bunkers and silos using Janssen's and Airy's theories, and design hopper bottoms and storage bins to ensure safe storage and structural integrity.

IV. COURSE CONTENT:

MODULE-I: SIMPLE CONNECTIONS–RIVETED, BOLTED PINNED AND WELDED CONNECTIONS (9)

Riveted connection, 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.

MODULE- II: DESIGN OF GANTRY GIRDER (9)

Introduction – Loads Acting on The Gantry Girder – Permissible Stresses - Types of Gantry Girders and Crane Sails – Crane Data – Maximum Moments and Shears – Design Procedure (Restricted To Electrically Operated Cranes)

MODULE-III: ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS (9)

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.

MODULE-IV: DESIGN OF STEEL TRUSS GIRDER BRIDGES (10)

Condition of first crack, ultimate load design, shear, vertical prestressing, diagonal tension in i- section, end block, magnel's method, empirical method general design requirements, mild steel reinforcement in prestressed concrete member, concrete cover and spacing of pre-stressing steel, slender beams, composite section, propped, design of propped composite section, un propped composite section, two stage prestressing, shrinking stresses, general design requirements for road bridges

MODULE-V: DESIGN OF STEEL BUNKERS AND SILOS (08)

Introduction, Jansen's theory, airy's theory, design of parameters, design criteria, analysis of bins, hopper bottom and design of bins.

V. TEXT BOOKS:

1. Dayaratnam, P. "*Design of Steel Structures*". S. Chand, 2012.
2. Ramachandra, Dr., and Vivendra. "*Design of Steel Structures. Vol. II*", Gehlot Scientific Publishers, Journals Department, 2012.
3. Duggal, S. K. "*Limit State Design of Steel Structures*". McGraw Hill Education Pvt. Ltd., New Delhi, 1994.

VI. REFERENCE BOOKS:

1. Gaylord, E. H., and C. N. Gaylord. "*Design of Steel Structures*". Tata McGraw-Hill Education, 2012.
2. Bureau of Indian Standards. IS 800: General Construction in Steel – Code of Practice. New Delhi: Bureau of Indian Standards, 2007.
3. Kuzmanovic, B. O., and N. Willems. "*Steel Design for Structural Engineers*". Prentice Hall, 1997.

VII. ELECTRONICS RESOURCES:

1. <http://nptel.ac.in/courses/105106113/>
2. https://www.iare.ac.in/sites/default/files/lecture_notes/lec%20notes%20ASD.pdf

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation