



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 19.01.2021

In addition to part -I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **CE F343**

Course Title : **Design of Steel Structures**

Instructor-in-charge : SHAMSHER BAHADUR SINGH

Co-Instructor: Dr. Dipendu Bhunia

Tutorial Instructors : Dr. S. B. Singh, Dr. Dipendu Bhunia, Mr. Ankit Mehra Mr. Manigandan

1. Course Description

The course intends to impart adequate analysis and design skills for common type of Civil Engineering Steel Structures as found in practice. An understanding of theory, loads and stresses to be used as per Indian standards for steel design work will be developed. This course deals with designing of tension, compression and bending members along with bolted and welded connections in structures using limit state method of design. Design of specific steel structure likes steel such as trusses and plate girder will be covered. Furthermore, plastic analysis and design of basic structures such as beams and pane frames will be introduced.

2. Scope and Objective of the Course:

Course on Design of Steel Structures is designed for first-degree students of Civil Engineering Discipline. The clear understanding of structural mechanics and/ or strength of materials is prerequisite for this course. The primary objectives of the course are:

- (i) to know the difference between fundamentals of Allowable Stress Design (ASD) and Limit State Design (LSD) Approaches.
- (ii) to analyze tension and compression members
- (iii) to design flexural members such as beams
- (iv) to design plate girders demonstrated through design example
- (v) to design bolted and welded connections in steel structures
- (vi) to understand the concepts of plastic analysis and design of beams and basic plane frame structures
- (vii) to develop skills for using commercial softwares for analysis and design of typical steel framed structures as course project to be executed over the whole semester

PREREQUISITES: (1) Course No. CE F241: Analysis of Structures

3. Text Book

- (i) N. Subramanian, "Design of Steel Structures", Oxford University Press, 2015.
- (ii) Teaching Resource for Structural Steel Design, Volume 1, 2 & 3. Institute for Steel Development & Growth, ISPAT Niketan 52/1A Ballygunge, Circulow Road, Calcutta 700019.

4. Reference Book



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
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AUGS/ AGSR Division

- i) A S Arya and Ajmani "Design of Steel Structures" Nemi Chand & Bros.
- ii) C. G. Salmon and John E. Johnson, "Steel Structures: Design and Behavior," Fourth Edition, Prentice Hall, NJ, USA
- iii) M. L. Gambhir, "Fundamentals of Structural Steel Design," McGraw Hill Education Ltd., New Delhi, 2013.
- iv) S. K. Duggal, "Limit State Design of Steel Structures," McGraw Hill Education (India) Ltd., New Delhi, 2014.
- v) P. Dayaratnam "Design of Steel Structures", Wheeler Pub. 1992.
- vi) E H Gaylord and C N Gaylord "Design of steel structures" McGraw Hill
- vii) P. Dayaratnam, "Handbook on design and detailing of structures", Wheeler Publishing 1994.
- viii) IS 800:2007 "Code of practice for General construction in steel "B.I.S.?"
- ix) IS 875 :1987 "Code of practice for design Loads"
- x) Design of Steel Structures- S Ramamrutham & R. Narayanan, Dhanpat Rai, Publishing co., (P) Ltd, New Delhi 110002, 2000.
- xi) B.C. Punmia, "Design of Steel Structures Volume I and II", Laxmi Publications (P) Ltd., New Delhi, 1998 (Eight edition).
- xii) R. Englekirk, "Steel Structures: Controlling Behavior through Design," Replika Press Pvt. Ltd. Kundli, India, 1994.
- xiii) K. M. Ghosh, "Analysis and Design Practice of Steel Structures," PHI, New Delhi, 2010.
- xiv) B. S. Smith and A. Coull, "Tall Building Structures: Analysis and design," Wiley India Pvt Ltd. New Delhi, 2011.
- xv) S. N. Manohar, "Tall Chimneys: Design and Construction," Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.

5. Course Plan:

Module No.	Lecture Session	Reference	Learning outcomes
1.	Introduction: Steel Design Specifications (Lectures:1-5)	TB, Ch.1-3	Types of loads, types of steel for various structural elements. Types of connections for structural framing, factor of safety, partial safety factors, load factors, steel vs. concrete, standard specifications, introduction to limit states and working stress design.
2.	Types of Connections (Lectures 6-10)	TB,Ch.5-6	To understand the various types of structural steel connections: such as riveted, bolted & welded connections
3.	Design of Tension Members (Lectures 11-13)	TB, (Ch.7)	Introduction, Types of sections, Net area, Net effective section for angles and Tees in tension, Design of tension members with Riveted/ Bolted End Connections, Lug Angles, Tension Splice, Members with Welded Connections, Shear Lag effects
4.	Design of Compression members (Lectures 14-18)	TB, Ch. 9	General theory of columns, Allowable stresses for compression members, general specifications for compression members, Design of built-up compression members, single and double lacings, batten plates, and column bases
5.	Design of Beams: (Lectures: 19-25)	TB (Ch.10)	Design Criteria, stresses in beams and permissible stresses, lateral stability of beams with unrestrained compression flanges, effective



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Pilani Campus
AUGS/ AGSR Division

			length of compression flanges and lateral bracings, and secondary design aspects
6.	Design of Connections (Lectures: 25-30)	TB, Ch.5-6	Simple Beam and end connections, design of framed connections, design of stiffened seat connection, eccentric connections
7.	Design of Plate Girders: (Lectures:31-35)	TB (Ch.11)	Design of web, flanges, curtailment of flanges, connection of flanges with webs, stiffeners, web and flange splices, economic depth of plate girders and Complete design principle of plate girder and detailing showing locations and geometry of intermediate and bearing stiffeners.
8.	Design of Gantry Girder (Lectures: 36-40)	TB, Ch.12	Understand the features of Crane girders and gantry girders, evaluation of basic design load effects such as maximum bending moment and maximum shear force for gantry girders depending upon whether the crane girder is manually or electrically operated.
9.	Plastic Analysis and Design (Lectures: 40-43)	TB, Ch.8, R-1	Plastic Analysis, and Design of simple beams and frames, shape factors, plastic hinge mechanism, theory of plastic bending, ultimate load of beams and simple frames

6.Evaluation Scheme:

Sr. No.	Evaluation Component	Duration	Percentage weightage	Date & Time	Remarks
1	Mid-term Examination	90 minutes	30	-	
2	Tutorials plus regular assignment	-	15	-	
3	Design Project on Analysis and Design of Steel Framed Structures using Commercial Software (Report and Comprehensive Viva-Voce Examination)	Executed during whole Semester and will be completed at least a week before the end of the class work	15	-	
4	Class Test (1 No)	60 minutes	10	Announced in the class	
5	Comp. Exp.	3 Hrs.	30	10/5 (FN)	



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Teaching Method: Teaching of the subject will be made by combination of power-point presentation and Blackboard writing. Most of the teaching will be based on blackboard writing. Necessary instructional materials (available and prepared by instructor) will also be supplied for ready reference through NALANDA website platform.

* The project will be assigned to the students individually or in a group. The students will be working in consultation with instructor-in-charge. There will be two evaluations (1) Midterm report (5% weightage) (2) Final Report (5% weightage) in the form of term paper based on computer analysis and results followed by comprehensive viva-voce examination (10% weightage).

7. Chamber Consultation Hour: 3-5 PM (Monday to Friday)

8. Notices: Civil Engineering Department Notice Boards and/ or through NALANDA website

9. Make-up Policy: Only genuine cases with prior information will be granted makeup for Midterm test and Comprehensive examination. However, no makeup will be given for other components of evaluation.

10. Note (if any): Assignments and/ or any class notes may be sent to students through NALANDA website platform.

Instructor-in-charge
Course No. CE F343

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