

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**

**INSTRUCTION DIVISION**

**SECOND SEMESTER 2015-16**

**Course Handout Part II**

Date: 13/1/2016

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 G612**  
*Course Title* : **Advance Steel Structures**  
*Instructor-in-charge* : SHAMSHER BAHADUR SINGH

**1. Scope**

This course examines the advanced analysis and designs of steel structures such as beam, beam-column, plate girder, connections, and industrial structural systems including consideration of high strength steel, steel properties, loads and environmental effects, torsion, lateral-torsional buckling, and plastic design. Furthermore, discussion on tall steel buildings and detailing in steel structures has been presented. Design is based on Load Resistance Factor Design Approach and/ or Limit State Design Approach.

**2. Course Objectives**

- (i) Differentiate between the design fundamentals of ASD & LRFD or Limit State Design Approach.
- (ii) Analyze open and closed steel members for torsion loading
- (iii) Design for torsional, flexural-torsional, and lateral torsional buckling
- (iv) Design for plate girders
- (v) Describe the basic principles of stability as applied to lateral steel frames, including second-order effects
- (vi) Design beam, beam-column, and frame bracing to provide structural stability
- (vii) Plastic Design Approach for framed structures
- (viii) Design of special structures such as Chimney may also be considered in the form of special project.
- (ix) Additional topics such as Fire Resistant Design and Fatigue Resistant Design could also be considered depending upon the time available.

**3. Text Book**

- (i) N. Subramanian, "Design of Steel Structures", Oxford University Press, December 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.

**Reference Book**

- i) C. G. Salmon and John E. Johnson, "Steel Structures: Design and Behavior," Fourth Edition, Prentice Hall, NJ, USA
- ii) M. L. Gambhir, "Fundamentals of Structural Steel Design," McGraw Hill Education Ltd., New Delhi, 2013.
- iii) S. K. Duggal, "Limit State Design of Steel Structures," McGraw Hill Education (India) Ltd., New Delhi, 2014.
- iv) P. Dayaratnam "Design of Steel Structures", Wheeler Pub. 1992.

- v) E H Gaylord and C N Gaylord "Design of steel structures" McGraw Hill
- vi) P. Dayaratnam, "Handbook on design and detailing of structures", Wheeler Publishing 1994.
- vii) IS 800:2007 "Code of practice for General construction in steel "B.I.S.?"
- viii) IS 875 :1987 "Code of practice for design Loads"
- ix) Design of Steel Structures- S Ramamrutham & R. Narayanan, Dhanpat Rai, Publishing co., (P) Ltd, New Delhi 110002, 2000.
- x) B.C. Punmia, "Design of Steel Structures Volume I and II", Laxmi Publications (P) Ltd., New Delhi, 1998 (Eight edition).
- xi) R. Englekirk, "Steel Structures: Controlling Behavior through Design," Replika Press Pvt. Ltd. Kundli, India, 1994.
- xii) K. M. Ghosh, "Analysis and Design Practice of Steel Structures," PHI, New Delhi, 2010.
- xiii) B. S. Smith and A. Coull, "Tall Building Structures: Analysis and design," Wiley India Pvt Ltd. New Delhi, 2011.
- xiv) S. N. Manohar, "Tall Chimneys: Design and Construction," Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.
- xv) E. H. Gaylord, C. N. Gaylord, and J. E. Stallmeyer, "Design of Steel Structures, 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2011.

### 3. Course Plan:

Lecture Nos.	Learning Objectives	Topics to be covered	Reference* Chap./Sec. #(Book)
1-5	Steel Design Specifications	Introduction, loads, structural elements, connections, structural framing, structural metals, factor of safety, load factors, steel vs. concrete, standard specifications, introduction to limit states and working stress design.	TB, Ch.1-2
6-10	Plastic and Local Buckling Behaviour	Plastic Theory, Plastic-collapse load, Conditions of Plastic Analysis, Theorems of Plastic Collapse, Methods of Plastic Analysis, Plastic Design of Frames, Special Considerations, Local Buckling of Plates, Cross-section classification, Behaviour and Ultimate Strength of Plates, Design of Rigid Frames	TB, Ch.4, RB#1, Ch.15
11-17	Design of Beams	Definitions, Design Criteria, stresses in beams and permissible stresses, lateral stability of beams with unrestrained compression flanges, effective length of compression flanges and lateral bracings, secondary design considerations	TB, Ch.6
18-20	Design of Plate Girder	Design of web, flanges, curtailment of flanges, connecting rivets, stiffeners, web and flange splices, economic depth of plate girders, example problem.	TB, Ch.7

21-24	Design of Gantry Girders	Loading Considerations, Selection of Gantry Girders, Crane girders, Purlins, roof trusses	TB, Ch. 8
25-28	Design of Beam-Columns	Introduction, General Behaviour of Beam-Columns, Design of Beam-Columns, Design of Eccentrically loaded Base Plate, Design Examples	TB, Ch.9
29-31	Design of Bolted Connections	Design strength of ordinary black bolts and High Strength Friction Grip Bolts, Moment Resisting Connections, Beam-to-Beam Connections, Beam and Column splices	TB, Ch. 10
32-34	Design of Welded Connections	Design of Welds, Moment Resisting Connections, Continuous Beam-to-Column Connections	TB, Ch. 11
35-39	Design of Industrial Buildings	Selection of Roofing and Wall Materials, Selection of Bay Width, Structural Framing, Purlins, Girts, and Eave Strut, Plane Trusses, End Bearings, Bracing of Trusses and Frames, Stability of Frames under Primary Bending Moments, Bracing Requirements, Overall stability when plastic hinges form	TB, Ch.12, RB#1, Ch. 14
40-43	Composite Steel-Concrete Construction	Composite Action, Advantages and Disadvantages, Computation of Elastic Section Properties, Design Procedure using Load and Resistance Factor Design	RB#1, Ch. 16
43-45	Special Topics	Introduction to Fire-Resistant Design, Fatigue Resistant Design, and Corrosion Protection of Steel Structures, Tall Building Structures	TB, Ch. 15-17.

#### 4. Evaluation Scheme

Sr. No.	Evaluation Component	Duration	Percentage weightage	Date & Time	Remarks
1	Mid-term Examination	90 minute	25	16/3 4:00- 5:30 PM	
2	Regular take-home assignments	-	10		
3	Design and Computer Projects evaluated by presentation along with Comprehensive Viva-Voce Examination	To be announced in the class	25		
4	Quiz Test in the class	-	05		
5	Comp. Exp.	3 Hrs.	35	9/5 AN	

Note: Assignments will be regularly given in the class and they must be submitted on or before the due date. If assignments are not submitted on due date, they will not be evaluated. In addition,

project assignments (2 Nos.) will be given and evaluated along with comprehensive viva-voce examination as mentioned in evaluation scheme given below.

**4. Teaching Methodology:**

Teaching in the class will be based on Power Point Presentation and chalk-board writing.

**5. Chamber Consultation Hour:** To be announced in the class. Students must adhere to the Announced timing.

**6. Notice:** All the notices concerning the course will be sent to the students on their preferred e-mail registered with the instructor-in-charge in the attendance register.

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**Instructor-in-charge**

**CE G612**