Design of Steel and Timber Structures
EG 3107 CE

Year: III
Semester: I

Total: 4 Hrs. /week
Lecture: 2 Hrs./week
Tutorial: 1 Hrs./week
Practical: 1 Hrs./week
Lab: Hrs./week

Course Description:
This course provides the general ideas and design of steel and timber structural members using relevant codes of practice. After completion of this course, students must be able to supervise steel fabrication and construction and he should be able to design simple steel and timber members and joints. Hence, it mainly focuses on the design of tension, compression, flexural members for axial, bending moment, shear and check as per code for strength and serviceability requirements.

Course Objectives:
After the completion of this course, the students will be able to:

6. Identify and select proper materials, calculate the design values for materials.
7. Able to design structural elements of steel beams and columns- compression and tension members, timber beams, steel and timber joints.
8. Understand concept of design and code provisions
9. Able to prepare the proper detailing of structural members (steel & timber) and their connections using NBC 101, 102 103, 104, 105, 111, 112; IS: 800 and related codes of practice.

Course Contents:

Theory

Unit 1: Introduction [2 Hrs.]

1.1 Types of rolled steel sections used in steel structures.
1.2 Grades of steel and characteristics strength; advantages and disadvantages of steel structures; use of steel table and relevant NBC: & IS: 800 codes
1.3 Types of loads on steel structure and its code specification. Codes of practice for design of steel structures
1.4 Methods of analysis and design

Unit 2: Working Stress Design Method (WSM) [3 Hrs.]

2.1 Basic assumptions in working stress design
2.2 Service load and permissible stresses
2.3 Design for tension, compression and bending

Unit 3:Limit State Design Method (LSM) [1 Hrs.]

3.1 Different limit states for steel design
3.2 Design strength of materials and design loads
3.3 Limit state of strength and serviceability

Unit 4: Joints in the Steel Structures: [4 Hrs.]

4.1 Types of joints: Rived, bolted and welded joints
4.2 Limit state of failure of failure of riveted and bolted joints
4.3 Rivets value and efficiency of joints

4.4 Design of simple riveted bolted joints under axial loads
4.5 Design of simple welded connections under axial loads

Unit 5: Design of Tension Members: [4 Hrs.]

5.1 Introduction
5.2 Types of tension members
5.3 Net sectional area of tension members
5.4 Design of members subjected to axial load: Simple and built-up beams
5.5 Introduction to tension splices and lug angles

Unit 6: Axially loaded Compression Members-Tubular and angle section: [4 Hrs.]

6.1 Introduction and Types of compression members
6.2 End condition, Effective lengths and their buckling behavior
6.3 Radius of gyration and slenderness ratio
6.4 Strength of compression members
6.5 Design of compressive members: Simple and built-up sections

Unit 7: Design of Flexural Members: [2 Hrs.]

7.1 Introduction and Types of flexural members
7.2 Design of simple I-beams

Unit 8: Design of Roof Trusses: [2 Hrs.]

8.1 Types of roof trusses and their components
8.2 Different types of loads on roof truss
8.3 Introduction to the design of roof trusses
8.4 Tubular sections

Unit 9: Timber Structures: [2 Hrs.]

9.1 Introduction of timber
9.2 Properties of timber
9.3 Use of timber as a structural member in construction, timber structures and factors affecting strength of timber
9.4 Code of practice (IS: 883) for design of timber structures; strength of timber
9.5 Advantage & disadvantage of timber structure

Unit 10: Design of Timber Structure: [6 Hrs.]

10.1 Design of compression members
10.2 Design of solid rectangular beam
10.3 Check for deflections
10.4 Types of joints and their connection

**** Note: IS: 800, IS: 883 and steel table are allowed in the examination***.

Tutorials [15 Hrs.]

1. Design of tension, compression, bending and shear members using WSM
2. Determination of rivets value and efficiency of joints.
3. Design of simple riveted bolted joints under axial loads with joint details
4. Design of simple welded connections under axial loads with joint details
5. Determination of net sectional area of tension members and their capacity.

6. Design of members subjected to axial load: Simple and built-up sections and lateral bracings.
7. Design of simple beams and simple built-up beams.
8. Introduction to different components of plate girders.
9. Design of simple steel roof trusses using rolled steel sections.
10. Design of simple compression timber members.
11. Design of simple flexural timber members.

Practical **[15 Hrs.]**

Design and draw followings:

1. Details bolted and riveted joints.
2. Details of welded joints.
3. Steel beam-column connection and column bases.
4. Steel roof truss joint details with riveted, bolted and welded connections.
5. Timber roof truss joint details using steel plates with bolted connections.
6. Common joints in different timber members of heritage structures.
7. Timber beam and column joint details.

References:

1. S Negi, "Design of Steel & Timber Structures", Tata McGraw Hill Publishing Co., New Delhi.
2. Dr. NR Chandak, "Design of Steel Structures", SK Kataria and Sons, New Delhi.
3. R Suwal, "Design of Steel and Timber Structures", R & R Group, Kathmandu
4. NBC 101, 102, 103, 104, 105, 111, 112, 113, other related codes and Nepal standards.
5. IS: 875 & 800 and related codes of practice.
6. BS, EURO codes, FEMA and relevant codes.

Evaluation System

Unit	Title	Hrs.	Marks
1	Introduction	2	6
2	Working Stress Design Method (WSM)	3	
3	Limit State Design Method (LSM)	1	6
4	Joints in the Steel Structures:	4	
5	Design of Tension Members:	4	8
6	Axially loaded Compression Members-Tubular and angle section	4	
7	Design of Flexural Members	2	8
8	Design of Roof Trusses	4	
9	Timber Structures	2	12
10	Design of Timber Structure	4	
Total		**30**	**40**