

Subject Code: 1ET4010601	Subject Title: DESIGN OF STEEL STRUCTURE
Pre-Requisite	----

RATIONALE:

Civil Engineering structures are normally made up of either Steel Sections or of Reinforced Cement Concrete. Normally, industrial structures are constructed using steel sections. In industry, to cover wider area without any obstruction at floor level due to columns etc., normally steel roof truss is provided and hence Load calculation using IS 875 is required for such trusses.

As per IS-800-2007, in this subject, students will analyse and design different components of steel structure.

In Steel Structure, Rolled Steel Sections are used and its connections at different stages on site is highly important for the safety of Structure and hence, study of Connection through Welding or Bolting is important. This course is therefore an important course for civil engineering students.

COURSE OBJECTIVE:

The course content should be taught and implemented with the aim to develop required skills so that students are able to acquire following competencies:

1. Design of Tension & Compression members of Steel Structure along with Foundation, Steel Beam and Welded and Bolt Connection as per IS 800-2007.
2. Structure Detailing of Steel Roof Truss and Different Steel Structure Component

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
3	0	4	5	60	40	40	60

DETAILS OF COURSE CONTENTS:

Unit	Topic and Subtopic	Total Hrs.	Weightage
1	BOLT AND WELDED CONNECTION 1.1 Rigid Connection, Pinned Connection, Semi Rigid Connection, 1.2 Classification of bolts : Black Bolts, Turned Bolts, HSFG Bolts, Grade of Bolts. 1.3 Lap and Butt Joint 1.4 Explain terms: Pitch of bolt, , Edge Distance, End distance, Gauge	5	15 %

	Distance, Bolt Hole , Tack Bolting 1.5 Design strength of Bolt : -Shear Capacity of Bolt – V_{dsb}, -Bearing Capacity of Bolt – V_{dpb}, -Bolt Value, -Efficiency of Joint 1.6 Numerical on Bolted Connection of Angle Section to Gusset Plate and for Efficiency of Joint having Chain Bolting 1.7 Types of Welded joints. 1.8 Explain Terms : Size of weld, Throat thickness, effective length, design stresses. 1.9 Design of fillet weld for truss members.		
2	TENSION MEMBER 2.1 Examples of Tension Members in Civil Engineering Structures 2.2 Design Strength of Tension Member : -Design Strength due to Yielding of Gross Section, -Design Strength due to Rupture of Critical Section for Angle Section -Design Strength due to Block Shear in Angle Section as per IS – 800-2007 2.3 Slenderness ratio of Tension Member as per IS – 800 – 2007 2.4 Numerical for Analysis & Design type based on 1.2 for Single and Double Angle Sections on same side and either side of Gusset Plate	5	10 %
3	COMPRESSION MEMBER : STRUT & COLUMN 3.1 Strut, Maximum Slenderness Ratio, Classification of Cross – Sections and Buckling Class as per IS-800-2007 3.2 Effective Length of Column as per IS-800-2007 3.3 Design Compressive Stress – f_{cd} according to IS-800-2007 3.4 Numerical on Strut made up of Single Angle , Double Angle same and either side of G.P, Built up Column. 3.5 Numerical on Column made up of ISHB, ISHB with Flange Plate, Double Channels -Back to Back and Toe to Toe.	9	20 %
4	STEEL ROOF TRUSS 4.1 Rolled Steel Section – ISA, I & H Section, Channel Section and its application in Steel Structure. 4.2 Types of Truss and members of Roof Truss. 4.3 Pitch of Truss, Rise, Spacing of Truss, Principal Rafter,. 4.4 Dead Load of Truss per panel point- Self Weight truss, Weight of Purlin, Wind Bracing , Weight of Roofing Material. 4.5 Live Load per panel point in Truss as per IS – 875 – Part II 4.6 Wind Load per panel point in Truss as per IS – 875 – Part III	11	25 %

5	LACING & BATTENS 5.1 Objective of Lacing 5.2 Types of Lacing : Single lacing, Double Lacing 5.3 Design requirements for Lacing. 5.4 Numerical on Single and Double Lacing. 5.5 Battening 5.6 Design requirements for Batten System.	3	7 %
6	LATERALLY RESTRAINED BEAM & PURLIN 6.1 Main Beam, Secondary Beam, Standard I Sections, Laterally restrained and unrestrained beam 6.2 Classification of Cross Section. 6.3 Laterally supported beam : -Strength of beam in Flexure -Strength of beam in Shear, -Deflection limits 6.4 Design of Laterally supported beam : -Simply Supported Beam with UDL over entire span -Simply Supported Beam with central point load 6.5 Section used for purlin. 6.6 Orientation of purlin. 6.7 Design of angle purlin.	6	15 %
7	COLUMN BASE 7.1 Types of Column Base 7.2 Design of Slab Base : Base plate and its Thickness, Concrete Block 7.3 Sketch of Gusseted Base 7.4 Numerical on Slab Base Foundation under Column made up of Single H Section	3	8 %

COURSE OUTCOME:

The theory should be taught and practical should be carried out in such a manner that students are able to demonstrate following course outcomes:

1. Calculate Dead Load , Live Load and Wind Load on panel points of a Roof Truss as per IS-875.
2. Design Bolt Connection of Angle Section to Gusset Plate & Welded Connection of Angle Section to Gusset Plate , Lacing System (Single or Double) for Built up Column , Batten System for Built up Column , laterally Restrained Simply Supported beam, Purlin made up Angle Section , Slab Base Foundation under Axially Loaded Column made up of Single H Section.
3. Analyze and Design Axially Loaded Tension Member made up of Angle Section , Strut made up of Angle Section , Axially Loaded Column.

LIST OF PRACTICAL/ EXERCISES:

SR. No.	Practical/Exercise
1	Find Forces in given Truss Members using Graphical Method due to D.L , L.L and W.L and Design Forces in the Members – Drawing Sheet – No: 01 ,A1 Size
2	Draw Plan & c/s Elevation of Eaves Level Joint , Ridge Joint and Two Other Joints of a Truss Selected in Sheet No:01 with all design details like Size of Angle Section , G.P , Connection Details , Purlin , Roofing Material – Drawing Sheet – No: 02 , A1 Size
3	Draw Plan and c/s Elevation of Built up column made up of Double Channel provided back to back with Single or Double Lacing Draw Plan and c/s Elevation of Slab Base Foundation under column made up of H section Sheet No:03 – A1 Size
4	Prepare following Neat sketches in Sketch Book 1. Different Types of Truss 2. Truss Details – Spacing of Truss , Principal Rafter, Main Tie, Members, Ridge, span, Roof Covering, Purlin etc... 3. Eaves Level Joint of Truss 4. Ridge Level Joint of Truss 5. Beam to Beam Connection at Same Level 6. Beam to Beam Connection at Different Level 7. Column to Beam Seated Connection (Weld & Bolt Connection) 8. Column to Beam framed Connection (Weld & Bolt Connection) 9. Slab base Foundation, Gusseted Base Foundation

LIST OF REFERENCES:

Sr.no.	Title	Author	Publication
1	Design of Steel Structures	L.S.Negi	Mc Graw Hill
2	Design of Steel Structures	S.K.Duggal	Tata Mcgraw Hill Education Private Limited
3	Design of Steel Structures: Theory And Practice	N. Subramanian	Oxford University Press (2010)
4	Design of Steel Structures (By Limit State Method As Per Is: 800—2007)	S S Bhavikatti	I. K. International Pvt Ltd
5	***IS-800 – 2007	--	Bureau of Indian Standard
6	***Handbook on Steel – SP-6	--	Bureau of Indian Standard
7	***IS – 875 – 1984 , Part – I, II, III	--	Bureau of Indian Standard

*** Students are permitted to appear in theory & practical examination with these IS codes.