

Lesson Plan for Design of Steel Structure (TH-5C), Winter-2025-26		
Discipline	Semester	Name of the teaching faculty
Civil Engineering	4TH	Manoj Ku Beherdalai, Lect., S-II(Civil)
Subject: DESIGN OF STEEL STRUCTURE (TH-5C)		No. of days per Week classes are allotted: 03
No. of weeks-15 weeks		Semester Duration: 22.12.2025 to 18.04.2026
Weeks	Class days	Theory
1ST	1ST	Types of Connections <ul style="list-style-type: none"> Lap joints, butt joints, single/double cover Riveted vs bolted vs welded comparison Bearing type vs HSFG bolts (IS 400:1982)
	2ND	Strength of Bolted Joints <ul style="list-style-type: none"> Failure modes: shear, bearing, tension Bearing strength: $d_b \times t \times f_u / \sqrt{3} \times \gamma_{m1}$ Pitch, edge distance (IS 800:2007 Cl.10.2)
	3RD	Solved Example <ul style="list-style-type: none"> Design bolted lap joint for 100 kN tension Bolt value calculation, number/spacing
2ND	1ST	Axially Loaded Tension Members <ul style="list-style-type: none"> Net area: $A_g - n \times d_h \times t$ Design strength calculation procedure
	2ND	Design Example 1 <ul style="list-style-type: none"> ISMC 200 tension member, M20 bolts Complete design with sketches
	3RD	Practice Problems <ul style="list-style-type: none"> 3 student problems on bolted connections
3RD	1ST	Types of Welds <ul style="list-style-type: none"> Fillet weld, butt weld, slot/plug weld Throat thickness, leg length relation
	2ND	Weld Strength <ul style="list-style-type: none"> Fillet: $0.7 \times s \times L_w \times f_{wn}$ Butt weld: full throat strength Permissible stresses f_{wn}, f_{ww} (IS 800)
	3RD	Fillet Weld Design <ul style="list-style-type: none"> Axial tension member weld design Minimum size table (6-10 mm)
4TH	WELD DESIGN & COMPARISON	
	1ST	Butt Weld Design <ul style="list-style-type: none"> Complete penetration vs partial Design example for 150 kN load
	2ND	Weld vs Bolt Comparison <ul style="list-style-type: none"> Advantages: speed, strength, aesthetics Disadvantages: inspection, heat effects
	3RD	Previous year question discussion.
5TH	1ST	Mixed Connections

		<ul style="list-style-type: none"> Bolted end + welded lap examples
	2ND	Unit I Revision
	3RD	Unit I Test
6TH	1ST	TENSION MEMBERS - SECTIONS Tension Member Types <ul style="list-style-type: none"> Plates, angles, channels, compound sections Section selection criteria
	2ND	Yielding Strength <ul style="list-style-type: none"> $T_{dg} = A_g \times f_y / \gamma_{m0}$ ($\gamma_{m0} = 1.1$) Gross area selection
	3RD	Design Example <ul style="list-style-type: none"> Plate tension member design
7TH	1ST	NET SECTION RUPTURE Net Area Calculation <ul style="list-style-type: none"> Chain/shear lag effects Angle net area factors (IS 800 Cl.6.3)
	2ND	Rupture Strength <ul style="list-style-type: none"> $T_{dn} = 0.9 \times A_{net} \times f_u / \gamma_{m1}$ Hole deduction rules
	3RD	Solved Examples <ul style="list-style-type: none"> Single angle net section design
8TH	1ST	BLOCK SHEAR & ANGLES Block Shear Failure <ul style="list-style-type: none"> $T_v = \min(\tau_{vf} \times A_{vg} + 0.9 f_u \times A_{nt} / \gamma_{m1})$ Block shear path identification
	2ND	Single Angle Design <ul style="list-style-type: none"> ISA 75×75×8, M16 bolts, gusset plate
	3RD	Double Angle Design <ul style="list-style-type: none"> Back-to-back angles, stitch fasteners
9TH	1ST	TENSION DESIGN PRACTICE Complete Design Procedure
	2ND	3 Practice Problems
	3RD	Unit II Test
10TH	1ST	COMPRESSION MEMBERS Compression Sections <ul style="list-style-type: none"> ISHB, ISMC, single/double angles
	2ND	Effective Length KL <ul style="list-style-type: none"> End conditions ($k=0.5$ to 2.0) Restrained vs unrestrained
	3RD	Slenderness Ratio λ <ul style="list-style-type: none"> $\lambda = KL/r$, $r = \sqrt{I/A}$ Permissible λ limits (IS 800 Table 4)
11TH	1ST	Design Compressive Stress <ul style="list-style-type: none"> f_{cd} from IS 800:2007 Table 7 χ_N reduction factor

	2ND	Column Design Example 1
		<ul style="list-style-type: none"> • ISHB 200 column, L=4m, pinned ends
	3RD	Column Design Example 2
		<ul style="list-style-type: none"> • Fixed base column design
12TH	1ST	COLUMN BASES Slab Base Design <ul style="list-style-type: none"> • Base plate thickness: $\sqrt{(3w/\gamma m_0)} \times B$
	2ND	Gusseted Base <ul style="list-style-type: none"> • Angle column gusseted base design
	3RD	Anchor Bolt Design
13TH	1ST	Unit III Test
	2ND	BUILT-UP SECTIONS Lacing Systems <ul style="list-style-type: none"> • Single lacing at 45°, double lacing
	3RD	Battening Systems <ul style="list-style-type: none"> • Minimum 4 battens, spacing rules
14TH	1ST	Diagrams & Applications
	2ND	BEAMS - BENDING Beam Sections <ul style="list-style-type: none"> • ISMB, ISLB, ISWB selection
	3RD	Bending Strength <ul style="list-style-type: none"> • $M_{bd} = \beta_b \times Z_p \times f_y / \gamma_{m0}$ • Plastic section modulus Z_p
15TH	1ST	Simple Beam Design <ul style="list-style-type: none"> • ISMB 450 for 50 kNm moment
		BEAM SHEAR & BUILT-UP
	2ND	Shear Strength <ul style="list-style-type: none"> • $V_d = A_v \times f_y / \sqrt{3} \times \gamma_{m0}$ • Shear buckling check
	3RD	Built-up Beams Box section, lattice beams


 21/12/2025
 Lect. 5-11 (Civil)