Department of CIVIL Engineering

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	Design of steel structures
2.	Course Code	CE-602
3.	Academic Year	2024-25
4.	Semester	6th
5.	Number of Lesson plans	40
6.	Faculty Assigned	Mr. Abhishek Chandra

Faculty Signature

Lesson Plan No. 1	Course Name: Design of steel Structures Topic: Use of design codes IS 800 and SP6 (1).	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Articulate the use of steel as structural Material in Construction. b. Able to understand and get familiar design codes IS 800 and SP6 (1).
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Introduction to Steel Structure - Introduce IS 800 - Introduce SP6(1) 2. **Concept** (30 minutes) a. Detail concept of Steel as structural Material and its failure. - Advantages and need of Steel Structure Designing. 3. Exercise (5 minutes) – - Designing where steel construction is applied - How it is different from other concept. https://nptel.ac.in/courses/105105162 Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on use of steel as structural Material in Construction 2. Homework -To go through the concept and analyze the assumption for steel structural Designing 3. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions Identification of different properties of following Section from code book (i) ISLB 350 @49.5kg/m (ii) ISHB 225 @ 46.8kg/m (iii) 1SA 110 x 110 x 10 @16.5kg/m Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2	Course Name: Design of steel Structures Topic: Study of different types of structural Steel and their properties	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Identify the different types of structural Steel and their properties.
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Steel as building Materials - Advantages of steel over other building materials 2. **Concept** (30 minutes) a. Detail study of the stress strain behavior of steel b. Manufacturing of steel, its constituents components. 3. Exercise (5 minutes) – - What does a steel as a building materials brings up to the table of a designer - How their Disadvantages can be compensated by proper use. https://nptel.ac.in/courses/105106112 Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on stress strain behavior of steel 2. Homework - To go through the concept behavior of steel in detail. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions • If in a stress-Strain curve of a material, the ultimate tensile strength point and the fracture points are very close, the material is said to be: • Longitudinal Strain is produced in :- solid or liquid or gases Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3	Course Name: Design of steel Structures Topic: Study of Steel Rolled section	Course No.: CE-602

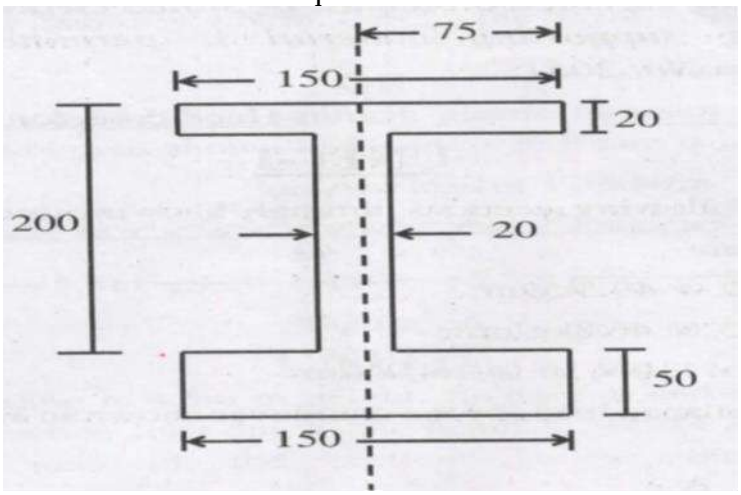
Objectives	At the end of the lesson the student shall be able to: a. They will able to get familiar by different types of steel rolled section that are used in structural designing
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - What is rolled Section steel 2. **Concept** (30 minutes) a. a. Detail concept of - Rolled steel Section - Different types of rolled section-Angle Section, ISMB,ISLB,ISHB - Sectional properties of rolled Section b. How rolled section can be used to form a buildup section by making proper connection c. Making familiar with rolled section given in IS code and steel handbook d. Picking a suitable section for different members of a structure 3. Exercise (5 minutes) – - Choose a suitable section for beam, column each and list out their all properties Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on usability of different types of section and choosing the suitable section for different design of structural member 2. Homework - To go through the IS code 800 and SP6(1) Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - A beam section is provided on the basis of (i) section modulus, (ii) deflection, (iii) shear a) i, ii b) ii, iii c) i, iii d) i, ii and iii - Which of the following is not correct? a) Angles and T section are strong in bending

	b) Channels can be used only for light loads c) I sections are most efficient and economical shapes d) I section with cover plates are provided when large section modulus is required - Which of the following is true? a) in case of rolled section, less thickness of plate is adopted to prevent local buckling b) for built-up section and cold formed section, longitudinal stiffeners are not provided to reduce width to smaller sizes c) local buckling cannot be prevented by limiting width-thickness ratio d) in case of rolled section, high thickness of plate is adopted to prevent local buckling Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 4	Course Name: Design of steel Structures Topic: Types of load and its combination	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Recognize the different types of loads as per IS 875. b. Application of loads in the calculation of final structural loading
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Types of loads - Different IS code for loading 2. **Concept** (30 minutes) a. a. Detail concept of Wind load calculation b. Dead load, live load, wind load and Earthquake load c. Calculation of wind load for different topographical condition and height of building d. Combination of loading 3. Exercise (5 minutes) – Calculate the design wind pressure if the basic wind speed is 44 m/s, risk coefficient is 1, topography factor is 1, terrain is with closely spaced buildings and height of building(class A) = 20m Free Writing/Minute Paper/Question of the Day Exercise.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on application of different types of loads on structural member 2. Homework - To go through the concept of Wind load Calculation and practice similar numerical. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - The probability that a specific load will be exceeded during life of structure depends on - What is the minimum imposed load on roof trusses as per IS code - What is characteristic load Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 5	Course Name: Design of steel Structures Topic: Shape factor and its impact	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Calculate the shape factor of different Shapes.
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Stress Strain Curve for Steel 2. **Concept** (30 minutes) a. Analysis Concept on flexural Member b. Equal Area Axis Determine location of equal area axis for the cross section in figure  c. Plastic moment and Elastic Moment - Combination of loading 3. Exercise (5 minutes) – - Find out the shape factor of any of the given Shapes:- Rectangle or Circle
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on shape factor and its structural impact. 2. Homework - Calculated the shape factor of a diamond section with unequal diagonals, the shorter being b and longer h; the shorter diagonal placed parallel to the z-z axis. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions

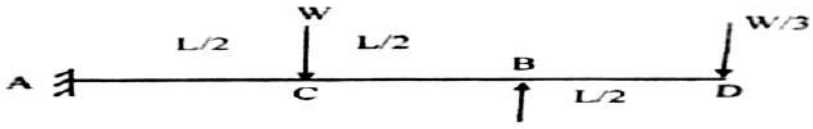
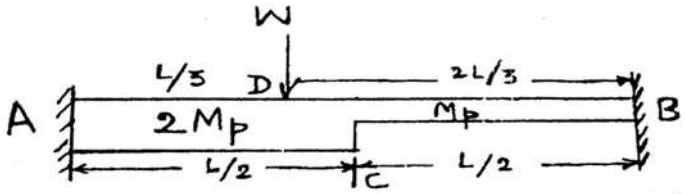
	- The plastic section modulus Z_P, of a rectangular section of width B and depth D is given by - Which section has minimum value of shape factor? - The shape factor in plastic method of analysis depends upon Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

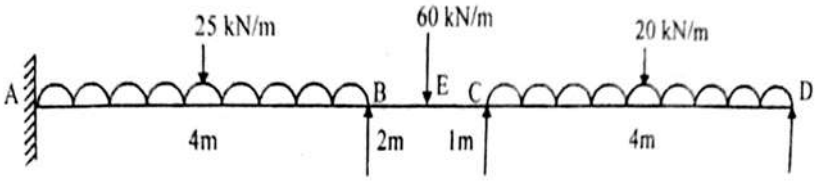
Lesson Plan No. 6	Course Name: Design of steel Structures Topic: Plastic analysis of steel	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of plastic analysis and its impact on structural design of member
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - About Plastic analysis 2. **Concept** (30 minutes) a. Assumptions in plastic Analysis b. Equal Area Axis c. Conditions in plastic analysis 3. Exercise (5 minutes) – Calculate the plastic section modulus, shape factor and plastic moment of the following sections (a) ISMB 200 :I xx= 2235.4 cm4, Z xx= 223.5 cm3, A= 32.33 cm2; thickness of web = 5.7 mm , thickness of flange = 10.8 mm (b) ISHT 150 : I xx = 573.7 cm4 , A= 37.42 cm2 and distance of C.G from top is 26.6 mm. Take f y = 250 N/mm2
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on the three theorems of plastic analysis? 2. Homework - Why is the plastic method of design more useful for redundant structures than the determinate structures - Differentiate between : a) 'plastic hinge' and 'real hinge' b) 'structure' and 'mechanism' c) partial collapse' and 'complete collapse' - The limiting b/t_f ratio of circular hollow tube to be considered as semi-compact is, with fy=250MPa…….. - The limiting d/t_f ratio of web of rolled channel to be considered as semi-compact, with fy =250MPa Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - If the number of possible plastic hinges is 4 and the degree of indeterminacy of the structure is 2 then the number of

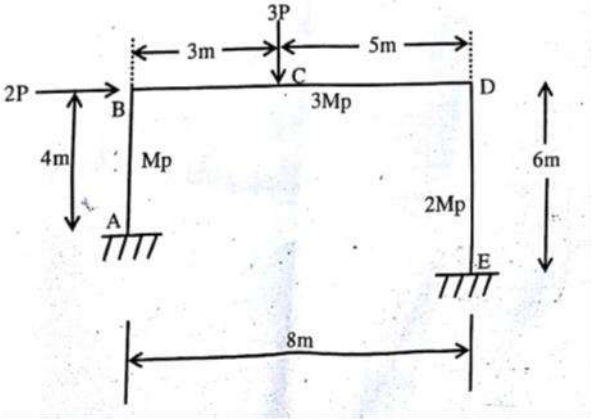
	possible independent mechanism(s) will be…… - What are the three conditions to be satisfied for a continuous beam of uniform cross-section? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

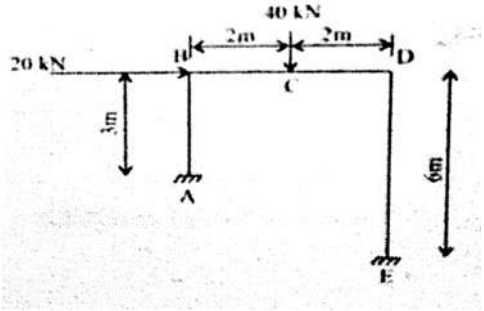
Lesson Plan No. 7	Course Name: Design of steel Structures Topic: Calculation of collapse load	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Apply the theorems of Plastic analysis in calculating the Collapse Load
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - About Static and Kinematic theorem - Understanding of Mechanism, Unstable structure and Collapse load 2. **Concept** (30 minutes) a. Calculation of Collapse load for determinant Structure Calculate the collapse load for the beam of uniform M_P,shown in fig below.  b. Calculation of Collapse load for indeterminant Structure A Fixed ended beam of varying section is subjected to load W at 1/3rd span as shown in fig. Find the collapse load  3. Exercise (5 minutes) – - A frame has an indeterminacy of 2 and the number of possible plastic hinges is 3. The collapse will be - A propped cantilever beam of span L and constant plastic moment capacity MP carries a concentrated load at mid span, then the load at collapse will be Think–Pair–Share
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on collapse load and its structural impact. 2. Homework - Problems for practice with different boundary and loading Conditions A three span continuous beam is subjected to working loads as shown

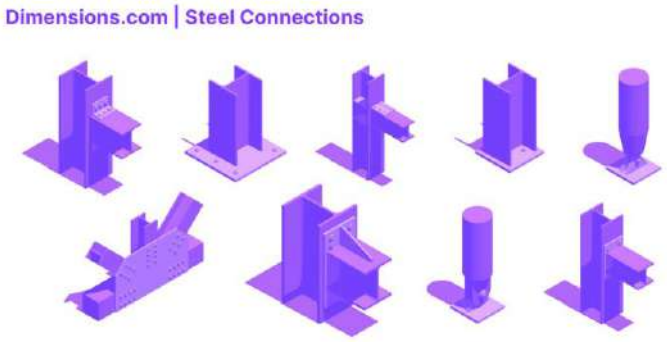
	in fig. Calculate the uniform value of plastic moment with which the beam would be safe. Take load factor as 1.8  Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - The limiting b/tf ratio of circular hollow tube to be considered as semi-compact is, with fy=250MPa…….. - The limiting d/tf ratio of web of rolled channel to be considered as semi-compact, with fy =250MPa…….. - If the order of indeterminacy is r, then the maximum number of plastic hinges required for total collapse is…… Spend 5 minutes to evaluate student assimilation of the lesson contents

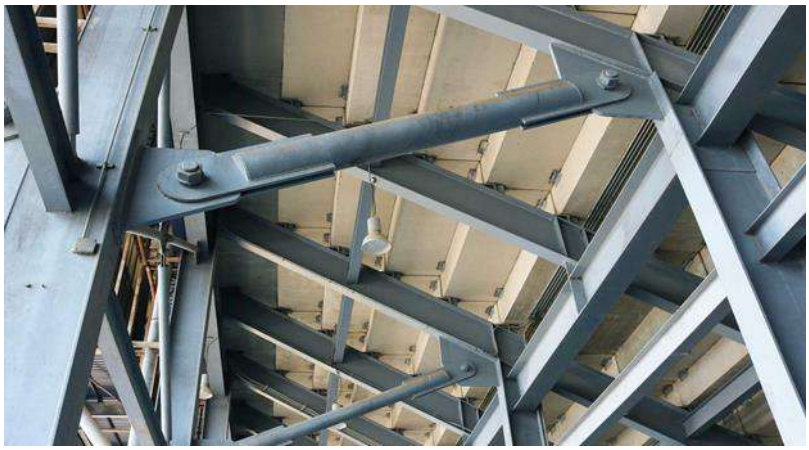
Lesson Plan No. 8	Course Name: Design of steel Structures Topic: Collapse load in frames	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Apply the theorems of Plastic analysis in calculating the Collapse Load in Frames
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Introduction of Mechanism - Portal Frame 2. **Concept** (30 minutes) a. Beam Mechanism, Sway mechanism and Combined Mechanism b. Calculation of Collapse load for Frames:- Analyze the collapse load and draw the bending moment diagram  3. Exercise (5 minutes) – - Which of the following is true about rigid construction? a. connections between members at their junction does not have sufficient rigidity b. connections between members at their junction have sufficient rigidity c. members are not connected d. connection between members at junction will not resist any moment - What is sway frame? a. longitudinal displacement of one end of member relative to other end is not effectively prevented b. transverse displacement of one end of member relative to other end is effectively prevented c. longitudinal displacement of one end of member relative to other end is effectively prevented d. transverse displacement of one end of member relative to other end

	is not effectively prevented - In first order elastic analysis, equilibrium is expressed in terms of a. geometry of deformed structure b. geometry of undeformed structure c. geometry of both deformed and undeformed structure d. geometry of any structure Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on analysis of frames to calculate collapse load 2. Homework - Problems for practice with different boundary and loading Conditions - Find out the fully plastic moment in the portal frame shown in fig of uniform cross section though out.  Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - When plastic analysis is used, the yield stress of grade of steel used shall not exceed _____ a) 250 MPa b) 500 MPa c) 450 MPa d) 800 MPa - Which of the following is not a main element of framed structure? a) Beam b) Column c) Shear connector d) Lattice member - A propped cantilever beam of span L and constant plastic moment capacity MP carries a concentrated load at mid span, then the load at collapse will be Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 9	Course Name: Design of steel Structures Topic: Introduction to Connections	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of connections and its uses b. Design of steel connections
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Need of good connection - Factors affecting good connection 2. **Concept** (30 minutes) - Types of connection - Advantages and disadvantages of different connections - Suitability of different types of connection for different use 3. Exercise (5 minutes) – - Think–Pair–Share:- Identify the different types of connection  

	
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on analysis of frames to calculate collapse load 2. Homework - To go through the concept and identify different connection at their home - How does the type of connection influence the ability to modify or disassemble a structure in the future? - How do the various types of connections (e.g., bolted, welded, riveted) impact the structural integrity and overall design of a project Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - What are the primary factors to consider when choosing between bolted, welded, or riveted connections for a particular structure? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 10	Course Name: Design of steel Structures Topic: Codal Provision for Connections	Course No.: CE-602

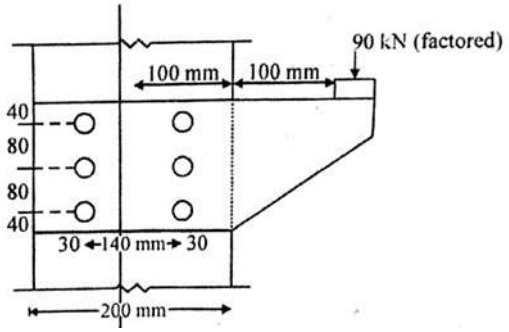
Objectives	At the end of the lesson the student shall be able to: a. Articulate the Failure of Connection. b. Design of Codal Provision for Connections
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Why we need of good connection - Factors affecting Strength of connection. 2. **Concept** (30 minutes) a. Types of connection-Lap and Butt Joint. b. Advantages and disadvantages of Bolted Connection 3. Exercise (5 minutes) – - What are the key structural differences between lap joints and butt joints, and how do these differences affect load distribution? Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on the need of good connection 2. Homework - How does the choice between lap and butt joints affect the overall aesthetic and visual appearance of a structure? - How does the presence of overlap in lap joints influence the material usage and cost of a project compared to butt joints? - What are the main advantages of using bolted connections in structural assemblies, and how do these advantages compare to other connection types, such as welded joints? Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions • What precautions can be taken to ensure bolted connections remain secure and free of issues such as loosening over time? • In what situations would you choose bolted connections over welded connections, and why Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 11	Course Name: Design of steel Structures Topic: Introduction to Bolted Connections	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Articulate the Concept of bolted Connection. b. Design of Codal Provision for Bolted Connections
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Why we need of good connection - Factors affecting Strength of connection. - Types of bolts and bolts joints 2. **Concept** (30 minutes) - Types of connection-Lap and Butt Joint. - Advantages and disadvantages of Bolted Connection. - Reason of failure of Bolted Joints - IS Specifications of bolted joints 3. Exercise (5 minutes) – In which scenario is a butt joint preferred over a lap joint? a) When there is a need for a demountable connection. b) When load distribution needs to be more efficient. c) When material overlap is required. d) When alignment precision is not important One disadvantage of lap joints is: a) Increased material use due to overlap. b) Lower load-carrying capacity. c) High precision required during assembly. d) Complex design and high cost Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on Design of Codal Provision for Bolted Connections 2. Homework - What measures can be taken to prevent failure in bolted connections, especially in environments prone to corrosion or dynamic loading? - How do environmental factors (such as temperature fluctuations

	or exposure to corrosive elements) influence the selection of materials and design for bolted joints? Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions Which IS code is used for structural steel bolted joints in India? a) IS 800 b) IS 456 c) IS 2062 d) IS 875 As per IS 800, the minimum edge distance for bolted joints should be: a) 1.0 times the diameter of the bolt. b) 1.5 times the diameter of the bolt. c) 2.0 times the diameter of the bolt. d) 2.5 times the diameter of the bolt. The IS code that provides guidelines for high-strength friction grip (HSFG) bolted joints is: a) IS 800 b) IS 1367 c) IS 4000 d) IS 2062 Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 12	Course Name: Design of steel Structures Topic: Design of bolted Connections	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design of Bolted Connections
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Failures of bolts and its connection 2. **Concept** (30 minutes) - Calculation of Strength and efficiency of bolted connection. - Designing a joint using an Ordinary black bolts: Bearing type connection:- Design the lap joint between plates of sizes 80×16 mm thick and 80×12mm thick so as to transmit a factored load of 75kN using single row of bolts of grade 4.6 and grade 410plate - Assume e =30mm and area of bolt=157 mm2 3. Exercise (5 minutes) – - Free Writing/Minute Paper/Question of the Day Exercise:- Learning of the day.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Design a joint with different orientation of plates to be jointed and different arrangement of bolts.- Consider a plate bracket 10 mm thick connected to the flange of a column ISHB200 @37.3 kg/m by 6 bolts of grade 4.6 as shown in fig. what should be the minimum size of bolts so that connection is safe.  Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - How does the spacing and edge distance of bolts affect the strength and failure mode of a bolted connection

	Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 13	Course Name: Design of steel Structures Topic: Design of Bolted Connections under no slip condition	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design of Bolted Connections under no slip condition
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Slip and No Slip Condition in bolted connection - Bearing Type of connection using HSFG bolts 2. **Concept** (30 minutes) - IS code recommendations on Design of Friction grip bolted Connection - Prying Forces on bolts - Design a HSFG bolted connection for both slip and No slip connection 3. Exercise (5 minutes) – In a no-slip bolted connection (such as an HSFG connection), the load transfer between plates is primarily through: a) Shear of the bolts. b) Friction between the plates. c) Bearing of the bolts on the plate holes. d) Tension in the bolts. High-strength friction grip (HSFG) bolts are designed to: a) Transfer loads through bearing. b) Prevent slipping between the connected plates by friction. c) Allow some movement between the plates under load. d) Be used only in non-structural applications. Which of the following is a key advantage of no-slip bolted connections (HSFG)? a) No need for precise bolt tightening. b) No stress concentration around bolt holes. c) Excellent performance under dynamic loading. d) Simplified construction and reduced cost. The performance of an HSFG bolted connection under no-slip condition depends on: a) The shear strength of the bolt.

	b) The tensile strength of the connected plates. c) The clamping force generated by the bolt pre-tension. d) The yield strength of the bolt material. Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on Design of Bolted Connections under no slip condition 2. Homework Numerical on Design of joints using HSFG bolt: - As ISA 110mm * 110mm*10mm carries a factored tensile force of 150kN. It is to be joints with a 1mm thick gusset plate. Design the joint using HSFG bolt when a) No slip is permitted b) when slip is permitted Assume steel is Fe 410 Grade Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions • How can you ensure that a bolted connection will remain secure over time in structures subject to vibrations or thermal expansion? • What are the key differences in designing bolted connections for static vs. dynamic loading conditions, and how do these differences impact long-term performance? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 14	Course Name: Design of steel Structures Topic: Introduction to welded connections	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Articulate about all the theory of welded Connection b. Explain all the IS code recommendations for welded connection
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - About welded connection :- Its uses and importance - Advantages and disadvantages - Types of weld 2. **Concept** (30 minutes) - Welding process and its defects - Joints of welding - IS code recommendations for welding connection 3. Exercise (5 minutes) – - • Which of the following is a common type of welded connection used in steel structures? a) Dowel joint b) Fillet weld c) Lap joint d) Threaded connection • The effective throat thickness of a fillet weld according to IS 800 should not be less than: a) 2 mm b) 3 mm c) 5 mm d) 6 mm • According to IS 800:2007, what is the main factor determining the strength of a welded joint? a) The diameter of the bolt b) The effective throat thickness of the weld c) The length of the weld d) The distance between welds • Which IS code provides guidelines on the general practice for steel welding in structural construction?

	a) IS 456 b) IS 800 c) IS 9595 d) IS 1893 Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Create a write up which includes all the important IS code recommendations for welding connection Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions • How does the choice between a fillet weld and a butt weld affect the overall strength and behavior of a structural joint? • What are the potential failure modes in welded connections, and how can they be minimized through design and proper execution? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 15	Course Name: Design of steel Structures Topic: Design of welded connection	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design a welded connection
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - About IS code recommendations 2. **Concept** (30 minutes) a. Calculating the load carrying capacity of weld b. Numerical on Design of welded connection using grove weld:- 10. Design the welded joint for a single angle section ISA 100 x 100 x 8 mm with a gusset 10 mm thick, using shop welds of the size 6 mm, along the end and both sides. The member carries an axial factored load of 200kN. 3. Exercise (5 minutes) – - Free Writing/Minute Paper/Question of the Day Exercise:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Numerical on Design of welded connection using fillet weld:- A diagonal member of the truss is an ISA 65x65x6 mm welded in field to a gusset plate 8mm thick. The grade of steel used for angle is Fe410. Design the joint to full strength of angle. - If fillet weld is provided along the length of member. - If fillet weld is provided along all sides of angle. - Area of angle = 744mm2 and distance of center of gravity from its heel is 18.1mm Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions - What is the primary advantage of a butt weld over a fillet weld? a) Easier to execute b) Higher load-carrying capacity in tension c) Requires less skilled labor d) Lower material cost The IS code specifies that the weld metal must be at least as

	strong as the: a) Bolts used in other connections b) Weld filler material c) Connected base material d) Edge of the plates What type of stress primarily governs the design of fillet welds in a T-joint? a) Shear stress parallel to the weld axis b) Tension stress perpendicular to the weld axis c) Compressive stress in the weld metal d) Shear stress perpendicular to the weld axis According to IS 800, the minimum leg length of a fillet weld should be: a) Equal to the thickness of the thinner plate b) Half the thickness of the thinner plate c) Equal to the thickness of the thicker plate d) Double the thickness of the thicker plate Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 16	Course Name: Design of steel Structures Topic: Introduction to Tension members	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Describe the tension member and its load carrying capacity.
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - About Tension member and its working - IS code recommendations of tension member 2. **Concept** (30 minutes) - Calculate the design strength:- Yielding of gross section - Rupture strength of critical section - Block shear Strength 3. Exercise (5 minutes) – Which of the following structural elements is designed primarily to resist tensile forces? a) Beam b) Column c) Tension member d) Slab The load-carrying capacity of a tension member depends primarily on: a) The bending strength of the member b) The compressive strength of the material c) The tensile strength of the material and the cross-sectional area d) The shear capacity of the member In a tension member, which of the following factors does NOT affect the member's load-carrying capacity? a) Cross-sectional area b) Length of the member c) Yield strength of the material d) Presence of defects (e.g., cracks) The ultimate load-carrying capacity of a tension member is typically calculated as:

	a) Yield strength × Cross-sectional area b) Ultimate tensile strength × Cross-sectional area c) Compressive strength × Cross-sectional area d) Shear strength × Cross-sectional area Use Nearpod to collect responses and discuss the answers.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Write up of all the IS recommendations for Tension members Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions • What role do material properties, such as yield strength and ultimate tensile strength, play in determining the capacity of a tension member? • What is the effect of connection design (e.g., bolted vs. welded) on the load-carrying capacity of a tension member? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 18	Course Name: Design of steel Structures Topic: Introduction to column	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Explain the modes of failure of column and its various related theories
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Definition and types of compression member - Factors affecting strength of compression member 2. **Concept** (30 minutes) - Modes of failure - Elastic buckling of euler column - Cross sections of rolled steel compression member. 3. Exercise (5 minutes) – - Free Writing/Minute Paper/Question of the Day Exercise:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Determine the design axial load on the column section ISMB 400, given that the height of the column is 3.5 m and that it is pin-ended. Also assume the following: fy = 250 N/mm2, fu = 410 N/mm2 ; E = 2×105 N/mm2 Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions Q1: Which of the following is NOT a common mode of failure in compression members? a) Yielding b) Buckling c) Fatigue d) Crushing Which of the following is commonly used as a cross-section for rolled steel compression members? a) I-section b) T-section

	c) L-section d) All of the above Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 19	Course Name: Design of steel Structures Topic: Analyse of compression member	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Analyse a compression member
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Effective Length Factor for Centrally Loaded Columns with various End 2. **Concept** (30 minutes) - Multiple column design curves: Merchant-Rankine formula - Buckling Class of Cross Sections (Table 10 IS 800 :2007) - The stress reduction factor χ for different buckling classes a, b, c and d is given in Table 8(a-d) of IS 800 :2007 - The design compressive stress fcd for various buckling classes - can be found in Table 9(a-d) of IS 800-2007. - Allowable slenderness ratio of compression members: Table 3 IS 800:2007 3. Exercise (5 minutes) – - Free Writing/Minute Paper/Question of the Day Exercise:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Calculate the compressive strength of a compound column consisting of ISHB 250 @ 54.7 kg/m with one cover plate of 300×16 mm on each flange (as shown in the figure) and having a length of 4 m. Assume that the bottom of the column is fixed and top is hinged and fy =250 N/mm2 Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions The slenderness ratio is a key factor in determining the stability of a compression member. It is defined as the ratio of: a) Length of the column to the radius of gyration b) Moment of inertia to the modulus of elasticity c) Cross-sectional area to the length of the column d) Yield stress to the ultimate stress

	The Euler buckling load is inversely proportional to the: a) Moment of inertia b) Modulus of elasticity c) Length of the column squared d) Radius of gyration Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 20	Course Name: Design of steel Structures	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design an ANGLE STRUTS
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Angle Struts - Concentric loading - Loaded through one leg 2. **Concept** (30 minutes) - COMPRESSIVE STRENGTH OF DOUBLE ANGLES - A discontinuous strut of length 4 m consists of two unequal angles ISA 100×75×8 and is connected to a 10 mm thick gusset plate by its longer leg. Determine the strength if it is connected on the: i) Opposite side of the gusset plate ii) Same side of the gusset plate 3. Exercise (5 minutes) – - In the design of angle struts, the effective length is used for calculating: a) Bending stress b) Shear stress c) Buckling stress d) Tensile stress Q2: For an angle strut subjected to axial compression, the main factor that influences its buckling strength is: a) Yield strength of steel b) Modulus of elasticity c) Slenderness ratio d) Tensile strength Q3: When using single-angle sections for struts, which of the following buckling modes is the most critical? a) Torsional buckling b) Lateral buckling c) Local buckling

	d) Flexural-torsional buckling
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework An ISA 150×150×12 used as a strut has the effective length as 3 m. Calculate the strength when it is connected by a) One bolt at each end b) Two bolts at each end c) Welded at each end Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions When designing an angle strut, how does the slenderness ratio influence the selection of cross-section dimensions, and what steps would you take to optimize the strut's design to prevent buckling? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 21	Course Name: Design of steel Structures Topic: Design of compression member	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design a compression member
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) Steps for design of compression members 2. **Concept** (30 minutes) - Slenderness ratio - Design a compression member carrying an axial load of 250kN. The effective length of the member is 3 m. Design the member with 2 equal angles in star orientation as shown in the figure below. 3. Exercise (5 minutes) – Which of the following is the primary design consideration for compression members? a) Flexural strength b) Tensile strength c) Buckling strength d) Shear strength Q2: The slenderness ratio of a compression member is defined as the ratio of: a) Effective length to the least radius of gyration b) Effective length to the cross-sectional area c) Length to the width of the member d) Cross-sectional area to the moment of inertia Q3: In the design of compression members, a lower slenderness ratio generally indicates: a) Higher likelihood of buckling b) Lower likelihood of buckling c) Greater bending moments d) Higher shear stresses Q4: For a built-up compression member such as a lattice column, the main purpose of lacing or battening is to:

	a) Reduce the effective length b) Reduce the slenderness ratio c) Prevent local buckling between the components d) Increase the cross-sectional area
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Design a single angle discontinuous strut to carry a factored load of 50 kN. Assume that the distance between its joints is 2 m. Use fy = 250 Mpa Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions How does the slenderness ratio influence the design of a compression member, and what measures can be taken to reduce it to improve the load-carrying capacity of the member? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 22	Course Name: Design of steel Structures Topic: Design of built up Compression member	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design a built up compression members
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Why Built-up Sections? - Examples of Built-up Sections 2. **Concept** (30 minutes) - Design of built-up compression member : Detail Steps - Slenderness ratio to be assumed while selecting the - Design a laced column 10.5 m long to carry factored axial load of 1000 kN. The column is restrained in position but not in direction at both the ends. Use 2 channel section placed as back to back as shown in the figure below.  3. Exercise (5 minutes) – In designing compression members, the effective length depends on: a) Type of material b) End conditions of the member c) Load application d) Cross-sectional shape Answer: b) End conditions of the member In a compression member with pinned ends, the buckling occurs about the: a) Axis with the highest radius of gyration b) Axis with the least moment of inertia c) Axis with the least radius of gyration d) Axis with the maximum area

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Design a laced column 12 m long to carry factored axial load of 1200 kN. The column is restrained in position but not in direction at both the ends. Use 2 channel section placed as back to back as shown in the figure. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions What are the challenges in designing built-up compression members, such as lattice columns, and how do elements like lacing or battening improve the structural performance of these members? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 23	Course Name: Design of steel Structures Topic: Design a compression members with lacing system	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design a compression members with lacing system
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Laced Column (Clause 7.6 IS 800 :2007) - Failure Modes of Latticed Compression Members 2. **Concept** (30 minutes) - General requirements Clause 7.6 of IS: 800-2007 - Design Specifications - Design Steps 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Design a laced column 10.5 m long to carry factored axial load of 1000 kN. The column is restrained in position but not in direction at both the ends. Provide single lacing system. Use 2 channel section placed as back to back. Assume steel of grade Fe 410 and bolts of grade 4.6. a) Design the lacing system with bolted connections b) Design the lacing system with site welded connections Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions How do elements like lacing improve the structural performance of these members? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 24	Course Name: Design of steel Structures Topic: Design of column with Lacing	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design of Connection for lacing system
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Bolted connection (If lacings are not over lapped each other) - Bolted connection (If lacings are over lapped each other) 2. **Concept** (30 minutes) - Design a laced column 10.5 m long to carry factored axial load of 1000 kN. The column is restrained in position but not in direction at both the ends. Provide single lacing system. Use 2 channel section placed as back to back. Assume steel of grade Fe 410 and bolts of grade 4.6. a) Design the lacing system with bolted connections b) Design the lacing system with site welded 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Design a laced column 10 m long to carry factored axial load of 1200 kN. The column is restrained in position but not in direction at both the ends. Provide single lacing system. Use 2 channel section placed as back to back. Assume steel of grade Fe 410 and bolts of grade 4.6. a) Design the lacing system with bolted connections b) Design the lacing system with site welded Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions For a built-up compression member such as a lattice column, the main purpose of lacing or battening is to: a) Reduce the effective length b) Reduce the slenderness ratio c) Prevent local buckling between the components d) Increase the cross-sectional area he use of double angle sections connected back-to-back is

	preferred for: a) Reducing bending moments b) Increasing the load-carrying capacity in tension c) Increasing the torsional resistance d) Reducing the effective length of the strut Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 25	Course Name: Design of steel Structures Topic: Design of Compression member	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design of Double lacing system
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Bolted connection (If lacings are not over lapped each other) - Bolted connection (If lacings are over lapped each other) 2. **Concept** (30 minutes) - Design a built-up double laced column with four angles to support an axial load of 800 kN. The column is 14 m long and both ends are fixed. Assume Fe 410 grade of steel 3. Exercise (5 minutes) – The primary purpose of a double lacing system in a built-up column is to: a) Resist shear forces b) Reduce the buckling length c) Connect the individual components and prevent local buckling d) Increase the overall strength of the member In a double lacing system, the inclination of lacing bars with respect to the axis of the member should be within the range of: a) 10° to 20° b) 30° to 70° c) 90° d) 15° to 25° In a double lacing system, which of the following is true about the spacing between lacing bars? a) It should be equal to the width of the column. b) It should not exceed the lesser of 50 times the thickness of the lacing bar or the member spacing. c) It should be 10 times the depth of the section. d) It should be the same as the length of the column.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework A Laced column of 10-m long is carrying a factored

	load of 1150 kN. The column is restrained in position but not in direction at both ends. Design a built up column using channel sections placed back to back. Design lacing plates using bolt connection Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions What are the practical challenges encountered in the construction of a double lacing system, and how would you address these challenges to ensure proper functionality and ease of construction? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 26	Course Name: Design of steel Structures Topic: Analysis of batten Plates	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Explain and analyse Batten plates
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Batten: General Requirements - Design requirements - Clause 7.7.2 of IS: 800-2007 2. **Concept** (30 minutes) - Batten: General Requirements - Design requirements - Clause 7.7.2 of IS: 800-2007 3. Exercise (5 minutes) – According to Clause 7.7.2 of IS: 800-2007, battens in built-up columns are primarily designed to resist: a) Bending moments b) Shear forces and bending moments due to buckling c) Axial forces d) Only shear forces Q2: In battened columns, the spacing between battens should not exceed: a) 20 times the least radius of gyration of the member b) 50 times the thickness of the batten plate c) 50 times the width of the column d) 30 times the depth of the column Q3: The minimum thickness of batten plates, as per IS: 800-2007, should be: a) 6 mm b) 10 mm c) 5 mm d) 8 mm

	Q4: In battened columns, batten plates are designed to resist: a) Axial tension and compression b) Lateral loads and buckling c) Bending moments and transverse shear d) Axial tension and bending moments.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Design of batten plates using weld connection, A batten column of 10-m long is carrying a factored load of 1150 kN. The column is restrained in position but not in direction at both ends. Design a built up column using channel sections placed back to back. Design batten plates using weld connection. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions • What is the primary role of battens in built-up compression members, and how does their design contribute to the overall stability of the structure • Clause 7.7.2 of IS: 800-2007 specifies design requirements for battens in compression members. How do the stipulations about the thickness, spacing, and design loads of battens ensure the structural integrity of the column? Students will answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 27	Course Name: Design of steel Structures Topic: Design of battens column	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Explain and analyse Batten plates
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) a) Splices: General Requirements b) Specifications for the design of splices 2. **Concept** (30 minutes) - Design Steps - Steps for the design of splice - A column ISHB 300 @ 576.8 N/m is to support a factored axial load of 500 kN, shear force of 120 kN and Bending moment of 40 kNm. Design the splice plate and Connection using 4.6 grade bolts. Use steel of grade Fe 410 3. Exercise (5 minutes) – In practical design and construction, what challenges might arise in implementing the batten requirements of IS: 800-2007, and how could these challenges be addressed to ensure compliance and structural safety? Students will answer and discuss
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Design of batten plates using weld connection, A batten column of 10-m long is carrying a factored load of 1150 kN. The column is restrained in position but not in direction at both ends. Design a built up column using channel sections placed back to back. Design batten plates using weld connection. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions According to IS: 800-2007, the length of battens should not be less than: a) The width of the column b) Twice the spacing of the connectors c) Three-quarters of the spacing between the centroids of the components d) Twice the depth of the column section

	Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 28	Course Name: Design of steel Structures Topic: Design of Steel Beam	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Explain the design consideration of beam
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Flexural members - Different types of beams - Nature of forces acting on beams 2. **Concept** (30 minutes) - -MODES OF FAILURE 1. Bending failure 2. Shear failure 3. Deflection failure - Types of steel sections - Considerations in design of beams 3. Exercise (5 minutes) – In steel beam design, the limit state of deflection is checked to ensure that: a) The beam does not buckle under axial load b) The beam does not experience excessive bending stress c) The beam does not undergo excessive vertical deflection d) The beam does not fail in shear The plastic section modulus of a steel beam is used in: a) Elastic design b) Plastic design c) Limit state design d) Both b) and c) Shear buckling in steel beams is more critical when: a) The beam section is deep and thin-walled b) The beam is short c) The beam section is compact and shallow d) The beam is subjected to pure bending Students will answer and discuss
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework

	Limitations of angles, t-sections and Channels. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions How does lateral-torsional buckling influence the design of steel beams, and what methods can be used to prevent this type of failure? Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 29	Course Name: Design of steel Structures Topic: Design of Flexural Members	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Explain the failure modes of Flexural members
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Main failure modes of hot-rolled beams - Selection of suitable section 2. **Concept** (30 minutes) - Conventional uses of various sections - Criterion of selecting a beam section - Design criteria - Deflection criteria - Limiting deflection - Effective length for lateral torsional buckling 3. Exercise (5 minutes) – The web of an I-section beam is primarily responsible for resisting: a) Bending moments b) Torsion c) Shear forces d) Lateral-torsional buckling Students will answer and discuss
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Write in detail the Design procedure. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions In steel beam design, how does the web of the beam contribute to resisting shear forces, and how do the thickness and depth of the web affect its ability to prevent shear buckling? Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 30	Course Name: Design of steel Structures Topic: Analysis of laterally supported beams	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Analyze laterally supported beams
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Laterally Supported Beam (Cl. 8.2.1, IS 800: 2007) - Design for Shear (Cl. 8.4, IS 800: 2007) 2. **Concept** (30 minutes) - Shear Areas of different Sections (Cl. 8.4.1.1, IS 800: 2007): - Web Buckling - Web Crippling 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Explain the difference between Web Buckling and Web Crippling. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions When designing a steel beam for a structure, how would you approach balancing between strength, stiffness, and economy? What factors would influence your decisions on section size, material selection, and support conditions Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 31	Course Name: Design of steel Structures Topic: Design of beam	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design laterally supported beam with low shear
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Laterally Supported Beam - Strength of Laterally Supported Beam 2. **Concept** (30 minutes) - Design steps for laterally supported beams - A cantilever beam of length 4.5 m supports a dead load (including self weight) of 18 kN/m and a live load of 12 kN/m. Assume a bearing length of 100 mm. Design the beam. 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework A cantilever beam of length 3 m supports a dead load (including self-weight) of 24 kN/m and a live load of 10 kN/m. Assume a bearing length of 120 mm. Design the beam.
Evaluation	1. Reflective Questions In the design of a laterally supported beam, the primary design check is typically for: a) Shear capacity b) Bending capacity c) Torsional buckling d) Lateral-torsional buckling Q2: A beam is considered laterally supported when: a) The web is stiffened b) The flange is braced to prevent lateral displacement c) The beam has a high depth-to-width ratio d) The beam has a long span Q3: For a laterally supported beam, the maximum moment capacity is typically governed by: a) The yield strength of the material

	b) Shear buckling of the web c) Lateral-torsional buckling d) Compression in the flange Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 32	Course Name: Design of steel Structures Topic: Design of beam for high shear	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design laterally supported beam with high shear
Teaching Aids (if any)	a. Power point presentation b. White board and Marker c. Use of Nearpod tool for online quiz
Teaching Development	1. **Introduction** (5 minutes) - Laterally Supported Beam with high shear 2. **Concept** (30 minutes) - Design steps for laterally supported beams with high shear - Design a laterally supported beam of effective span 5 m for the following data. Grade of steel: Fe 410 Factored maximum B.M. = 180 kN-m Factored maximum S. F. = 220 kN Check for deflection is not required 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Design a laterally supported beam of effective span 6 m for the following data. Grade of steel: Fe 410 Factored maximum B.M. = 150 kN-m Factored maximum S. F. = 200 kN Check for deflection is not required
Evaluation	1. Reflective Questions In a beam with low shear, which of the following is likely to govern the design? a) Web crippling b) Lateral-torsional buckling c) Bending moment capacity d) Shear capacity of the web For a laterally supported steel beam with low shear, shear failure is typically prevented by ensuring: a) The web is thick enough to resist shear forces b) The flange is stiff enough to resist bending c) The depth-to-width ratio is minimized d) The beam has enough bracing to prevent lateral movement When designing a laterally supported beam, the limiting condition in the case of low shear is typically:

	a) Shear strength b) Flexural strength c) Web buckling d) Bearing capacity Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 33	Course Name: Design of steel Structures Topic: Design of laterally unsupported beam	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design laterally unsupported beam
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) Laterally Unsupported Beam (Cl. 8.2.2, IS 800: 2007) 2. **Concept** (30 minutes) - Design bending strength for laterally unsupported beams - Strength calculation of laterally unsupported beams - Calculate the design bending strength of ISLB 300 @ 0.369 kN/m considering the beam to be (a) Laterally supported (b) Laterally unsupported Assume the design force is less the design shear strength and is of low shear. The effective length of the beam (LLT) is 4 m. Assume Fe410 grade of steel. 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework Calculate the design bending strength of ISLB 350 @ considering the beam to be (a) Laterally supported (b) Laterally unsupported Assume the design force is less the design shear strength and is of low shear. The effective length of the beam (LLT) is 5 m. Assume Fe410 grade of steel.
Evaluation	1. Reflective Questions In the case of a beam with low shear forces, what are the key factors that determine the bending moment capacity, and why does shear become a secondary concern in this case? Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 34	Course Name: Design of steel Structures Topic: Introduction to slab base	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Explain Slab Base
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Column base - Types of column bases 2. **Concept** (30 minutes) - Slab base - Theoretical Considerations - Steps for the design of slab base 3. Exercise (5 minutes) – The primary function of a steel slab base in a column is to: a) Transfer axial loads directly to the foundation b) Provide lateral stability to the column c) Transfer bending moments to the foundation d) Resist horizontal forces in the structure In the design of a slab base, the thickness of the base plate is primarily determined by: a) The lateral forces on the structure b) The axial compressive load from the column c) The moment in the column d) The height of the column The gusset plates in a slab base are provided to: a) Increase the thickness of the base plate b) Transfer lateral forces c) Reduce the effective span of the base plate d) Support eccentric loads
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Design procedure of slab base
Evaluation	1. Reflective Questions How does the thickness of the base plate in a slab base affect the overall performance of a steel column foundation, and what factors would you consider when determining the appropriate thickness?

	Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 35	Course Name: Design of steel Structures Topic: Design of slab base	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design Slab Base
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Design procedure of slab base 2. **Concept** (30 minutes) - Design a slab base for a column ISHB 300 @ 618 N/m subjected to an factored axial compressive load of 1200 kN for the following condition: a) Load is transferred to the base plate by direct bearing of column flanges. b) Load is transferred to the base plate by welded connections; the column end and the base plate are not machined for bearing. The base rests on concrete pedestal of grade M20. 3. Exercise (5 minutes) – The gusset plates in a slab base are provided to: a) Increase the thickness of the base plate b) Transfer lateral forces c) Reduce the effective span of the base plate d) Support eccentric loads Answer: c) Reduce the effective span of the base plate In a steel slab base, the base plate size is designed to ensure that: a) The axial load is uniformly distributed b) The base plate can resist both bending and shear c) The base plate covers the entire foundation area d) The bearing pressure on the concrete does not exceed the allowable limit
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - -Design a slab base for a column ISHB 350 subjected to an factored axial compressive load of 1400 kN for the following condition: a) Load is transferred to the base plate by direct bearing of column flanges. b) Load is transferred to the base plate by welded connections; The column end and the base plate are not machined for bearing. The base rests on concrete pedestal of grade M25.

Evaluation	1. Reflective Questions What challenges might arise when designing a slab base for columns subjected to eccentric loading or bending moments, and how can these be addressed through design modifications? Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 36	Course Name: Design of steel Structures Topic: Design of eccentrically loaded base plate	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design eccentrically loaded base plate
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Eccentrically loaded base plate 2. **Concept** (30 minutes) - Design of Eccentrically loaded base plate - Design Procedure - Design a slab base for a column of section ISHB 300@58.78 kg/m, carrying a factored load of 1000kN. Bearing capacity of soil may be taken as 300kN/m2 . Assume Fe 410 grade for steel and M15 for concrete 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - A column ISHB 350 @ 661.2 N/m carries an axial compressive factored load of 1700kN. Design a suitable welded gusset base. The base rests on M-15 grade of concrete
Evaluation	1. Reflective Questions In a practical construction scenario, what factors would you prioritize when designing a slab base to ensure both safety and cost-effectiveness, and how would you balance these considerations? Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 37	Course Name: Design of steel Structures Topic: Introduction of gusset base	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Explain gusset base
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Gusset Base - Uses 2. **Concept** (30 minutes) - Clause 7.4.2, IS 800 – 2007 - Clause 7.4.2.1, IS 800 – 2007 - Theoretical Considerations 3. Exercise (5 minutes) – The primary function of a gusset base is to: a) Transfer only bending moments from the column to the foundation b) Provide a connection for tension members c) Increase the effective load-bearing area of the base plate d) Transfer both axial loads and bending moments from the column to the foundation Gusset bases are commonly used in: a) Short columns under pure axial compression b) Columns subjected to axial loads and bending moments c) Beams under uniform bending d) Columns with negligible moments In the design of a gusset base, the gusset plate is primarily used to: a) Increase the thickness of the base plate b) Transfer shear forces between the column and the foundation c) Transfer loads from the column flanges to the base plate d) Reduce the column's effective length
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Steps for the design of gusseted base
Evaluation	1. Reflective Questions How does the presence of a gusset plate in a base design improve the load

	transfer mechanism in steel structures, particularly for columns subjected to combined axial loads and moments? Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 38	Course Name: Design of steel Structures Topic: Design of gusset base	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design gusset base
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Design consideration of gusset base 2. **Concept** (30 minutes) - A column section ISHB 350 @ 710.2 N/m carries a factor axial compressive load of 1700 kN and factored bending moment of 85 kN-m. Design the base plate and its connections. Assume concrete pedestal of M-20 grade 3. Exercise (5 minutes) – In a gusset base design, the thickness of the gusset plate is generally determined by: a) The height of the column b) The width of the column c) The magnitude of axial loads and moments d) The length of the base plate Q5: The anchor bolts in a gusset base are primarily used to: a) Secure the gusset plate to the base plate b) Transfer vertical loads to the foundation c) Prevent sliding and resist horizontal forces d) Increase the load-bearing capacity of the base plate Q6: When designing a gusset base, it is important to ensure that: a) The column does not rotate b) The base plate can resist bending moments c) The gusset plate provides adequate stiffness to prevent excessive deformation d) The base plate remains unstressed
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - A column section ISHB 300 carries a factor axial compressive load of 1500 kN and factored bending moment of 65 kN-m. Design the base

	plate and its connections. Assume concrete pedestal of M-25 grade
Evaluation	1. Reflective Questions In practice, what challenges might arise when designing and installing gusset bases, particularly in terms of ensuring proper alignment and load transfer between the column, gusset plate, and foundation? Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 39	Course Name: Design of steel Structures Topic: Introduction of Plate girder	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Describe the plate girder and its designing consideration
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Introduction of plate girders - IS code recommendation 2. **Concept** (30 minutes) - Types of Plate Girders - Components of Plate Girders - Splices for Flange and Web - Application of Plate Girders 3. Exercise (5 minutes) – Minute Paper:- Learning of the day
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Discuss the Advantages and Disadvantages of Plate Girder - Selection of Cross section for Plate girder
Evaluation	1. Reflective Questions How does the use of a plate girder differ from using a rolled steel section, and in what situations would you recommend the use of plate girders in structural design Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 40	Course Name: Design of steel Structures Topic: Design of plate girder	Course No.: CE-602

Objectives	At the end of the lesson the student shall be able to: a. Design the plate girder
Teaching Aids (if any)	a. Power point presentation b. White board and Marker
Teaching Development	1. **Introduction** (5 minutes) - Minimum thickness of web based on flange buckling - Tension field method 2. **Concept** (30 minutes) - Procedure of Design of Plate Girder - Design a welded plate girder of span 24 m to carry a super imposed load 35 kN/m. Avoid using of bearing and intermediate stiffeners. Use Fe415 steel 3. Exercise (5 minutes) – Minute Paper:- Learning of the day Discussion on limitations of Plate girder
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students 2. Homework - Design a welded plate girder of span 24 m to carry a super imposed load 35 kN/m. Avoid using of bearing and intermediate stiffeners. Use Fe415 steel.
Evaluation	1. Reflective Questions In modern construction, how can the principles of sustainability influence the design of plate girders, and what practices can be adopted to ensure environmentally friendly design without sacrificing structural integrity Spend 5 minutes to evaluate student assimilation of the lesson contents