Techno India NJR Institute of Technology

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Course File

Subject Title/Subject Code: Design of Steel Structures

6CE4-04

Semester: VI Year: III

Name of the Faculty: Mr. Rakesh Yadav

E-mail id: Rakesh.yadav@technonjr.org

Class Schedule

Total Number of Lectures: 40

i) Course Objective

Upon completing the Design of Steel Structures course, students will be able to analyze the structural behavior of steel components using plastic analysis methods and classify cross-sections as per IS 800-2007. They will gain the ability to design bolted and welded connections, considering load transfer mechanisms and accounting for axial and eccentric loadings according to IS codes. Students will learn to calculate the design strength of tension and compression members, including considerations for net section rupture, block shear, and buckling behavior. They will develop skills in designing various steel structural elements, such as beams, columns, plate girders, and gantry girders, addressing aspects like lateral torsional buckling and web buckling. Additionally, students will be equipped to evaluate the structural performance of roof trusses, purlins, and pre-engineered building components under diverse loading conditions, including wind loads.

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VISSION & MISSION OF INSTITUTE

VISSION

Empowering student with recent and emerging technologies to create innovative technical leaders capable of contributing to industrial and societal needs for betterment of mankind across the globe.

MISSION

M1: To provide dynamic learning environment to students by providing constant exposure to latest technologies by linking closely with the industries.

M2: To establish effective interface with industry to obtain live problems to enhance critical thinking and problem-solving skills among students and consultancy projects for faculty.

M3: To provide avenues and opportunities to faculty for domain specific trainings and qualification upgradation.

M4: To develop ethical leaders with strong communication skills.

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VISION & MISSION OF DEPARTMENT

Department Vision

To increase students learning of fundamentals for designing and planning of buildings and latest technologies through industry-aligned project-based learning which will help in transforming students to be good civil engineering professionals leading to innovation and incubation of new ideas.

Department Mission

M1: To create experimental learning through solving problems of Government, Society, Smart Cities, Industry and other entities.

M2: To teach the latest technologies to the students as beyond the syllabus activity so that they are updated and industry ready.

M3: To enable engineering students, understand industry-aligned technologies and learn to find solutions from their early engineering days and this is the only way to produce globally relevant engineers solving real-life problems applying current technologies.

M4: To enable students to generate projects through problem faced by and requirement of Smart cities, industry, Government and other entities whereby those outlined problem statements are to be studied deeply by a group of faculty members to convert them into real-time project format.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs 1: To provide an in-depth understanding of the fundamentals of Civil Engineering and create a foundation for lifelong learning to facilitate a progressive career in the construction Industry, as an entrepreneur and in pursuit of higher studies.

PEOs 2: To equip the students with technical and analytical skills to develop innovative solutions to complex real-life problems using existing and novel technologies. To equip the students with good communication and interpersonal skills, inter-disciplinary teamwork and leadership skills to enable them to fulfill professional responsibilities.

PEOs 3: To expose them to various contemporary issues which will enable them to become ethical and responsible towards themselves, co-workers, Society and the Nation.

PEOs 4: To make the student's industry ready by imparting education related to the latest technologies so that they can grab future industry jobs.

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PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: To be aware of and initiate some-work on future technologies and new developments which may impact the future Industry 4.0.

PSO2: Hands on training on upcoming technologies and project-based learning.

PSO3: Get exposure to BIM (Building Information Modeling).

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PROGRAMME OUTCOMES (POs)

A student will develop:

PO01. ENGINEERING KNOWLEDGE: An ability to apply knowledge of Mathematics, Science and Engineering Fundamentals in Electronics and Communication Engineering.

PO02. PROBLEM ANALYSIS: Ability to analyze and interpret data by designing and conducting experiments. Develop the knowledge of developing algorithms, designing, implementation and testing applications in electronics and communication related areas.

PO03. DESIGN/ DEVELOPMENT OF SOLUTION: An ability to Design a system Component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

PO04. CONDUCTION OF INVESTIGATION OF COMPLEX PROBLEMS: Ability to Identify, formulate and solve engineering problems.

PO05. MODERN TOOL USAGE: An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

PO06. THE ENGINEERING AND SOCIETY: Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.

PO07. ENVIRONMENT & SUSTAINABILITY: Understand the impact of professional engineering solution in societal and environmental contexts, and demonstrate the knowledge of, and need of sustainable development.

PO08. ETHICS: An ability to understand the professional, social and ethical responsibility.

PO09. INDIVIDUAL AND TEAM WORK: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. COMMUNICATION: An ability to Communicate effectively in order to succeed in their profession such as, being able to write effective reports and design documentation, make effective presentations.

PO11. PROJECT MANAGEMENT & FINANCE: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environment.

PO12. LIFE-LONG LEARNING: Recognize the need and an ability to engage in life-long learning.

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COURSE OUTCOMES (COs) OF THE SUBJECT

CO No.	Mapping	Statement
CO36404.1	**Remembering**	Learner will be able to solve the designing of tension and compression members
CO36404.2	**Understanding**	Learner will be able to solve the designing of beams and beam columns.
CO36404.3	**Applying**	Learner will be able to solve the designing of bolt and weld connections.
CO36404.4	**Analyzing**	Learner will be able to solve the designing of the gantry girder.
CO36404.5	**Evaluating**	Classify and design the structural steel components of industrial building.

COS MAPPING WITH POs AND PSOs

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO36404.1	3	3	3	3	0	0	0	1	0	0	2	3	2	1	1
CO36404.2	3	2	2	3	0	0	0	1	0	0	1	1	2	1	1
CO36404.3	2	2	2	1	0	0	0	2	0	0	2	1	2	1	1
CO36404.4	2	2	2	2	0	0	0	1	0	0	2	2	2	1	1
CO36404.5	2	3	3	32	0	0	0	1	0	0	2	2	2	1	1
CO36404 (AVG)	2.4	2.4	2.4	8.2	0	0	0	1.2	0	0	1.8	1.8	2	1	1

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UNIVERSITY ACADEMIC CALENDAR

Academic Calendar for Even Semester for Session

Course: Bachelor of Technology (B.TECH.)				
Course: Bachelor of Technology (B.TECH.)				
Semester	II	IV	VI	VIII
Commencement of Classes	26.02.2024	15.02.2024	15.02.2024	02.01.2024
First Mid Term	02.04.2024	20.03.2024	20.03.2024	15.02.2024
Second Mid Term	03.06.2024	06.05.2024	06.05.2024	21.03.2024
Last Working Day	10.06.2024	31.05.2024	31.05.2024	20.04.2024
Commencement of Practical Exams	01.07.2024	03.06.2024	03.06.2024	22.04.2024
Commencement of Theory Exams	19.06.2024	14.06.2024	15.06.2024	02.05.2024
Project (VIII)	06.05.2024 to 15.05.2024			
Practical Training (After II Sem.)	15.07.2024 To 31.07.2024			
Practical Training (After IV Sem.)	01.07.2024 To 17.08.2024			
Practical Training (After VI Sem.)	01.07.2024 To 17.08.2024			
Commencement of Classes for next Odd Semesters (2023-24)	I	III	V	VII
	01.08.2024	01.08.2024	20.08.2024	20.08.2024

Academic Calendar of Institute

Academic Calendar for Even semester for session 2023-24

Academic Calendar for even Semester for Session 2023-24 (Even Semester)

Course: Bachelor of Technology (B.TECH.)				
Semester	**II**	**IV**	**VI**	**VIII**
Commencement of Classes	26-02-2024	15-02-2024	15-02-2024	2-01-2024
Commencement of First Mid Term	20-04-2024	25-03-2024	25-03-2024	15-02-2024
Commencement of Second Mid Term	05-06-2024	24-05-2024	24-05-2024	21-03-2024
Last Working Day	15-06-2024	31-5-2024	31-5-2024	20-04-2024
Commencement of Practical Exams	01-07-2024	04-6-2024	03-6-2024	22-04-2024
Commencement of Theory Exams	19-6-2024	15-6-2024	14-6-2024	02-05-2024
Project (VIII)	06.05.2024 to 15.05.2024			
Practical Training (After II Sem.)	15.07.2024 To 31.07.2024			
Practical Training (After IV Sem.)	01.07.2024 To 17.08.2024			
Practical Training (After VI Sem.)	01.07.2024 To 17.08.2024			

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Evaluation Scheme

FACULTY DETAILS:

Name of the Faculty	:	Rakesh Yadav
Designation	:	Assistant Prof.
Department	:	Civil Engineering

1. TARGET

a) Percentage Pass: 100%
b) Percentage I class: 60 %

2. METHOD OF EVALUATION

- [x] Continuous Assessment Examinations (Mid-Term 1, Mid-Term 2)
- [x] Assignments / Seminars
- [ ] Mini Projects
- [x] Quiz
- [x] Semester Examination

Others_____

3. List out any new topic(s) or any innovation you would like to introduce in teaching the subject in this Semester.
4. Take the help of creative tools to stimulate creativity. Include slide presentations, demonstration or forms of visual exercises that will excite the young minds and capture their interest.

Signature of Faculty: **Signature of HOD**

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UNIVERSITY SYLLABUS

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

3rd Year - VI Semester: B.Tech. (Civil Engineering)

6CE-04: DESIGN OF STEEL STRUCTURES

Credit: 3 **Max. Marks: 100(IA:30, ETE:70)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Types of Steels and their broad specifications. Structural steel forms- hot rolled, tubular, light gauge etc and their applicability. Classification of cross sections as per IS 800-2007- Plastic, compact, semi compact and slender- characteristics	2
3	Plastic analysis of steel structures, fundamentals, shape factor, static and mechanism method of analysis, bending of beams of uniform cross sections (any shape)	3
4	Connections: Types of bolts, load transfer mechanism, prying action. Design of bolted and welded connections under axial and eccentric loadings with IS provisions	3
5	Tension Members: Design strength in gross section yielding, net section rupture and block shear. Design of axially loaded members.	3
6	Compression Members: Types of buckling, Imperfection factor, Buckling curves for different cross sections as per IS. Design of compression members: Axially loaded members including made up of angle section: single and in pair; built up columns including design of lacings and battens as per IS.	6
7	Beams: Design of beams: simple and compound sections. Design of laterally supported and unsupported beams including for web buckling, web crippling, lateral torsional buckling.	6
8	Member design under combined forces: Compressive load and uniaxial moment. tension and uniaxial moment	3
9	Column Bases: Design of column bases for axial and eccentric compressive loads: Slab and gusseted base.	2

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Rajasthan Technical University, Kota

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

3rd Year - VI Semester: B.Tech. (Civil Engineering)

10	Design of plate girder: Design of welded and bolted sections including web and flange splicing, horizontal, intermediate and bearing stiffeners. Shear strength determination by post critical and tension field action methods. End panel design options and procedure as per IS 800. Curtailment of flange plates. Connections for flange plate to flange angles and flange angles to web, etc. Design of welded connections	**7**
11	Design of gantry girder	**2**
12	Design of roof trusses members for combined forces, wind loading etc. Purlin design	**2**
13	Introduction to Pre Engineered Buildings , characteristics and their applications.	**1**
14	Introduction of truss girder bridges-its members including portal and sway bracings etc. Design aspects of foot over bridges.	**1**
	TOTAL	**42**

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PRESCRIBED BOOKS

1. Design of Steel Structures by S.K. Duggal, TMH Publication
2. Design of Steel structures by S. S. Bhavikatti, I.K. International Pvt. Ltd.
3. Design of Steel Structures by Dr. B.C Punmia , Lakshmi Publication (P) Ltd.
4. Design of Steel Structures (By Limit state method as per IS 800:2007 by Dr. N.R. Chandak, S.K. Kataria & Sons

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WEEKLY TIME TABLE OF THE TEACHER

First Time Table: with effect from (Date):

Day	1	2	3	4	5	6	7
Monday				DSS			
Tuesday				DSS			
Wednesday				DSS			
Thursday				DSS			
Friday				DSS			
Saturday				DSS			

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COURSE-PLAN

UNIT	Lect. No.	TOPICS	Teaching Methods/ Teaching Aids
1	**1**	**Introduction:** Objective, scope and outcome of the course	White Board
2	2	Student should be able to understand about types of steel and theirbroad specifications. Also, Structural steel forms- hotrolled, tubular, light gauge etc.	White Board
3	2	Student should able to identify the classification of cross sections as perIS 800-2007- Plastic, compact, semi compactand slender- characteristics	White Board
4	**3**	**Plastic analysis of steel structures**	White Board
5	3	Student should able to analyze Shape factor for different shapes of elements	White Board
6	3	Student should be able to understand Static and mechanism method of analysis	White Board
7	3	Student should be able to analyze beams, using method of analysis	White Board
8	3	Student should be able to analyze beams, using method of analysis	White Board
9	3	Student should able to calculate bending of beams of uniform cross sections (any shape)	White Board
10	**4**	**Connections:** Student should be able to understand Types of bolts, load transfermechanism, prying action	White Board
11	4	Student should be able to design of bolted connection under axial & eccentric loadings	White Board
12	4	Student should be able to design of welded connection under axial & eccentric loadings	White Board
13	**5**	**Tension Members.** Student should be able to design of strength in gross section yielding	White Board
14	5	Student should be able to design of section rupture and block shear strength	White Board

15	5	Student should be able to design of axially loaded members	White Board
16	**6**	**Compression Members:** Student should be able to understand behavior of compressive members, buckling forms, Imperfection factor, buckling curves for different cross sections as per IS codes	White Board
17	6	Student should be able to design of compression members: Axially loaded columns	White Board
18	6	Student should be able to design of compression members: Axially loaded columns	White Board
19	6	Student should be able to design Built up columns including design of lacings and battens as per IS	White Board
20	6	Student should be able to design Built up columns including design of lacings and battens as per IS	White Board
21	**7**	**Beams or Flexural Members** Student should be able to understand the behavior of flexural members andboundary conditions.	White Board
22	7	Student should be able to design of beams: simple and compound sections	White Board
23	7	Student should be able to design of laterally supported and unsupported beams	White Board
24	7	Student should be able to design of laterally supported and unsupported beams	White Board
25	7	Students should able to define the failure mode of beams as Web crippling, lateral torsional buckling	White Board
26	**8**	**Member design under combined forces:** Students should able to compute Compressive load and Uniaxial moment	White Board
27	8	Students should able to analyze Compressive load and Uniaxial moment	White Board
28	**9**	**column bases:** Student should be able to classify column bases for axial and eccentriccompressive loads: slab and gusseted base	White Board
29	9	Student should be able to design of slab base	White Board
30	9	Student should be able to design of gusseted base	White Board
31	**10**	**Design of plate girder**:	White Board

		Student should be able to design of welded and bolted sections includingweb and flange splicing	
32	10	Student should be able to design of plate girder	White Board
33	10	Student should be able to design of plate girder	White Board
34	10	Student should be able locate Curtailment of flange plates and design of connections for flange plate to flange angles and flange angles to web	White Board
35	**11**	**Design of gantry girder:** Students should able to compute horizontal, vertical, impact and surge load	White Board
36	12	Student should be able to design of Gantry Girder	White Board
37	**12**	**Design of roof trusses members**: Students should able to compute combined forces, wind loading	White Board
38	12	Student should be able to design of Purlins	White Board
39	**13**	Introduction to Pre-Engineered Buildings	White Board
40	**14**	Introduction of truss girder bridges-its members including portal and sway bracings etc.	White Board

Signature of Faculty: **Signature of HOD**

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Assignment – 1
B. TECH 3rd – YEAR (VI SEM.)
Subject: - *Design of Steel Structures (6CE-04)*

1. Discuss the different types of structural steel forms (hot-rolled, tubular, light gauge) and their respective applications. Classify cross-sections as per IS 800-2007 into plastic, compact, semi-compact, and slender sections, and describe their characteristics.

2. Define shape factor and explain its importance in the plastic analysis of steel structures. Analyze a simply supported beam subjected to a uniformly distributed load using the mechanism method to determine its plastic moment capacity.

3. Explain the load transfer mechanism in bolted connections. What is prying action, and how does it affect the design of bolted connections? Design a bolted connection for a tension member using IS provisions, considering both axial and eccentric loading.

4. Derive the expressions for the design strength of a tension member due to (i) yielding of gross section, (ii) rupture of net section, and (iii) block shear. Design an axially loaded tension member with given properties and loads, ensuring that all failure modes are checked.

5. Discuss the various types of buckling and the factors affecting the buckling strength of a compression member. Design an axially loaded compression member using angle sections, considering the buckling curve and imperfections as per IS 800-2007.

6. Explain the design criteria for laterally supported and unsupported beams. What is

lateral torsional buckling, and how does it influence beam design? Design a simply supported beam using rolled steel sections to carry a given uniformly distributed load. Consider both web buckling and web crippling.

7. Describe the design considerations for steel members subjected to combined compressive loads and uniaxial moments. For a given member subjected to tension and uniaxial bending, determine the required cross-sectional dimensions using IS provisions.

8. Explain the difference between slab bases and gusseted bases in the design of column bases. Design a column base for a given steel column subjected to axial and eccentric loads, following IS code requirements.

9. Discuss the concept of shear strength determination using post-critical and tension field action methods for plate girders. Design a welded plate girder for a given span and loading conditions, including the design of stiffeners and connections as per IS 800.

10. Describe the design considerations for roof truss members subjected to combined forces, including wind loading. For a given span and load data, design a gantry girder and select suitable sections for the truss members.

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Assignment – 2
B. TECH 3rd – YEAR (V SEM.)
Subject: - *Estimation & Costing*

1. Discuss the significance of using IS 800-2007 in the design of steel structures. What are the key changes introduced in this code compared to the previous versions?

2. A simply supported steel beam with a span of 6 meters is subjected to a uniformly distributed load of 20 kN/m, excluding self-weight. Design the beam using rolled steel sections, considering lateral torsional buckling as per IS 800-2007. Assume the beam is laterally supported only at the ends.

3. Explain the concept of block shear failure in tension members. How is it different from net section rupture? Illustrate with a diagram and provide conditions where block shear is critical.

4. A tension member is made of an ISA (100 mm x 100 mm x 10 mm) angle section. Determine the design tensile strength due to yielding of the gross section, rupture of the net section, and block shear if the member is subjected to an axial tensile force of 150 kN. Use IS 800-2007 provisions.

5. Design a column of effective length 3.5 meters using a single rolled steel section. The column is subjected to an axial load of 300 kN. Assume that the column is hinged at both ends. Consider buckling and use IS 800-2007 for the design.

6. A bolted connection is to be designed for a tension member subjected to a tensile load of 100 kN. The connection uses 16 mm diameter bolts of grade 4.6 and plates of 10 mm thickness. Calculate the number of bolts required and the minimum length of the connection.

7. A welded connection is used to connect two plates each of thickness 10 mm, subjected to a shear force of 100 kN. Design the size of the weld using IS 800-2007. Assume double fillet welds and provide a diagram of the joint.

8. A steel plate girder has a span of 15 meters and is subjected to a uniformly distributed load of 50 kN/m, including self-weight. Design the plate girder section, considering the need for stiffeners and web buckling criteria. Use IS 800-2007 provisions.

9. Design a gusseted base for a column section ISHB 300 subjected to a factored load of 600 kN. The column is placed on an M25 concrete pedestal. Determine the size of the base plate and thickness as per IS 800-2007.

10. A roof truss spans 12 meters and is subjected to a wind load of 1.2 kN/m². Calculate the forces in the members of the truss using the method of joints, and design one of the compression members considering buckling. Assume the truss is supported at the ends with pinned connections.

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SAMPLE QUIZ QUESTIONS

1. What is the value of the shape factor for a rectangular section?
   a) 1.5
   b) 1.67
   c) 2.0
   d) 1.12
   Answer: b) 1.67

2. Which type of steel section is most commonly used for columns in multi-story buildings?
   a) Angle sections
   b) Channel sections
   c) I-sections
   d) T-sections
   Answer: c) I-sections

3. What is the maximum permissible slenderness ratio for a compression member subjected to dead and live loads as per IS 800-2007?
   a) 180
   b) 200
   c) 250
   d) 300
   Answer: b) 180

4. Which of the following methods is used for plastic analysis of steel structures?
   a) Elastic method
   b) Ultimate load method
   c) Mechanism method
   d) Finite element method
   Answer: c) Mechanism method

5. In a bolted connection, what is the minimum edge distance for a 20 mm bolt as per IS 800-2007?
   a) 20 mm
   b) 25 mm
   c) 30 mm
   d) 40 mm
   Answer: c) 30 mm

6. What is the typical grade of structural steel used for hot-rolled steel sections in construction?
   a) Fe250
   b) Fe415
   c) Fe500
   d) Fe600
   Answer: a) Fe250

7. Which of the following factors does NOT affect the lateral torsional buckling of a beam?
   a) Moment of inertia about the weak axis
   b) Effective length of the beam
   c) Moment of inertia about the strong axis
   d) Type of loading
   Answer: c) Moment of inertia about the strong axis

8. For a tension member, the critical limit state to be checked is:
   a) Buckling
   b) Yielding of the gross section
   c) Flexural strength
   d) Shear strength
   Answer: b) Yielding of the gross section

9. In a welded connection, the throat thickness for a fillet weld is typically:
   a) 0.707 times the weld size
   b) Equal to the weld size
   c) 1.5 times the weld size
   d) Twice the weld size
   Answer: a) 0.707 times the weld size

10. What is the role of intermediate stiffeners in a plate girder?
    a) To resist lateral torsional buckling
    b) To increase the bending capacity of the flange
    c) To prevent shear buckling of the web
    d) To connect the flange to the web
    Answer: c) To prevent shear buckling of the web

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Mid Term Paper-I

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR
B. TECH III YEAR (VI SEM.) – MT-I (APRIL'23)
Design Of Steel Structure (6CE4-04)

Time: 3 Hr **Max. Marks:** 70

Note:

1. The paper is divided into 2 parts: Part-A and, Part-B.
2. Part-A contains 10 questions and carries 2 mark each.
3. Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

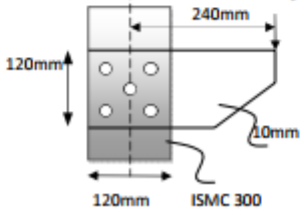
	SECTION A (WORD LIMIT 25 WORDS)	
a	Write an advantages and Disadvantages of structural steel.	CO1
b	Define the Limit State Design Method in steel designing.	CO1
c	Differentiate of bolted and welded connections.	CO1
d	Brief the failure modes of the bolted connection with their sketch	CO1
e	Write the design steps of bolted connections.	CO2
f	What is Prying force action?	CO2
g	What do you mean by Block shear failure?	CO2
h	What are the section classifications as per IS 800:2007?	CO2
i	Define the term 'Web Buckling' and 'Web Crippling'?	CO3
j	What do you mean by laterally supported and unsupported beam?	CO3

Section B (50 Marks)

Q1 Explain the design steps of bolted connections. [CO1]

OR

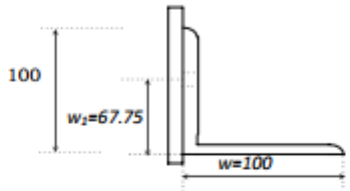
Q1 A plate bracket connection is shown in fig., a factored load P acts at 240 mm from centroidal axis of the column. There are 5 bolts of M20 of grade 4.6 are used. Determine the maximum value of the factored load P which can be carried safely. [CO1]



Q2 Design the welded joint for a single angle section ISA 100x100x8 mm with a gusset plate of 10 mm thick, the member is subjected to a working pull of 300 kN. Assume connection is made in workshop. [CO1]

OR

Q2 Design a single Equal angle 100 x 100 x 8 mm, connected to a gusset plate at the ends with 20mm diameter bolts with the connection length of 250mm to transfer tension as shown in Fig. Take fy = 250 Mpa and fu = 410 Mpa. [CO1]



Q3 Explain in brief the failure modes of the tension member with their sketch. [CO2]

OR

Q3 what is the prying action in tension member? How it is accounted for? [CO2]

Q4 Discuss the design steps of laced column as per IS 800:2007. ? [CO2]

OR

O4 An ISMB 450 is to be used as a short column carrying axial load. The height of Column is 3.5 m and it is pin ended. Determine the design axial load carrying-Capacity of the section. Assume fy = 250 Mpa, fu = 410 Mpa and E = 2 x 105 Mpa. [CO2]

Q5 Explain the slab base and gusseted base with neat sketch. [CO3]

OR

Q5 Design a double angle discontinuous strut to carry a factored load of 135 KN, the Length of strut is 3 m. check the capacity of angles when placed back to back with a 12 mm thick gusset plate. Use steel of grade Fe 410. [CO3]

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Marks and Gap Analysis of Mid-Term I

S.No.	University Roll No.	Name of Student	Mid-Term 1 MM-70	Remark (Remedial Class need or not – Y/N)
1.	21ETCCE001	Dev vaishnav	52	N
2.	21ETCCE002	Hitesh Sutradhar	47	N
3.	21ETCCE004	Naved khan	50	N
4.	21ETCCE006	Pushpendra gehlot	52	N
5.	21ETCCE007	Shalin Dak	45	N
6.	21ETCCE009	Tamanna kumawat	58	N
7.	21ETCCE300	Muniraj Sharma	56	N
8.	22ETCCE200	Moiz Udaipurwala	52	N
9.	22ETCCE201	Vikas Suthar	52	N

(Y, if obtained marks are <50%)

Signature of Faculty: **Signature of HOD**

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Remedial Action Taken to Remove the Gaps (After Mid- Term 1)

S.no.	University Roll no.	Name of Student	Topics to be discussed in Remedial Class	Schedule Date of Remedial Class	Outcome Achieved
1.	NIL				
2.					

Signature of Faculty: **Signature of HOD**

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Mid Term Paper-II

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 3rd – YEAR (VI SEM.) – MT-II SUBJECT: DESIGN OF STEEL STRUCTURES (6CE3-01)

Time: 3 Hr **Max. Marks: 70**

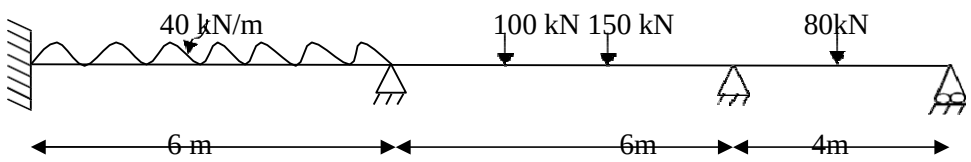
Note:

1. **The paper is divided into 2 parts: Part-A and Part-B.**
2. **Part-A contains 10 questions and carries 2 marks each.**
3. **Part-B contains 5 questions. Each question has two options and carries 10 marks each.**

Part- A (20 Marks)

A.	Define shape factor.	CO3
B.	What are the conditions and basic theorems of plastic analysis?	CO3
C.	What do you mean by 'formation of plastic hinge' in beams?	CO4
D.	Differentiate slab base and column base.	CO4
E.	Write the purposes of gantry girder in industrial building?	CO4
F.	List the loads that should be considered while designing a gantry girder.	CO4
G.	List the components of plate girder.	CO5
H.	Write the various loads to analysis of roof trusses.	CO5
I.	List the components of roof trusses. Brief the application of purlins	CO5
J.	What are the various types of stiffeners?	CO5

Part- B (50 Marks)

1. Explain shape Factor and its applications. Determine the shape factor for Diamond shaped section.	CO3
OR	
1. Find out the value of plastic moment capacity in continuous beam. 	CO3

2. Draw neat sketch of gantry girder. Explain design steps of gantry girder.	CO4
OR	
2. Explain the followings with neat sketch (Any two) a) Type of stiffeners in plate girder b) Discuss the tension field action of thin web	CO4

3. Determine maximum bending moment and shear force on gantry girder for given data: Span of gantry girder = 5 m Crane capacity = 200 kN Span of crane girder =15 m Self weight of crane girder excluding trolley = 200 kN Self weight of trolley = 30 kN Minimum hook approach = 1 m Distance between wheels = 3.5m c/c Self weight of rails = 0.3 kN/m	CO4
OR	
3. Determine the moment capacity and shear capacity of the plate girder in span 20 m subjected to 80 kN/m of including self weight. Assume the steel FE 410.	CO4

4. Describe the pre engineering buildings. Also explain the various components of it.	CO5
OR	
4 Explain briefly : a) Lateral bracing b) Portal bracing	CO5

5. Explain Use of internal gusset plates in through type plate girder	CO5
OR	
5 Write a short note on “Overturning effect due to wind load on Railway Bridge.	CO5

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Marks and Gap Analysis of Mid-Term II

S.No.	University Roll No.	Name of Student	Mid-Term 2 MM-70	Remark (Remedial Class need or not – Y/N)
1.	21ETCCE001	Dev vaishnav	51	N
2.	21ETCCE002	Hitesh Sutradhar	46	N
3.	21ETCCE004	Naved khan	49	N
4.	21ETCCE006	Pushpendra gehlot	51	N
5.	21ETCCE007	Shalin Dak	44	N
6.	21ETCCE009	Tamanna kumawat	57	N
7.	21ETCCE300	Muniraj Sharma	55	N
8.	22ETCCE200	Moiz Udaipurwala	51	N
9.	22ETCCE201	Vikas Suthar	51	N

(Y, if obtained marks are <50%)

Signature of Faculty: **Signature of HOD**

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Remedial Action Taken to Remove the Gaps (After Mid- Term 1I)

S.no.	University Roll no.	Name of Student	Topics to be discussed in Remedial Class	Schedule Date of Remedial Class	Outcome Achieved
1.	NIL				
2.					

Signature of Faculty: **Signature of HOD**

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Model Question Paper

1005318

7E7062

Roll No. _____ Total No. of Pages : 4

7E7062

B.Tech VII Semester (Main/Back) Examination, November - 2019

Civil Engg.

7CE2A Design of Steel Structures - I

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

1. I.S. 800-2007 *2. Steel Tables*

Unit - I

1. a) Discuss briefly types of steels used in structures. (4)

b) How a cross section is classified as per the code? Briefly state their characteristics. (4)

c) Using kinematical method or otherwise compute the collapse load for the beam shown in fig. 1. (8)

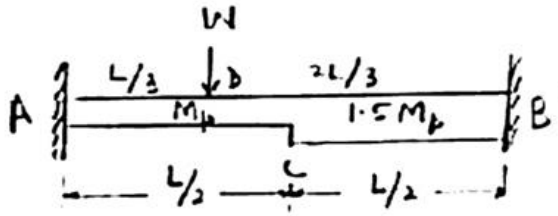


Fig. - 1

OR

1. a) Calculate the shape factor for a diamond section. **(4)**

   b) A portal frame is loaded as shown in Fig. 2. Compute the true value of collapse load. **(12)**

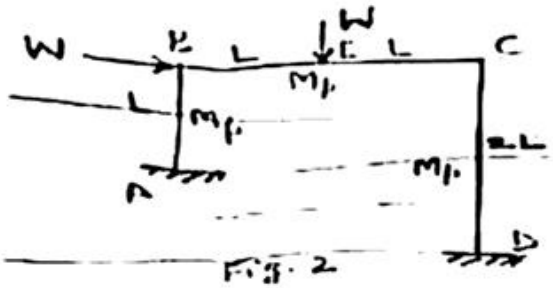
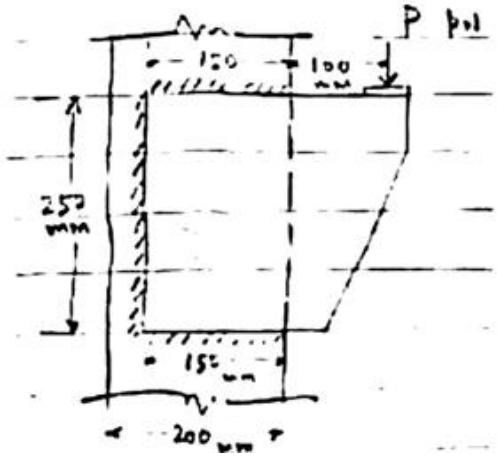


Fig. 2

Unit - II

2. a) Calculate the strength of a 20 mm diameter bolt of grade 4.6 to be used in a lap joint. The main plates are 12 mm thick each. **(4)**

   b) Fig.3 shows an eccentrically loaded fillet weld connection. Calculate the maximum value of factored load P to be applied as shown so that the connection is safe. The weld sized throughout is 6 mm. **(12)**



OR

2. a) Briefly explain 'prying action' in bolted connection. **(4)**

   b) Design a single angle section for a tension member to carry a factored axial load of 200 kN. Use unequal angle and 18 mm. bolts. **(12)**

Unit - III

3. a) What are buckling classes and how do they affect compressive carrying capacity of columns? **(6)**

   b) An angle section ISA 100×75×10 has been used in a steel roof truss as a strut. Find the maximum factored axial load which it can take safely. The length between centres of connections may be taken as 1.5 m. **(10)**

OR

3. Design a built up column taking two channels placed face to face, to carry an axial compressive load of 1300 kN. the height of the column is 3.5 m and is hinged at both ends. Also design a single system of lacings for the column. **(16)**

Unit - IV

4. a) What is 'lateral torsional buckling' with reference to a beam design. **(4)**

   b) A beam of span 4.0 m is simply supported at the ends. It carries a super imposed load of 20 kN/m over the whole length. Design a suitable I section for the beam if it is laterally supported. **(12)**

OR

4. a) Differentiate between "web buckling" and "web crippling" in a beam design. **(6)**

   b) A simply supported beam of span 5 m consists of a section ISLB 450 @ 65.26 kg/m. The compression flange of the beam is laterally unrestrained. Determine the design moment of the beam. Also calculate maximum u.d.l. which it can carry safely. **(10)**

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STUDENT PERFORMANCE REPORT

Roll No.	Name of Student	I Mid-Term	II Mid-Term	Average
21ETCCE001	Dev vaishnav	52	51	51.5
21ETCCE002	Hitesh Sutradhar	47	46	46.5
21ETCCE004	Naved khan	50	49	49.5
21ETCCE006	Pushpendra gehlot	52	51	51.5
21ETCCE007	Shalin Dak	45	44	44.5
21ETCCE009	Tamanna kumawat	58	57	57.5
21ETCCE300	Muniraj Sharma	56	55	55.5
22ETCCE200	Moiz Udaipurwala	52	51	51.5
22ETCCE201	Vikas Suthar	52	51	51.5

Signature of Faculty: **Signature of HOD**

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RESULT ANALYSIS

S.NO.	RTU ROLL NUMBER	NAME OF STUDENT	END TERM MARKS	SESSIONAL MARKS	TOTAL
		MAX MARKS	**70**	**30**	**100**
1.	21ETCCE001	Dev vaishnav	27	23	50
2.	21ETCCE002	Hitesh Sutradhar	31	21	52
3.	21ETCCE004	Naved khan	1	22	23
4.	21ETCCE006	Pushpendra gehlot	16	23	39
5.	21ETCCE007	Shalin Dak	26	20	46
6.	21ETCCE009	Tamanna kumawat	AB	26	AB
7.	21ETCCE300	Muniraj Sharma	44	25	69
8.	22ETCCE200	Moiz Udaipurwala	33	23	56
9.	22ETCCE201	Vikas Suthar	33	23	56

TOTAL	PASS	FAIL	ABSENT	PASS %
9	7	1	1	77.78%

Indirect Assessment:

Overall Teacher Self-Assessment (at the completion of course) in terms of course objective and outcomes

Course Objectives:

Upon completing the Design of Steel Structures course, students will be able to analyze the structural behavior of steel components using plastic analysis methods and classify cross-sections as per IS 800-2007. They will gain the ability to design bolted and welded connections, considering load transfer mechanisms and accounting for axial and eccentric loadings according to IS codes. Students will learn to calculate the design strength of tension and compression members, including considerations for net section rupture, block shear, and buckling behavior. They will develop skills in designing various steel structural elements, such as beams, columns, plate girders, and gantry girders, addressing aspects like lateral torsional buckling and web buckling. Additionally, students will be equipped to evaluate the structural performance of roof trusses, purlins, and pre-engineered building components under diverse loading conditions, including wind loads.

Course Outcomes:

At the end of this course students will be able to:

CO1: Learner will be able to solve the designing of tension and compression members.

CO2: Learner will be able to solve the designing of beams and beam columns.

CO3: Learner will be able to solve the designing of bolt and weld connections..

CO4: Learner will be able to solve the designing of the gantry girder

CO5: Classify and design the structural steel components of industrial building.

Methodology to identify bright student

It is done by considering a range of criteria, including academic performance, creativity, critical thinking, problem-solving skills, and enthusiasm for learning. Bright students often excel in multiple areas. Observed how students perform in the classroom. In terms of active participation, engagement in discussions, leadership, and the ability to grasp complex concepts.

Efforts to keep students engaged

1. **Active Learning:** Incorporate active learning strategies, such as group discussions, problem-solving activities, and hands-on projects. Active participation keeps students engaged and encourages critical thinking.
2. **Varied Teaching Methods:** Use a variety of teaching methods, including lectures, group work, multimedia presentations, and interactive activities to cater to different learning preferences.
3. **Technology Integration:** Leverage technology, such as online platforms, educational apps, and interactive software, to make lessons more engaging and interactive.

Methodology to identify weak student

It is done by considering a range of criteria, including classroom observation, formative assessment, summative assessment, assignment review etc. Weak students are struggling students with sensitivity and a desire to support their learning. Some measures, such as additional tutoring, personalized assignments, or alternative assessment methods, to help students succeed.

Targeted inventions for weak student

1. Additional Resources

Offer supplementary learning materials, such as textbooks, online resources, or multimedia content, to provide alternative explanations and reinforce key concepts.

2. Remedial classes

Establish a tutoring program where students can receive extra help from teachers.

3. Flipped classroom

Students are assigned pre-class learning materials, often in the form of videos, readings, or online modules, to cover the foundational concepts before coming to class.