

Course File

Engineering Mechanics (3CE3-04)

Semester: III Year: II (2023-24)

Name of faculty: Nishit Jain

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Total Number of Lectures: 28

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VISSION & MISSION OF INSTITUTE

Vision

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.

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.

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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).

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.

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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 Overview:

Engineering Mechanics is the practical application of mechanics concerned with the behavior of bodies subjected to external forces or displacement. The main objective of this course to help student's development a thorough understanding of the theories and principle and thereby acquire analytical capability required to solve real life problems.

- . Relevance to Branch: The subject has the significance to understand & develop intuitive understanding of the subject to present world engineering examples to give students a feel of how engineering mechanics is useful in engineering practices.
- a. Relevance to Society: Providing adequate information about the mechanics which are beneficial to the society development and comfort to the occupant.
- b. Relevance to self-knowledge: Understand concept of mechanical behavior of materials and calculations of same using appropriate equations.

Course Outcome:

3CE3-04	Cognitive Level	
3CE3-04.1	Understand	Describe free body diagrams and Solve the resultant of forces and/or Moments.
3CE3-04.2	Apply	Apply laws of mechanics to determine efficiency of simple machines with Consideration of friction.
3CE3-04.3	Apply	Execute solutions for planar frames and analyses the motion.
3CE3-04.4	Apply	Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.
3CE3-04.5	Apply	Solve the centroid and second moment of area of sections.

Prerequisites:

Necessary Background: Vector calculus, ordinary and partial differential equations, some exposure to complex variables. Undergraduate course in fluid mechanics or a background in Newtonian mechanics.

Mapping COs, POs and PSOs:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO23304.1	2	2	0	1	0	1	1	0	0	0	0	1	1	1	0
CO23304.2	2	2	0	1	0	1	0	0	0	1	0	0	1	1	0
CO23304.3	2	2	0	1	0	2	0	2	1	1	2	1	1	1	0
CO23304.4	2	2	0	1	0	2	0	2	1	1	2	1	1	1	0
CO23304.5	2	2	0	0	0	1	0	0	0	1	0	0	1	1	0

UNIVERSITY ACADEMIC CALENDAR

Academic Calendar for Odd Semester for Session

RAJASTHAN TECHNICAL UNIVERSITY KOTA				
Course: Bachelor of Technology (B.TECH.) for Odd Semester				
Semester	I	III	V	VII
Induction Program	17.08.2023			
Commencement of Classes	11.09.2023	24.08.2023	04.09.2023	04.09.2023
Commencement of First Mid Term	02.11.2023	03.10.2023	05.10.2023	05.10.2023
Commencement of Second Mid Term	07.12.2023	16.11.2023	20.11.2023	20.11.2023
Last Working Day	23.12.2023	02.12.2023	02.12.2023	30.11.2023
Commencement of Practical Exams	02.01.2024	04.12.2023	23.12.2023	14.12.2023
Commencement of Theory Exams	18.01.2024	14.12.2023	08.12.2023	07.12.2023
Winter Break				

ACADEMIC CALENDAR OF INSTITUTE

Academic Calendar

Academic Calendar for Odd Semester for Session 2023-24 (Odd Semester)

Course: Bachelor of Technology (B.TECH.)				
Semester	I	III	V	VII
Induction Program	10-08-2023			
Commencement of Classes	20-08-2023	11-09-2023	30-08-2023	22-08-2023
Commencement of First Mid Term	04-11.2023	02-11.2023	02-11.2023	27-09-2023
Commencement of Second Mid Term	15-01-2024	27-12-2023	27-12-2023	05-12-2023
Last Working Day	20-01-2024	12-01-2024	12-01-2024	20-12-2023
Commencement of Practical Exams	29-01-2024	15-01-2024	15-01-2024	31-12-2023
Commencement of Theory Exams	15-02-2024	30-01-2024	29-01-2024	27-12-2023

Evaluation Scheme

FACULTY DETAILS:

Name of the Faculty : Mr. Nishit Jain
Designation : Assistant Professor
Department : Civil Engineering

1. TARGET

- a) Percentage Pass : 100 %
- b) Percentage I class: 70 %

2. METHOD OF EVALUATION

- 2.1. Continuous Assessment Examinations (Mid-Term 1 & 2)
- 2.2. Assignments / Seminars
- 2.3. Mini Projects
- 2.4. Quiz
- 2.5. 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.

1. 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

UNIVERSITY SYLLABUS



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

II Year - III Semester: B.Tech. (Civil Engineering)

3CE3-04: ENGINEERING MECHANICS

Credit: 2
2L+0T+0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

SN	CONTENT	Hrs.
1	Introduction: objective, scope and outcome of the course.	1
2	Statics of particles and rigid bodies: Fundamental laws of mechanics, Principle of transmissibility, System of forces (conservative and non-conservative), Resultant force, Resolution of force, Moment and Couples, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem.	4
3	Plane trusses: Types of structures, Trusses, Support Conditions, Types of Loadings, Classification of trusses, Determinacy of trusses, Basic assumptions of truss analysis (zero force member, tension or compression member), Method of joints, Method of sections.	4
4	Centroid & Moment of inertia (M.I.): Location of centroid, Moment of inertia (mass and area), Parallel axis and perpendicular axis theorems, M.I of composite section, M.I. of solid bodies, Polar moment of inertia, principle axis and principle moment of inertia.	4
5	Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium. Work, Energy and Power: Work of a force, weight and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservation of energy.	4
6	Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction.	2
7	Springs: Stiffness of springs, springs in series and parallel, Introduction to laminated plate springs, leaf spring, close coiled helical springs, open coiled springs.	2
8	Simple Stresses and Strains: Concept of stress and strain in three dimensions and generalized Hooke's law; Young's modulus, Shear stress, Shear strain, Modulus of rigidity, Complementary shear stress; Poisson's ratio, Volumetric strain, Bulk modulus, relation between elastic constants, Stress and strain thin cylinder and spherical cell under internal pressure.	7
TOTAL		28

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

TEXT/REFERENCEBOOKS

1. Vector Mechanics for Engineers, and Johnston, TataMcGraw-Hill.
2. Engineering Mechanics, Hibbeler, Pearson Education.

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3. Engineering Mechanics, Meriam and Kraige, John Wiley & Sons.
4. Engineering Mechanics, Timoshenko and Young, Tata Mc Graw-Hill.
5. Engineering Mechanics, Shames, Pearson Education

WEEKLY TIME TABLE OF THE TEACHER

First Time Table: with effect from (Date): Effective from 17 August 2023

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

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COURSE-PLAN

Lect. No.	UNIT	TOPICS	Teaching Methods/ Teaching Aids
1.	1	INTRODUCTION: Objective, scope and outcome of the course.	White Board, PPT,
2.	2	Student should be able to understand Fundamental laws of mechanics, Principle of transmissibility	White Board, PPT, Demonstration
3.	3	Student should be able to understand System of forces (conservative and non-conservative), Resultant force, Resolution of force	White Board
4.	3	Student should be able to understand Moment and Couples, Resolution of a force in to a force and a couple	White Board
5.	3	Student should be able to understand Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem	White Board
6.	4	Student should be able to understand Plane trusses: Types of structures, Trusses, support Conditions, Types of Loadings	White Board, PPT
7.	4	Student should be able to understand Classification of trusses, Determinacy of trusses, Basic assumptions of truss analysis (zero force member, tension or compression member)	White Board
8.	4	Student should be able to understand METHOD OF JOINTS	White Board
9.	5	Student should be able to understand Method of sections	White Board, PPT
10.	5	Student should be able to understand CENTROID & MOMENT OF INERTIA (M.I.): Location of centroid, Moment of inertia (mass and area)	White Board
11.	5	Student should be able to understand Parallel axis and perpendicular axis theorems	White Board
12.	6	Student should be able to understand M.I of composite section, M.I. of solid bodies	White Board, PPT,
13.	6	Student should be able to understand Polar moment of inertia, principle axis and principle moment of inertia.	White Board
14.	6	Student should be able to understand Virtual work: Principle of Virtual Work, Active forces boundaries	White Board, PPT, Demonstration

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15.	6	Student should be able to understand Active force diagram, Stability of equilibrium	White Board
16.	6	Student should be able to understand Work of a force, weight and couple, Power, Efficiency, Energy	White Board
17.	6	Student should be able to understand Kinetic energy of rigid body, Principle of work and energy, Conservation of energy.	White Board
18.	7	Student should be able to understand Types of Friction, Laws of friction, Angle of friction, Angle of repose	White Board
19.	7	Student should be able to understand Ladder, Wedge, Belt Friction	White Board, PPT
20.	7	Student should be able to understand Stiffness of springs, springs in series and parallel, Introduction to laminated plate springs.	White Board
21.	7	Student should be able to understand Leaf spring, close coiled helical springs, open coiled springs.	White Board, PPT
22.	7	Student should be able to understand Concept of stress and strain in three dimensions	White Board
23.	8	Student should be able to understand generalized Hooke's law; Young's modulus	White Board, PPT,
24.	8	Student should be able to understand Shear Stress, Shear Strain	White Board
25.	8	Student should be able to understand Modulus of rigidity, Complementary shear stress	White Board, Demonstration
26.	8	Student should be able to understand Poisson's ratio, Volumetric strain, Bulk modulus	White Board
27.	8	Student should be able to understand Relation between elastic constants	White Board
28.	8	Student should be able to understand Stress and strain thin cylinder and spherical cell under internal pressure	White Board

Signature of Faculty:

Signature of HOD

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Assignment Sheet

ASSIGNMENT NO. 1

CO.N O.	Problem description
1	<p>A. Explain various types of system of forces with suitable examples.</p> <p>B. In the figure shown below, masses P and Q are suspended with inelastic strings, and are in static equilibrium. Determine the mass of block Q.</p> <p>C. Determine the support reactions and force in all members of the Truss shown below.</p>
2	<p>A. Compute the centroid of area shown in figure below and find moment of inertia of area about horizontal axis passing through its centroid.</p> <p>B. State and prove law of parallelogram of forces.</p> <p>C. Determine the magnitude and direction of the resultant of force system shown in figure below.</p>

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3	<p>A. DeterminethesupportreactionsandforcesinmembersAB,BDand CD,oftheTrussshownbelow.</p> <p>B. Computethecentroidoftheareashowninfigurebelow.Thenfindits</p>
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SAMPLE QUIZ QUESTIONS

Q1: What is the primary objective of studying the statics of particles and rigid bodies?

- a) To study dynamic motion
- b) To understand the principles of equilibrium
- c) To analyze fluid flow
- d) To design electrical circuits

Solution: b) To understand the principles of equilibrium

Q2: Which of the following best describes the Principle of Transmissibility?

- a) The sum of forces in a system is always zero
- b) A force can be applied at any point along its line of action without changing the equilibrium
- c) Forces can be transmitted through cables
- d) Forces are always transmitted through rigid bodies

Solution: b) A force can be applied at any point along its line of action without changing the equilibrium

Q3: The resultant of two concurrent forces of 50 N and 30 N acting at an angle of 90° is:

- a) 80 N
- b) 20 N
- c) 58.31 N
- d) 40 N

Solution: c) 58.31 N

Q4: Lami's theorem is applicable when:

- a) Three forces acting at a point are in equilibrium
- b) Four forces acting on a body are in equilibrium
- c) The system is under dynamic conditions
- d) The system is frictionless

Solution: a) Three forces acting at a point are in equilibrium

Q5: In a Free Body Diagram (FBD), which of the following is represented?

- a) Internal stresses
- b) Only forces applied externally
- c) Both external forces and moments
- d) Forces only acting on internal joints

Solution: c) Both external forces and moments

Q6: A truss is statically determinate if:

- a) $m + r < 2j$
- b) $m + r > 2j$
- c) $m + r = 2j$
- d) None of the above

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Solution: c) $m + r = 2j$

Q7: The method of joints in truss analysis involves:

- a) Analyzing the entire structure at once
- b) Considering the equilibrium of each joint separately
- c) Using the properties of materials to find forces
- d) Ignoring zero-force members

Solution: b) Considering the equilibrium of each joint separately

Q8: In a truss, a zero-force member is one that:

- a) Carries the maximum load
- b) Does not carry any force
- c) Is in compression
- d) Is subjected to bending

Solution: b) Does not carry any force

Q9: A tension member in a truss:

- a) Is subjected to pulling forces
- b) Is subjected to compressive forces
- c) Always experiences bending
- d) Is unaffected by external loads

Solution: a) Is subjected to pulling forces

Q10: The centroid of a composite area can be found using:

- a) Parallel axis theorem
- b) Perpendicular axis theorem
- c) Integration only
- d) Division of area into simpler shapes

Solution: d) Division of area into simpler shapes

Q11: The moment of inertia of a rectangular section about its base is given by:

- a) $\frac{bh^3}{12}$
- b) $\frac{bh^3}{36}$
- c) $\frac{bh^3}{3}$
- d) $\frac{bh^2}{3}$

Solution: c) $\frac{bh^3}{3}$

Q12: The Parallel Axis Theorem is used to find:

- a) The centroid of a body
- b) The moment of inertia about any axis parallel to the centroidal axis
- c) The force in a beam
- d) The displacement of a point

Solution: b) The moment of inertia about any axis parallel to the centroidal axis

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Q13: The polar moment of inertia is primarily used in the analysis of:

- a) Shear stresses
- b) Bending moments
- c) Torsion
- d) Axial forces

Solution: c) Torsion

Q14: The Principle of Virtual Work states that:

- a) The work done by all forces is always positive
- b) The total virtual work done by all external forces in equilibrium is zero
- c) Work and energy are equivalent
- d) Virtual work only applies to dynamic systems

Solution: b) The total virtual work done by all external forces in equilibrium is zero

Q15: Which of the following is true for the principle of conservation of energy?

- a) Energy can be created or destroyed
- b) Total mechanical energy remains constant if only conservative forces are acting
- c) Kinetic energy is always conserved
- d) The principle applies only to non-conservative forces

Solution: b) Total mechanical energy remains constant if only conservative forces are acting

Q16: Stability of equilibrium means:

- a) The system will always move towards a lower energy state
- b) The system returns to its original position after a disturbance
- c) The system remains in motion after being disturbed
- d) The system will never return to its original position

Solution: b) The system returns to its original position after a disturbance

Q17: Static friction differs from kinetic friction because:

- a) Static friction is always less than kinetic friction
- b) Static friction acts when there is relative motion between surfaces
- c) Static friction acts to prevent the initiation of sliding
- d) Kinetic friction only occurs in liquids

Solution: c) Static friction acts to prevent the initiation of sliding

Q18: The angle of repose is the:

- a) Angle at which a body begins to slide on an inclined plane
- b) Angle at which maximum friction is achieved
- c) Angle between the normal force and the frictional force
- d) Angle at which no frictional force exists

Solution: a) Angle at which a body begins to slide on an inclined plane

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Q19: Belt friction is significant in:

- a) Water pipelines
- b) Transmission of power in belt-driven systems
- c) Heat exchangers
- d) Hydraulic systems

Solution: b) Transmission of power in belt-driven systems

Q20: When two springs with stiffness (k_1) and (k_2) are in series, the equivalent stiffness (k_{eq}) is given by:

- a) $(k_1 + k_2)$
- b) $(\frac{k_1 \times k_2}{k_1 + k_2})$
- c) $(\frac{k_1}{k_2})$
- d) $(k_1 \times k_2)$

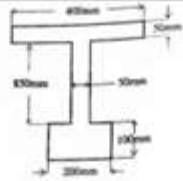
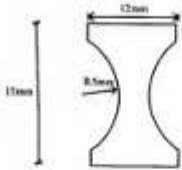
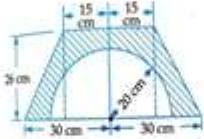
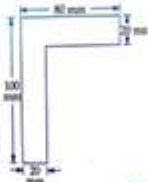
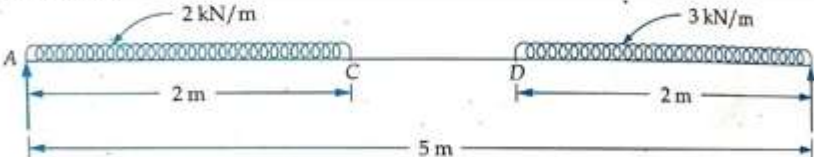
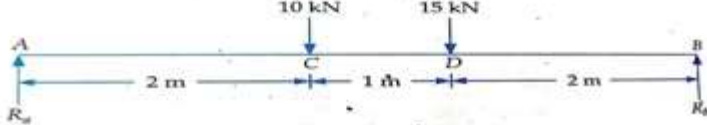
Solution: b) $(\frac{k_1 \times k_2}{k_1 + k_2})$

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MID-TERM PAPERS

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR B. TECH 2nd - YEAR (III SEM.) - MT-I Engineering Mechanics (Subject Code: 3CE3-04/ 3ME3-04) Time: 2 Hr Max. Marks: 70		
Note: The paper is divided into 2 parts: Part-A and, Part-B. Part-A contains 10 questions and carries 2 mark each. Part-B contains 5 questions. Each question is having two options and carries 10 marks each		
PART A: 20 MARKS (WORD LIMIT 25 WORDS)		
A.	State Lamé's theorem.	CO1
B	What is a free body diagram?	CO1
C	State Newton's second law of motion.	CO1
D.	What is parallelogram law of forces?	CO1
E	What is the difference between space & plane frame?	CO2
F	What is the condition for statically determinate structure?	CO2
G	What do you understand by COG & Centroid?	CO2
H	State perpendicular axis theorem.	CO2
I	What all forces are omitted while applying the principle of virtual work?	CO3
J	State principle of Virtual Work.	CO3
PART B: 50 MARKS		
1	An eye bolt as shown in fig is subjected to $F_1 = 100 \text{ N}$ and $F_2 = 150 \text{ N}$. Determine the magnitude and direction of resultant force. <div style="text-align: center;"> </div>	CO1
OR		
	Analyze the following truss and find forces in all the members.	
2	For simply supported truss as shown,. Find BD, DE, EG, CE, using method of section. <div style="text-align: center;"> </div>	CO2
OR		
	The resultant of two forces F_1 & F_2 when acting at 20° is 24.635 N and when acting at 70° is 20.679 N . Find the magnitude of forces.	
	Find the MOI Ixx of the shape as shown below.	

			
	OR		
3.	<p>The cross section of cast iron beam as shown below. Determine the MOI of section about horizontal & Vertical axis passing through the centroid of the section.</p>	CO3	
			
	<p>Locate the position of the centroid of the plane shaded area depicted in fig given.</p>	CO2	
			
	OR		
4.	<p>Locate the position of the centroid of the plane shaded area depicted in fig given.</p>	CO2	
			
	<p>A Beam of span 5m is supported at A and B and is subjected to a load system shown in the fig. Using the Principle of virtual work, find the reaction at A and B.</p>	CO3	
			
	OR		
5.	<p>A Beam of span 5m is supported at A and B and is subjected to a load system shown in the fig. Using the Principle of virtual work, find the reaction at A and B.</p>	CO3	
			

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Marks and Gap Analysis of Mid-Term 1

S.No	University Roll No.	Name of Student	Mid-Term 1 MM-70	Remark (Remedial Class need or not – Y/N)
1.	22ETCCE001	ANKIT KUMAR	52	N
2.	22ETCCE002	ARMAAN CHAUHAN	45	N
3.	22ETCCE003	AYUSH SINGH JHALA	47	N
4.	22ETCCE004	PARIDHI NINAMA	61	N
5.	22ETCCE005	PRAVEEN DANGI	56	N
6.	22ETCCE006	ROSHNI TABIYAR	63	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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TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

DEPARTMENT OF CIVIL ENGINEERING

II MIDTERM- 2023-24

SUB: ENGINEERING MECHANICS (3CE3-04)

TIME: 3Hrs

MM:70

PART-A (word limit 25)

[10*2=20]

1. Write down the expression of stiffness for spring. [CO1]
2. Write the names of different types of friction. [CO1]
3. State the Lami's theorem. [CO2]
4. Write the conditions for equilibrium of a body. [CO2]
5. What is the difference between close coiled helical springs and open coiled helical springs? [CO3]
6. State the principle of virtual work. [CO3]
7. What do you mean by complementary shear stress. [CO4]
8. What is the value of poisson's ratio for mild steel. [CO4]
9. What are the units of work done. [CO5]
10. What are the various characteristics of a force? [CO5]

PART-B (Word limit: 100)

[5*4=20]

1. A load with as mass 5 Kg was lifted up by Pulley to the height of 0.8 m for pile work. (Use, $g= 9.81 \text{ ms}^{-2}$). What is Potential Energy the load. [CO1]
2. Explain Stress Strain Curve of mild steel in tension showing its all principal points. [CO2]
3. Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 45? [CO3]
4. State and explain Newton's laws of mechanics. [CO4]
5. Explain the method of sections and method of joints for plane truss. [CO5]

PART C (Any three)

[3x10=30]

1. Four forces of magnitude P, 2P, $3\sqrt{3}P$, and 4P are acting at a point O. The angles made by these forces with x - axis are 0° , 60° , 150° , and 300° respectively. Find the magnitude and direction of the resultant force. [CO1]
2. Bring out the differences among perfect, deficient and redundant trusses. [CO2]
3. Find the moment of inertia of a rectangular section 60 mm wide and 40 mm deep about its centre of gravity. [CO3]
4. A trolley of mass 200 kg moves on a level track for a distance of 500 metres. If the resistance of the track is 100 N, find the work done in moving the trolley. [CO4]
5. A circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40kN. The modulus of elasticity for steel is 200 kN/mm². Find
 - a. Stresses
 - a. Strain
 - b. Elongation of rod due to applied load. [CO5]

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Marks and Gap Analysis of Mid-Term II

Sr. No.	University Roll No.	Name of Student	Mid-Term 2 MM-70	Remark (Remedial Class need or not – Y/N)
1.	22ETCCE001	ANKIT KUMAR	51	N
2.	22ETCCE002	ARMAAN CHAUHAN	44	N
3.	22ETCCE003	AYUSH SINGH JHALA	46	N
4.	22ETCCE004	PARIDHI NINAMA	60	N
5.	22ETCCE005	PRAVEEN DANGI	55	N
6.	22ETCCE006	ROSHNI TABIYAR	62	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 II)

Sr. No.	University Roll no.	Name of Student	Topics to be discussed in Remedial Class	Schedule Date of Remedial Class	Course Outcome
1.	NIL				

Signature of Faculty:

Signature of HOD

PREVIOUS YEAR PAPERS

3E1213

3E1213

B.Tech. III-Sem. (Main & Back) Examination, January/February - 2024
Civil Engg.
3CE3-04 Engineering Mechanics
3E1213

Total No. of pages

Time : 3 Hours **Maximum Marks : 70**
Instructions to Candidates:

Attempt all Ten questions from Part A, Five questions out of seven questions from Part B and Three questions out of five questions from Part C.
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)

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory **(10×2=20)**

1. State Lami's theorem.
2. Define 'zero force member' in a truss.
3. Define coplanar, collinear, and concurrent forces.
4. Write down the assumption used in the analysis of pin-jointed frames.
5. Define the complementary shear stress.
6. State the parallel axis theorem of the moment of inertia.
7. State the principle of virtual work.
8. Define the angle of friction and coefficient of friction.
9. Define the modulus of rigidity and bulk modulus.
10. What is the parallelogram law of forces?

3E1213/2024**(1)****[Contd....**

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PART - B

(Analytical/Problem solving questions)

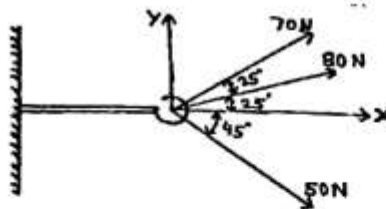
Attempt any Five questions

(5×4=20)

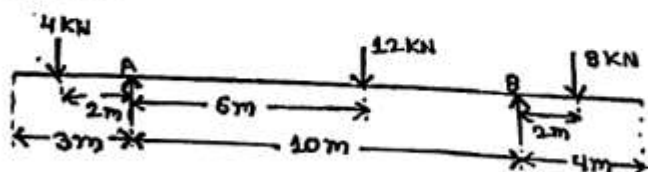
1. Draw and explain the stress-strain curve of mild steel in tension showing all its principal points.
2. Explain the difference between perfect, deficient, and redundant trusses with example.
3. A sphere of weight 100 N is tied to a smooth wall by a string as shown in the figure. The string makes an angle of 15° with the vertical wall. Calculate the tension 'T' in the string and reaction 'R' of the wall.



4. Determine the resultant of forces shown in the figure below:



5. State and prove the 'law of conservation of energy'.
6. By the Principle of virtual work, determine the reactions for the beam shown in the figure below.



3E1213

(2)

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7. Define the terms:
- Centre of gravity.
 - Centroid.
 - Polar moment of inertia.
 - Radius of gyration.

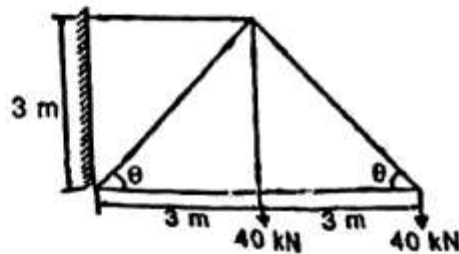
PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

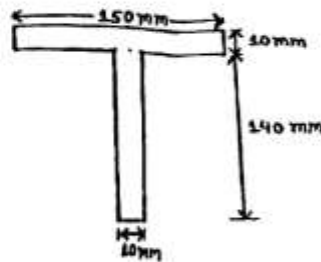
Attempt any three questions

(3×10=30)

- A circular rod of 25 mm diameter and 50 mm long is subjected to a tensile force of 60 kN. Determine the modulus of Rigidity, Bulk modulus, and change in volume if Poisson's ratio = 0.3 and Young's modulus $E = 2 \times 10^5 \text{ N/mm}^2$.
- Find the forces in all the members of the truss shown in the figure and tabulate the results.



- Determine the moment of inertia of the section shown in the figure about an axis passing through the centroid and parallel to the topmost fiber of the section. Also, determine the moment of inertia about the axis of symmetry. Hence find the radius of gyration.



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(3)

[Contd....

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4. A rough inclined plane with the coefficient of friction (μ) = 0.2, rises 1 cm for every 5 cm of its length. Calculate the effort required to drag a body weighing 100 N up the plane;
- when the effort is applied horizontally.
 - when the effort is applied parallel to the plane.
5. a) Differentiate between open-coiled and close-coiled helical springs.
- b) A close-coiled helical spring is subjected to an axial pull of 600 N. The spring is made out of a 16mm diameter rod, and has 12 complete coils, each of mean diameter 120mm. Compute
- deflection under the pull, and
 - energy stored in the spring during extension. The modulus of rigidity of the material of spring is (G) = $0.85 \times 10^5 \text{N/mm}^2$.

3E1213	Roll No. _____	Total No. of Pages : 2
	<div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">3E1213</div> <p>B.Tech. III Sem. (Main) Examination, April/May - 2022 Civil Engineering 3CE3-04 Engineering Mechanics</p>	

Time : 2 Hours

Maximum Marks : 70

Instructions to Candidates:

Attempt all ten questions from Part A. All five questions from Part B and three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(As Mentioned in form No. 205)

PART - A

(word limit 25)

(10×2=20)

1. Write down the expression of stiffness for spring.
2. Write the names of different types of friction.
3. State the Lami's theorem.
4. Write the conditions for equilibrium of a body.
5. What is the difference between close coiled helical springs and open coiled helical springs.
6. State the principle of virtual work.
7. What do you mean by complementary shear stress.
8. What is the value of poisson's ratio for mild steel.
9. What are the units of work done.
10. What are the various characteristics of a force?

PART - B

(word limit 100)

(5×4=20)

1. A load with as mass 5 kg was lifted up by a pulley to the height of 0.8 m for pile work. (Use, $g = 9.81 \text{ ms}^{-2}$). What is Potential Energy the load.
2. Explain Stress - Strain Curve of mild steel in tension showing its all principal points.

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(1)

Contd....

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3. Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 45° ?
4. State and explain Newton's laws of mechanics.
5. Explain the method of sections and method of joints for plane truss.

PART - C

(Any three)

(3×10=30)

1. Four forces of magnitude P , $2P$, $3\sqrt{3}P$, and $4P$ are acting at a point O . The angles made by these forces with x - axis are 0° , 60° , 150° , and 300° respectively. Find the magnitude and direction of the resultant force.
2. Bring out the differences among perfect, deficient and redundant trusses.
3. Find the moment of inertia of a rectangular section 60 mm wide and 40 mm deep about its centre of gravity. <https://www.rtuonline.com>
4. A trolley of mass 200 kg moves on a level track for a distance of 500 metres. If the resistance of the track is 100 N, find the work done in moving the trolley.
5. A circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40kN. The modulus of elasticity for steel is 200 kN/mm². Find
 - i. Stresses.
 - ii. Strain.
 - iii. Elongation of the rod due to applied load.

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STUDENT PERFORMANCE REPORT

Roll No.	Name of Student	I Mid-Term	II Mid-Term	Average
22ETCCE001	ANKIT KUMAR	52	51	51.5
22ETCCE002	ARMAAN CHAUHAN	45	44	44.5
22ETCCE003	AYUSH SINGH JHALA	47	46	46.5
22ETCCE004	PARIDHI NINAMA	61	60	60.5
22ETCCE005	PRAVEEN DANGI	56	55	55.5
22ETCCE006	ROSHNI TABIYAR	63	62	62.5

Signature of Faculty:

Signature of HOD

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RESULT ANALYSIS

S.N O.	RTU ROLL NUMBER	NAME OF STUDENT	END TERM MARK S	SESSIONA L MARKS	TOTA L
			70	30	100
1.	22ETCCE001	ANKIT KUMAR	37	23	60
2.	22ETCCE002	ARMAAN CHAUHAN	1	20	21
3.	22ETCCE003	AYUSH SINGH JHALA	4	21	25
4.	22ETCCE004	PARIDHI NINAMA	40	27	67
5.	22ETCCE005	PRAVEEN DANGI	35	25	60
6.	22ETCCE006	ROSHNI TABIYAR	55	28	83

TOTAL	PASS	FAIL	ABSENT	PASS %
6	4	2	0	66.67 %

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Indirect Assessment:

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

Course Objectives:

Engineering Mechanics is the practical application of mechanics concerned with the behavior of bodies subjected to external forces or displacement. The main objective of this course to help student's development a thorough understanding of the theories and principle and thereby acquire analytical capability required to solve real life problems.

1. Relevance to Branch: The subject has the significance to understand & develop intuitive understanding of the subject to present world engineering examples to give students a feel of how engineering mechanics is useful in engineering practices.
2. Relevance to Society: Providing adequate information about the mechanics which are beneficial to the society development and comfort to the occupant.
3. Relevance to self-knowledge: Understand concept of mechanical behavior of materials and calculations of same using appropriate equations.

Course Outcomes:

CO1: At the end of this course students will be able to:

CO2: Describe free body diagrams and Solve the resultant of forces and/or Moments.

CO3: Apply laws of mechanics to determine efficiency of simple machines with Consideration of friction.

CO4: Execute solutions for planar frames and analyses the motion.

CO5: Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies. Solve the centroid and second moment of area of sections.

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Methodology to identify bright student

Considered 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

Considered a range of criteria, including classroom observation, formative assessment, summative assessment, assignment review e.t.c. 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 interventions 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.