Semester - 1

FUNDAMENTALS OF ENGINEERING MECHANICS

Course Code	Teaching hours per week				Self study hours	Credits	Exam hours	Course type	CIE Marks	ESE Marks
	L	T	P	R	SS					
26NNMES105	3	1	0	0	5	3	2Hrs. 30 Min	Theory	40	60

1. **Preamble:** The course exposes the students to the fundamental concepts of mechanics and enhances their problem-solving skills. It introduces students to the influence of applied force systems and the geometrical properties of the rigid bodies while stationary or in motion.
2. **Pre-requisites:** Nil

Module No.	Syllabus Description	Contact Hours
1	Introduction to statics: introduction to branches of mechanics, concept of rigid body scalars and vectors, vector operations, representing a force in vector form, forces in space. Force systems: rectangular components in 2D and 3D, moment and couple, resultant. Equilibrium: system isolation and the free-body diagram, equilibrium conditions 2D and 3D Support reactions of beams (point load and UDL only)	10
2	Friction:-laws of friction–analysis of blocks and ladder Centroid of composite areas- – moment of inertia- parallel axis and perpendicular axis theorems. Polar moment of inertia, radius of gyration, mass moment of inertia-ring and disc	10
3	Dynamics–rectilinear translation- equations of motion in Kinematics and kinetics– D'Alembert's principle. –motion on horizontal and inclined surfaces, motion of connected bodies, problems on lift. Impulse momentum equation and work energy equation (concepts only)	8
4	Curvilinear translation- equations of kinematics projectile motion (solution starting from differential equations). Rotation–kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis –rotation under a constant moment	8
	Total hours	36

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Comprehend the fundamental principles of mechanics and identify and describe the components of system of forces acting on the rigid body	**K2**
CO2	Apply the conditions of equilibrium to different force systems.	**K3**
CO3	Apply the laws of friction to analyze mechanics problems, and determine centroid and moment of inertia of simple and composite areas	**K3**
CO4	Apply kinematics and kinetics principles, including D'Alembert's principle, to analyze rectilinear motion of bodies on horizontal and inclined surfaces and in connected systems.	**K3**
CO5	Apply the principles of projectile motion and rotational motion to analyze and solve basic engineering problems involving motion of particles and rigid bodies.	**K3**

Note: K1-Remember, K2-Understand, K3-Apply, K4-Analyse, K5-Evaluate, K6-Create

CO-PO Mapping Table:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2	1	-	-	-	-	-	-	-	1
CO2	3	3	1	-	-	-	-	-	-	-	1
CO3	3	3	1	-	-	-	-	-	-	-	1
CO4	3	3	1	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	1

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination- 1	Internal Examination- 2	Total
5	15	10	10	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3=24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9=36marks)**	**60**

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Mechanics	Timoshenko and Young	McGraw Hill Publishers	5th Edition 2017
2	Engineering Mechanics: Combined Statics and Dynamics	Russell C. Hibbeler	Pearson Education,	14th Edition 2015
3	Engineering Mechanics- Statics and Dynamics,	Irving H. Shames	Prentice Hall Of India.	4th Edition 2008
4	Text book of Engineering Mechanics	R. K. Bansal	Laxmi publications pvt ltd.	4th Edition 2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Mechanics Statics	J.L. Meriam, L. G.	Wiley	9th Edition 2020
2	Engineering Mechanics	Kraige	PHI Learning	2011

Video Links or any other Reference Materials		
Sl No	**Weblink, Publication Details**	**Module**
1	https://nptel.ac.in/courses/112106286	All modules
2	Virtual labs https://ed-dei.vlabs.ac.in/	3

MODEL QUESTION PAPER

FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY(FISAT)
(Autonomous)
FIRST SEMESTER B. TECH DEGREE EXAMINATION (2026 Scheme), <Month & Year>

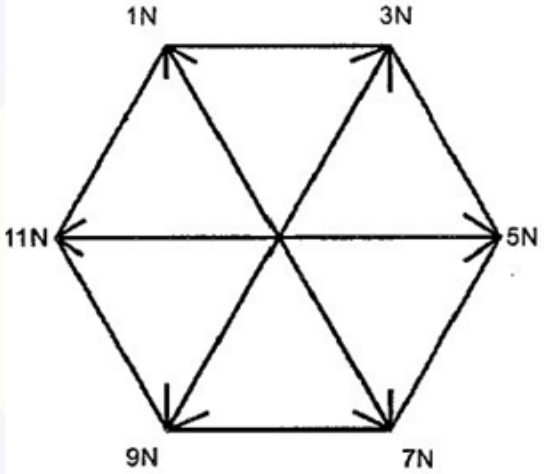
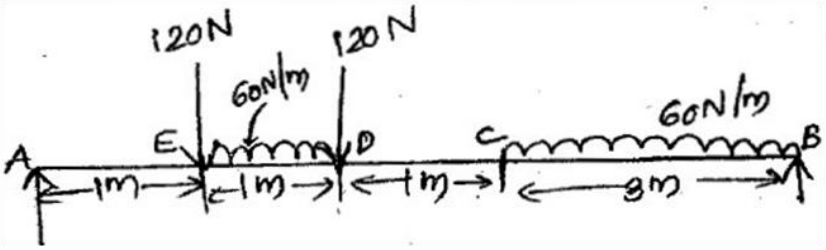
Course Code: 26NNMES105

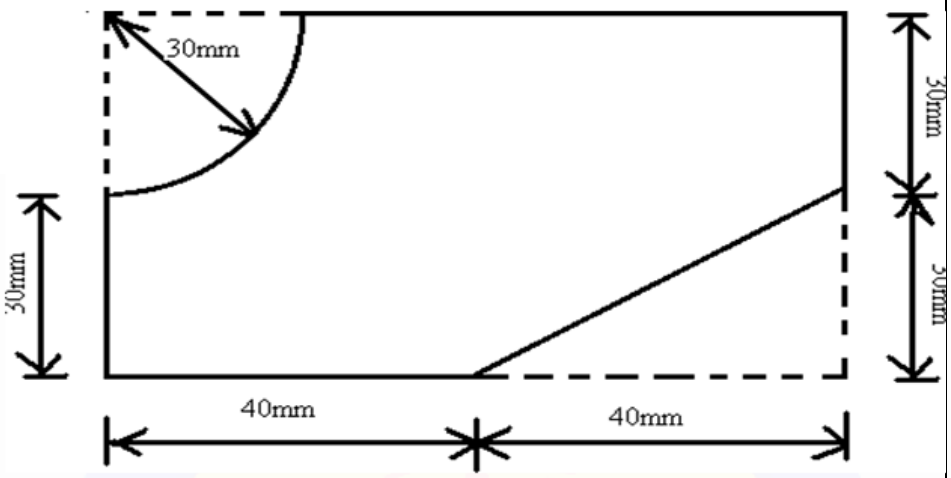
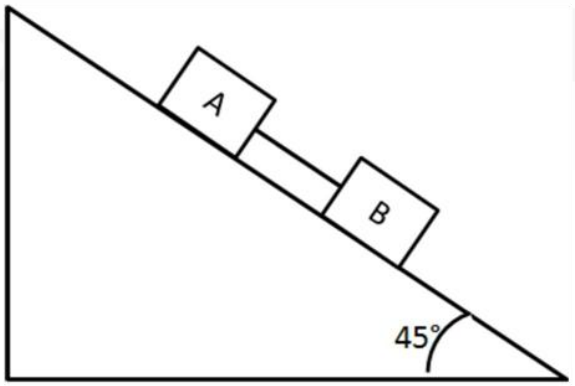
Course Name: FUNDAMENTALS OF ENGINEERING MECHANICS

Max. Marks: 60 | Duration: 2 hours 30 minutes

PART A

		Answer all questions. Each question carries 3 marks	CO	Marks
1		A force of magnitude 60N is applied at the origin of x-y-z axes and through the point A(1,1.5,2.25). Determine the components of force along the x-, y-, and z-axes.	CO1	(3)
2		Explain free-body diagram with an example.	CO1	(3)
3		Distinguish between angle of friction and angle of repose.	CO3	(3)
4		Define the terms moment of inertia and polar moment of inertia.	CO3	(3)
5		State and explain D'Alembert's principle.	CO4	(3)
6		The equation of motion of a particle moving in a straight line is given by $s=20t+5t^2-3t^3$ where s is in metres and t in seconds. Find the velocity and Acceleration at the start.	CO4	(3)

7		Differentiate between curvilinear motion and projectile motion.	CO5	(3)
8		A body is projected at an angle such that its horizontal displacement is 3 times that of maximum height. Find the angle of projection.	CO5	(3)
PART B				
Answer any one full question from each module. Each question carries 9 marks				
Module 1				
9	a)	Concurrent forces 1, 3, 5, 7, 9 and 11 N are applied at the center of the regular hexagon acting towards its vertices as shown in Figure 3 . Determine the magnitude and direction of the resultant. 	CO1	(9)
10	a)	Determine the reactions at the supports A and B of the beam loaded as shown in the figure. 	CO2	(9)
Module 2				
11	a)	A uniform ladder 4m in length rests against a vertical wall with which it makes an angle of 45°. The coefficient of friction between the ladder and wall is 0.4, and between the ladder and floor is 0.5. If a man whose weight is one-half of the weight of the ladder ascends it, how high will he be when the ladder slips?	CO3	(9)

12	a)	Calculate the centroid of the composite area shown in figure. 	CO3	(9)
		Module 3		
13	a)	An elevator weights 2500 N and is moving vertically downwards with constant acceleration. Write the equation for the elevator cable tension. Starting from rest it travels a distance of 35 metres during an interval of 10 seconds. Find the cable tension during this time. Neglect all other resistance sto motion. What are the limits of cable?	CO4	(9)
14	a)	Two masses M_A= 20 kg and M_B= 10 kg are connected by a bar of negligible mass. Find the acceleration of the system when it slides down an inclined plane of inclination 45° as shown in figure. Also find the force in the bar. Assume μ_A=0.2 and μ_B=0.4. 	CO4	(9)

Module 4				
15	a)	A car starts from rest on a curved road of radius 250 m and attains a speed of 18 km/hour at the end of 60 seconds while travelling with a uniform acceleration. Find the tangential and normal accelerations of the car 30seconds after it started.	CO4	(9)
16	a)	A flywheel rotates for 5s with a constant angular acceleration and describes during that time 100 rad. Then it rotates with constant angular velocity and during the next 5s describes 80 rad. Find the initial angular velocity and angular acceleration.	CO5	(9)
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