INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**ENGINEERING MECHANICS**
Course Code	:	**AMEB03**
Regulation	:	IARE - R18
Year	:	2019 – 2020
Class	:	B. Tech II Semester
Branch	:	Aeronautical Engineering
Team of Instructors	:	Mr. G. Venkateswarlu, Assistant Professor

COURSE OBJECTIVES (COs):

The course should enable the students to:

I	Students should develop the ability to work comfortably with basic engineering mechanics concepts required for analyzing static structures.
II	Identify an appropriate structural system to studying a given problem and isolate it from its environment, model the problem using good free-body diagrams and accurate equilibrium equations
III	Understand the meaning of centre of gravity (mass)/centroid and moment of Inertia using integration methods and method of moments
IV	To solve the problem of equilibrium by using the principle of work and energy, impulse momentum and vibrations for preparing the students for higher level courses such as Mechanics of Solids, Mechanics of Fluids, Mechanical Design and Structural Analysis etc...

COURSE OUTCOMES (COs)

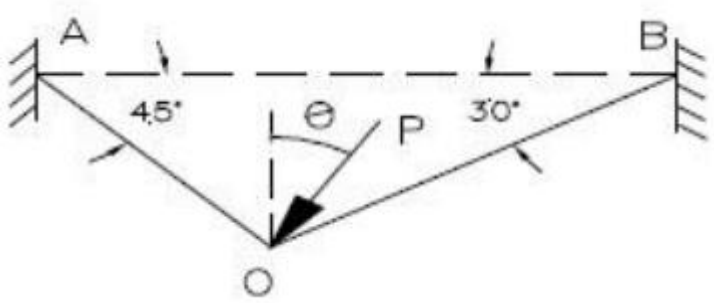
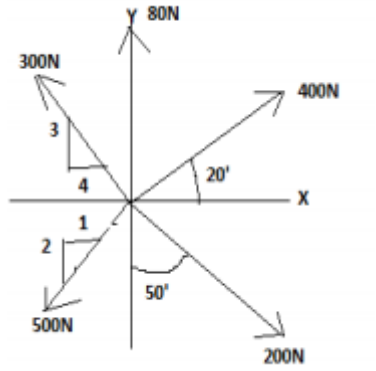
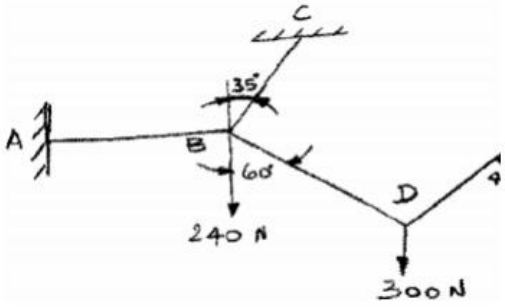
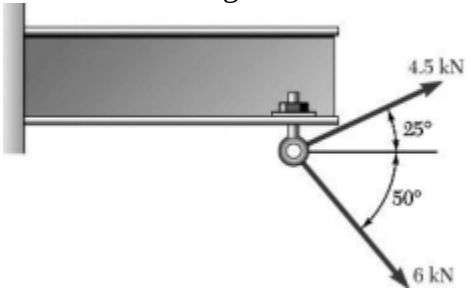
CO 1	Draw free body diagrams and determine the resultant of forces and/or moments.
CO 2	Understand the concept of friction with multiple body contact and applications.
CO 3	Assess the centre of gravity of standard geometries and composite section and moment of inertia
CO4	Study of motion of connected bodies and rigid body motion.
CO5	Estimate frequency, time period of vibrating bodies.

COURSE LEARNING OUTCOMES (CLOs)

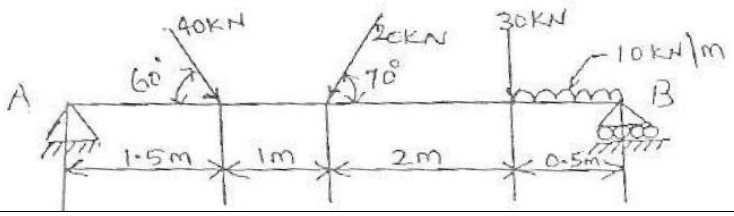
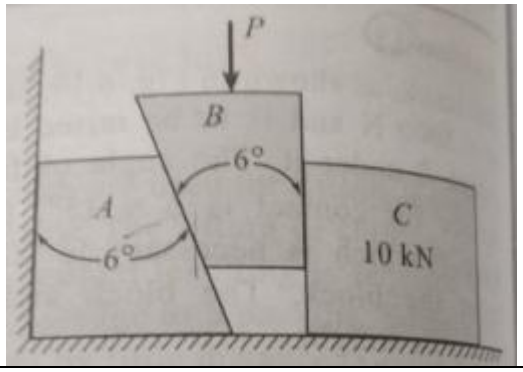
Students, who complete the course, will be able to demonstrate the ability to do the following:

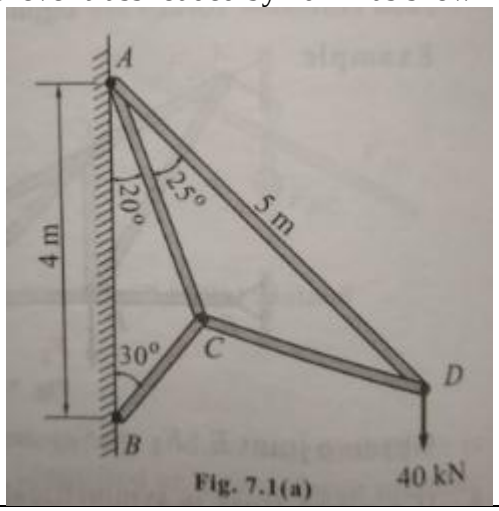
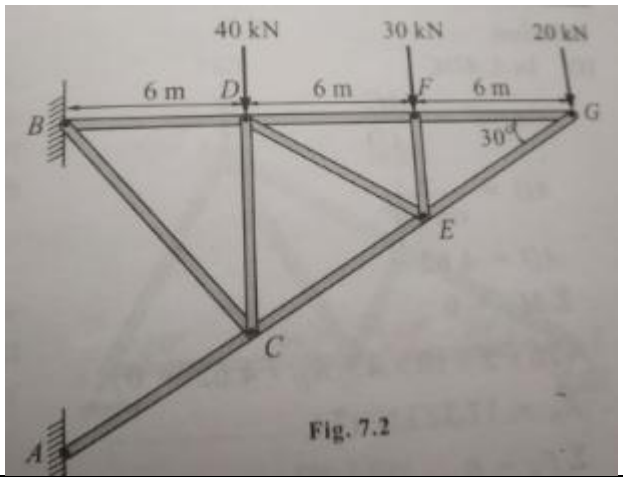
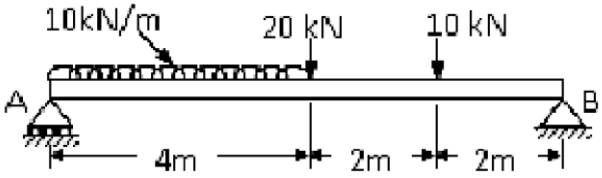
AAEB01.01	A basic understanding of the laws and principle of mechanics
AAEB01.02	The ability to solve simple force system problems in mechanics
AAEB01.03	Determine the resultant and apply conditions of static equilibrium to a plane force system
AAEB01.04	Solve the problems of simple systems with the friction, calculate the linear moving bodies in general plane motion and applications of friction
AAEB01.05	Analyze planer and spatial systems to determine the force in the members of truss and frames
AAEB01.06	Solve the problems on different types of beams
AAEB01.07	Obtain the centroid, center of gravity, first moment and second moment of area
AAEB01.08	Understand the concept of virtual work and an ability to solve practical problems
AAEB01.09	Understand the concepts of kinematics of the particles and rectilinear motion
AAEB01.10	Explore knowledge & ability to solve various particle motion problems.
AAEB01.11	Derive the D' Alembert's principle and apply it to various field problems of kinetic motion.
AAEB01.12	Determine the impact, impulse and impulsive forces occurring in the system and able to solve the problems
AAEB01.13	Develop the work energy relations and apply to connected systems.
AAEB01.14	Understand the fixed axis rotation theory and solving the field problems by application of work energy method.
AAEB01.15	Introduction to concepts of vibration and explain the relation between simple harmonic motion and the equilibrium systems.
AAEB01.16	Derive the expressions for the concepts of simple, compound and torsional pendulums.
AAEB01.17	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.

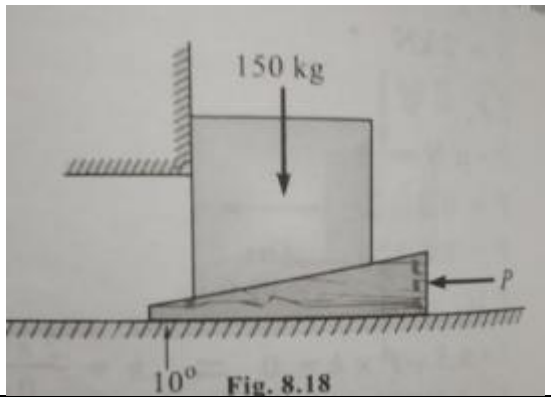
UNIT – I				
INTRODUCTION TO ENGINEERING MECHANICS				
PART - A (SHORT ANSWER QUESTIONS)				
S No	**QUESTIONS**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes (CLOs)**
1	State force and its characteristics	Remember	CO 1	AAEB01:01
2	Define system of Forces and give the classification of system of forces	Understand	CO 1	AAEB01:01
3	Explain principle of transmissibility with examples	Remember	CO 1	AAEB01:02
4	Define statics, kinetics and kinematics	Understand	CO 1	AAEB01:01
5	Compare and contrast the differences between bending moment, torque and couple with neat sketches	Understand	CO 1	AAEB01:01
6	Illustrate the concept of Free Body Diagrams(FBD) with neat sketches	Understand	CO 1	AAEB01:02
7	State Law of Moments (Varignans Theorem) and explain	Understand	CO 1	AAEB01:01
8	Describe various equations of equilibrium with neat sketches	Understand	CO 1	AAEB01:01
9	State coplanar nonconcurrent forces with equations of equilibrium	Understand	CO 1	AAEB01:01
10	State coplanar concurrent forces with equations of equilibrium	Remember	CO 1	AAEB01:02
PART - B (LONG ANSWER QUESTIONS)				
1	State Lami's theorem with a neat sketch?	Remember	CO 1	AAEB01:01
2	State the Parallelogram law of forces?	Understand	CO 1	AAEB01:01
3	State Newton's three laws of motion?	Remember	CO 1	AAEB01:01
4	List out the differences exist between Kinetics and Kinematics with neat sketches	Remember	CO 1	AAEB01:01
5	Compare and contrast the differences between 'Resultant' and 'Equilibrant'	Remember	CO 1	AAEB01:01
6	Distinguish between couple and moment with neat sketches.	Understand	CO 1	AAEB01:01
7	Illustrate the procedure to find the resultant of several forces acting at a point	Remember	CO 1	AAEB01:02
8	Determine the magnitude and the direction of the resultant of two forces 7 N and 8 N acting at a point with an included angle of 60^{o} with between them. The force of 7 N being horizontal	Understand	CO 1	AAEB01:02
9	Two coplanar forces act towards a point with an angle of 45^{0} between them. If their resultant is 100kN and one of the forces is 20kN calculate the other force	Understand	CO 1	AAEB01:03
10	Two forces act at an angle of 1200. The bigger forces is 60N and the resultant is perpendicular to the smaller one. Find the smaller force.	Understand	CO 1	AAEB01:02

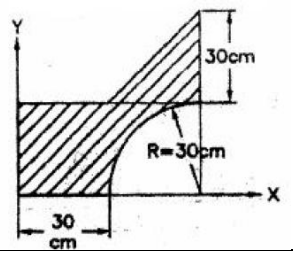
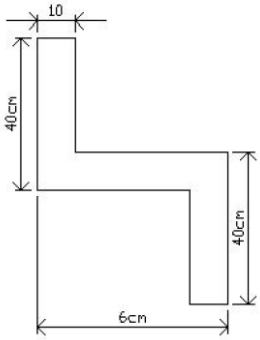
PART - C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	A force P is applied at 'O' to the string AOB as shown in fig. If the tension in each part of string is 50 N, Find the direction and magnitude of force P for equilibrium conditions. 	Remember	CO 1	AAEB01:02
2	Determine the resultant of system of forces acting as shown in fig. 	Remember	CO 1	AAEB01:02
3	A system of connected flexible cables as shown in figure is supporting two vertical forces 240 N and 300 N at points B and D. Determine the forces in various segments of the cable. 	Remember	CO 1	AAEB01:03
4	Two forces are applied to an eye bolt fastened to a beam. Determine the magnitude and direction of their resultant. 	Remember	CO 1	AAEB01:02

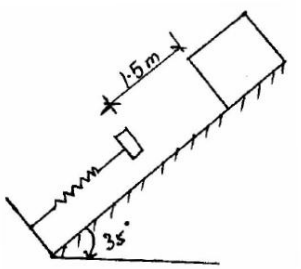
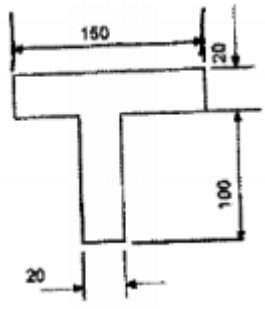
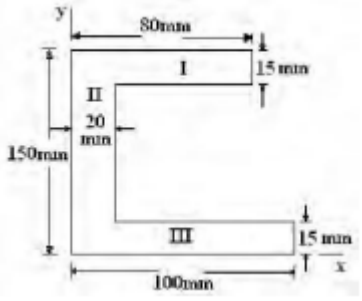
5	Find the magnitude of two forces such that if they act at right angle, their resultant is $\sqrt{10}$, but they act at 60^0 their resultant is $\sqrt{13}$	Remember	CO 1	AAEB01:03
6	The five forces 20N, 30N, 40N, 50N and 60N are acting at one of the angular points of a regular hexagon, towards the other five angular points taken in order. Find the direction and magnitude of the resultant force	Understand	CO 1	AAEB01:02
7	The following forces act at a point a. 30kN inclined at 35^0 towards North to East. b. 22kN towards North c. 30kN inclined at 30^0 towards North to West d. 35kN inclined at 25^0 towards South to West. Find the magnitude and direction of the resultant force.	Understand	CO 1	AAEB01:02
8	Determine the horizontal force P to be applied to a block of weight of 1800N to hold it in position on a smooth inclined plane, which makes an angle 30^0 with horizontal reference line.	Understand	CO 1	AAEB01:03
9	A uniform plank ABC of weight of 30N and 2m long is supported one end A and at a point B 1.4m from A. find the maximum weight W that can be placed at C, so that the plank does not topple	Understand	CO 1	AAEB01:02
10	The force of magnitudes 10KN, 20KN, 25KN & 40KN are concurrent in space and are directed through the points A(3,2,5), B(1,7,4), C(4,-2,4) & D(-2,4,-3) respectively. Determine the resultant of the force system of forces. Given that system of forces are concurrent at the origin.	Understand	CO 1	AAEB01:03
UNIT – II				
FRICTION AND BASICS STRUCTURAL ANALYSIS				
PART - A (SHORT ANSWER QUESTIONS)				
1	List the different types of friction with examples?	Understand	CO 2	AAEB01:04
2	Describe the following i) Friction ii) Angle of friction	Understand	CO 2	AAEB01:04
3	Define the following (i)Angle of Repose (ii)Coefficient of frictions	Understand	CO 2	AAEB01:04
4	Differentiate between static and dynamic friction?	Understand	CO 2	AAEB01:01
5	State laws of solid friction with neat sketch.	Understand	CO 2	AAEB01:04
6	What do you understand by the limiting friction? And define angle of repose.	Remember	CO 2	AAEB01:04
7	Describe the principle of a screw jack?	Remember	CO 2	AAEB01:04
8	Define a beam? And explain different types of beams with neat sketches?	Remember	CO 2	AAEB01:06
9	Define the term Limiting friction	Understand	CO 2	AAEB01:04
10	Compare the differences between beam and column	Remember	CO 2	AAEB01:06
PART - B (LONG ANSWER QUESTIONS)				
1	Derive an expression for the minimum effort required along the inclined plane to keep a body in equilibrium position when it is at point of sliding downwards on a inclined plane.	Remember	CO 2	AAEB01:06

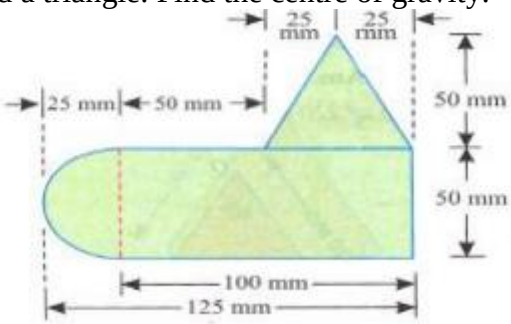
2	Solve reactions at points A & B 	Understand	CO 2	AAEB01:06
3	Explain the difference between coefficient of friction and angle of friction	Remember	CO 2	AAEB01:04
4	Derive an expression for the maximum force required along the horizontal plane to keep a body in equilibrium position when it is at point of sliding downwards on a inclined plane.	Remember	CO 2	AAEB01:04
5	Two 6^0 of wedges are used to push a block horizontally as shown figure. Calculate the minimum force reqiured to push the block of weight 10KN. Take coefficient of friction as 0.25 for all contact surfaces. 	Remember	CO 2	AAEB01:04
6	A body of weight 300N is lying on arough horizontal surface having coefficient of friction as 0.3. find the magnitude of force, which can move the body, while acting at an angle $25^0$with the horizontal.	Remember	CO 2	AAEB01:04
7	A body resting on a rough horizontal plane, required a pull of 180N inclined at 30^0 to the plane just to move it. It is found that a push of 220N inclined at 30^0 to the plane just to move the body. Determine the weight of the body and coefficient of friction.	Remember	CO 2	AAEB01:04
8	A object of weight 100N is kept in position on a inclined 30^0 to the horizontal by a horizontal applied force. If the coefficient of friction of the surface of the inclined plane is 0.25. Determine the minimum magnitude of force.	Remember	CO 2	AAEB01:04

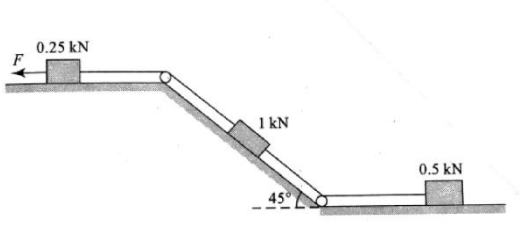
9	Find the force and its nature in member AD and BC for given cantilever truss loaded by 40KN as shown figure  Fig. 7.1(a)	Remember	CO 2	AAEB01:05
10	Find the forces in the members DF, DE, CE, and EF by method of joints for the pin-jointed frame as shown in figure  Fig. 7.2	Understand	CO 2	AAEB01:05
11	A beam AB is supported and loaded as shown in fig.1. Find the reactions at the supports. 	Understand	CO 2	AAEB01:06
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	A ladder 6m long and with 300N weight is resting against a wall at an angle of 60^0 to the ground. A man weighing 750N climbs the ladder. At what position along the ladder from bottom does he induce slipping? The coefficient of friction for both wall and the ground with ladder is 0.2.	Understand	CO 2	AAEB01:04
2	A uniform ladder of length of 3.25m & weight of 250N is placed against a smooth wall with its lower end 1.25M from the wall. Coefficient of friction between the ladder and floor is 0.3. what is the frictional force acting on the ladder at the point of contact between the ladder and the	Understand	CO 2	AAEB01:04

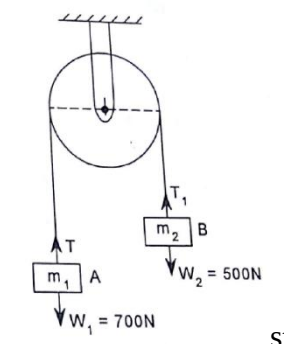
	floor? Show that the ladder will remain in equilibrium in this position.			
3	A block of mass 150kg is raised by a 10^0wedge weight 50kg under it and by appling a horizontal force at its end. Taking coefficient of friction between all surfaces of contact as 0.3, find minimum force that should be applied to raise the block.  Fig. 8.18	Remember	CO 2	AAEB01:04
4	A ladder of 7M length rests against a vertical wall with which it makes an angle of 45^0. The coefficient of friction for wall and the floor are 0.33 and 0.50 respectively. If a man whose weigth is one-half of that of the ladder. How far he will be able to climb the ladder.	Remember	CO 2	AAEB01:04
5	A screw jack has mean diameter of 50mm and pitch 10mm. if the coefficient of friction between its screw and nut is 0.15, find the effort required at the end of the 700mm long handle to raise a load of 10KN	Remember	CO 2	AAEB01:04
6	A screw press is used to compress books. The thread is a double thread (square head) with a pitch of 4mm and a mean diameter of 25mm. the coefficient of friction for the contact surface of the thread is 0.3. Find the torque for a pressure of 500N.	Understand	CO 2	AAEB01:04
7	A screw jack with single start square threads has outside and inside diameters of the thread 68mm and 52mm respectively. The coefficeint of friction is 0.1for all the pairs of surfaces in contact. If the length of lever is 0.5M, find the force required to lift the load of 2KN.	Understand	CO 2	AAEB01:04
8	A mean radius of the screw of a square threaded screw jack is 25mm. the pitch of thread is 7.5mm. if the coefficient of the friction is 0.12, what effort applied at the end of the lever 60cm length is needed to raise a weight of 2KN	Understand	CO 2	AAEB01:04
9	A differential screw jack has a pitch of 12mm, 10mm and 300mm arm length. What will be the efficiency of the machine, if it can lift a load of 7.5KN by an effort of 30N.	Understand	CO 2	AAEB01:04
10	In a differential screw jack has pitch of 10mm and 7mm. if the efficiency of machine is 28%. Find the effort required at the end of the arm 360mm long to lift aload of 5KN.	Understand	CO 2	AAEB01:04

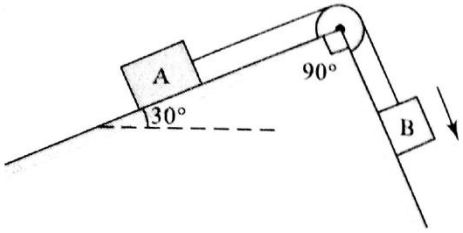
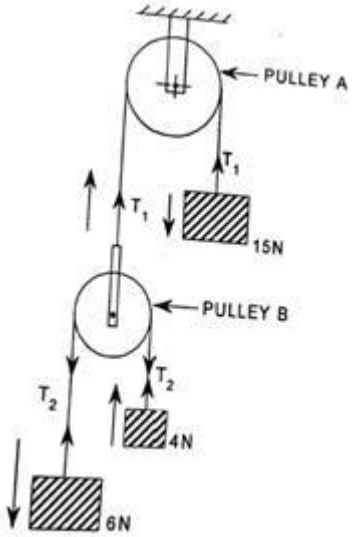
UNIT-III				
CENTROID AND CENTRE OF GRAVITY AND VIRTUAL WORK AND ENERGY METHOD				
PART - A (SHORT ANSWER QUESTIONS)				
1	Distinguish between centroid and center of gravity.	Understand	CO 3	AAEB01:07
2	Define polar moment of inertia	Understand	CO 3	AAEB01:07
3	Describe the Radius of gyration	Remember	CO 3	AAEB01:07
4	State and prove parallel axis theorem	Remember	CO 3	AAEB01:07
5	State and prove perpendicular axis theorem	Remember	CO 3	AAEB01:08
6	State the principle of conservation of energy	Understand	CO 3	AAEB01:10
7	Explain the term work done by friction force	Understand	CO 3	AAEB01:08
8	Explain the term work done by spring force	Remember	CO 3	AAEB01:10
9	Define the term power.	Remember	CO 3	AAEB01:10
10	Describe the various methods of finding the centre of gravity of a body	Remember	CO 3	AAEB01:10
PART – B (LONG ANSWER QUESTIONS)				
1	State and explain briefly the parallel axis theorem.	Remember	CO 3	AAEB01:07
2	State and proof the perpendicular axis theorem.	Remember	CO 3	AAEB01:07
3	State and proof the Pappusguildinus theorem for area and volume.	Remember	CO 3	AAEB01:07
4	Determine the co-odinates of centroid of the shaded area shown in figure. 	Remember	CO 3	AAEB01:08
5	Design Moment of Inertia about the co-ordinate axes of plane area shown in fig. Also find Polar Moment of Inertia. 	Remember	CO 3	AAEB01:07
6	Derive an expression for centroid of semi-circle.	Remember	CO 3	AAEB01:07
7	Derive an expression for MI for a rectagle section.	Remember	CO 3	AAEB01:07

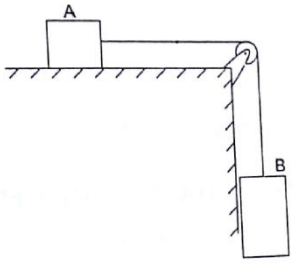
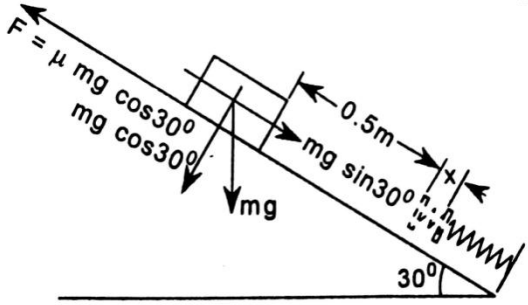
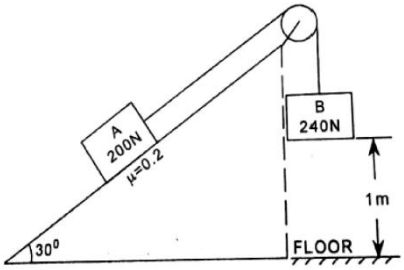
8	State and prove work energy principle	Remember	CO 3	AAEB01:10
9	Explain the following terms 1. Work done by weight force 2. Work done by friction force and 3. Work done by spring force	Remember	CO 3	AAEB01:12
10	A force of 500N is acting at 30^0 to the horizontal on a block of mass 50kg resting on a horizontal surface. Determine the velocity after the block has travelled a distance of 10M. coefficient of kinetic friction is 0.5.	Understand	CO 3	AAEB01:12
11	A block of mass 50 kg slides down a 35° incline and strikes a spring 1.5 m away from it as shown in Fig. The maximum compression of the spring is 300 mm when the block comes to rest. If the spring constant is 1 kN/m, Solve the coefficient of kinetic friction between the block and the plane. 	Remember	CO 3	AAEB01:13
12	A pump lifts $40m^3$ of water to aheight of 50m and delivers it with a velocity of 5m/s. what is the amount of energy spent during the process? If the job is done in half an hour, what is the input power of the pump which has an overall efficiency of 70%	Understand	CO 3	AAEB01:12
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	Find the centre of gravity of the "T "lamina as shown in figure. All dimensions are in mm 	Remember	CO 3	AAEB01:07
2	Find the centroid of the plane lamina shown in Figure 	Remember	CO 3	AAEB01:07

3	Uniform lamina shown in fig consists of rectangle, a semi circle and a triangle. Find the centre of gravity. 	Remember	CO 3	AAEB01:07
4	Derive an expression for centroid of triangular area with neat sketch.	Remember	CO 3	AAEB01:07
5	Derive an expression for centroid of circle with neat sketch.	Remember	CO 3	AAEB01:07
6	Derive an expression for centroid of rectangle area with neat diagram.	Understand	CO 3	AAEB01:13
7	Determine the distance in which a car moving at 90kmph can come to rest after the power switched off if coefficient of friction is 0.8 on road and tyres.	Understand	CO 3	AAEB01:10
8	Derive an expression for range along an inclined plane. What is the necessary condition for obtaining maximum range along an inclined plane?	Remember	CO 3	AAEB01:15
9	A body *A* is projected vertically upwards from the top of a tower with a velocity of 40m/s, the tower being 180m high. After *t* seconds, another body *B* is allowed to fall from the same point. Both the bodies reach the ground simultaneously. Calculate *t* and the velocities of *A* and *B* on reaching the ground.	Remember	CO 3	AAEB01:14
10	A mean radius of the screw of a square threaded screw jack is 25mm. the pitch of thread is 7.5mm. if the coefficient of the friction is 0.12, what effort applied at the end of the lever 60cm length is needed to raise a weight of 2KN	Remember	CO 3	AAEB01:15
UNIT-IV				
PARTICLE DYNAMICS AND INTRODUCTION TO KINETICS				
PART – A (SHORT ANSWER QUESTIONS)				
1	Define the terms velocity and acceleration	Understand	CO 4	AAEB01:13
2	Define angular displacement, angular velocity and angular acceleration	Understand	CO 4	AAEB01:13
3	State the terms Kinetics and kinematics	Understand	CO 4	AAEB01:13
4	Define the term rigid body	Remember	CO 4	AAEB01:13
5	State the principle of D'Alembert's.	Remember	CO 4	AAEB01:13
6	Compare and contrast Newton's second law with D'Alembert's principle.	Remember	CO 4	AAEB01:13
7	Define the term momentum of a body with units	Remember	CO 4	AAEB01:13
8	Distinguish between mass and weight.	Remember	CO 4	AAEB01:13

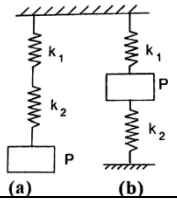
9	Write governing equations of velocity and acceleration of fixed axis rotation	Remember	CO 4	AAEB01:13
10	Define instantaneous centre of velocity	Remember	CO 4	AAEB01:13
PART – B (LONG ANSWER QUESTIONS)				
1	Derive an expression for acceleration of a cylinder rolling without slipping when subjected to horizontal force at the centre.	Understand	CO 4	AAEB01:13
2	The rectilinear motion of a particle is defined by the displacement-time equation as $x=x_0+v_0t+(1/2)at^2$. Find the displacement and velocity at time t=2s while x_0=250mm, v_0=125mm/s and a=0.5mm/s^2.	Remember	CO 4	AAEB01:13
3	A particle starts from rest and moves along a straight line with constant acceleration a. If it acquires a velocity v=3 mm/s^2, after having travelled a distance S=7.5m, find the magnitude of the acceleration.	Remember	CO 4	AAEB01:14
4	A flywheel of diameter 50cm starts from rest with constant angular acceleration of 2 rad/s^2. Determine the tangential and the normal components of acceleration of a point on its rim 3s after the motion began.	Understand	CO 4	AAEB01:13
5	A particle moves in straight line and the displacement as function of time is $x= 3t^3+ 4 t^2- 2t + 1$. Determine the distance travelled, velocity and acceleration at the starting point and after 10seconds.	Understand	CO 4	AAEB01:14
6	A car of mass 1000kg descends a hill of $\sin^{-1}(1/6)$. The frictional resistance to motion is 200N. Calculate using work energy method, the average braking effort to bring the car to rest from 48kmph in 30m.	Understand	CO 4	AAEB01:13
7	A hammer of mass 400kg falls through a height of 3m on a pile of negligible mass. If it drives the pile 1m into the ground, find the average resistance of the ground for penetration.	Apply	CO 4	AAEB01:13
8	A mass of 5kg is dropped from a height of 2 metres upon a spring whose stiffness is 10N/mm. Determine the compression in the spring and energy stored in the spring.	Understand	CO 4	AAEB01:13
9	For the system of connected bodies as shown in the figure given below, calculate the force F required to make the motion impending to the left. Use the method of virtual work and take coefficient of friction for all contiguous surfaces except pulleys as 0.25. 	Understand	CO 4	AAEB01:13

10	A pulley whose axis passes through the centre 'O' carries a load as shown in figure given below. Neglect the inertia of pulley and assuming that the cord is inextensible; determine the acceleration of the block A, tension in the  string	Understand	CO 4	AAEB01:13
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	A particle in rectilinear motion, with acceleration as function of time is a = 3t-2. The distance travelled and velocity at stating is -4 m and 3 m/s. Determine the velocity and displacement after 10 seconds	Understand	CO 4	AAEB01:13
2	A particle starts moving along a straight line with initial velocity of 25m/s, from O under a uniform acceleration of -2.5 m/s2. Determine (i) Velocity, displacement and the distance travelled at t= 5 sec (ii) How long the particle moves in the same direction? What is its velocity, displacement and the distance covered then? (iii) The instantaneous velocity , displacement and the distance covered at t=15 sec (iv) The time required to come back to O, velocity, displacement and distance covered then (v) Instantaneous velocity, , displacement and distance covered at t=25 sec	Remember	CO 4	AAEB01:13
3	The acceleration of a particle as function of time is A = kV. Where V is instantaneous velocity and K is constant. If V_o and S_o are the initial velocity and initial displacement, determine the velocity and displacement after time t seconds.	Understand	CO 4	AAEB01:12
4	Two blocks A and B are connected by an inextensible string moving over a frictionless pulley as shown in the figure given below. If the blocks are released from rest, determine the velocity of the system after the travel of 4s. Take the masses of blocks A and B as 20 and 60 kg	Understand	CO 4	AAEB01:13

	respectively and coefficient of friction for all the contiguous surfaces as 0.3  			
5	The acceleration of the particle as function of velocity is a= -3v, where v is the instantaneous velocity. The initial displacement is -2m and initial velocity is 3m. per sec. Determine the velocity and displacement of the particle after 2 seconds.	Understand	CO 4	AAEB01:13
6	Two cars *A* and *B* travelling in the same direction get stopped at a traffic signal. When the signal turns green, car *A* accelerates at 0.75 m/s^2. 1.75 seconds later, car *B* starts and accelerates at 1.1 m/s^2. Determine (i) when and where *B* will overtake *A* and (ii) The speed of each car at that time.	Understand	CO 4	AAEB01:14
7	A system of weights connected by string passing over pulleys A and B is shown in figure given below. Find the acceleration of three weights assuming weightless strings and ideal conditions for pulleys  	Apply	CO 4	AAEB01:13
8	Two blocks A and B are connected with inextensible string as shown in figure given below. If the system is released from rest, determine the velocity of block A after if has moved 1.5m. Assume the coefficient of	Understand	CO 4	AAEB01:13

	friction between block A and the plane is 0.25. Masses of block A and B are 200kg and 300kg respectively. 			
9	A block of mass 5kg resting a 30^o inclined plane is released. The block after travelling a distance of 0.5m along inclined plane hits a spring of stiffness 15N/cm as shown in figure given below. Find the maximum compression of spring. Assume coefficient of friction between block and the inclined plane as 0.2. 	Understand	CO 4	AAEB01:13
10	Two blocks of A (200N) and B (240N) are connected as shown in figure given below. When the motion begins, the block B is 1m above the floor. Assuming the pulley to be frictionless and weightless, determine (i) The velocity of block A when the block B touches the floor (ii) How far the block A will move up the plane? 	Understand	CO 4	AAEB01:13
UNIT-V				
MECHANICAL VIBRATIONS				
PART - A (SHORT ANSWER QUESTIONS)				
1	State vibrations and its types	Remember	CO 5	AAEB01:15
2	Define the terms amplitude and freuency with neat sketch.	Understand	CO 5	AAEB01:15
3	State natural, forced and damped vibrations	Remember	CO 5	AAEB01:16
4	State methods of determining frequency of natural oscillations	Understand	CO 5	AAEB01:15

5	State newtons method to determine frequency of oscillations	Remember	CO 5	AAEB01:15
6	State damped vibrations with examples	Understand	CO 5	AAEB01:16
7	State steady state forced vibrations and unsteady state forced vibrations with examples	Understand	CO 5	AAEB01:16
8	State extreme, mean positions in vibrating body and corresponding energy transformations	Understand	CO 5	AAEB01:15
9	Write the expression for time period of a torsional pendulum	Understand	CO 5	AAEB01:16
10	State the significance of natural frequency in natural vibrations	Understand	CO 5	AAEB01:15
PART - B (LONG ANSWER QUESTIONS)				
1	In U tube, fluid is filled upto length L. Under small initial disturbance, determine the frequency of oscillations. If the length of fluid is 0.5 m, find the frequency of oscillations in hertz	Remember	CO 5	AAEB01:15
2	A prismatic bar of length L and mass M is hinged at top end and hanged vertical down. For small initial disturbance, determine the frequency of natural vibrations. If the length is 0.5 m and mass is 2 kg, find the frequency of oscillations in cycles per sec.	Remember	CO 5	AAEB01:16
3	A disc of mass 2 kg and radius 0.25m is hinged at the centre with torsional spring of stiffness K_t= 500NM/ rad. Determine the frequency of oscillations and time period.	Remember	CO 5	AAEB01:16
4	State Simple Harmonic Motion (SHM) and prove that acceleration is directly proportional to displacement in Simple Harmonic Motion.	Remember	CO 5	AAEB01:16
5	A body moving with SHM has amplitude of 1m and period of oscillation of 2 seconds. What will be its velocity and acceleration at 0.4s after passing an extreme position?	Remember	CO 5	AAEB01:16
6	A body moving with SHM has amplitude of 30cm and the period of one complete oscillation is 2s. What will be the speed and acceleration of the body 2/5 of a second after passing the mid position	Remember	CO 5	AAEB01:15
7	A vertical shaft 5mm in diameter and 1.2m in length has its upper end fixed to the ceiling. At the lower end it carries a rotor of diameter 180mm and weight 30N. The modulus of rigidity for the material of the rotor is $0.85x10^5$ N/mm^2. Calculate the frequency of torsional vibrations for the system.	Remember	CO 5	AAEB01:16
8	To a sprig of mass M_s and stiffness k a lumped mass m is attached at one end and the other end is fixed. By including the inertia of the spring, determine the frequency of oscillations and time period.	Understand	CO 5	AAEB01:15
9	A weight of 10N attached to a spring oscillates at a frequency of 60 oscillations per minute. If the maximum amplitude is 30mm, find the tension induced in the spring.	Understand	CO 5	AAEB01:15

	Also find the spring constant and the maximum velocity in the spring.			
10	A disc of mass M and radius r is kept on horizontal rough surface and attached to spring of stiffness K at the centre and other end of the spring is fixed to the wall. For small initial disturbance, determine the frequency of oscillations	Remember	CO 5	AAEB01:15
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	In a mechanism, a cross head moves in straight guide with simple harmonic motion. At distance of 125mm and 200mm from its mean position, it has velocities of 6m/s 3m/s respectively. Find the amplitude, maximum velocity and period of vibration. If the cross head weighs 2N, calculate the maximum force on it in the direction of motion.	Remember	CO 5	AAEB01:15
2	When a particle is executing SHM, draw the displacement velocity and acceleration graphs with respect to the angular position.	Remember	CO 5	AAEB01:16
3	A load is suspended from a vertical spring. At rest it deflects the spring 12mm. Calculate the time period. If it is displaced further 25mm below the ret position and then released.	Understand	CO 5	AAEB01:15
4	The frequency of free vibrations of a weight W with spring constant k is 12 cycles/s. When the extra weight of 20N is coupled with weight W, the frequency reduced to 10 cycles/s. Find the weight W and stiffness k of the spring.	Remember	CO 5	AAEB01:17
5	Determine the period of vibration of a weight P attached to springs of stiffness k1 and k2 in two different cases as shown in figure given below. 	Remember	CO 5	AAEB01:16
6	A particle is moving with its acceleration directed to and proportional to its distance from a fixed point. When the distance of the particle from equilibrium position has values of 1.3m and 1.8m, the corresponding velocities are 5m/s and 2 m/s. Determine (a) Amplitude and time period of oscillations (b) Maximum velocity and maximum acceleration	Understand	CO 5	AAEB01:15
7	A vertical shaft 5mm in diameter and 1m in length has its upper end fixed to the ceiling. At the lower end it carries a rotor of diameter 200mm and weight 20N. The modulus of rigidity for the rotor is 0.85×10^5 N/mm^2. Calculate the frequency of torsional vibration for the system.	Remember	CO 5	AAEB01:15
8	A vertical shaft 7mm in diameter and 1.7m in length has its upper end fixed to the ceiling. At the lower end it carries a rotor of diameter 180mm and weight 50N. The modulus of rigidity for the material of the rotor is 0.95×10^5	Understand	CO 5	AAEB01:15

	N/mm^2. Calculate the frequency of torsional vibrations for the system.			
9	A body moving with SHM has amplitude of 50cm and the period of one complete oscillation is 3s. What will be the speed and acceleration of the body 1/5 of a second after passing the mid position	Understand	CO 5	AAEB01:15
10	A prismatic bar of length L and mass M is hinged at one end in horizontal direction and the other end is supported by spring of stiffness k laterally fixed toe the ground. Determine the frequency of oscillations under small initial disturbance	Understand	CO 5	AAEB01:16

Prepared by:
Mr. G.Venkateswarlu, Assistant Professor

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