VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
B.E. II-Semester Advanced Supplementary Examinations, September-2023

Engineering Mechanics
(Common to Civil, Mech. O : EEE)

Time: **3 hours**

Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

| Q. No.	Stem of the question	M	L	CO	PO
1.	Show that Product of Inertia about its axis of symmetry is Zero	2	1	1	1
2.	Define radius of gyration	2	1	1	1
3.	Differentiate between rectilinear and curvilinear motion	2	1	2	1
4.	A bomb is released from an airplane flying at a speed of 800 kmph on a straight level course 200 m above the ground. Find the time required for bomb to reach the ground, and the horizontal distance travelled by the bomb after its release.	2	2	2	1
5.	A block of mass 50kg rests on a horizontal plane. Compute the magnitude of horizontal force 'P' required to give the block an acceleration of a = 4rn/s² to the right. The coefficient of friction between the block and the plane is 0.30	2	2	3	1
6.	State D' Alembert's principle	2	1	3	1
7.	State the principle of work energy in rotation with formula	2	1	4	1
8.	Determine the work done in pulling a block of weighing 20kN for a length of 6m on a smooth inclined plane which makes 45° with the horizontal.	2	2	4	5
9.	State the principle of conservation of linear momentum of a particle	2	1	5	1
10.	Define co-efficient of restitution	2	1	5	1

Part-B (5 × 8 = 40 Marks)

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11. a)	Find the moment of inertia of an aluminum pipe of 150mm outer diameter and 120mm inner diameter and 3.5m height about its longitudinal axis YY.(density, ρ=2560 kg/m3).	4	2	1	5
b)	Determine the product of inertia of the area in fig. with respect to and axis through the origin	4	2	1	5

Fig.1

All dimensions are in mm
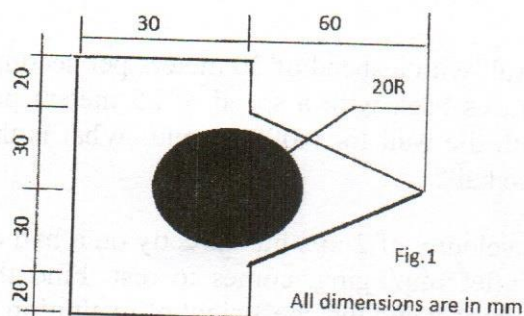
12. a)	A car has an initial speed of 25m/s and a constant deceleration of 3m/s^2. Determine the velocity of the car when t=4s. What is the displacement of the car during the 4s time interval? How much time is needed to stop the car?	4	2	2	5
b)	A projectile is fired with an initial velocity of 250m/s at a target located at a horizontal distance of 4km and vertical distance of 700 m above the gun .Determine the value of firing angle to hit the target .Neglect air resistance.	4	2	2	5
13. a)	Determine the force 'P' that will give the body in fig. an acceleration of 0.2 m/sec^2. The coefficient of kinetic friction is 0.20.	3	1	3	4
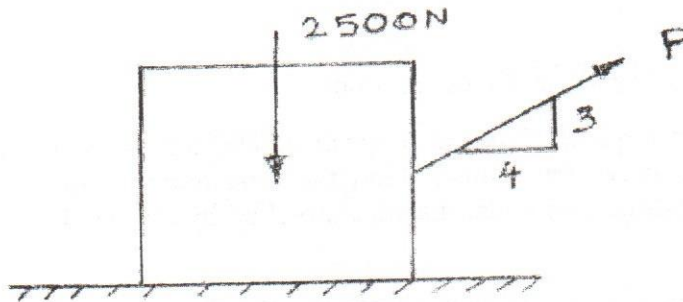
b)	Two blocks shown in Figure below are originally at rest. Determine: (i) the acceleration of each block (ii) tension in cables. Assume the effect of friction in the pulleys, between the blocks and inclines (30^0-60^0) as negligible. Mass of the pulley can also be neglected.	5	3	3	5
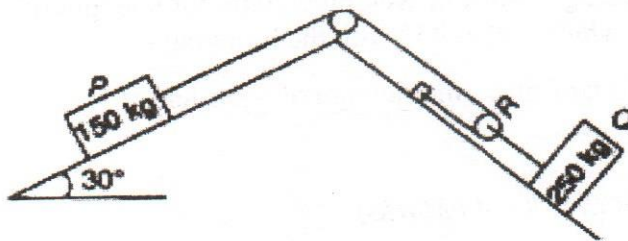
14. a)	Define work energy principle. Also derive the equation for work energy.	4	1	4	5
b)	A body weighing 20N is projected up a 20^0 inclined plane with a velocity of 12m/s, coefficient of friction is 0.15. Find: i) The maximum distance S, that the body will move up the inclined plane ii) Velocity of the body when it returns to its original position.	4	3	4	5
15. a)	A soccer ball is heading toward a wall with a speed of 20 meters per second. After hitting the wall, the ball bounces back with a speed of 25 meters per second. The ball was in contact with the wall for 0.003 second. What is the average force the wall exerted on the ball?	4	2	5	5
b)	A ball of mass 2 kg moving with a velocity of 2 m/s hits directly on a ball of mass 4 kg at rest. The first ball, after impinging, comes to rest. Find the velocity of the second ball after the impact and the coefficient of restitution.	4	2	5	5

16. a)	Determine the mass moment of inertia of the right circular cone of mass 'm' base radius 'r', and height 'h', with respect to a geometric axis.	4	3	1	5
b)	A body A is projected vertically upwards from the top of a tower with a velocity of 40 m/s, the tower being 180m high. After t sec, 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.	4	2	2	5
17.	Answer any *two* of the following:				
a)	A 20 kg block starting from rest slides up a 30^0 inclined plane under the action of a 175 N force directed along the inclined plane. The coefficient of kinetic friction between the block and the plane is 0.2. Determine the (i) speed of the block after it slides 4.5 m and (ii) the distance travelled by the block when its speed becomes 4.5 m/s.	4	2	3	5
b)	By using work energy equation calculates the velocity and acceleration of block A and block B shown in Fig. after block A has moved 1.5m from rest. The coefficient of friction is 0.3 and the pulleys are frictionless and weightless. Also calculate the tension in the spring.	4	4	4	5

c)	A bullet of mass 30 grams and moving with a velocity of 630 m/s penetrates a wooden block of mass 3 kg and emerges with a velocity of 180 m/s. How long does the block moves?	4	3	5	5

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	25%
ii)	Blooms Taxonomy Level – 2	35%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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