Register Number:……..

KUMARAGURU
college of technology
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B.E DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Third Semester

MECHANICAL ENGINEERING

U18MET3002: Engineering Mechanics

COURSE OUTCOMES

CO1: Apply the fundamental concepts in determining the effect of forces on a particle.
CO2: Make use of various principles in the determination of effect of forces in a rigid body.
CO3: Determine the geometry dependent properties of solids and sections
CO4: Solve problems in static friction
CO5: Identify motion and determine the velocity and acceleration of a particle
CO6: Apply the principles of kinetics in solving problems in dynamics

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	State Lami's theorem and explain its significance in static equilibrium.	CO1	[K_2]
2.	What are the assumptions made in the analysis of coplanar forces?	CO1	[K_2]
3.	State the principle of transmissibility of forces.	CO2	[K_2]
4.	Define Varignon's theorem and write its application.	CO2	[K_2]
5.	Differentiate between centroid and center of gravity.	CO3	[K_2]
6.	Illustrate the concept of co-efficient of friction.	CO4	[K_2]
7.	Discuss the importance of rolling resistance in real-world applications.	CO4	[K_2]
8.	What is projectile motion? State the conditions for maximum range.	CO5	[K_2]
9.	Describe curvilinear motion and its types.	CO5	[K_2]
10.	Discuss the work-energy principle for a particle.	CO6	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. A steel cable is used in the construction of a bridge to hold a load of 1500 kg. The cable forms an angle of 45° with the horizontal. Considering gravitational acceleration as 9.81 m/s²:

	a)	Calculate the tension in the cable to maintain equilibrium.	8	CO1	[K_3]
	b)	If an additional force of wind acts horizontally on the load with a magnitude of 300 N, how will it affect the equilibrium? Determine the new tension in the cable.	8	CO2	[K_3]
12.		In a manufacturing setup, a conveyor belt is used to transport goods weighing 500 N. The belt is inclined at an angle of 30° to the horizontal, and the coefficient of friction between the belt and the goods is 0.35			
	a)	Determine the force required to move the goods up the incline at constant velocity.	7	CO2	[K_3]
	b)	Analyze the situation if the coefficient of friction is reduced to 0.25 due to lubrication. Calculate the new force required.	7	CO3	[K_3]
	c)	Discuss the role of friction in this setup and its effect on the machinery's performance.	2	CO1	[K_2]
13.	a)	Explain the concept of mass moment of inertia and derive the mass moment of inertia for a solid cylinder about its central axis.	7	CO3	[K_3]
	b)	A thin-walled cylindrical tank has a radius of 1 meter and a height of 2 meters. It is rotating about its central vertical axis. Calculate the mass moment of inertia if the tank has a mass of 500 kg.	7	CO1	[K_3]
	c)	Explain the significance of the radius of gyration in the design of structures.	2	CO2	[K_2]
14.	a)	A 500 N block is to be raised using a 2° wedge. The coefficient of friction between the wedge and the block is 0.25. Calculate the force required to raise the block using the wedge.	8	CO4	[K_3]
	b)	A 15 kg crate is pushed across a rough floor with a constant horizontal force of 60 N. The coefficient of kinetic friction between the crate and the floor is 0.25. Calculate the acceleration of the crate.	8	CO5	[K_3]
15.	a)	Calculate the velocity and acceleration of a particle moving in a circular path with a constant angular velocity of 10 rad/s and a radius of 2 m.	8	CO5	[K_3]
	b)	Analyze the motion of a projectile launched at an angle of 60° with an initial velocity of 20 m/s. Determine the maximum height and range.	8	CO6	[K_3]
16.	a)	Using the principle of impulse momentum, solve a problem involving the collision of two bodies.	7	CO6	[K_3]
	b)	Apply D'Alembert's principle to solve a problem of motion in a pulley system.	7	CO4	[K_3]
	c)	Discuss the practical applications of impulse momentum in vehicle safety.	2	CO5	[K_2]

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