



LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – MATHEMATICS

SIXTH SEMESTER – APRIL 2025

UMT 6503 – MECHANICS



Date: 30-04-2025

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 PM

SECTION A - K1 (CO1)

	Answer ALL the Questions -	(10 x 1 = 10)
1.	Answer the following	
a)	Define: Hooke's Law.	
b)	Write the Moment of a force about a line.	
c)	Define Angle of friction.	
d)	Write the formula for horizontal range of a projectile.	
e)	Define: Momentum of Inertia.	
2.	Fill in the blanks	
a)	If m is the mass of the particle and v is the velocity, then mv is called _____	
b)	When the resultant of forces acting at a point is zero then the forces are called _____	
c)	The relation between the Angle of friction λ and the coefficient of friction μ is _____	
d)	If the angle of projection of a projectile is $\alpha > 90^\circ$ then the algebraic value of the range _____	
e)	MI of a solid sphere of radius a is _____	

SECTION A - K2 (CO1)

	Answer ALL the Questions	(10 x 1 = 10)
3.	MCQ	
a)	The vector sum of the constituent forces of a couple is a) Positive b) Negative c) Zero d) None of these	
b)	P, Q, R are forces along the sides of BC, CA, AB of a triangle ABC taken in order. If their resultant passes through the incentre then a) $P+Q+R=0$ b) Negative c) $P/A + Q/B + R/C = 0$ d) $P/\cos A + Q/\cos B + R/\cos C = 0$	
c)	When two particles attract each other with a force of attraction whose magnitude is a) $\frac{\gamma m_1 m_2}{3r}$ b) $\frac{\gamma m_1 m_2}{2r}$ c) $\frac{\gamma m_1 m_2}{r}$ d) $\frac{\gamma m_1 m_2}{r^2}$	
d)	The time taken to attain the maximum height is a) $t = \frac{u \sin \alpha}{2g}$ b) $t = \frac{u \sin \alpha}{g}$ c) $t = \frac{2u \sin \alpha}{g}$ d) $t = \frac{u^2 \sin \alpha}{2g}$	
e)	MI of a circular ring is a) $\frac{M a^2}{2}$ b) $\frac{M a^2}{3}$ c) $M a^2$ d) $\frac{3M a^2}{2}$	
4.	True or False	
a)	Tension of a force which comes into play when an elastic body is deformed by application of forces	
b)	The vector sum of the constituent forces of a couple is negative.	
c)	The angle of friction is the angle made by the reaction with the normal.	

d)	When a particle is projected the height of the directrix above the origin is $\frac{u^2}{2g}$.
e)	The radius of gyration of circular ring is $\frac{a}{2}$
SECTION B - K3 (CO2)	
Answer any TWO of the following (2 x 10 = 20)	
5.	The magnitude of the resultant of two given forces P, Q is R. If Q is doubled then R is doubled. If Q is reversed, then also R is doubled. Show that P: Q: R = $\sqrt{2} : \sqrt{3} : \sqrt{2}$.
6.	ABCDEF is a regular hexagon. Forces P, 2P, 3P, 2P, 3P, 6P act along AB, BC, DC, ED, EF, AF. Show that the six forces are equivalent to a couple and find the moment of the couple.
7.	State and prove parallelogram law of forces.
8.	Find MI of a circular lamina.
SECTION C – K4 (CO3)	
Answer any TWO of the following (2 x 10 = 20)	
9.	State and prove Lami's theorem.
10.	Five forces acting at a point are represented in magnitude and direction by the lines joining the vertices of any pentagon to the midpoints of their opposite sides. Show that they are in equilibrium.
11.	State and prove Varignon's theorem.
12.	Show that a couple and a force in the same plane reduce to a single force.
SECTION D – K5 (CO4)	
Answer any ONE of the following (1 x 20 = 20)	
13.	A Smooth wedge of mass M is placed on a smooth horizontal plane and a particle of mass m slides down on its slant surface which is inclined at an angle α to the horizontal. Show that the acceleration of the wedge is $\frac{m g \sin \alpha \cos \alpha}{M + m \sin^2 \alpha}$.
14.	a) Show that the path of a projectile is a parabola. b) A ball is projected so as to just clear two parallel walls the first of height 'a' at a distance 'b' from the point of projection under the second height 'b' at a distance 'a' from the point of projection. Supposing the path of the ball to lie in a plane perpendicular to the walls. Find the range on the horizontal plane and show that the angle of projection exceeds $\tan^{-1} 3$.
SECTION E – K6 (CO5)	
Answer any ONE of the following (1 x 20 = 20)	
15.	(a) If v_1 and v_2 be the velocities of a projectile at the end of a focal chord of its path and U is the velocity at the vertex, prove that $\frac{1}{v_1^2} + \frac{1}{v_2^2} = \frac{1}{U^2}$. (b) Show that the greatest height which a particle with initial velocity v can reach on a vertical wall at a distance 'a' from the point of projection is $\frac{v^2}{2g} - \frac{g a^2}{2 v^2}$.
16.	a) Find the moment of inertia of elliptic lamina. b) State and prove parallel axis theorem.

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