LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **MATHEMATICS**

SIXTH SEMESTER – **NOVEMBER 2024**

UMT 6503 – MECHANICS

Date: 23-11-2024 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)	Describe resultant and components of the forces.	
b)	Define the arm of a couple.	
c)	State Newton's third law with an example.	
d)	Define the angle of projection.	
e)	Examine moment of inertia for a uniform rod.	
2.	**Fill in the blanks**	
a)	A body is said to be rigid if a distance between any two of its particles that remains____.	
b)	Two forces whose line of action are parallel are said to be ____ parallel forces, if they act in the opposite direction.	
c)	The mass of a body is the quantity of ____ contained in the body.	
d)	If m is the mass of a particle and r is its perpendicular distance from a given line , the quantity mr^2 is called ___ .	
e)	Motion of a particle on a rough horizontal plane under the action of a constant forces is ___.	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Choose the correct answer for the following**	
a)	Forces acting on a particle are in equilibrium if and only if they (i) are equal in magnitude (ii) have attraction and repulsion (iii) have unequal forces (iv) move in same direction	
b)	The moment of a torque of a force F about a point O and P be any point on the line of action is defined by (i) $M=OF\times P$ (ii) $M=OP\times F$ (iii) $F=OP\times M$ (iv) $P=OM\times F$	
c)	Time taken by the particle to reach the greatest height of the projectile is (i) $T=\frac{usin\alpha}{g}$ (ii) $T=\frac{u^2 sin\alpha}{g}$ (iii) $T=\frac{usin\alpha}{2g}$ (iv) $T=\frac{ucos\alpha}{g}$	
d)	The moment of inertia of a body of mass M about an axis as Mk^2, then k is called	

	(i) the radius of gyration (ii) the radius of gravitation (iii) constant (iv) radius distance

e)	The mutual actions of any two bodies are always equal and oppositely directed is (i) Newtons third law (ii) couples (iii) like parallel forces (iv) projectile
4.	**State True or False**
a)	A science that deals with the forces acting on bodies is called mechanics.
b)	The rate of change of momentum of a body is proportional to the impressed force and takes place in the direction opposite in which the force acts.
c)	In C.G.S. system the unit of force is called a dyne.
d)	The perpendicular axes theorem is applicable only to rigid body.
e)	The path of a projectile is called trajectory.
SECTION B - K3 (CO2)	
Answer any TWO of the following	**(2 x 10 = 20)**
5.	Find the magnitude and direction of the resultant of two given forces with a common point of application.
6.	If P & Q are interchanged in position, show that the point of application of the resultant will be displaced along AB through a distance 'd' where $d=\frac{P-Q}{P+Q}\cdot AB$.
7.	Explain briefly about Atwood's machine.
8.	State and prove perpendicular axes theorem.
SECTION C – K4 (CO3)	
Answer any TWO of the following	**(2 x 10 = 20)**
9.	The greatest and least magnitudes of the resultant of two forces of constant magnitudes are R and S respectively. Analyze when the forces act at an angle 2ϕ, the resultant is of magnitude $\sqrt{R^2\cos^2\varnothing+S^2\sin^2\varnothing}$.
10.	A uniform rod 'AB' of length $2a$ &W is resting on two pegs C & D in the same level at a distance 'd' apart the greatest weights that can be placed at A &B without tilting the rods are W_1 and W_2 respectively. Show that $\frac{W_1}{(W+W_1)}+\frac{W_2}{(W+W_2)}=\frac{d}{a}$.
11.	Two bodies of masses m_1 and m_2 are connected by a light in extensible string passing over a light smooth fixed pulley at the edge of a smooth horizontal table; m_2 is lying on the table and m_1 is hanging freely. Criticize the resulting motion and tension in the string.
12.	Examine the moment of inertia of a rectangular lamina.
SECTION D – K5 (CO4)	
Answer any ONE of the following	**(1 x 20 = 20)**
13.	(a) State and prove Lami's theorem. (b) 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. Compare $P:Q:R=\sqrt{2}:\sqrt{3}:\sqrt{2}$.
14.	(a) State and prove Varignon's theorem on moment. (b) Determine the resultant of two like parallel forces.
SECTION E – K6 (CO5)	
Answer any ONE of the following	**(1 x 20 = 20)**
15.	Compile that the path of a projectile is parabola.
16.	(a) Construct the moment of inertia of a solid right circular cone about its axis.

	(b) Derive that the M.I of a hollow sphere whose external and internal radii are a and b about its diameter is $\frac{2M}{5}\left(\frac{a^5-b^5}{a^3-b^3}\right)$.

$$$$$$$$$$$$$$$