

(FOR THE CANDIDATES ADMITTED

24UMS407

DURING THE ACADEMIC YEAR 2024-2025 ONLY)

REG.NO. :

N.G.M. COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS: MAY 2026

B.Sc.- MATHEMATICS

MAXIMUM MARKS: 75

SEMESTER IV

TIME: 3 HOURS

PART - III

24UMS407 – DYNAMICS

SECTION – A

(10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

(K1)

1. The time of flight is _____

a) $\frac{2u \sin \alpha}{g}$

b) $\frac{2u \cos \alpha}{g}$

c) $\frac{2g \sin \alpha}{u}$

d) $\frac{2g \cos \alpha}{u}$

2. Newton's second law of motion states that _____.

a) $f = mF$

b) $F = mf$

c) $m = Ff$

d) $f = m/F$

3. The magnitude of the resultant velocity is _____.

a) $\sqrt{r^2 + \dot{r}^2 \theta^2}$

b) $\sqrt{\dot{r}^2 + r^2 \theta^2}$

c) $\sqrt{\dot{r}^2 + \dot{r}^2 \theta^2}$

d) $\sqrt{\dot{r}^2 + r^2 \dot{\theta}^2}$

4. Change of momentum is _____.

a) $\int_{t_1}^{t_2} M dt$

b) $\int_{t_1}^{t_2} V dt$

c) $\int_{t_1}^{t_2} P dt$

d) $\int_{t_1}^{t_2} u dt$

5. The coefficient of elasticity is denoted by _____.

a) ρ

b) e

c) E

d) $-e$

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES

(K2)

6. Define angle of projection.

7. Write the differential equation for simple harmonic function on a curve.

8. Write the (p, r) equation of the branch of the hyperbola nearer to the focus.

9. What do you mean by impulse of a constant force?

10. Define the force of restitution.

SECTION – B

(5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K3)

11. a) A bomb was released from an aeroplane when it was at a height of 1960 m. above a point A on the ground and was moving horizontally with a speed of 100 m/sec. Find the distance from A of the point where the bomb strikes the ground.

(OR)

b) From a point on a plane, which is inclined at an angle β to the horizon, a particle is projected with a velocity u at an angle α with the horizontal, in a plane passing through the normal to the inclined plane and the line of greatest slope. Find the range on the inclined plane.

12. a) A particle is suspended from a fixed point by a spiral spring of natural length a and modulus λ . If it is displaced slightly in the vertical direction, discuss the subsequent motion.

(OR)

b) Discuss the horizontal oscillations of a particle tied to an elastic spring.

13. a) The velocities of a particle along and perpendicular to a radius vector from a fixed origin

are λr^2 and $\mu \theta^2$. Show that the equation to the path of the particle is $\frac{\lambda}{\theta} + C = \frac{\mu}{2r^2}$.

(OR)

b) Derive the pedal equation of the central orbit.

14. a) Show that the principle of energy must never be used in problems where impulsive forces occur.

(OR)

b) A jet of water leaves a nozzle of 3 cm diameter at a speed of 2 m/sec and impinges normally on a plane inelastic wall so that the velocity of the water is destroyed on reaching the wall. Find in gm. weight the thrust on the wall.

15. a) A smooth sphere whose mass is m and whose coefficient of restitution is e , impinges obliquely on a fixed smooth plane, find the velocity and direction of motion after impact.

(OR)

b) A ball is thrown from a point on a smooth horizontal ground with the speed V at an angle α to the horizon. If e is the coefficient of restitution, then find the local time for which the ball rebounds on the ground and the horizontal distance travelled by it.

SECTION – C

(5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) Show that the path of a projectile in vacuo is a parabola.

(OR)

b) For a given initial velocity, show that there are two possible directions of projection so as to obtain a given range on an inclined plane.

17. a) Analyze the composition of two simple harmonic motion of the same period in two perpendicular directions.

(OR)

b) One end of an elastic string, whose modulus of elasticity is λ and whose unstretched length is a , is fixed to a point on a smooth horizontal table and the other end is tied to a particle of mass m lying on the table. The particle is pulled to a distance where the extension of the string is b and then let go. Determine the time of a complete oscillation.

18. a) A point P describes a curve with constant velocity and its angular velocity about a given fixed point O varies inversely as the distance from O . Show that the curve is an equiangular spiral whose pole is O and that the acceleration of the point is along the normal at P and varies inversely as OP .

(OR)

b) A particle moves in a plane with an acceleration which is directed to a fixed point in the plane. Obtain the differential equation of its path.

19. a) A shot of mass m penetrates a thickness t of a fixed plate of mass M . If M were free to move and the resistance supposed to be uniform, then obtain the thickness penetrated.

(OR)

b) A mass m after falling freely through a distance ' a ' begins to raise a mass M greater than itself and connected with it by means of an inextensible string passing over a fixed pulley. Determine the end of time at which M will have returned to its original position.

20. a) A particle falls from a height h upon a fixed horizontal plane. If e is the coefficient of restitution, obtain the whole distance described before the particle has finished rebounding. Also, determine the whole time taken.

(OR)

b) A particle is projected from a point on an inclined plane and the r^{th} impact it strikes the plane perpendicularly and at the n^{th} impact is at the point of projection. Show that $e^n - 2e^r + 1 = 0$.
