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Reg. No. : .....

Code No. : 20070 E **Sub. Code : SMMA 64**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2022.

Sixth Semester

Mathematics — Core

DYNAMICS

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Time taken by the projectile to reach the greatest height is ———

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

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

2. The time of flight of a projectile on an inclined plane is ———

(a) $\frac{u\sin(\alpha-\beta)}{g}$ (b) $\frac{2u\sin\alpha}{g}$

(c) $\frac{2u\sin(\alpha-\beta)}{g}$ (d) $\frac{2u\sin(\alpha-\beta)}{g\cos\beta}$

3. The ball is inelastic if

(a) $v = u$ (b) $v = 0$

(c) $u = \sin\alpha$ (d) $v = 1$

4. In Newton's experimental law, the value of e always lies between

(a) 1 and 2 (b) −1 and 1

(c) 0 and 1 (d) none of these

5. The equation of simple harmonic motion is

(a) $\frac{d^2x}{dt^2} = \mu x$ (b) $\frac{d^2x}{dt^2} = -x$

(c) $\frac{d^2x}{dt^2} = x$ (d) $\frac{d^2x}{dt^2} = -\mu x$

6. The frequency is the reciprocal of ———

(a) amplitude (b) displacement

(c) period (d) none

7. The transverse component of velocity is ———

(a) $\dot{r}$ (b) $r\theta$

(c) $r\dot{\theta}$ (d) $\dot{r}\dot{\theta}$

8. The polar equation of the equiangular spiral

(a) $r = e^{\cot\alpha}$ (b) $r = ae^{\cot\alpha}$

(c) $r = ae^{\theta\cot\alpha}$ (d) $r = \cot\alpha$

9. $(p-r)$ equation of the equiangular spiral is

(a) $p = \sin\alpha$ (b) $p = r\sin\alpha$

(c) $p = r$ (d) $p = \cos\alpha$

10. $(p-r)$ equation of the parabola is

(a) $p = ar$ (b) $p = ar^2$

(c) $p^2 = ar$ (d) $p^2 = ar^2$

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

11. (a) Define a projectile and derive the greatest height attained by it.

Or

(b) Derive the range on an inclined plane.

12. (a) Explain the impact of a smooth sphere on a fixed smooth plane.

Or

(b) Explain the oblique impact of two smooth spheres.

13. (a) Define simple harmonic motion and derive the equation of motion.

Or

(b) Derive the general solution of the simple harmonic motion equation.

14. (a) Explain the equiangular spiral.

Or

(b) Derive the radial component of acceleration.

15. (a) Explain the $(p-r)$ equation of the circle.

Or

(b) Explain the velocities in a central orbit.

PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).

16. (a) Prove that the path of a projectile is a parabola.

Or

(b) Find the greatest distance of the projectile from the inclined plane and show that is attained in half the total time of flight.

17. (a) Find the loss of kinetic energy due to direct impact of two smooth spheres.

Or

(b) Explain the Newton's experimental law.

18. (a) Find the differential equation of a SHM.

Or

(b) Explain the geometrical representation of simple harmonic motion.

19. (a) Explain the velocity and acceleration in plan coordinates.

Or

(b) Find the differential equation of central orbits.

20. (a) Find the pedal equation of the central orbit.

Or

(b) Find the law of force to an internal point under which a body will describe a circle.
