**22MAU308**

**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**BSc DEGREE EXAMINATION MAY 2024**
(Third Semester)

Branch - **MATHEMATICS**

**MECHANICS**

Time: Three Hours Maximum: 50 Marks

**SECTION-A (5 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (5 x 1 = 5)

1. Moment of a force about a point on the line of action of the force is -------
   (i) +ve (ii) -ve (iii) 0 (iv) $\infty$

2. Work done by an extensible string of length 'l' is ---------
   (i) $-T\,\Delta l$ (ii) $T/l$ (iii) $T\,\Delta l$ (iv) $Tl$

3. What is the resultant of two equal velocities u,u at an angle $\alpha$ is ------
   (i) $u\cos\alpha/2$ (ii) $2u\sin\alpha/2$ (iii) $u\sin\alpha/2$ (iv) $2u\cos\alpha/2$

4. Kinetic energy is----------
   (i) mv (ii) $\frac{1}{2}mv$ (iii) $\frac{1}{2}mv^2$ (iv) $mv^2$

5. Moment of inertia of an uniform circular disc about a diameter 'a' is ----------
   (i) $\frac{Ma^2}{2}$ (ii) $Ma^2$ (iii) $\frac{Ma^2}{4}$ (iv) $\frac{3Ma^2}{4}$

**SECTION - B (15 Marks)**
Answer **ALL** Questions
**ALL** Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. a) Find the resultant of two unlike and unequal parallel forces acting on a rigid body.
   OR
   b) Prove that if any number of forces acting on a rigid body is represented in magnitude, direction and line of action by sides of a polygon taken in order, then they are equivalent to a couple whose moment twice the area of the polygon.

7. a) Determine the C.G of three rods forming a triangle.
   OR
   b) Prove that the algebraic sum of the works done by a number of coplanar forces on a particle in any displacement of particle is equal to the work done by their resultant.

8. a) A particle has two simultaneous velocities of equal magnitudes in two directions. If one of them is halved in magnitude, the angle which the resultant velocity makes with the other is halved also. Find the angle between the directions.
   OR
   b) Derive the relative angular velocity between two moving points.

**Cont...**

9. a) State Newton's laws of motion.

OR

b) Derive the work done in stretching an elastic string.

10. a) Define the following: i) Angle of projection ii) Range iii) Time of flight.

OR

b) Find the M.I of an uniform circular disc.

## SECTION -C (30 Marks)

Answer **ALL** questions

**ALL** questions carry **EQUAL** Marks (5 x 6 = 30)

11. a) State and prove Varigon's theorem on moments.

OR

b) Prove that the resultant of any number of couples in the same plane on a rigid body is a single couple whose moment is equal to the algebraic sum of the moments of the several couples.

12. a) Determine the C.G of a uniform sector of a circle, $2\alpha$ being the central angle.

OR

b) A thin wire is bent into the form of a triangle ABC and heavy particles of weight P,Q,R are placed at the angular points. If the centre of mass of the particles coincides with that of the wire, then prove that $\frac{P}{b+c} = \frac{Q}{c+a} = \frac{R}{a+b}$.

13. a) State and prove parallelogram law of velocities.

OR

b) Find the angular velocity of a particle moving along any curve.

14. a) i) State and prove the Principle of work – Energy.
ii) Verify the principle of conservation of energy in the case of a particle sliding down a smooth inclined plane.

OR

b) i) State and prove the Principle of conservation of energy.
ii) Calculate the work done in sliding a block of weight of 22 kg up a plane inclined at $30^0$ to the horizontal through a distance of 15m. against a frictional force of 30 N.

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

OR

b) Show that the M.I of a hollow sphere whose external and internal radii are a and b about a diameter is $\frac{2M}{5}\left(\frac{a^5-b^5}{a^3-b^3}\right)$.Deduce the M.I o.0f a hollow sphere of radius a.

Z-Z-Z END