

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

**BSc DEGREE EXAMINATION MAY 2019
(Fourth Semester)**

Branch – MATHEMATICS

MECHANICS – II (DYNAMICS)

Time : Three Hours

Maximum : 75 Marks

SECTION-A (20 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 x 2 = 20)

- 1 State the triangle of velocities.
- 2 Define the angular velocity.
- 3 State the Newton's laws of motion.
- 4 Calculate the work done in sliding a block of weight of 22 kg up a plane inclined at 30° to the horizontal through a distance of 15m against a frictional force of 30 N.
- 5 Find the greatest height attained by a projectile and the time taken to reach the greatest height.
- 6 If the greatest height attained by the particle is a quarter of its range on the horizontal plane through the point of projection, find the angle of projection.
- 7 State any two fundamental laws of impact.
- 8 A ball of mass 8 gm moving with a velocity of 10 cm per sec impinges directly on another of mass 24 gm moving at 2 cm per sec in the opposite direction. If $e = \frac{1}{2}$, find the velocities after impact.
- 9 Find the moment of inertia of a uniform circular ring about a diameter and about a tangent line.
- 10 State Routh's rule.

SECTION - B (25 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 5 = 25)

- 11 a To a man walking along a level road at 5 km/h, the rain appears to be beating into his face at 8 km/h at an angle of 60° with the vertical. Find the true direction and velocity of the rain.
OR
- b A ship is sailing due west and the apparent direction of the wind as shown by the fluttering of the flag on the mast is from north. The wind is known to be blowing from a point 30° east of north. Show that its velocity is double that of the ship.
- 12 a Prove that the work done in raising a number of particles from one position to another is wh where w is the total weight of the particles and h is the vertical distance through which the centre of gravity of the particles has been raised.
OR
- b State and prove the principle of conservation of energy.
- 13 a A particle is thrown over a triangle from one end of a horizontal base and grazing the vertex falls on the other end of the base. If A and B are the base angles and α the angle of projection, show that $\tan\alpha = \tan A + \tan B$.
OR
- b If v_1 and v_2 be the velocities of a projectile at the ends of a focal chord of its path and u is the velocity at the vertex prove that $v_1^{-1} + v_2^{-1} = u^{-2}$.

- 14 a Discuss the direct impact of two smooth spheres.
OR
b Explain the oblique impact of two smooth spheres.
- 15 a State and prove the theorem of perpendicular axes.
OR
b Find the moment of inertia of a rectangular lamina.

SECTION - C (30 Marks)

Answer any **THREE** Questions

ALL Questions Carry **EQUAL** Marks (3 x 10 = 30)

- 16 A railway carriage is moving at the rate of 80 km/h. A bullet enters a compartment 8m long and 3m broad by the window at a corner in the direction of the line joining that corner to the middle point of the opposite side of the compartment and is observed to leave it out of the window at the diagonally opposite corner. Show that the velocity of the bullet is 100 km/h.
- 17 Find the potential energy of a particle at a height h.
- 18 Show that the path of a projectile is a parabola.
- 19 A particle is projected from a point on an inclined and at the r^{th} impact, it strikes the plane perpendicularly and at the n^{th} impact is at the point of projection. Show that $e^n - 2e^r + 1 = 0$.
- 20 Find the M.I. of a uniform right circular cylinder of height h, radius r and mass m about (i) Its axis (ii) Any generator (iii) A diameter of one of the circular ends (iv) A line through its centre of gravity perpendicular to its axis.

Z-Z-Z

END