

**PSG COLLEGE OF ARTS & SCIENCE**  
(AUTONOMOUS)  
**BSc DEGREE EXAMINATION DECEMBER 2018**  
(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 ( 1 0 x 2 = 20)

- 1 Find the resultant of two equal velocities  $u, u$  at an angle  $a$ .
- 2 Distinguish between speed and velocity.
- 3 State the Newton's laws of motion.
- 4 State and prove the principle of conservation of linear momentum.
- 5 Find the horizontal range  $R$  of a projectile.
- 6 Determine the maximum horizontal range.
- 7 Prove that the principle of energy must never be used in problems where impulsive forces occur.
- 8 A ball of mass  $8\text{gm}$  moving with a velocity of  $10\text{cm per sec}$  impinges directly on another of mass  $24\text{gm}$ , moving at  $2\text{cm per sec}$  in the same direction. If  $e = \text{---}$ , find the velocities after impact.
- 9 State the theorem of parallel axes.
- 10 State Routh's rule.

**SECTION - B (25 Marks)**

Answer **ALL** Questions

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

- 11 a A ship  $P$  is sailing due east at a speed of  $16\text{km/h}$  when another ship  $Q$  which is due north of  $P$  at a distance of  $10\text{km}$  from it starts at a speed of  $12\text{km/h}$  in a southern direction. Find the velocity of  $Q$  relative to  $P$ . What is the least distance apart that  $Q$  will attain from  $P$  and how long after starting will it attain it?

OR

- b Find the angular velocity of a particle moving along a circle with uniform speed.

- 12 a Show that power =  $F.V$ .

OR

- b State and prove the principle of energy.

- 13 a A shell bursts on contact with the ground and pieces from it fly in all directions with all velocities upto  $30\text{metres per second}$ . Show that a man  $30\text{m}$  away is in danger for  $5\text{sec}$  nearly.

OR

- b A revolver can fire a bullet with a muzzle velocity of  $63\text{m per sec}$ . Is it possible to hit the top of a tower  $400\text{m}$  away its height being  $30\text{m}$ ?

- 14 a Find the impact of a smooth sphere on a fixed smooth plane.

OR

- b Find the loss of kinetic energy due to direct of impact of two smooth spheres.

- 15 b Show that the M.I of a triangular lamina of mass M about a side is  $\frac{mh^2}{6}$ , Where h is the altitude from the opposite vertex.

**SECTION - C (30 Marks)**

Answer any **THREE** Questions

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

- 16 A boat capable of moving in still water with a speed of  $u$  km an hour, crosses a river,  $\frac{1}{2}$  km broad flowing with a velocity of  $v$  km an hour. find (i) the time of crossing by the shortest route. (ii) the minimum time of crossing.

- 17 Find the potential energy of a particle at a height h.

- 18 Prove that the path of a projectile is a parabola.

- 19 A particle falls from a height h upon a fixed horizontal plane: if e be the coefficient of restitution, show that the whole distance

described before the particle has finished rebounding is  $h \left( \frac{1+e^n}{1-e} \right)$ . show

also that the whole time taken is  $\frac{1+e}{1-e} \sqrt{\frac{2h}{g}}$ .

- 20 Show that the M.I about the x axis of the portion of the parabola  $y^2 = 4ax$  bounded by the x- axis and the latus rectum, supposing the surface density

at each point to vary as the cube of the abscissa is  $\frac{12}{11} m a^3$  where m is the mass of the lamina.

Z-Z-Z

END