B.Sc. DEGREE EXAMINATION,NOVEMBER 2019
III Year V Semester
Dynamics

Time : 3 Hours   **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. A particle has two velocities $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$. Its resultant velocity is equal to $\overrightarrow{v_1}$ in magnitude. Show that, when the velocity $\overrightarrow{v_1}$ is doubled, the new resultant is perpendicular to $\overrightarrow{v_2}$.

2. Define angular velocity of a particle.

3. Define amplitude of a simple harmonic motion.

4. The maximum velocity of a particle executing Simple harmonic motion is 1m/sec, and its period 1/5 of the second. Find the amplitude and maximum acceleration.

5. A particle is projected with a velocity of 490m/sec. At an elevation of 30^0. Find the greatest height attained by the particle.

6. Define range of a projectile on an inclined plane.

7. State Newton's experimental law.

8. State conservation of linear momentum.

9. Define moment of inertia of a particle.

10. Show that the Moment of inertia of an isosceles right angled triangle about its hypotenuse whose length is a is $\dfrac{Ma^2}{24}$

11. A boat which can steam in still water with a velocity of 48km.p.h is steaming with its bow pointed due east when it is carried by a current which flows northward with a speed of 14 km.p.h. Find the actual distance it would travel in 12 minutes.

12. Show that when two spheres of equal masses m collide directly the velocities of the spheres are interchanged if e=1.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. A man can swim perpendicularly across a stream of breadth 100m in 4 minutes when there is no current and in 5 minutes when there is a downward current. Find the velocity of the current.

14. A ship A steaming in the direction 30^0 north of east at 30 knots, sees another ship B at 20 nautical miles in the east. Find the minimum speed of B so that it may intercept A.

15. A particle moves along a circle with a uniform speed. Show that the motion of its projection on a fixed diameter is simple harmonic.

16. A particle is projected from a point O on the ground with a velocity u inclined to the horizontal at an angle . It hits the ground at A. Find the velocity of a particle at time t.

17. Two equal balls of mass m are in contact on a table. A third equal ball strikes both symmetrically and remain at rest after impact. Show that e $=\dfrac{2}{3}$.

18. A shot of mass m is discharged horizontally from a gun of mass M which is free to recoil horizontally. If the velocity of m relative to the gun is v, find the velocities of m and M and show that the total kinetic energy generated is $\dfrac{1}{2}\dfrac{mMv^2}{m+M}$

19. Find the moment of inertia of an elliptic lamina.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. The line joining two points A, B is of constant length a and the velocities of A, B are in directions which make angles α and β respectively with AB. Prove that the angular velocity of AB about A is $\dfrac{usin(\beta - \alpha)}{acos\beta}$, where u is the velocity of A.

21. Two bodies of masses m and m' are attached to the lower end of an elastic string whose upper end is fixed and hang at rest. m' falls off. Show that the distance of m from the upper end of the string at time t is $a + b + c \ cos\sqrt{\dfrac{g}{b}} t.$

22. A particle is projected from a point whose perpendicular distance from a plane inclined at 60^0 to the horizon is d. Prove that it cannot strike the plane perpendicularly if the square of the velocity of projection is less than $\dfrac{1}{2} \ gd \left(\sqrt{3} - 1\right).$

23. A ball dropped from a height h on a horizontal plane bounces up and down. If the coefficient of restitution is e, prove that

(i) The whole distance H covered before it comes to rest is $h\,\dfrac{1+e^2}{1-e^2}$

(ii) The total time T taken is $\dfrac{1+e}{1-e}\sqrt{\dfrac{2h}{g}}$.

24. Find the Moment of inertia of a square lamina of side l about one of its diagonals. The density at any point varying as the square of its distance from this diagonal.