

SUBJECT CODE : 19PH/MC/ME24
B.Sc. DEGREE EXAMINATION APRIL 2023
BRANCH III - PHYSICS
SECOND SEMESTER

COURSE : MAJOR CORE
PAPER : MECHANICS
TIME : 3 HOURS

MAX. MARKS: 100

SECTION – A

ANSWER ALL QUESTIONS:

25 MARKS

I CHOOSE THE CORRECT ANSWER:

(10 X 1 = 10)

1. If a body of mass m collides head on elastically with velocity u with another identical body at rest. After collision velocity of the second body will be.
a) zero b) u c) $2u$ d) none of the above
2. Two perfectly elastic bodies A and B of equal mass travelling along the line joining them with velocities 15m/s and 10m/s . After collision their velocities will be
a) $10\text{m/s}, 10\text{m/s}$ b) $15\text{m/s}, 15\text{m/s}$ c) $10\text{m/s}, 15\text{m/s}$ d) $15\text{m/s}, 10\text{m/s}$
3. Two balls of equal mass have head on collision with speed 6m/s each. If the coefficient of restitution is $1/3$, the speed of each ball after impact will be.
a) 18m/s b) 2m/s c) 6m/s d) 7m/s .
4. A body of mass 5 kg is thrown vertically up with a kinetic energy of 490 J . The height at which the kinetic energy of the body becomes half of the original value is
a) 12.5m b) 2.5 m c) 2.5m d) 5m .
5. Analogue of mass in rotational motion is
a) moment of inertia b) angular momentum c) gyration d) none of the above
6. Moment of inertia of a rod of mass m and length L about its end I. If one fourth of its length is cut away then moment of inertia of the remaining rod about its one end will be
a) $3L/4$ b) $9L/16$ c) $27L/64$ d) $L/16$
7. Moment of inertia of a body depends on
a) Axis of rotation b) torque c) angular momentum d) angular velocity
8. For a system of N particles the degree of freedom is
a) N b) $2N$ c) $3N$ d) $4N$
9. A solid sphere rolls down two different inclined planes of the same heights but different angles of inclination. In each case, the ball will reach the bottom _____
a) with same speed b) with different speed
c) immediately d) with different speed but same time
10. A bullet of mass 5g is fired at a velocity of 900m/s from a rifle of mass 2.5kg . What is the recoil velocity of rifle.
a) 0.9m/s b) 180m/s c) 900m/s d) 1.8m/s

II FILL IN THE BLANKS:**(5 X 1 =5)**

11. Maximum potential energy of a particle corresponds to _____ equilibrium
12. Explosion is an example of perfect _____ collision
13. Moment of inertia of a disc with axis passing through centre of gravity is _____
14. Work done by conservative forces are _____ independent
15. The number of constraints for a diatomic molecule is _____

III. ANSWER IN A SENTENCE OR TWO:**(5 X 2 = 10)**

16. State Newtons Law of Universal gravitation
17. Differentiate conservative and non conservative forces.
18. Where is the centre of mass of a ring and disc?
19. Explain “angular momentum is conserved in the absence of external torque”
20. Explain generalized coordinates.

SECTION B**ANSWER ANY FIVE OF THE FOLLOWING:****(5 X 6=30)**

21. A train accelerating uniformly from rest attains a maximum speed of 40m/s in 20s. It travels at this speed for 20 s and is brought to rest with a uniform retardation in the next 40s. What is the average velocity during this period.
22. A smooth sphere of mass 8kg, moving with a velocity of 10m/s impinges directly on another mass 24kg moving at 2m/s in the opposite direction. If $e=0.5$ find the velocities of the balls after impact.
23. Four solid spheres each of radius 10 cm and mass 1kg, 2kg, 3kg and 4kg are attached to the periphery of a massless plate of radius 1m. What is the moment of inertia of the system about the centre of the plate.
24. A uniform chain of length 2m is kept on a table such that a length of 60 cm hangs freely from the edge of the table. The total mass of the chain is 4kg. What is the work done in pulling the entire chain on the table.
25. Using Lagrangian equations find the time period of a simple pendulum.
26. Obtain the moment of inertia of a uniform rod about an axis passing through one end of the rod.
27. Obtain an expression for the time taken by a body to roll down an inclined plane.

SECTION C**ANSWER ANY THREE OF THE FOLLOWING:****(3 X 15=45)**

28. a) S.T when the vector sum of the external forces acting upon a system of particles equals zero, the total linear momentum of the system remains constant.
b) A vessel at rest explodes, breaking into three pieces. Two pieces having equal masses fly off perpendicular to one another with the same speed of 30m/s. The third piece has three times the mass of each other piece. What is the direction and magnitude of its velocity immediately after explosion?
29. Discuss the theory of oblique impact of two masses also the loss of kinetic energy due to oblique impact.
30. Obtain the expression for the moment of inertia of a solid sphere and spherical shell with its axis passing through the centre of gravity.
31. Obtain Lagrangian equations of motion from D'Alembert's principle.