

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2019 – 2020 & thereafter)
SUBJECT CODE:19PH/MC/ME24
B.Sc. DEGREE EXAMINATION APRIL 2022
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. The unit of impulsive force is
a) N b) Ns c) Ns^{-1} d) Ns^{-2}
2. In oblique impact between two bodies, the direction of motion of each is along
a) common tangent b) inclined with common normal
c) common normal d) None
3. Collision between atomic particles are
a) complete inelastic b) elastic c) inelastic d) None
4. Which of the following should be constant for a body to have a constant momentum?
a) Acceleration
b) Force
c) Velocity
d) All of the above
5. Generalised coordinates
a) Depend on each other
b) Are independent of each other
c) Are necessarily spherical coordinates
d) All of the above
6. A bead sliding on a rigid curved fixed in space is obviously subject to a ----- constraint
a) Holonomic
b) Non-holonomic
c) Rhenomous
d) Scleronomous
7. Which of the following is the mathematical representation of law of conservation of total linear momentum?
a) $dP/dt = 0$
b) $dF/dt = 0$
c) $dP/dt = F_{\text{internal}}$
d) $dF/dt = P$
8. Find the force that exists in an electromagnetic wave.
a) Electrostatic force
b) Magnetostatic force
c) Lorentz force
d) Electromotive force
9. What will be the radius of gyration of a circular plate of diameter 10cm?
a) 1.5cm
b) 2.0cm
c) 2.5cm
d) 3cm

10. In a rigid body in rotational motion, the distance between two particles
 a) remains constant b) increases c) decreases d) None

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

11. When torque acting upon a system is zero, _____ will be a constant.
 12. Rocket works on the principle of _____.
 13. In rotational motion _____ replaces mass in translation motion.
 14. The Lagrangian function $L =$ _____.
 15. The energy of rotational motion is _____.

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

16. Define work and power with formula.
 17. What is meant by degrees of freedom?
 18. State the law of conservation of linear momentum and derive it from the Newton's second law of motion.
 19. Differentiate translatory and rotatory motion.
 20. What is Lorentz force?

SECTION B

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

21. State the principle of conservation of energy. Mention the different forms of energy.
 22. Show that the force $F = (2xy + yz^2)\hat{i} + (x^2 + xz^2)\hat{j} + 2xyz\hat{k}$ is a conservative force.
 23. A solid sphere of mass 0.5kg and diameter 1m rolls without slipping with a constant velocity of 5m/s along a smooth straight line. Calculate its total energy.
 24. A ball of mass 6 kg moving with a velocity 10 ms^{-2} impinges directly on another ball of mass 24 kg moving with velocity 2 ms^{-2} in the opposite direction. If the coefficient of restitution is 0.5, find the velocities of the balls after impact.
 25. What is Lagrange's equation and apply it to find solution for Atwood's machine with neat sketch of diagram.
 26. Explain the conservation of angular momentum in proton scattering by heavy nucleus.
 27. Explain the effect of electric and magnetic forces on charged particle.

SECTION C

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

28. Explain the D'Alembert's principle and derive the Lagrangian equations of motion for a conservative system.
 29. What are conservative and non-conservative forces? Explain in detail the potential and kinetic energy of a conservative system.
 30. Explain the basic forces of nature. State Newton's law of universal gravitation and derive an expression.
 31. Explain the one-dimension elastic collision of two different masses and discuss their velocities after collision with special cases.
 32. State and prove perpendicular axis theorem and using it derive an expression to determine the moment of inertia of a rectangular lamina about an axis through its C.G perpendicular to its plane.