

Yashwantrao Chavan College of Science Karad

B.Sc. – I

Paper I: Mechanics I

Question Bank - 2023-2024

Q.1 Select the most correct alternative.

- 1 The scalar product of a vector with itself is equal to.....
a it's magnitude b square of its magnitude c zero d infinity
- 2 Moment of inertia of a spherical shell about its diameter.....
a $\frac{2}{3} MR^2$ b $\frac{3}{2} MR^2$ c $\frac{5}{3} MR^2$ d $\frac{1}{2} MR^2$
- 3 Acceleration $a^{\vec{}}$ is aorder derivative of position vector $r^{\vec{}}$ with respect to the parameter time t.
a First b second c third d Fourth
- 4 The time rate of change of linear momentum is.....
a Linear acceleration b angular acceleration c force d energy
- 5 The energy possessed by the body by virtue of its motion is.....
a kinetic energy b potential energy c Mechanical energy d total energy
- 6 If the frame of reference is changed then.....
a the value of physical quantity is not changed b the physical laws are changed c the conservation laws are not obeyed d the conservation laws are obeyed
- 7 Mass is the measure of in linear motion.
a moment of inertia b inertia c force d acceleration
- 8 Dynamics of a body can be studied in a more simple way by assuming that the whole mass of the body is concentrated at a point called.....
a geometrical centre b centre of gravity c centre of mass d centre of force
- 9 Moment of inertia in rotational motion is analogous to thein translational motion.
a Momentum b mass c force d torque
- 10 The triangle law of vector addition can be used to find the resultant of.....
a only two vectors b parallel vectors c unit vector only d more than two vectors
- 11 The relation between linear velocity \vec{v} , the radius vector \vec{r} and angular velocity $\vec{\omega}$ of a particle is
a $\vec{v} = \vec{r} \times \vec{\omega}$ b $\vec{v} = \vec{\omega} \times \vec{r}$ c $\vec{\omega} = \vec{v} \times \vec{r}$ d $\vec{\omega} = \vec{r} \times \vec{v}$

- 12 The total mechanical energy is conserved if the force acting on the system is.....
 a Conservative b conservative c Frictional d Electromagnetic
- 13 The energy possessed by the body by virtue of its position.....
 a kinetic energy b potential energy c mechanical energy d total energy
- 14 If magnitude of two $\vec{A} \times \vec{B} = AB$, then the two vectors must be.....
 a a parallel to each other b antiparallel to each other c coplanar d perpendicular to each other
- 15 If the vector product of two nonzero vectors is zero, the vectors must be.....
 a Either parallel or antiparallel b perpendicular c inclined at an angle 45° with each other d always antiparallel
- 16 Velocity $v \rightarrow$ is a order derivative of position vector $r \rightarrow$ with respect to the parameter time t.
 a First b second c third d fourth
- 17 If the total force acting on a particle or a system of a particle is zero, then the of the particle or system is conserved.
 a Linear momentum b angular momentum c kinetic energy d energy
- 18 If the total torque acting on a particle or a system of a particle is zero, then the of the particle or system is conserved.
 a Linear momentum b angular momentum c kinetic energy d) energy
- 19 Just as force produces linear motion,.....produces rotational motion.
 a Torque b moment of inertia c angular momentum d angular acceleration
- 20 Acceleration of a body rolling down an inclined plane is independent . of the body.
 a Radius b radius of gyration c mass d inclination θ

Q.2 Answer the following questions in brief.

1. Obtain the expression for the moment of inertia of a solid cylinder about an axis passing through its centre and perpendicular to its own axis.
2. State and prove law of conservation of linear momentum for a single particle and system of particles.
3. Define vector product or cross product of two vectors. State right hand rule and right handed screw rule about the direction of the resultant vector.
4. Show that an instantaneous acceleration of a particle is a derivative of instantaneous velocity of a particle with respect to the time.
5. Define first order homogeneous differential equation and discuss variable separation method to obtain its solution.

Q.3 Answer the following questions in short.

- 1 Define scalar or dot product of two vectors. State its characteristics.
- 2 Define moment of inertia and radius of gyration. Explain the physical significance of moment of inertia.
- 3 State and explain the triangle law of vector addition.
- 4 State and explain the law of parallelogram of vector addition.
- 5 Solve, — $dy/dx + x^2y = 0$.
- 6 What is the differential equation? Define order, degree and linearity of a differential equation.
- 7 State and prove work energy theorem.
- 8 Define angular momentum of a particle and find an expression for angular momentum of a rotating body.
- 9 Define torque and obtain an expression for it in terms of angular momentum for a particle rotating about a point.
- 10 Find an expression for kinetic energy of a body rotating about an axis.