

5

CIRCULAR MOTION

MCQs from Previous Papers

Fully Solved Original ECAT MCQs-2008

- Which of these is a unit of angular momentum or moment of linear momentum?
(A) $J s^2$ (B) J/s (C) $J s$ ✓ (D) J/s^2
- The direction of angular momentum is along the outward normal to the xy plane. The disc is rotating
(A) First anticlockwise and then clockwise (B) Anticlockwise ✓
(C) First clockwise and then anticlockwise (D) Clockwise
- If $\vec{L} = \vec{r} \times \vec{p}$, then \vec{L} is ;
(A) Along \vec{r} (B) Along \vec{p} (C) Perpendicular to both \vec{r} and \vec{p} ✓
(D) Parallel to \vec{r} and \vec{p}
- Angular momentum for uniform circular motion is
(A) mvr ✓ (B) $\frac{1}{2} mvr$ (C) $\frac{1}{4} mvr$ (D) $\frac{\sqrt{3}}{2} mvr$
- If a body having moment of inertia $2kg m^2$, is rotating with an angular velocity of 4 rad/sec, then its angular momentum in $kg m^2/s$ is
(A) 8 ✓ (B) 16 (C) 2 (D) 6

Fully Solved Original ECAT MCQs-2009

- A body is rotating in a vertical circle. Its angular momentum is maximum at
(A) Top (B) Bottom ✓ (C) Middle (D) Every point
- If a torque of 20 N m is applied on a body for 10 sec, then change in its angular momentum in $kg m^2/s$ is
(A) 2000 (B) 200 ✓ (C) 20000 (D) 1000
- Angular momentum of a body under a central force is
(A) Maximum (B) Zero (C) Minimum (D) Constant ✓
- If a gymnast sitting on a rotating stool with his arms out stretched lowers his arms, then his angular speed
(A) Increases ✓ (B) Becomes zero (C) Remains constant (D) Decreases
- If earth contracts and its radius becomes half of its original value, then 1 day =
(A) 6 hours ✓ (B) 12 hours (C) 18 hours (D) 24 hours

Fully Solved Original ECAT MCQs-2010

- In uniform circular motion, which of the following does not remain constant?
(A) Speed (B) Angular momentum (C) K.E (D) Momentum ✓
- Which of the following quantities remains constant in a planetary motion?
(A) Speed (B) K.E (C) Angular momentum ✓
(D) Angular speed
- A tyre of a moving car has both translational and rotational K.E. If its angular velocity is 2 rad/sec and moment of inertia is $1 kg m^2$ then its rotational K.E is (in J)
(A) 1 (B) 2 ✓ (C) 3 (D) 4

4. If by some process, angular velocity of Earth around its own axis is doubled then which statement is correct?
 (A) $K.E_{rot} = \text{doubled}$, $T = \text{halved}$ (B) $K.E_{rot} = \text{fourfold}$, $T = \text{halved}$ ✓
 (C) $K.E_{rot} = \text{constant}$ (D) $T = \text{constant}$

Fully Solved Original ECAT MCQs-2011

1. A body has an angular momentum of 10 J s and angular inertia of 1 kg m^2 . Its rotational K.E in J is
 (A) 100 (B) 50 ✓ (C) 25 (D) 10
2. If a hoop is rolling downwards on an inclined plane of height 9.8 m then its speed at the bottom of plane is
 (A) 4.9 ms^{-1} (B) 9.8 ms^{-1} ✓ (C) 19.6 ms^{-1} (D) 10 ms^{-1}
3. The rotational K.E of hoop is _____ its translational K.E
 (A) Four times than its (B) Equal to its ✓ (C) Half than its (D) Double than its
4. If value of g is 10 m/s^2 , then critical velocity of satellite close to earth is
 (A) 8 m/s (B) 8 km/s ✓ (C) 80 m/s (D) 80 km/s
5. Trackers in cars use global positioning system which consists of how many satellites?
 (A) 12 (B) 24 ✓ (C) 6 (D) 18

Fully Solved Original ECAT MCQs-2012

1. If the total energy of an earth satellite is positive, it means that:
 (A) The satellite may fall to the earth (B) The satellite moves nearer to the earth
 (C) The satellite escapes from the orbit (D) The satellite is bound to the earth ✓
2. If a satellite is orbiting around earth then _____ can not be used to measure time
 (A) Pendulum clock (B) Elastic spring watch (C) Atomic clock
 (D) Electric oscillation clock ✓
3. A body which weighs 100 N at ground in lift now weighs 200 N in a moving lift. The acceleration of lift is (Take $g = 10 \text{ m/s}^2$)
 (A) 10 ms^{-2} downwards (B) 10 ms^{-2} upwards ✓ (C) 0 (D) 1 ms^{-2} downwards
4. When a lift is falling freely, then $T =$
 (A) $m(g + a)$ (B) $m(g - a)$ ✓ (C) mg (D) zero

Fully Solved Original ECAT MCQs-2013

- The weight of a man in an elevator moving up with an acceleration equal to $3g$ will become
 (A) Zero (B) Two times greater (C) Three times greater (D) Four times greater ✓
- In orbiting satellites, centripetal acceleration is
 (A) Greater than g (B) Less than g (C) Equal to g (D) zero ✓
- If orbital radius of a satellite is 10 km and then it is increased to 40 km. Now its orbital velocity is
 (A) Doubled (B) Halved (C) Unchanged ✓ (D) Increased by 4 times
- How much the velocity of moon should be increased so that it escapes away from Earth's gravitational field,
 (A) 1% (B) 21.2% ✓ (C) 81.1% (D) 41.4%

Fully Solved Original ECAT MCQs-2014

Angular speed of a satellite around Earth is

- (A) $\sqrt{\frac{GM}{r^3}}$ (B) $\frac{\sqrt{GM}}{r}$ (C) $\frac{\sqrt{GM^2}}{r^3}$ (D) $\frac{\sqrt{GM^2}}{r}$ ✓

Keeping same orbital speed, if orbital radius of Earth around sun is halved then 1 year =

- (A) 365 days ✓ (B) 182 days (C) 90 days (D) 730 days

The planet nearest to Earth is

- (A) Mercury (B) Jupiter ✓ (C) Mars (D) Pluto

The mean distance from Saturn to Sun is 9 times greater than the mean distance from Earth to sun.

- How long is a Saturn year?
 (A) 18 Earth years✓ (B) 27 Earth years (C) 81 Earth years (D) 243 Earth years
5. If radius of satellite is 10 m, then its linear speed around its own axis to produce artificial gravity is ($g = 10 \text{ m/s}^2$)
 (A) 5 m/s (B) 10 m/s✓ (C) 15 m/s (D) 20 m/s
6. If a space station has $R = 9.8 \text{ m}$ then the frequency in revolution per second about its own axis required to produce artificial gravity is
 (A) 2π (B) $1/2\pi$ ✓ (C) 4π (D) $1/4\pi$
7. A pendulum on Earth has a time period 1 sec. Its time period in a box orbiting Earth is
 (A) 1s (B) 5s✓ (C) 0 (D) ∞ (undefined)
8. Radius of Geostationary orbit is:
 (A) $3.43 \times 10^4 \text{ km}$ (B) $4.23 \times 10^4 \text{ km}$ (C) $4.23 \times 10^4 \text{ m}$ (D) $2.23 \times 10^4 \text{ m}$ ✓

Fully Solved Original ECAT MCQs-2015

1. The Geostationary satellite moves above the surface of earth at:
 (A) 26000 km (B) 40000 km✓ (C) 36000 km (D) 30000 km
2. Geo-stationary satellite has a time period:
 (A) 365 days (B) 24 days (C) 1 day✓ (D) 6 months
3. Geostationary satellite are use for:
 (A) Navigation (B) Weather observations✓ (C) World communication (D) All of these
4. Einstein's theory says that light rays may bend due to:
 (A) Force of gravity (B) Geo-discs (C) Both a & b (D) None of these✓
5. Minimum number of geostationary satellites required to cover the whole Earth are 3. The angular displacement between them will be
 (A) 60° ✓ (B) 120° (C) 180° (D) 240°
6. According to Einstein, space time is
 (A) Plane (B) Curved✓ (C) Spherical (D) Elliptical
7. Gravitational force does not obey inverse square law in
 (A) Weak gravitational fields (B) Medium gravitational fields✓
 (C) Strong gravitational fields (D) All types of fields

Fully Solved Original ECAT MCQs-2016

1. Angle of bending of light according to Einstein is _____ times than according to Newton during solar ellipse.
 (A) 2✓ (B) 4 (C) 6 (D) 8
2. The point on the rim of a wheel moves 0.3 m when wheel turns through an angle of 60° . The radius of wheel is:
 (A) $\frac{1.8}{\pi} \text{ m}$ (B) $\frac{\pi}{1.8} \text{ m}$ (C) $\frac{0.9}{\pi}$ (D) $\frac{\pi}{0.9}$ ✓
3. The angular speed for daily rotation of earth is
 (A) $\frac{\pi}{60} \text{ rad/s}$ (B) $\frac{\pi}{3600} \text{ rad/s}$ (C) $\frac{\pi}{86400} \text{ rad/s}$ (D) $\frac{\pi}{43200} \text{ rad/s}$ ✓
4. The angular speed of second's hand of clock in rad/sec is
 (A) $\frac{\pi}{60}$ (B) $\frac{\pi}{20}$ (C) $\frac{\pi}{30}$ ✓ (D) $\frac{\pi}{40}$
5. The dimensions of angular velocity are same as that of
 (A) Frequency✓ (B) Time period (C) Linear velocity (D) Linear acceleration
6. The direction of angular velocity is along
 (A) Tangent to the circle (B) Inward radius (C) Outward radii
 (D) The axis of rotation✓
7. If a disc is rotating anticlockwise in xy plane, then $\vec{\omega}$ is along

8. If the angular velocity of a body increases from zero to 60 rev/min in 1s, then its angular acceleration in rad/sec^2 is
 (A) π (B) 2π ✓ (C) 3π (D) 4π

Fully Solved Original ECAT MCQs-2017

- The dimensions of angular acceleration are
 (A) LT^{-2} (B) T^{-1} (C) T^{-2} ✓ (D) LT^{-1}
- If a fan is switched ON, then its angular acceleration and angular velocity are
 (A) Parallel✓ (B) Antiparallel (C) Perpendicular (D) Inclined at an angle less than 90°
- If a wheel of diameter 1m is rotating at 2 rads^{-1} then its linear rim velocity in m/s is
 (A) 1✓ (B) 2 (C) 0.5 (D) 0.75
- A toy car is rotating in a circle with angular speed of 60 rev/min. If radius of circle is 1m, then linear speed of car in m/s is
 (A) 2π ✓ (B) π (C) 9π (D) 3π
- \vec{v} and $\vec{\omega}$ are
 (A) Parallel (B) Antiparallel (C) Perpendicular✓ (D) Inclined at 60° with each other

Fully Solved Original ECAT MCQs-2018

- If $\vec{r} = 4\hat{i}$ and $\vec{\omega} = 4\hat{j}$ then \vec{v} is along
 (A) +x-axis (B) +z-axis (C) -z-axis✓ (D) -y-axis
- Three particles of a rigid body rotating about a fixed axis are located at 5 cm, 10 cm and 15 cm from axis of rotation. Which particle has greater tangential velocity?
 (A) 5 cm (B) 10 cm (C) 15 cm✓ (D) All have same tangential speed
- The speed of a wheel increases from 2 rad/sec to 4 rad/sec. If angular displacement is 2 rad then angular acceleration is
 (A) 3 rad/sec^2 ✓ (B) 4 rad/sec^2 (C) 5 rad/sec^2 (D) 6 rad/sec^2
- The mud flies off from the tyre of a moving cycle in the direction of
 (A) Tangent to the circle✓ (B) Radius (C) Circumference (D) Diameter
- Linear velocity \vec{v} and centripetal force \vec{F}_C are _____ to each other.
 (A) Perpendicular✓ (B) Parallel (C) Antiparallel (D) Inclined at 45° to each other

Fully Solved Original ECAT MCQs-2019

- The acceleration of a body undergoing uniform circular motion is constant in
 (A) Magnitude only✓ (B) Direction only (C) Both magnitude and direction (D) Neither magnitude nor direction
- A body have tangential acceleration in
 (A) Elliptical motion (B) Uniform circular motion (C) Linear motion (D) Variable circular motion✓
- Work done by centripetal force in half revolution =
 (A) $2 \frac{mv^2}{r}$ (B) $\frac{mv^2}{2r}$ (C) Zero✓ (D) $\frac{2mv^2}{3r}$
- A cyclist bends while taking a turn to

- (A) Reduce reaction (B) Reduce speed (C) Produce centripetal force✓
 (d) Reduce friction

Fully Solved Original ECAT MCQs-2021

1. A motorcyclist doubles its velocity while taking a turn. The force exerted outwardly will be
 (A) Doubled (B) Increased by 4 times✓ (C) Halved (D) Decreased by 4 times
2. A body of mass 5 kg is moving in a circle of radius 1 m with angular speed of 2 rad/s. The centripetal force is
 (A) 40 N (B) 30 N (C) 10 N (D) 20 N✓

Fully Solved Original ECAT MCQs-2022

1. A stone attached to a string is being whirled in a vertical circle. The string is likely to break (as tension is maximum) when the stone is at
 (A) Lowest position✓ (B) Highest position (C) Any point (D) At middle
2. A mass of 2 kg is moving in a circle with initial speed of 5 r.p.m. Keeping radius constant, the tension in string is doubled. The new speed is nearly
 (A) 14 rpm (B) 10 rpm (C) 2 rpm (D) 7 rpm✓
3. The angle of banking $\theta =$
 (A) $\tan^{-1} \frac{v^2}{r}$ (B) $\tan^{-1} \frac{v^2}{rg}$ ✓ (C) $\tan^{-1} \frac{v}{g}$ (D) $\tan^{-1} \frac{v}{r^2g}$

Fully Solved Original ECAT MCQs-2023

1. A car moving in a curved path will avoid skidding if
 (A) $u = \tan \theta$ (B) $u > \tan \theta$ ✓ (C) $u < \tan \theta$ (D) $u \leq \tan \theta$
2. Short legs have _____ moment of inertia.
 (A) Large (B) Constant (C) Less✓ (D) Zero
3. Two discs have same thickness. If diameter of A is twice that of B, then moment of inertia of A as compared to that of B is _____ times as large.
 (A) Twice (B) Four✓ (C) Eight (D) Sixteen
4. A sphere of mass of 1 kg and radius 1 m has rotational inertia _____ kg m^2 about its axis passing through the diameter.
 (A) 2 (B) 1 (C) 0.4 ✓ (D) 0.6
5. If a thin rod of 120 g has a length of 1m, then its moment of inertia in kg m^2 about its central axis is
 (A) 0.1 ✓ (B) 0.01 (C) 1 (D) 1.1
6. If a torque of 10 Nm produces an angular acceleration of 2 rad/sec^2 then moment of inertia of the body is
 (A) 5 kg m^2 ✓ (B) 10 kg m^2 (C) 2 kg m^2 (D) 3 kg m^2

A point on the rim of a wheel moves 0.2 m when the wheel turns through an angle of 14.3 degrees. The radius of the wheel is:

- (A) 0.05 m (B) 0.08 cm
 (C) 0.8 m (D) 0.008 m

Explanatory Answer: (C)

Given $s = 0.2 \text{ m}$, $\theta = 14.3^\circ = \frac{14.3}{57.3} \text{ rad.} = 0.25 \text{ rad.}$

$r = ?$, use $s = r \theta$