Rotational Dynamics

1. For a body undergoing rotational motion, its radius of gyration depends on

A. Size
B. Shape
C. Axis of rotation
D. All of the above

2. A rigid body consists of a network of point masses. Which of the following about the individual mass is true, as the body rotates about an axis?

A. Each mass has the same linear acceleration.
B. Each mass has the same linear velocity.
C. Each mass has the same angular velocity and angular acceleration about the same axis.
D. All of the above.

3. In rotational motion, the physical quantity that imparts angular acceleration is, ` [NEB 2079]

A.Force

B.Torque

C.Moment of inertia

D.Angular Momentum

4. Which Quantity in rotational motion is analogous to force in linear motion? [NEB 2080]

A.Force

B.Torque

C.Moment of inertia

D.Angular Momentum

5. The moment of inertia of a body does not depend upon its:

A. mass
B. Angular velocity
C. Distribution of mass
D. Axes of rotation

6. Force in linear motion has its analogue in rotational motion is:

A. Angular momentum
B. Angular velocity
C. Torque
D. Moment of inertia

7. A body of moment of inertia I rotating about an axis has angular momentum L, the rotational kinetic energy of the body is,

A. $\frac{1}{2}LI$

B. $\frac{1}{2}LI^2$

C. $\frac{1}{2I}L^2$

D. $2LI$

8. Two bodies have their moment of inertia I and $2I$ respectively about their axes of rotation. If their kinetic energies of rotation are equal, their angular momentum will be in the ratio,

A. $2:1$

B. $1:2$

C. $\sqrt{2}:1$

D. $1:\sqrt{2}$

9. A fan makes 10 revolutions in 3 second which is just switched on. Considering uniform acceleration the number of revolution made by fan in next 3 second is:

A. 10

B. 20

C. 30

D. 40

10. A ring, a disc, solid sphere, hollow sphere are dropped from the same inclined plane of same height then which of the following reaches the ground first,

A. Ring

B. Disc

C. Solid Sphere

D. Hollow Sphere

$$a = \frac{g\ sin\theta}{1 + {}^{I}/_{mR^2}}$$

Moment of inertia (about an axis passing through cg and perpendicular to plane):

Ring: $I = MR^2$

Disc: $I = \frac{1}{2}\ MR^2$

Solid sphere: $I = \frac{2}{5} MR^2$

Hollow sphere: $I = \frac{2}{3} MR^2$

11. When the size of the earth is reduced to half, mass remaining same, the time period of the earth rotation will be:

A. $6\ hours$

B. $12\ hours$

C. $24\ hours$

D. $48\ hours$

12. A flywheel rotating about a fixed axis has a kinetic energy of $225\ J$ when its angular speed is $30\ rad/s$. What is the moment of inertia of the flywheel about its axis of rotation?

A. $0.3kgm^2$

B. $0.5kgm^2$

C. $0.6kgm^2$

D. $0.8kgm^2$

13. The moment of inertia of a body of mass M about a given axis is I. What is the radius of gyration? [MOE 2014]

A. $\frac{I}{M}$

B. IM

C. $\sqrt{\frac{I}{M}}$

D. $\sqrt{IM}$

14. Two circular rings have their masses in the ratio 1:2 and their radius are in the ratio 3:1. The ratio of their moment of inertia is:

A. 1: 3

B. 3: 2

C. **9: 2**

D. 9: 4

$MI\ of\ circular\ ring\colon\ I = MR^2$

15. The moment of inertia of a body about a given axis is $1.2\ kg\ m^2$. Initially, the body is at rest. In order to produce a rotating kinetic energy of $1500\ joules$, an angular acceleration of $25\ rad/\sec^2$ must be applied about that axis for a duration of

A. $\boldsymbol{2s}$

B. $4s$

C. $8s$

D. $10s$

16. A wheel rotates with a constant angular acceleration of $2\ rad/s^2$. If the wheel start from rest the number of revolutions it makes in the first ten second will be approximately:

A. 8

B. $\boldsymbol{16}$

C. 24

D. 32

17. A couple produce

A. Purely linear motion

B. No rotation

C. Purely rotational motion

D. Linear and rotational motion both

18. If a body is rotating about an axis, passing through its centre of mass then its angular momentum is directed along its

A. Radius

B. Tangent

C. Circumference

D. Axis of rotation

19. K_1 and K_2 are radii of gyrations of a uniform rod about the axes passing through its centre and one end respectively and perpendicular to its length. .

$K_1 : K_2$ is equal to:

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:\sqrt{3}$

MI of Rod:

. Centre: $I = \frac{1}{12} ML^2$

. One end: $I = \frac{1}{3} ML^2$

20. If a gymnast on a rotating stool with his arms outstretched suddenly lowers his arms

$$I\omega = constant$$

A. The angular velocity decreases

B. The moment of inertia decreases

C. The angular velocity remains constant

D. The angular momentum increases

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