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SET 3 – System of Particles and Rotational Motion

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1. The position of the centre of mass of a system of particles depends on:
(a) distribution of mass
(b) shape of the system
(c) external force
(d) size of particles

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2. The torque is defined as:
(a) r × F
(b) F × r
(c) F/r
(d) F · r

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3. The moment of inertia of a body is smallest when the axis passes through:
(a) centre of gravity
(b) edge
(c) tangent
(d) corner

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4. The moment of inertia of a uniform rod of length L about its end is:
(a) $ML^2/3$
(b) $ML^2/12$
(c) $ML^2/2$
(d) ML^2

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5. The perpendicular axis theorem is applicable to:
(a) plane lamina
(b) solid sphere
(c) rigid body
(d) cube

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6. The unit of angular momentum is same as that of:
(a) energy × time
(b) torque × time

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(c) force × distance
(d) work

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7. Rotational kinetic energy is given by:
(a) ½ Iω²
(b) Iω²
(c) ½ Iω
(d) I/ω²

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8. The angular velocity of a rotating body changes when:
(a) torque acts
(b) inertia changes
(c) radius changes
(d) both (a) and (b)

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9. The condition for equilibrium of a rigid body is:
(a) net force = 0
(b) net torque = 0
(c) both (a) and (b)
(d) either (a) or (b)

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10. The point where total mass of a system may be considered concentrated is called:
(a) centre of gravity
(b) centroid
(c) centre of mass
(d) equilibrium point

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11. The torque acting on a particle due to force F is zero when:
(a) r and F are parallel
(b) r and F are perpendicular
(c) r = 0
(d) both (a) and (c)

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12. Moment of inertia of a disc about a diameter =
(a) ½ MR²
(b) ¼ MR²

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(c) ⅔ MR²
(d) ¾ MR²

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13. For a rolling body, total kinetic energy =
(a) translational + rotational
(b) rotational − translational
(c) translational only
(d) rotational only

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14. The relation between linear velocity v and angular velocity ω is:
(a) v = ωR
(b) v = ω/R
(c) v = R/ω
(d) ω = vR

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15. The moment of inertia of a ring about a diameter =
(a) ½ MR²
(b) MR²
(c) ⅔ MR²
(d) 2/5 MR²

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16. The radius of gyration (k) is related to moment of inertia (I) and mass (M) as:
(a) I = Mk²
(b) I = M/k²
(c) I = k/M
(d) k = IM²

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17. The rotational analog of Newton's second law is:
(a) τ = Iα
(b) τ = Iω
(c) τ = F/I
(d) τ = mα

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18. If angular acceleration is zero, torque will be:
(a) zero
(b) infinite

(c) constant
(d) maximum

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19. The unit of angular acceleration is:
(a) rad/s²
(b) m/s²
(c) rad/s
(d) s/rad

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20. The moment of inertia of a solid sphere about its diameter is:
(a) 2/5 MR²
(b) ½ MR²
(c) ⅔ MR²
(d) 3/5 MR²

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21. The angular momentum of a body rotating with angular velocity ω is:
(a) Iω
(b) Iα
(c) Fω
(d) mω

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22. The centre of mass of an equilateral triangle lies:
(a) at centroid
(b) at vertex
(c) at midpoint of base
(d) outside triangle

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23. For a uniform circular ring, the radius of gyration about its centre =
(a) R
(b) R/√2
(c) R/2
(d) 2R

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24. A torque of 20 N·m acts on a body having I = 10 kg·m². The angular acceleration = ?
(a) 2 rad/s²
(b) 0.5 rad/s²

(c) 5 rad/s²
(d) 10 rad/s²

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25. The perpendicular distance between two equal and opposite forces is called:
(a) moment arm
(b) lever arm
(c) couple arm
(d) torque

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26. The SI unit of moment of inertia is:
(a) kg·m²
(b) kg·m
(c) N·m²
(d) J

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27. In pure rolling motion, the velocity of the point of contact is:
(a) zero
(b) maximum
(c) minimum
(d) ωR

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28. The law of conservation of angular momentum holds when:
(a) net external torque = 0
(b) net force = 0
(c) angular acceleration = constant
(d) angular velocity = constant

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29. A rotating body possesses:
(a) kinetic energy
(b) potential energy
(c) pressure energy
(d) both (a) and (b)

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30. The parallel axis theorem gives relation between moments of inertia about:
(a) parallel axes
(b) perpendicular axes

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(c) same axes
(d) intersecting axes

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31. The moment of inertia of a hollow sphere about its diameter =
(a) ⅔ MR^2
(b) ½ MR^2
(c) 2/5 MR^2
(d) 3/5 MR^2

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32. The torque acting on a particle is perpendicular to:
(a) r
(b) F
(c) both (a) and (b)
(d) none

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33. When a dancer spreads her arms, her angular velocity:
(a) decreases
(b) increases
(c) remains same
(d) becomes infinite

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34. Work done by a torque τ for angular displacement θ is:
(a) τθ
(b) τ/θ
(c) θ/τ
(d) $\tau^2\theta$

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35. The rotational kinetic energy of a flywheel depends on:
(a) I and ω
(b) only ω
(c) only I
(d) radius

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36. If a torque-free system is in motion, angular momentum is:
(a) conserved
(b) not conserved

(c) zero
(d) decreasing

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37. The ratio of translational to rotational kinetic energy for pure rolling on a horizontal surface is:
(a) depends on shape
(b) always 1:1
(c) 2:1
(d) 1:2

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38. A rigid body is said to be in equilibrium if:
(a) $\Sigma F = 0$ and $\Sigma \tau = 0$
(b) $\Sigma F = 0$
(c) $\Sigma \tau = 0$
(d) $\Sigma F \neq 0$

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39. The rotational analogue of linear momentum is:
(a) angular momentum
(b) moment of inertia
(c) torque
(d) angular velocity

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40. The moment of inertia of a circular disc about tangent in its plane is:
(a) $3/2\ MR^2$
(b) $\frac{1}{2}\ MR^2$
(c) MR^2
(d) $2/5\ MR^2$

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41. The rate of change of angular momentum equals:
(a) torque
(b) angular velocity
(c) acceleration
(d) angular displacement

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42. Angular momentum of a particle of mass *m* moving with velocity *v* in a circle of radius *r* is:
(a) mvr

(b) mv^2r
(c) mr^2
(d) mvr^2

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43. A rigid body rotates with angular acceleration α under torque τ, then τ/α = ?
(a) I
(b) ω
(c) L
(d) F

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44. The unit of angular displacement is:
(a) radian
(b) degree
(c) revolution
(d) all of these

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45. In rotational motion, kinetic energy depends on:
(a) I and ω^2
(b) ω only
(c) I only
(d) α

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46. The total angular momentum of a system is conserved when:
(a) net external torque = 0
(b) net force = 0
(c) moment of inertia = constant
(d) ω = constant

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47. The centre of mass of Earth-Moon system lies:
(a) inside Earth
(b) inside Moon
(c) midway between
(d) outside both

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48. Torque is the rotational analogue of:
(a) force
(b) mass

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(c) energy
(d) power

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49. A particle moves in a circle of radius r with uniform speed v, its angular momentum about the centre is:
(a) mvr
(b) mv/r
(c) mr/v
(d) mv^2r

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50. The moment of inertia of a uniform disc about any diameter is:
(a) ½ MR^2
(b) ¼ MR^2
(c) ⅔ MR^2
(d) 3/4 MR^2

✅ ANSWERS – SET 3

1 (a)	2 (a)	3 (a)	4 (a)	5 (a)	6 (b)	7 (a)	8 (d)	9 (c)	10 (c)
11 (d)	12 (a)	13 (a)	14 (a)	15 (a)	16 (a)	17 (a)	18 (a)	19 (a)	20 (a)
21 (a)	22 (a)	23 (a)	24 (c)	25 (c)	26 (a)	27 (a)	28 (a)	29 (a)	30 (a)
31 (a)	32 (c)	33 (a)	34 (a)	35 (a)	36 (a)	37 (a)	38 (a)	39 (a)	40 (a)
41 (a)	42 (a)	43 (a)	44 (d)	45 (a)	46 (a)	47 (a)	48 (a)	49 (a)	50 (a)