QUESTIONS FROM COMPETITIVE EXAMS

1.1 Introduction

(MHT-CET 2002)

1. A car is moving with speed 30 m/s on a circular path of radius 500 m. Its speed is increasing at the rate of 2 m/s^2. The acceleration of the car is
   a) 9.8 m/s^2 b) 1.8 m/s^2 c) 2 m/s^2 d) 2.7 m/s^2
2. The ratio of angular speeds of minute hand and hour hand of a watch is
   a) 6 : 1 b) 1 : 6 c) 1 : 12 d) 12 : 1

(MHT-CET 2003)

3. When particle revolves with uniform speed on a circular path
   a) no force acts on it b) no acceleration acts on it
   c) no work is done by it d) its velocity is constant

(MHT-CET 2004)

4. A particle moves for 20 s with velocity 3 m/s and then moves with velocity 4 m/s for another 20 s and finally moves with velocity 5 m/s for next 20 s. What is the average velocity of the particle ?
   a) 3 m/s b) 4 m/s c) 5 m/s d) zero

(MAH-EN-CET 2004)

5. A wheel of diameter 20 cm is rotating at 600 rpm. The linear velocity of particle at its rim is
   a) 6.28 cm/s b) 62.8 cm/s c) 0.628 cm/s d) 628.4 cm/s

(MHT-CET 2005)

6. Angular velocity of an hour hand of a watch is
   a) $\frac{\pi}{43200}$ rad/s b) $\frac{\pi}{21600}$ rad/s c) $\frac{\pi}{30}$ rad/s d) $\frac{\pi}{1800}$ rad/s

(MHT-CET 2008)

7. If a particle moves with uniform speed its tangential acceleration will be
   a) v^2 / r b) $r\omega^2$ c) zero d) infinite

(MHT-CET 2012)

8. If a particle is moving in a circular path of radius 'r' with a uniform speed v, then the angle described by it in one second will be
   a) v r b) 1/vr c) v/r d) v/r^2
9. A particle is performing circular motion with its diameter d and velocity v. Then the angular displacement of the particle in time t is
   a) $\frac{vt}{d}$ b) $\frac{2vt}{d}$ c) $\frac{vt}{2d}$ d) $\frac{d}{vt}$

(MHT-CET 2014)

10. Three identical spheres each of mass 1 kg are placed touching one another with their centres in a straight line. Their centres are marked as A, B, C respectively. The distance of centre of mass of the system from A is
    a) $\frac{AB+AC}{2}$ b) $\frac{AB+BC}{2}$ c) $\frac{AC-AB}{3}$ d) $\frac{AB+AC}{3}$

(MHT-CET 2022)

19. In non uniform circular motion, the ratio of tangential to radial acceleration is

a) $\frac{\alpha^2 r^2}{v}$ b) $\frac{\alpha^2 r}{v}$ c) $\frac{\alpha r^2}{v^2}$ d) $\frac{v^2}{r^2 \alpha}$

20. The relative angular speed of hour hand and second hand of a clock is

a) $\frac{311\pi}{578}$ b) $\frac{719\pi}{21600}$ c) $\frac{421\pi}{11600}$ d) $\frac{119\pi}{15600}$

1.2 Dynamics of Circular Motion (Centripetal Force and Centrifugal Force)

(MAH-EN-CET 2004)

21. Centripetal force in vector form can be expressed as

a) $\vec{F} = \frac{mv^2}{r}$ b) $\vec{F} = -\frac{mv^2}{r^2}\vec{r}$ c) $\vec{F} = -m\omega^2\vec{r}$ d) $\vec{F} = -\frac{mv^2\vec{r}}{\vec{r}}$

(MHT-CET 2006)

22. When a vehicle is moving along a horizontal curved road, centripetal force is provided by

a) vertical component of normal reaction
b) horizontal component of normal reaction
c) frictional force between road surface and tyres
d) all of these

23. A body of mass m is performing UCM with frequency n along the circumference of circle having radius r, force is given by

a) $4\pi n m^2$ b) $4\pi^2 n^2 mr$ c) $\pi^2 n^2 mr$ d) $1/2\pi n m^2$

(MHT-CET 2008)

24. Tension of a string is 6.4 N and load applied to it at its lower end is 0.1 kg. If the length of string is 6 m, then its angular velocity will be

a) 3 rad/s b) 4 rad/s c) 2 rad/s d) 1 rad/s

(MH-CET 2015)

25. A particle of mass 'm' is moving in circular path of constant radius 'r' such that centripetal acceleration is varying with time 't' as K^2rt^2 where K is a constant. The power delivered to the particle by the force acting on it is

a) $m^2K^2r^2t^2$ b) mK^2r^2t c) mK^2rt^2 d) mKr^2t

(MHT-CET 2009)

26. A particle of mass m is rotating in a plane in circular path of radius r. Its angular momentum is L. The centripetal force acting on the particle is

a) $\frac{L^2}{mr}$ b) $\frac{L^2m}{r}$ c) $\frac{L^2}{m^2r^2}$ d) $\frac{L^2}{mr^3}$

(MHT-CET 2010)

27. KE of a particle of mass m performing UCM in a circle of radius r is E. Find the acceleration of the particle.

a) $\frac{2E}{mr}$ b) $\left(\frac{2E}{mr}\right)^2$ c) 2 Emr d) $\frac{4E}{mr}$

(MH-CET 2017)

36. A ceilling fan rotates about its own axis with some angular velocity. When the fan is switched off, the angular velocity becomes $\left(\frac{1}{4}\right)^{th}$ of the original in time 't' and 'n' revolutions are made in that time. The number of revolutions made by the fan during the time interval between switch off and rest are (Angular retardation is uniform)

a) $\frac{4n}{15}$ b) $\frac{8n}{15}$ c) $\frac{16n}{15}$ d) $\frac{32n}{15}$

(MH-CET 2018)

37. The path length of oscillation of simple pendulum of length 1 metre is 16 cm. Its maximum velocity is ($g = \pi^2$ m/s^2)

a) 2π cm/s b) 4π cm/s c) 8π cm/s d) 16π cm/s

(MHT-CET 2020)

38. A particle rotates in a horizontal circle of radius 'R' in a conical funnel with speed 'v'. The inner surface of the funnel is smooth. The height of the plane of the circle from the vertex of the funnel is

a) $\frac{v^2}{g}$ b) $\frac{v}{2g}$ c) $\frac{v}{g}$ d) $\frac{v^2}{2g}$

(MHT-CET 2021)

39. A bob of simple pendulum has mass 'm' and is oscillating with amplitude 'A'. If the length of pendulum is 'L', then the maximum tension in the string is

a) $\frac{mg}{\left[1-\left(\frac{A}{L}\right)^2\right]}$ b) $\frac{mg}{\left[1+\left(\frac{A}{L}\right)^2\right]}$ c) $mg\left[1-\left(\frac{A}{L}\right)^2\right]$ d) $mg\left[1+\left(\frac{A}{L}\right)^2\right]$

(MHT-CET 2022)

40. A string of length 'L' fixed at one end carries a mass 'm' at the other end. The string makes $3/\pi$ r.p.s. around the vertical axis through fixed end. The tension in the string is

a) 9 mL b) 18 mL c) 36 mL d) 72 mL

1.4 Vertical Circular Motion

(MHT-CET 2001)

41. A fighter aeroplane flying in the sky dives with a speed of 360 km/h in a vertical circle of radius 200 m. Weight of the pilot sitting in it is 75 kg. What will be the value of force with which the pilot presses his seat when the aeroplane is at highest position? ($g = 10$ m/s^2)

a) 3000 N b) 4500 N c) (75 × g) N d) 300 N

42. A mass of 5 kg tied to a string of length 1.0 m is rotated in vertical circle with a uniform speed of 4 m/s. The tension in the string will be 170 N when the mass is at ($g = 10$ m/s^2)

a) highest point b) midway

c) bottom d) cannot be predicted

(MHT-CET 2004)

43. A simple pendulum of mass m and length l stands in equilibrium in vertical position. The maximum horizontal velocity that should be given to the bob at the bottom so that it completes one revolution is

a) $\sqrt{lg}$ b) $\sqrt{2lg}$ c) $\sqrt{3lg}$ d) $\sqrt{5lg}$

53. The moment of inertia of a disc about a tangent axis in its plane is

a) $\frac{MR^2}{4}$ b) $\frac{3MR^2}{2}$ c) $\frac{5}{4}MR^2$ d) $\frac{7MR^2}{4}$

(MHT-CET 2004)

54. The centre of mass of two particles system divides, the distance between them

a) inverse ratio of squares of masses of particles

b) direct ratio of squares of masses of particles

c) inverse ratio of masses of particles

d) direct ratio of masses of particles

(MAH-EN-CET 2004)

55. If radius of solid sphere is doubled by keeping its mass constant, then

a) $\frac{I_1}{I_2}=\frac{1}{4}$ b) $\frac{I_1}{I_2}=\frac{4}{1}$ c) $\frac{I_1}{I_2}=\frac{3}{2}$ d) $\frac{I_1}{I_2}=\frac{2}{3}$

(MHT-CET 2005)

56. Moment of inertia of a disc about an axis which is tangent and parallel to its plane is I. Then the moment of inertia of disc about a tangent, but perpendicular to its plane will be

a) $\frac{3I}{4}$ b) $\frac{3I}{2}$ c) $\frac{5I}{6}$ d) $\frac{6I}{5}$

(MHT-CET 2006)

57. Calculate the M.I. of a thin uniform ring about an axis tangent to the ring and in the plane of the ring, if its M.I. about an axis passing through the centre and perpendicular to plane is 4 kg m^2.

a) 12 kg m^2 b) 3 kg m^2 c) 6 kg m^2 d) 9 kg m^2

(MHT-CET 2008)

58. Two discs having same mass, rotate about the same axis with their densities ρ_1 and ρ_2 respectively such that $(\rho_1 > \rho_2)$, then the relation between I_1 and I_2 will be

a) $I_1 < I_2$ b) $I_1 = I_2$ c) $I_1 > I_2$ d) $I_1 = 2I_2$

(MHT-CET 2011)

59. About which of the following axes moment of inertia of a disc is minimum?

a) Axis passing through its centre and perpendicular to its plane.

b) Axis along the diameter.

c) Axis along the tangent and in its own plane

d) Axis along the tangent and perpendicular to its plane.

(MHT-CET 2012)

60. Moment of inertia of a solid sphere about its diameter is I. If that sphere is recast into 8 identical small spheres, then moment of inertia of such small sphere about its diameter is

a) I/8 b) I/16 c) I/24 d) I/32

61. Two uniform circular discs A and B of radii R and 4R with thicknesses x and x/4 respectively, rotate about their axes passing through their centres and perpendicular to there planes. If M.I. of first disc is I_A and that of second disc is I_B then

a) $I_A = I_B$ b) $I_A > I_B$ c) $I_B > I_A$ d) data is insufficient

(MHT-CET 2020)

68. Two rings of radii R and nR made from the same wire have the ratio of moments of inertia about an axis passing through their centre and perpendicular to the plane of the rings as 1 : 8. The value of n is

a) $2\sqrt{2}$ b) 2 c) 4 d) $\frac{1}{2}$

(MHT-CET 2021)

69. Two circular loops A and B are made of the same wire and their radii are in the ratio 1 : n. Their moments of inertia about the axis passing through the centre and perpendicular to their plane are in the ratio 1 : m. The relation between 'm' and 'n' is

a) $m = n^4$ b) $m = n^2$ c) $m = n$ d) $m = n^3$

(MHT-CET 2022)

70. Match the following columns (R = radius, K = Radius of gyration)

Column I		Column II	
A)	'K' for a solid sphere rotating about its tangent.	p)	$\sqrt{2}$ R
B)	'K' for a ring rotating about its tangent perpendicular to its plane	q)	$\frac{R}{2}$
C)	'K' for a uniform solid right circular cone rotating about its central axis	r)	$\frac{\sqrt{7}}{\sqrt{5}}$ R
D)	'K' for a uniform disc rotating about its diameter	s)	$\frac{\sqrt{3}}{\sqrt{10}}$ R

a) A - q; B - r; C - p; D - s b) A - r; B - q; C - s; D - p

c) A - p; B - r; C - q; D - s d) A - r; B - p; C - s; D - q

1.6 Radius of Gyration

(MHT-CET 2003)

71. Radius of gyration of disc rotating about an axis perpendicular to its plane passing through its centre is (If R is the radius of disc)

a) $\frac{R}{2}$ b) $\frac{R}{\sqrt{2}}$

c) $\frac{R}{\sqrt{3}}$ d) $\frac{R}{3}$

(MHT-CET 2006)

72. A uniform disc of mass 2 kg is rotated about an axis perpendicular to the plane of the disc. If radius of gyration is 50 cm, then the M.I. of disc about same axis is

a) 0.25 kg m^2 b) 0.5 kg m^2 c) 2 kg m^2 d) 1 kg m^2

(MH-CET 2016)

73. Let 'M' be the mass and 'L' be the length of a thin uniform rod. In first case, axis of rotation is passing through centre and perpendicular to the length of the rod. In second case axis of rotation is passing through one end and perpendicular to the length of the rod. The ratio of radius of gyration in first case to second case is

a) 1 b) $\frac{1}{2}$ c) $\frac{1}{4}$ d) $\frac{1}{8}$