Physics(problems) Assignment – CIRCULAR MOTION

1. A 0.5 kg of mass is rotated in a horizontal circle of radius 20 c.m. calculate the centripetal force acting on it, if angular speed of revolution is0.8 red/s.(F = 0.064 N)

2. A body of mass 1 kg is tied to a string and revolved in a horizontal circle of radius 1m. Calculate the maximum number of revolution per minute, so that the string dose not break, Breaking tension of the string is 9.86 N.(n = 30 rpm)

3. Find the angular speed of revolution of earth required so that the body on its surface at equator would feel no weight, (Radius of earth = 6400 km, g = 9.8 m/s^2) (w = 1.237 x 10^{-3} rad / s)

4. One kg mass tied at the end of the string 0.5 m long is whirled in a horizontal circle, The breaking tension in the string is 50 N. Find the greatest speed that can be given to the mass .(5 m / s)

5. A 0.5 kg mass is rotated in a horizontal circle of radius 20 cm. Calculate the centripetal force acting on it, if its angular speed of rotation is 0.6 rad / s (0.036 N)

6. A cion kept on a horizontal rotating disc has its center at a distance of 0.1 m from the axis of rotation of the disc. If the coefficient of friction between the coin and the disc is 0.25, find the speed of the disc at which coin would be about to slip off.(w = 4.95 rad /s)

7. A cion kept on a horizontal rotating disc has its center at a distance of 0.25 m from the Axis of rotation of the disc . If m = 0.2 , find the angular velocity of the disc at which the coin is about to slip off . (g = 9.8 m /s^2) (w = 2.8 rad / s)

8. A coin just remains on a disc rotating at 120 r.p.m. when kept at the distance of 1.5 cm from the axis of rotation brtween the cion and th (0.2417)

9. Calculate the angular velocity of earth due to its spin motion (w = 7.27 x 10^{-5} rad / s)

10. Calcuate the angular speed of minute hand of a clock (w = 1.744 x 10^{-3} rad / s)

11. What is the angular displacement of the minute hand in 20 minutes (2.095 rad)

12. What is angular seep of a second hand of a clock ? If the second hand is 10 cm long, find the liner speed at its tip.(1.0466 x 10^{-2} m / s)

13. The frequency of a particle performing circular motion changes from 50 r.p.m. to 180 r.p.m. in 20 second /s. Calculate the angular acceleration (0.628 rad / s^2)

14. Determine the angular acceleration of a rotating body which slows down from 500 r.p.m. to rst in 10 second. (5.233 rad / s)

15. An object of mass 0.4 kg is whirled horizontal circle of radius 2 m . If it performs 60 rev / min . Calculate the centripetal force acting on it. (31.55 N)

16. With what maximum speed a car be safely driven along a curve of radius 40 m on a horizontal road , if the coefficient of friction between the car types and road surface is 0.3 ? (10.84 m /s)

17. A flyover bridge is in the from of a circular are of radius 30 m . Find the limiting speed at which a car can cross the bridge without losing contact with the road at the highest point . Assume the centre of gravity of the car to be 0.5 m above the road .
   (17.289 m /s).

18. Calculate the maximum speed with which a car can be safely driven along a curved road of radius 30 m and banked at 30° with the horizontal .(13.03m/s)

19. A curved road of radius 90m is to be banked so that a vechicle may move along the curved road, with a uniform speed of 75.6 km/h without any tendency to slip off. What must be the angle of banking ?(g=9.8m /s^2) . (26°, 34')

20. A vehicle is moving along a circular road which is inclined to the horizontal at 10°.The maximum velocity with which it can move safely is 36 km/h. Calculate the length of the circular road. (363.6 m)

21. The vertical section of a road over a bridge in the direction of its length is in the from of an are of a circle of radius 4.4 m. Find the greatest velocity at which a vehicle can cross the bridge without losing contact with the road at the point , if the centre of gravity of the vehicle is 0.5 m from the ground. (Given: g=9.8 m/s^2) (v = 6.9296 m/s)

22. Calculate the angular speed of the second hand and minute hand and of a clock.
    (w = 1.744 x 10^{-3} rad / s)

23. What is the angular speed of the minute hand of a clock ? If the minute hand is 7 cm long, what is the liner speed at its tip? $(1.2208 \times 10^{-4}$ m / s)

24. Calculate the angular speed and linear speed of tip of a second hand of a clock, if second hand 4 cm long. $(v = 0.4187 \times 10^{-2}$ m / s)

25. At what angular speed should the earth rotate about its axis so that apparent weight of a body on the equator will be zero? $(1.237 \times 10^{-3}$ rad / s)

26. A body of mass 2 kg is tied to a string, 1.5 m long and revolved in a horizontal circle about the other end. If it performs 300 r.p.m., calculate its. Linear velocity and centripetal acceleration. $(1478.9$ m /s$^2)$

27. An electron of mass 9×10^{-31}kg is revolving in a stable orbit of radius 5.37×10^{-11} m. If electrostatic force of attraction between electron and proton is 8 1 10-8 N. Find the velocity of electron. $(2.185 \times 10^6$m/s$)$

28. A mass of 5kg is tied at the end of the string 1.2m long rotates in a horizontal circle.If the breaking tension in the string is 300 N, find the maximum number of rotations per minute the mass can make. (67.56 rpm)

29. The breaking tension of a string is 80kg wt. A mass of 1kg is attached to the string and rotated in a horizontal circle on a horizontal surface of radius 2m. Find the maximum number of revolutions made without breaking. $(g=9.8$m/s$^2)$ (n=3.153 rps

30. A string breaks under a tension of 10kg.wt.if a string is used to revolve a body of mass 1.2gm in a horizontal circle of radius 50cm,what is the maximum speed with which a body can be revolved ? When a body is revolving at maximum speed,when is its period ?
(0.01553 s)

31. A bucket containing water is tied to one end of a rope 8m long and rotated about the other end in vertical circle. Find the minimum number of rotations per minute in order that in the bucket may not speed? (10.57 rpm)

32. A motor cyclist rides in a vertical in a hollow sphere of radius 5 m . Find the minimum angular speed required so that it does not loose contact contact with the sphere at the highest point. (1.4 rad /s)

Four Marks Each

1. A conical pendulum has length 1m and the angle made by the string with the vertical is 10°. The mass of the bob is 0.2 kg.Find (i) the tension in the string (ii) the period of the circular motion of the bob $(g=9.8$m/s^2) (10.57 rpm) / (1.991 s)

2. A small spheruica body is tied to a string of length 0.5 m and revolved in a vertical circle such that the tension in the string is zero at the body in the (i) lowest position (ii)highest position $(g=9.8$m/s$^2)$ (2.214 m/s)

3. A motor cyclist going along banked circular path has to lean inwards making an angle of 21° 49 with the vertical in order to keep his balance. If the path length is 1km long, find the speed of the motor cyclist.$(g=9.8$m/s$^2)$ (22.99 m/s)

4. Find the angle of banking of railway track of radius of curvature 250m,if the optimum velocity of the train is 90km/h.Also find the elevation of the outer track over the inner track, if the two tracks are 1.6 m apart. (0.3957 m)

5. Find the angle which a bicycle and its rider must make with the vertical when travelling at 18 km/h around a horizontal curve of radius 10 m. $(14^o,19`)$

6. The distance between two rail of rail track is 1.6 m along a curve of radius 800m.The outer rail is raised above the inner rail by 10cm. With what maximum speed can a train be safely driven along the curve ? (22.17 m/s)

7. Find the angle of baking of curved railway track of radius 600 m ,if the maximum safety speed limit is 54 km/hr. If the distance between the rails ids 1.6m, find the elevation of the outer track above the inner track. (0.06096 m)

8. The circumference of a track is 1.256 km. Find the angle of banking of the track, if the maximum speed at which a car can be driven safely along it is 25m/s. $(17^o,41`)$

9. The radius of curvature of meter gauge railway line at a place where the train is moving with a speed of 10m/s is 50 m. If there is no side thrust on the rails, find elevation of the outer rail above the inner rail. (0.2 m)

10. A coin just remains on a disc rotating at a steady rate of 180 r.p.m. A coin is kept at a distance of 2 cm from the axis of rotation .Find the coefficient of friction between the coin and the disc. (0.7244)

11. A ball of mass 100g is suspended by a string 40cm long. Keeping the string always taut, the ball describes a horizontal circle of radius 10cm.Find the angular speed. (5.034 rad/s)

12. A particle describes a horizontal circle on the smooth inner surface of a conical funnel as shown in figure. If the height of the plane of the circle above the vertex is 9.8 cm, find the speed of the particle. (0.98 m/s)