Marks

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks)

UNIT — I

III (a) Explain the term moment of inertia. State the theorems of moment of inertia. 3

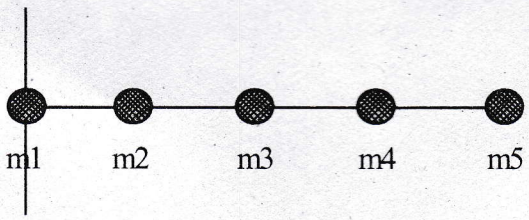
(b) A disk of moment of inertia 1.5 kgm^2 is initially at rest. It is acted upon by a constant torque of 120 Nm for 5 s. Find the final angular momentum and kinetic energy of the disk. 6

(c) A thin circular ring of mass 0.5 kg and radius 15 cm is rolling at a constant speed of 60 rpm. Calculate its moment of inertia, angular momentum and total kinetic energy. 6

OR

IV (a) Why does a cyclist lean inward while riding along a curved path ? Write down the relevant formula for the leaning angle. 3

(b) Five masses ml = 1 kg, m2 = 2 kg, m3 = 3 kg, m4 = 4 kg and m5 = 5 kg are arranged along a line as shown in figure such that the separation between adjacent masses is 0.2 m. Calculate the moment of inertia and radius of gyration of the system about an axis perpendicular to the line of masses and through the mass ml.



6

(c) A wheel starting from rest rotates with a constant angular acceleration of 5π rad/s^2 for 10 s. Calculate the final angular velocity and the total number of revolutions it makes within this duration. 6

UNIT — II

V (a) What is meant by escape velocity ? Derive än expression for it. 3

(b) Derive the expression for orbital velocity and period of an artificial satellite around the Earth. 6

(c) Given that the radius of the Earth as 6400 km and acceleration due to gravity at the surface of the Earth, g = 9.8 ms^{-2}. Calculate the value of acceleration due to gravity at an altitude, h = 10 km. Also calculate the value of g at a depth d = 10 km. 6

OR