Roll No. ..... Total Pages : 3

GSQ/M-21 1723

DYNAMICS

Paper–BM-363

Time Allowed : 3 Hours] [Maximum Marks : 27

Note : Attempt **five** questions in all, selecting **one** question from each Unit. Question No. **1** is compulsory.

Compulsory Question

1. (i) Define the Radial and transverse acceleration. 1

   (ii) Define the periodic motion. Show that S.H.M. is periodio. 2

   (iii) A car weighing 250 kg. travelling at 19.6 m/sec. is brought to rest in 4.9 m by application of breaks. Find force of resistance of brakes. 2

   (iv) Define the Absolute unit of force and gravitational unit of force. 1

   (v) Write differential equation of central orbit in polar form. 1

UNIT–I

2. (a) If the particle moves along the curve $r = a\, e^{\theta \cot x}$ with constant angular velocity, show that resultant acceleration of the posticle makes an angle 2α with the radius vector. 2½

   (b) A ship streams due west with a velocity of 15 km/hr relative to the current which is flowing at the rate of 6 km of a train going north at a rate of 30 km/hr. relative of ship? 2½

3. (a) At the end of three successive seconds, the distance of moving point with S.H.M. from its mean position measured in the same direction are 1, 5, 5. Show that the period of complete oscillation is $\frac{2\pi}{\theta}$ sec. where $\cos\theta\frac{3}{5}$. 2½

(b) A particle is attached to the middle point of a uniform elastic string which is stretched between two points A and B on a smooth horizontal table. If the particle is pulled to some point C between A and B then liberated, show that the motion is sample harmonic and find the period of motion. What is the amplitude? 2½

UNIT–II

4. (a) An engine and train weight 200 metric tons and engine can exert a push of 5 metric tons wt. Find the tension in the coupling if the engine alone weighs 60 metric tons, the resistance bang equal to 10 kg per tons. 2½

(b) To one end of a light string passing over a smooth fixed pully is attached a particle of mass m_1 and the other end carries a light pulley over which passes a light string to whose ends are attached particles of masses m_1 and m_2, Show that the mass m_1 will remain at rest if $\frac{4}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$. 2½

5. (a) An engine gets upto a velocity of 30 m.p.h. in one minute and 50 sec. from rest in a train of 200 tons wt. on a level line if the resistances are 14 lbs wt. per ton and the velocity is uniformly accelerate, find the greatest H.P., the engine is developing and the greatest velocity it can get, if the H.P. is maintained. 2½

(b) A bullet fired with a velocity of 1600 ft/sec. passes through three planks in succession. If it loses a velocity of 400 H/sec. thickness to which the resistance is supposed to be proportional. 2½

UNIT–III

6. (a) A particle is placed outside of a smooth vertical circle if the particle starts from a point whose angular distance is α from the highest point of the circle, show that it will fly off the curve when $\cos\theta_1 = \frac{2}{3}\cos\alpha$.

(b) A heavy particle slides down a smooth cycloid starting from rest at the cusp, the anis being vertical and vertex downwards. Prove that magnitude of acceleration is g. 2½

7. (a) A Cricket ball thrown from a height of 6 ft. an angle of 30º to the horizon with a speed of 60 ft/sec is caught by another fieldsman at a height of 2 ft. from the ground. How for apart were the two men? 2½

(b) A triangle ABC, right angled at C is placed in a vertical plane with AB horizontal and C upper most. A particle fixed from A passes exactly through C and B. Show that the angle and the clarity of projection u are given by $\tan\theta = \frac{c}{p}$ and $u^2 = \frac{(c^2 + p^2)}{2p}$, where AB = C and P is the attitude of the triangle. 2½

UNIT–IV

8. (a) Find the law of force towards the pole under which the curve $r^n = a^n \cos n\theta$ can be described, hence obtain the law of force under which a cardioid can be described. 2½

(b) A particle moves in a plane under a central force which varies inversely as the square of the distance from the fixed point. Find the orbit. 2½

9. (a) If a planet were suddenly stopped in the orbit when at a distance 'a' from the sun, show that it would fall in the sum in time $\frac{\sqrt{2}\,\pi\, a^{3/2}}{4\sqrt{\mu}}$ which is $\frac{\sqrt{2}}{8}$ times the peroid of the planet's revolution. 2½

(b) Show that the path of particle which is moving so that its acceleration is always directed to a fixed point and is equal to $\frac{\mu}{(\text{distance})^2}$ is a conic section and distinguish between the three cases that arises. 2½