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V.P.& R.P.T.P.Science College.Vallabh Vidyanagar.
Internal Test B.Sc. Semester VI
US06CMTH06 (Mechanics-2)
Saturday , 17^{th} March 2018 11.00 a.m. to 12.30 p.m. Maximum Marks :25

Que.1 Fill in the blanks. 3

(1) If a particle slide down on a smooth incline plane starting from the rest then kinetic energy at time t is ....
(a) $mgh - mgx\sin\alpha$ (b) $mgx\sin\alpha$ (c) $mgh - mgx$ (d) mgx

(2) The equation of motion of a projectile with resistance for the forces along tangential direction is given by ....
(a) $m\ddot{x} + R\cos\theta = 0$ (b) $m\ddot{y} + R\sin\theta + mg = 0$ (c) $mv\frac{dv}{ds} + mg\sin\theta + R = 0$ (d)$\frac{v^2}{\rho} + g\cos\theta = 0$

(3) For the curve $u = \frac{1}{a}\ e^{n\theta}$, perpendicular distance from the centre to the tangent to the path is proportional to ....
(a) v (b) $\frac{1}{v}$ (c) u^3 (d) $\frac{1}{u^3}$

Que.2 Answer the following (Any Two) 4

(1) State and prove principle of angular momentum about a point.
(2) If R is maximum horizontal range of the projectile, prove that a point whose horizontal and vertical distances are R/2 and R/4 resp., lie on the path provided that the tangent of angle of projection is 1 or 3.
(3) In usual notation prove that $\left(\frac{du}{d\theta}\right)^2 + u^2 = \frac{2(E-V)}{h^2}$.

Que.3 (a) The rate of change of angular momentum of a system relative to the mass center is equal to the moment of the external forces about the mass center. 3
(b) State and prove principle of energy . 3

OR

Que.3 (a) Obtain equation of motion of a particle in (i) tangent and normal form (ii) polar form. 3
(b) State and prove principle of conservation of energy for system of particle . 3

Que.4 (a) A bomb is dropped vertically downward from rest under the force of gravity. The resistance of air is $mgcv^2$. Show that the velocity of a bomb is , $\sqrt{\frac{1-e^{-2ghc}}{c}}$ when it strikes the ground. 4
(b) A particle just clear a wall of height b, at a distance a and and strikes the ground at a distance c, from the point of projection. Prove that the angle of projection is given by, $\alpha = \tan^{-1}\left(\frac{bc}{ac-a^2}\right)$. 2

OR

Que.4 (a) A particle of mass m is projected vertically upward in medium for which resistance R is mk^2v^2 .If the initial velocity is v_0 then show that the particle returns to the point of projection with velocity v_1 such that $\frac{1}{v_1^2} = \frac{1}{v_0^2} + \frac{k^2}{g}$. 3
(b) For a particle, moving with resistance which is independent of height, prove that $\frac{1}{v}\frac{dv}{d\psi} = \tan h\psi + \phi(v)$. 3

Que.5 (a) Obtain equation of orbit described under a central force varying directly as the distance , in the form $\frac{x^2}{a^2} + \frac{y^2k^2}{v_0^2} = 1$, where v_0 is the initial velocity of the particle in the direction of y-axis and (a , 0) is the initial position of particle . 3
(b) State and prove the theorem of $K\ddot{O}NIG$. 3

OR

Que.5 (a) In usual notation prove that the semi latus rectum and the eccentricity are given by $l = \frac{h^2}{\mu}$; $e = \sqrt{1 + \frac{2Eh}{\mu^2}}$ respectively . 6

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