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V.P.& R.P.T.P.Science College.Vallabh Vidyanagar.
Internal Test
B.Sc. Semester VI
US06CMTH06 (Mechanics - 2)
Saturday , 15^{th} March 2014
3.30 p.m. to 5.00 p.m.

Maximum Marks: 30

Que.1 Answer the following (Any three) 6

(1) State and prove principle of linear momentum of a system .

(2) State and prove d'Alembert's principle .

(3) Find the maximum height H attained by the projectile

(4) A particle is projected upward in the direction of making an angle 60^o with the horizontal. Show that its velocity at maximum height is half of its initial velocity (Neglect resistance of air) .

(5) In a motion under a central force , prove that the areal velocity is constant .

(6) By using theorem of parallel axes find moment of inertia of a rod of mass m and length $2a$ about a line through one end perpendicular to the rod .

Que.2 (a) State and prove principle of conservation of energy . 4

(b) Obtain equation of motion of a particle in (i) cartesian form (ii) tangent and normal form . 4

OR

Que.2 (a) State and prove principle of angular momentum of a system relative to the mass center . 5

(b) If the vector sum of the external forces is zero then prove that the linear momentum of the system is constant . 3

Que.3 (a) Obtain the equation of motion of projectile with resistance in the form
$x = x_0 + u_x\, t - \frac{1}{2}\,\phi\, u_x\, t^2 \;\; ; \;\; y = y_0 + u_y\, t - \frac{1}{2}\, g\, t^2 - \frac{1}{2}\,\phi\, u_y\, t^2 \left(1 - \frac{gt}{3\, u_y}\right)$. 5

(b) Obtain differential equation of hodograph . 3

OR

Que.3 (a) Obtain equation of path of projectile in the form $y = x \tan\alpha \left(1 - \frac{x}{R}\right)$, where R is horizontal range . Hence prove that the angle of projection is given by $\tan^{-1}\left[\frac{y}{x}\left(\frac{R}{R-x}\right)\right]$. 5

(b) Find the velocity of a particle at any point of its trajectory . 3

Que.4 (a) If a particle moves in a central orbit under inverse square law then prove that its orbit is conic .Also determine the condition that a conic is an ellipse ,parabola or hyperbola . 5

(b) In usual notation prove that $v^2 = \mu\left(\frac{2}{r} - \frac{1}{a}\right)$. 3

OR

Que.4 (a) State and prove the theorem of parallel axes. 4

(b) Find the moment of inertia of a solid sphere of mass m and radius a about its diameter. 4