

V.P.& R.P.T.P.Science College.Vallabh Vidyanagar.

Internal Test

B.Sc. Semester VI

US06CMTH06 (Mechanics - 2)

Saturday , 15th March 2014

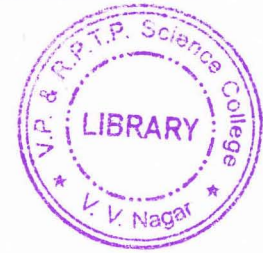
3.30 p.m. to 5.00 p.m.

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° 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 .

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

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Que.3 (a) Obtain the equation of motion of projectile with resistance in the form

$$x = x_0 + u_x t - \frac{1}{2} \phi u_x t^2 \quad ; \quad y = y_0 + u_y t - \frac{1}{2} g t^2 - \frac{1}{2} \phi u_y t^2 \left(1 - \frac{gt}{3 u_y} \right) .$$

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- (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

