V.P.& R.P.T.P.Science College.Vallabh Vidyanagar.
Internal Test
B.Sc. Semester V
US05CMTH06 (Mechanics)
7/10/2013, Monday 3:30 p.m. to 5:00 p.m.

Maximum Marks: 30

Que.1 Answer the following. 6

(1) 1 poundal = ... dynes .
(a) 13862 (b) 13826 (c) 13268 (d) 13628

(2) If resultant of two force is maximum, then angle between them is .....
(a) $\frac{\pi}{2}$ (b) π (c) 0^o (d) $\frac{\pi}{4}$

(3) If line of action of $\bar{P}$ is parallel to a line L then moment of $\bar{P}$ about L = ...
(a) 0 (b) 2 (c) 1 (d) -1

(4) The force acting along on a particle are in equilibrium and angle between $P\&Q$ is 120, $Q\&R$ is 90, then the ratio of forces is $P : Q : R$ = ...
(a) $3 : 1 : 2$ (b) $-1 : \sqrt{3} : 2$ (c) $-\sqrt{3} : 2 : 1$ (d) $2 : 1 : \sqrt{3}$

(5) Transverse component acceleration of a particle moving in a plane is .....
(a) $\frac{1}{r}\frac{d}{dt}\left(r^2\dot{\theta}\right)$ (b) $\frac{1}{r}\frac{d}{dt}(r^2\theta)$ (c) $\frac{1}{r^2}\frac{d}{dt}\left(r^2\dot{\theta}\right)$ (d) $\frac{1}{r^2}\frac{d}{dt}\left(r\,\dot{\theta}\right)$

(6) If a particle moves in a plane with constant speed then $\angle(\bar{a}, \bar{v})$ = ...
(a) π (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) 0

Que.2 Answer the following. (Any three) 6

(1) If $V = x^2 + y^2 + z^2 + xy + x$, then at which points in the space vector grad$V$ is parallel to Z-axis?
(2) If two forces $\bar{P}, \bar{Q}$ are acting along a same line but opposite direction, then prove that magnitude of their resultant is $R = |P - Q|$.
(3) Three forces acting at a point are in equilibrium. If the angle between first and second is 90^o, second and third is 120^o ,then find out the proportion of forces.
(4) If particle is in equilibrium under the action of forces 1 ,1 ,$\sqrt{3}$ lb.wt. How do they act?
(5) In usual notation prove that $s^2 = y^2 + 2cy$.
(6) Define hodograph and derive the hodograph for a particle moving in a circle with constant speed .

Que.3 Find the component of gradient of V along a co-ordinate axis. 6

OR

Que.3 A particle moves on a straight line under a retardation Kv^{m+1}, where v is the velocity at time t. Show that
(i) $Ks = \frac{1}{m-1}[\frac{1}{v^{m-1}} - \frac{1}{u^{m-1}}]$ (ii) $Kt = \frac{1}{m}[\frac{1}{v^m} - \frac{1}{u^m}]$, where u is initial velocity. 6

Que.4 A door of weight w , height 2a , width 2b is hinged at top and bottom .If the reaction at upper hinge has no vertical component , find the components of reaction at both hinge ,assume that the weight of the door acts at it's center .Determine this reaction for a door of weight 34.5 lb wt and measuring 6ft 10in by 3ft 2in . 6

OR

Que.4 State and prove theorem of Varignon. 6

Que.5 Obtain the general equation of common catenary in the form $y = c(\cosh \frac{x}{c} - 1)$ and hence prove that $y = c(\cosh \frac{x}{c})$. 6

OR

Que.5 A particle moves in a catenary $S = c \tan \psi$. The direction of its acceleration at a point makes equal angle with the tangent and normal to the path at the point. If the speed at the vertex where $\psi = 0$ is u then show that the velocity and resultant acceleration at any point are given by ue^{ψ} and $\frac{\sqrt{2}u^2 e^{2\psi} \cos^2 \psi}{c}$ respectively. 6

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