V.P.& R.P.T.P. Science College ,Vidyanagar.
B.Sc.( SEMESTER - V ) Internal Test
MATHEMATICS : US05CMTH06 ( Mechanics - 1 )
Date. 10/10/2019 ; Thursday 11.00 a.m. to 12.15 p.m. Maximum Marks: 25

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Que.1 Fill in the blanks. 5

(1) [ Angular Momentum ] = ..................
(a) $ML^2T^{-2}$ (b) $MLT^{-1}$ (c) $ML^2T$ (d) $ML^2T^{-1}$

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

(3) Dimension of power is .................
(a) $MLT^{-2}$ (b) $ML^2T^{-2}$ (c) $ML^2T^2$ (d) $ML^2T^{-3}$

(4) If density $\rho$ is constant then the body is said to be .......................
(a) homogeneous (b) heterogeneous (c) exact (d) rigid

(5) Radial component of acceleration of a particle moving in a plane is .................
(a) $\ddot{r} + r\,\dot{\theta}^2$ (b) $\ddot{r} - r\,\dot{\theta}$ (c) $\dot{r} - r\,\dot{\theta}^2$ (d) $\ddot{r} - r\,\dot{\theta}^2$

Que.2 (a) State and prove Law of Parallelogram of two forces .Hence find resultant force when two forces are acting (i) along the same line and same direction (ii) along the same line and opposite direction (iii) along right angles. 5

**OR**

Que.2 (b) If the fundamental law of mechanics of a particle moving on a straight line is 5
$m\frac{d}{dt}\left(\frac{\dot{x}}{\sqrt{1-\frac{\dot{x}^2}{c^2}}}\right) = F$ . Find the distance traveled from the rest in time '$t$' under the action of a force F .

Que.3 (a) State and prove theorem of Varignon . 5

**OR**

Que.3 (b) A door of weight $w$ . height $2a$ , width $2b$ is hanged 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 . 5

Que.4 (a) Prove that the force of attraction of a thin spherical shell at any 5
(i) external point of shell is directed toward the centre and magnitude of force is $GM/r^2$ .
(ii) internal point of shell is zero .

**OR**

Que.4 (b) A rod $AB$ is movable about point $A$ , and at B attached a string whose other end is tied to a ring. The ring slides on a smooth horizontal wire passing through $A$ . By using principle of virtual work prove that horizontal force necessary to keep the ring at rest is $\frac{w\,\cos\alpha\,\cos\beta}{2\,\sin(\alpha+\beta)}$ , where $w$ is weight of the rod , $\alpha$ and $\beta$ are the inclination of the rod and the string to the horizontal. 5

Que.5 (a) Derive differential equation of suspension bridge. Also show that it represent the equation of parabola and also find its tension . 5

**OR**

Que.5 (b) 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 $ue^{\psi}$ and $\frac{\sqrt{2}u^2e^{2\psi}\cos^2\psi}{c}$ respectively. 5

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