V.P.& R.P.T.P. Science College ,Vidyanagar.
B.Sc.(SEMESTER - V) Internal Test
MATHEMATICS : US05CMTH06 (Mechanics - 1)
Date. 9/10/2017 ; Monday 11.00 a.m. to 12.30 p.m. Maximum Marks: 25

Que.1 Fill in the blanks. 3

(1) Newton is unit of force in .....
(a) C.G.S (b) F.P.S (c) M.K.S (d) None of this

(2) A branch of mechanics which deals with the equilibrium of systems at rest is known as .....
(a) dynamics (b) statics (c) motion (d) acceleration

(3) If density ρ varies from point to point in a body , then the body is said to be .....
(a) homogeneous (b) rigid (c) exact (d) heterogeneous

Que.2 Answer the following (Any Two) 4

(1) State Fundamental laws of Newtonian Mechanics.

(2) ABCD is a square of side 2 unit, forces 1 , 2 , 3 , 4 lb wt act along $\overline{AB}, \overline{CB}, \overline{DC}, \overline{DA}$ respectively . Find the algebraic sum of their moments about Center of a square .

(3) State and prove Pappu's theorem for plane curve .

Que.3 (a) Find the component of gradient of V along a co-ordinate axis. 4

(b) Resolve the force of 100 gm wt into two components making an angle 60^o and 30^o on either side . 2

OR

Que.3 (a) If resultant $\bar{R}$ of two forces $\bar{P}$ and $\bar{Q}$ make an angle α with first force $\bar{P}$ and β with the other force $\bar{Q}$ then prove that (i) $P = \dfrac{R\sin\beta}{\sin(\alpha+\beta)}$ (ii) $Q = \dfrac{R\sin\alpha}{\sin(\alpha+\beta)}$. 4

(b) A uniformly accelerated automobile passes through two telephone poles with velocities 10 and 20 mph respectively . Calculate its velocity when it is half way between the poles. 2

Que.4 (a) State and prove theorem of Varignon . 3

(b) The end of a rope 7 m long are attached to two pegs A and B , 5 m apart ,the line $\overline{AB}$ being horizontal , A body of weight 500 gms hangs from the rope at a point 3 m from one end . What are the tensions in two part of the rope ? 3

OR

Que.4 (a) State and prove necessary condition of equilibrium of system of particles in terms of moment. 3

(b) O is the circumcenter of the $\triangle ABC$. If forces $\vec{P}, \vec{Q}$ and $\vec{R}$ are acting along $\overline{OA}, \overline{OB}$ and $\overline{OC}$ are in equilibrium. Show that $\dfrac{P}{a^2(b^2+c^2-a^2)} = \dfrac{Q}{b^2(a^2+c^2-b^2)} = \dfrac{R}{c^2(a^2+b^2-c^2)}$. 3

Que.5 (a) Prove that the force of attraction of a thin spherical shell at any external point of shell is directed toward the centre and magnitude of force is GM/r^2 . 3

(b) In usual notations prove that $\delta W = X\delta x + Y\delta y + Z\delta z$. 3

OR

Que.5 (a) Find the center of gravity of the area bounded by the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ in the first quadrant. 3

(b) A light rigid rod of length $2b$ terminated by heavy particles of weight w and W ,is placed inside the smooth hemispherical bowl of radius a,which is fixed with its own rim horizontally . If the particle of weight w rests just below the rim then prove that $wa^2 = W(2b^2 - a^2)$. 3

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