(29)

KPK, PUBLIC SERVICE COMMISSION

Competitive Examination for the Posts of PMS, 2016

APPLIED MATHEMATICS, PAPER-1

Time Allowed: 03 Hours **Max: Marks: 100**

Section A

Q.1 (a) Find the Volumes of solids generated by revolving the regions bounded by the lines and curves about the x-axis (10)

$y = \sqrt{\cos x}$, $0 \le x \le \frac{\pi}{2}$, $y = 0$, $x = 0$

(b) Find the centres and radii of the spheres (10)

$x^2 + y^2 + z^2 + 4x - 4z = 0$

Q.2 (a) State and explain Green's theorem. (10)

(b) A triangular body with the vertices (10)
$(0,0)$, $(0,1)$ and $(1,0)$ has the density function $\rho(x,y) = xy$. Find the total mass and coordinates of centre of gravity.

Q.3. (a) Use triple integral to find the volume (10)
enclosed between $x^2 + y^2 = 25$ and the plane $z = 5$ and $x + z = 9$

(b) what is principal of virtual work and its applications. (10)

Q.4 (a) State and explain Gauss theorem. (10)

(b) Find the centroid of the plane region (10)
bounded by parabola $y = 4x - x^2$ and the line $y = x$

(30)

Section B

Q.5 (a) Derive the tangential and normal components of velocity and acceleration (10)

(b) State and explain Keplers Law (10)

Q.6 (a) A projectile is projected at an angle θ so as to hit a target "M" which makes an angle α ($\alpha < \theta$) with the horizontal. Show that the range of the projectile is $R = \frac{2 V_0 \cos\theta \sin(\theta - \alpha)}{g \cos^2 \alpha}$ (10)

(b) Show that the angular momentum of the torque-free symmetrical top rotates in the body coordinates about the symmetry axis with an angular frequency Ω. (10)

Q.7 (a) Define Simple Harmonic Motion and derive the mathematical expression for velocity and frequency when the body is executing Simple Harmonic Motion. (10)

(b) If R_i is an antisymmetric matrix associated with the coordinates of the ith mass point of a system with elements $R_{mn} = \epsilon_{mnl} x_l$. Show that the matrix of inertia tensor can be written as $I = -m_i (R_i)^2$ (10)

Q.8 (a) State and explain parabola of safety (10)

(b) Derive the radial and transverse components of velocity and acceleration. (10)