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B.A./B.Sc.(General) 2nd Semester
1055
MATHEMATICS
Paper -I : Solid Geometry

Time : 3 Hours] **[Max. Marks : 30**

Note :- Attempt **five** questions, selecting at least **two** questions from each section.

SECTION-I

I. (a) Shift the origin to a suitable point so that the equation

$$2x^2 + 3y^2 - z^2 - 8x + 2z + 7 = 0$$

is be transformed from into an equation in which the first degree terms are present .

(b) Show that the directions equally inclined to three mutually perpendicular directions whose direction cosines are $< l_1, m_1, n_1 >, < l_2, m_2, n_2 >, < l_3, m_3, n_3 >$ are given by

$$\left\langle \frac{l_1 + l_2 + l_3}{\sqrt{3}}, \frac{m + m + m}{\sqrt{3}}, \frac{n_1 + n_2 + n_3}{\sqrt{3}} \right\rangle$$ 2,4

II. (a) Find the centre of the two spheres which touch the plane $4x + 3y = 47$ at the point (8, 5, 4) and the sphere $x^2 + y^2 + z^2 = 1$.

(b) Find the equations of the two tangent planes to the sphere $x^2 + y^2 + z^2 = y$, which pass through the line $x + y = 6$, $x - 2z = 3$. 3,3

III. (a) Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ at the pointt P(1, -2, 1) and also cuts orthogonally the sphere $x^2 + y^2 + z^2 - 4x + z - 4x + 6y + 4 = 0$.

(b) Find the equation of tbe sphere through the point (0,0,0) coaxial with the sphere $x^2 + y^2 + z^2 - 4x + 6y + = 0$ and the sphere which has the points (1,2,-3) and (5, 0,1) as the extremities of a diameter. 3,3

IV. (a) Find the equation of the cylinder whose generator are

Parallel to the line $\frac{x}{y} = \frac{y - 4}{5} = \frac{z + 1}{-4}$ and which has for its

Guiding the curve hyperbola $3x^2 - 4y^2 = 5, z = 2$.

(b) Obtain the equation of the right circular cylinder describe on the circle through the points (a, 0, 0), (0, a, 0) and (0, 0, a) as the guiding circle. 3,3

SECTION-II

V. (a) A variable plane is parallel to the given plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 0$

and meets the axis in A,B, C .Prove that the circle ABC lies on the cone

$$yz\left(\frac{b}{c} + \frac{c}{b}\right) + zx\ \frac{c}{a} + \frac{a}{c}\ + xy\left(\frac{a}{b} + \frac{b}{a}\right) = 0$$

(b) Find the equation of cone whose vertex is at (-1, 1, 2) and whose guiding curve is $3x^2 - y^2 = 1, z = 0$. 3,3

6. (a) A right circular cone passes through x-axis , y-axis and line $x = y = z$, show that semi vertical angle of the cone is given by :

$$\cos^{-1}\left[(9 - 4\sqrt{3})^{-\frac{1}{2}}\right]$$

(b) If $x = \frac{y}{2} = z$ represents one of the three mutually perpendiculars generators of the cone $11yz + 6zx - 14xy = 0$, then find the equation of other two . 3,3

7. (a) Prove that the angle between the lines given by

$x + y + z = 0, ayz + bzx + cxy = 0$ is $\frac{\pi}{2}$ if $a + b + c = 0$.

(b) Find the locus of points from which three mutually perppendicular tangent lines can be drawn to ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$. 2,4

8. (a) Reduce the equation $x^2 + 4y^2 + 3z^2 + 2x - 8y + 9z - 10 = 0$ into the standard form and identify the quadatic surface represented by it.

(b) Reduce the equation

$$3x^2 - y^2 - z^2 + 6yz - 6x + 6y - 2z - 2 = 0$$

to the standard form and state the nature of surface represented by it . 2,4