(*c*) (*i*) Find the area of the triangle that is determined by the points

$P_1(2, 2, 0)$, $P_2(-1, 0, 2)$ and $P_3(0, 4, 3)$.

(*ii*) Find two unit vectors that are parallel to *yz*-plane and are orthogonal to the vector $3\hat{i} - \hat{j} + 2\hat{k}$.

6,6,6

5. (*a*) Let L be the line whose parametric equations are :

$L : x = 2t, \quad y = 1 - t, \quad z = 2 + t.$

Find parametric equations of the line that contains the point P(0, 2, 1) and intersects the line L at a right angle.

(*b*) (*i*) Let $L_1$ and $L_2$ be two lines whose parametric equations are :

$L_1 : x = 2 - t, \quad y = 2t, \quad z = 1 + t$

$L_2 : x = 1 + 2t, \quad y = 3 - 4t, \quad z = 5 - 2t.$

Show that $L_1$ and $L_2$ are parallel and find the distance between them.

(*ii*) Find the distance between the given parallel planes :

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

$$6x - 3y - 3z - 5 = 0$$

29/5/17 Eve.

This question paper contains **4+2** printed pages]

**Roll No.** | | | | | | | | | | | |

S. No. of Question Paper : **297**

Unique Paper Code : **235451** **G**

Name of the Paper : **Mathematics (Analytical Geometry and Applied Algebra)**

Name of the Course : **B.A. (Prog.) Discipline Course**

Semester : **IV**

Duration : **3 Hours** Maximum Marks : **75**

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*All* questions are compulsory.

Attempt any *two* parts from each question.

1. (*a*) Sketch the parabola :

$$y = 4x^2 + 8x + 5$$

and label the focus, vertex and directrix.

(*b*) Describe the graph of the equation :

$$9x^2 + 4y^2 + 18x - 24y + 9 = 0.$$

P.T.O.

(*c*) Find the centre, vertices, foci and asymptotes of the hyperbola whose equation is :

$$16x^2 - y^2 - 32x - 6y = 57$$

and sketch its graph. 6,6,6

2. (*a*) Find an equation for the parabola that has its vertex at (1, 2) and its focus at (4, 2). Also sketch its rough graph showing the reflection property of parabola at the point (4, –4).

(*b*) Find an equation of the ellipse whose foci are (2, 1) and (2, –3) and the length of its major axis is 6.

(*c*) Find an equation for the hyperbola with vertices (2, 4) and (10, 4) and whose foci are 10 units apart. 6,6,6

3. (*a*) Identify and sketch the curve $xy = 1$.

(*b*) Let an $x'y'$-coordinate system be obtained by rotating an $xy$-coordinate system through an angle of $\theta = 60°$ and then find an equation of the curve :

$$\sqrt{3}xy + y^2 = 6$$

in $x'y'$-coordinates.



(*c*) (*i*) Find the component form of $\vec{v}+\vec{w}$ and $\vec{v}-\vec{w}$ in 2-space, given that :

$$\|\vec{v}\| = 1, \|\vec{w}\| = 1, \vec{v}$$

makes an angle of $\frac{\pi}{6}$ with the positive $x$-axis, and $\vec{w}$ make an angle of $\frac{3\pi}{4}$ with the positive $x$-axis.

(*ii*) Find $\vec{u}$ and $\vec{v}$ if

$$\vec{u} + 2\vec{v} = 3\hat{i} - \hat{k} \text{ and}$$

$$3\vec{u} - \vec{v} = \hat{i} + \hat{j} + \hat{k}.$$ 6,6,6

4. (*a*) A sphere S has centre in the first octant and is tangent to each of the three coordinate planes. The distance from the origin to the sphere is $3-\sqrt{3}$ units. What is the equation of the sphere ?

(*b*) (*i*) Show that two non-zero vectors $\vec{v}_1$ and $\vec{v}_2$ are orthogonal if and only if their direction cosines satisfy :

$$\cos\alpha_1 \cos\alpha_2 + \cos\beta_1 \cos\beta_2 + \cos\gamma_1 \cos\gamma_2 = 0.$$

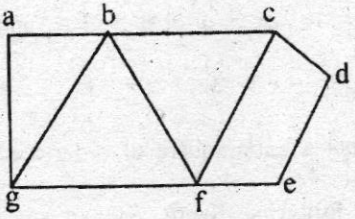
(*ii*) Find two unit vectors in 2-space that make an angle of 45° with $4\hat{i} + 3\hat{j}$.

P.T.O.

(*c*) In the following figure find :

(*i*) All sets of two vertices whose removal disconnects the graph.

(*ii*) All sets of two edges whose removal disconnects the graph.




6.5,6.5,6.5

(*c*) (*i*) Find an equation of the sphere with centre (2, 1, –3) that is tangent to the plane :

$$x - 3y + 2z = 4.$$

(*ii*) Find the equation of the plane through (1, 2, –1) that is perpendicular to the line of intersection of the planes :

$$2x + y + z = 2 \quad \text{and}$$

$$x + 2y + z = 3. \qquad 7,7,7$$

6. (*a*) Construct a Latin square of order 5 on {0, 1, 2, 3, 4}.

(*b*) In the following figure find all sets of three corners that have all 11 corners under serveillance. Give a careful logical analysis.