[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 240 **E** **Your Roll No.....**

Unique Paper Code : 235451

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

Name of the Paper : Analytical Geometry and Applied Algebra

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **All** questions are compulsory.
3. Attempt any **two** parts from each question.

1. (a) Identify and sketch the curve

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

Also label the focus, vertex, and directrix. (6½)

(b) Sketch the conic represented by the equation

$$x^2 + 4y^2 + 2x + 16y + 13 = 0$$

and also label the foci, the vertices and the ends of minor axis. (6½)

(c) Sketch the hyperbola whose equation is

$$9x^2 - 16y^2 + 72x - 32y - 16 = 0$$

and also label the vertices, foci and asymptotes. (6½)

2. (a) State reflection property of parabolas together with a figure. Also find equation of the parabola with focus (6, 0) and directrix $x = -6$. (6)

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(b) Find an equation of the ellipse whose foci are (0, 1) and (0, –3) and major axis of length 6. (6)

(c) Find an equation for a hyperbola with vertices (±2, 0) and foci (±3, 0). (6)

3. (a) Identify and sketch the curve $xy = 1$. (6½)

(b) Sketch the graph of the equation in 3-space

$x^2 + z^2 = 49$ (6½)

(c) Does the triangle in 3-space with vertices (–1, 2, 3), (2, –2, 0) and (3, 1–4) have an obtuse angle ? Justify your answer. (6½)

4. (a) Find the area of the triangle with vertices P(1, 5, –2), Q(0, 0, 0) and R(3, 5, 1). (6)

(b) Let θ be the angle between the vectors $\vec{u} = 2\hat{i} + 3\hat{j} - 6\hat{k}$ and $\vec{v} = 2\hat{i} + 3\hat{j} + 6\hat{k}$. Then show that $\sin^2\theta + \cos^2\theta = 1$. (6)

(c) Find the orthogonal projection of $\vec{v} = (4, -1, 7)$ on $\vec{b} = (2, 3, -6)$ and also find the vector component of $\vec{v}$ orthogonal to $\vec{b}$. (6)

5. (a) Let L_1 and L_2 be the lines whose parametric equations are

L_1: $x = 4t$, $y = 1 - 2t$, $z = 2 + 2t$

L_2 : $x = 1 + t$, $y = 1 - t$, $z = -1 + 4t$

Find parametric equations for the line that is ⊥ to the lines L_1 and L_2 and passes through their point of intersection. (6½)

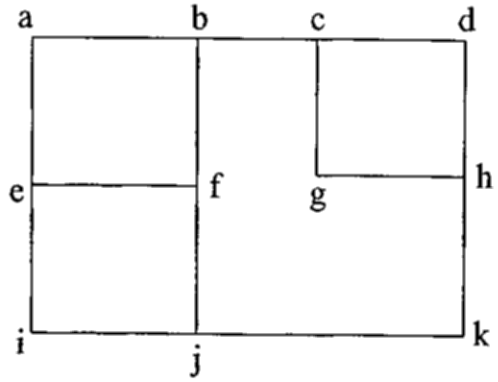
(b) Find the equations of the plane that contains the line $x = -2 + 3t$, $y = 4 + 2t$, $z = 3 - t$ and is perpendicular to the plane $x - 2y + z = 5$. (6½)

(c) Fine the distance between the given skew lines.

$x = 1 + 7t,\ y = 3 + t,\ z = 5 - 3t$

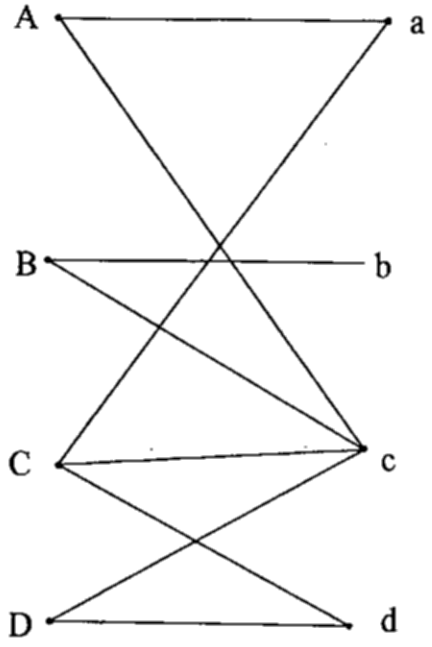
$x = 4 - t,\ y = 6,\quad z = 7 + 2t$ (6½)

6. (a) A state lagislative has many committee that meet for one hour each week. One wants to a schedule of committee meeting times that minimize the total number of hours but such that two committees with overlapping membership do not meet at the same time for the following figure.



(6)

(b) Find a matching or explain why none exists for the following graph.



(6)

(c) Show that the given Latin square cannot be obtained from a group table.

A	B	C	D	E
B	A	E	C	D
C	D	A	E	B
D	E	B	A	C
E	C	D	B	A

(6)