This question paper contains 3 printed pages. *Your Roll No. .....*

Sl. No. of Ques. Paper : **2320** **GC-3**
Unique Paper Code : **62354343**
Name of Paper : **Analytical Geometry and Applied Algebra**
Name of Course : **B.A. (Prog.) Mathematics (CBCS)**
Semester : **III**
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.

SET-C

1. (a) Identify and sketch the curve:

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

and also label the focus, vertex and directrix. 6

(b) Describe the graph of the curve:

$$3(x+2)^2 + 4(y+1)^2 = 12$$

Also find its centre and foci. 6

(c) Describe the graph of the hyperbola:

$$x^2 - y^2 - 4x + 8y - 21 = 0$$

And sketch its graph. 6

2. (a) Find the equation of the parabola that has its vertex at $(1,2)$ and focus at $(4,2)$. Also state the reflection property of parabola. 6

(b) Find the equation of the ellipse whose length of major axis is 26 and foci $(\pm 5, 0)$ and also sketch it. 6

(c) Find and sketch the curve of the hyperbola whose foci are $(6,4)$ and $(-4,4)$ and eccentricity is 2. 6

3. (a) Consider the equation:

$$3x^2 + 2xy + 3y^2 = 19.$$

P. T. O.

Rotate the coordinate axes to remove the xy-term. Then identify the type of conic represented by the equation and sketch its graph. 6

(b) Let an x'y' - coordinate system be obtained by rotating an xy - coordinate system through an angle $\theta = 30°$.

(i) Find the x'y' - coordinate of the point whose xy - coordinates are (2, 4).
(ii) Find an equation of the curve $2x^2 + 2\sqrt{3}xy = 3$ in x'y' - coordinates . 6

(c) Find the equation of two spheres that are centered at the origin and are tangent to the sphere of radius 1 centered at $(0,0,7)$. 6

4(a) (i) Find a vector of length 9 and oppositely directed to $\mathbf{v} = -5\mathbf{i} + 4\mathbf{j} + 8\mathbf{k}$.

(ii) Sketch the surface $2x + z = 3$ in 3-space. $3+3\frac{1}{2}$

(b) (i) Find the vector component of $\mathbf{v} = 2\mathbf{i} - \mathbf{j} + \mathbf{k}$ orthogonal to $\mathbf{b} = \mathbf{i} + 2\mathbf{j} + 28\mathbf{k}$.

(ii) Find the area of triangle with vertices P(2, 0, −3), Q(1,4, 5), R(7, 2, 9). $3+3\frac{1}{2}$

(c) Prove that

$$\|\mathbf{u}+\mathbf{v}\|^2 + \|\mathbf{u}-\mathbf{v}\|^2 = 2\|\mathbf{u}\|^2 + 2\|\mathbf{v}\|^2$$

and interpret the result geometrically. $6\frac{1}{2}$

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

(i) Show that the lines L_1 and L_2 intersect at the point (2, 0, 3).
(ii) Find the parametric equation of line that is perpendicular to L_1 and L_2 and passes through their point of intersection. $3+3\frac{1}{2}$

(b) (i) Determine whether the points P_1 (6, 9, 7) , P_2 (9, 2, 0) and P_3 (0, −5, −3) lie on the same line.

(ii) Where does the line

$x = 2 - t$, $y = 3t$, $z = -1 + 2t$

intersect the plane $2y + 3z = 6$. $3+3\frac{1}{2}$

(c) (i) Find the equation of the plane through (1, 4, 3) that is perpendicular to the line

$x = 2 + t$, $y + 3 = 2t$, $z = -t$.

(ii) Determine whether the planes

$3x - 2y + z = 1$, $4x + y - 2z = 4$

are parallel, perpendicular or neither. $3+3\frac{1}{2}$

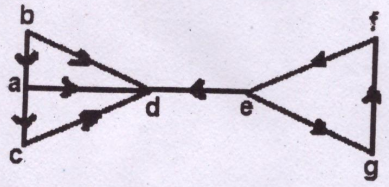
6. (a) Given three containers 3, 7, and 10 liters respectively with the largest being full of water, determine a minimum sequence of pouring method of dividing this quantity of water into two equal amounts of 5 liters using the three containers and no other measuring devices. $6\frac{1}{2}$

(b) Is the following square a Latin square? Can it be a group with the multiplication operation defined?

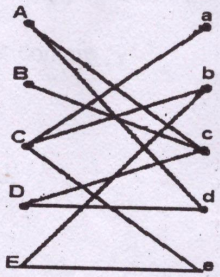
*	1	2	3	4	5
1	1	2	3	4	5
2	2	1	4	5	3
3	3	4	5	2	1
4	4	5	1	3	2
5	5	3	2	1	4

$6\frac{1}{2}$

(c) (i) Given the influence model. Find the sets of minimum number of vertices which can influence every other vertex in the graph.



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



$3+3\frac{1}{2}$

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