This question paper contains 4 printed pages]

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

S. No. of Question Paper : **7753**

Unique Paper Code : **2352201202**

Name of the Paper : **Analytic Geometry**

Type of the Paper : **DSC**

Name of the Course : **Bachelor of Arts (Programme) with Mathematics as Major**

Semester : **II**

Duration : **3 Hours** Maximum Marks : **90**

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

Attempt any *two* parts of each question.

Each part carries **7.5** marks.

Use of calculators is not allowed.

1. (*a*) Identify and sketch the curve :

$$4y^2 - x^2 + 40y - 4x = -60.$$

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

$$x^2 + 9y^2 + 2x - 18y + 1 = 0.$$

(*c*) Sketch the curve and label the focus, vertex and directrix :

$$(y + 1)^2 = -7(x - 4).$$

P.T.O.

2. (*a*) Find the equation of the parabola with vertex (5, –3); axis parallel to the *y*-axis and passes through (9, 5).

(*b*) Identify and sketch the curve :

$$x^2 + 4xy - 2y^2 - 6 = 0.$$

(*c*) (*i*) Find the vector of length 2 and oppositely directed to $\vec{v} = -3i + 4j + k$.

(*ii*) Find unit vector oppositely directed to $6i - 4j + 2k$.

3. (*a*) For $\vec{u} = \langle 1, 2, -2 \rangle$ and $\vec{v} = \langle 3, 0, 1 \rangle$, find :

(*i*) $\vec{v} \times \vec{u}$

(*ii*) $\vec{u} \times \vec{v}$

(*iii*) $\vec{u} \times \vec{u}$

(*iv*) $\vec{v} \times \vec{v}$.

(*b*) Find the angles between the lines whose direction ratios are :

(i) 5, –12, 13 and –3, 4, 5.

(*ii*) 1, 1, 2 and $\sqrt{3} - 1, -\sqrt{3} - 1, 4$.

(*c*) Find the parametric equations of line :

(*i*) passing through (4, 2) and parallel to $\vec{v} = -i + 5j$;

(*ii*) passing through (1, 2, –3) and parallel to $\vec{v} = 4i + 5j - 7k$;

(*iii*) passing through the origin in 3 – space and parallel to $\vec{v} = i + j + k$.

4. (*a*) (*i*) Find an equation of the plane passing through the point (3, –1, 7) and perpendicular to the vector $\vec{n} = \langle 4, 2, -5 \rangle$.

(*ii*) Determine whether the planes $3x - 4y + 5z = 0$ and $-6x + 8y - 10z - 4 = 0$ are parallel.

(*b*) Show that the lines $\frac{x+5}{3} = \frac{y+4}{1} = \frac{z-7}{-2}$ and $3x + 2y + z - 2 = 0 = x - 3y + 2z - 13$ are coplanar and find the equation to the plane in which they lie.

(*c*) Find the magnitude and the equations of the line of shortest distance between the lines :

$$\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7} \text{ and } \frac{x-15}{3} = \frac{y-29}{8} = \frac{y-5}{-5}.$$

5. (*a*) Find the equations of the sphere through the circle $x^2 + y^2 + z^2 = 1$, $2x + 4y + 5z = 6$ and touching the plane $z = 0$.

(*b*) Find the equation of the sphere which touches the sphere :

$$x^2 + y^2 + z^2 - x + 3y + 2z - 3 = 0,$$

at the point (1, 1, –1) and passes through the origin.

(*c*) Find the equation of curve whose vertex is the point (1, 1, 0) and whose guiding curve is :

$$y = 0, x^2 + z^2 = 4.$$

P.T.O.

6. (*a*) Find the equation of the right circular cylinder of radius 2 whose axis is the line :

$$\frac{(x-1)}{2} = \frac{(y-2)}{2} = \frac{(z-2)}{2}$$

(*b*) Find the equation of a cylinder whose generating lines have the direction cosines (l, m, n) and which passes through the circle $x^2 + z^2 = a^2$, $y = 0$.

(*c*) Show that the general equation of a cone which touches the three co-ordinate planes is :

$$\sqrt{fx} \pm \sqrt{gy} \pm \sqrt{hz} = 0;$$

f, g, h being parameters.