[This question paper contains 4 printed pages.]

Your Roll No.............

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Sr. No. of Question Paper : 5037

Unique Paper Code : 2352201202

Name of the Paper : DSC : Analytic Geometry

Name of the Course : **Bachelor of Arts**

Semester : II

Duration : 3 Hours Maximum Marks : 90

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 section.

4. **All** questions carry equal marks.

1. (a) Show that the equation of the parabola with axis y=0 and passing through (3, 2), and (2, –3) is

$$y^2 = -5\left(x - \frac{19}{5}\right).$$ Also sketch the graph.

(b) Identify and sketch the curve

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

(c) Describe the graph of the equation

$$x^2 - 4y^2 + 2x + 8y - 7 = 0.$$

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 the parabola.

(b) Identify and sketch the curve $3x^2 + 2xy + 3y^2 = 19$.

(c) A box is dragged along the floor by a rope that applies a force of 50 lb at an angle of 60° with the floor. How much work is done in moving the box 15 ft?

3. (a) Express the vector v as the sum of a vector parallel to $\vec{b}$ and a vector orthogonal to $\vec{b}$ where $\vec{v} = -2\hat{i} + \hat{j} + 6\hat{k}$, $\vec{b} = -2\hat{j} + \hat{k}$.

(b) Find two unit vectors that are orthogonal to both $\vec{u} = -7\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{v} = 2\hat{i} + 4\hat{k}$.

(c) Use a scalar triple product to determine whether the vectors $\vec{u} = \hat{i} - 2\hat{j} + \hat{k}$, $\vec{v} = 3\hat{i} - 2\hat{k}$ and $\vec{w} = 5\hat{i} - 4\hat{j}$ lie in the same plane.

4. (a) Find the parametric equation of the line that passes through origin and is parallel to the line L: $x = t$, $y = -1 + t$, $z = 2$.

(b) Find the direction cosines of two lines that are connected by the relations

$l + m - n = 0$, $mn + 6ln - 12lm = 0$.

(c) Find the equation of the plane through the points P(–2,1,4) and Q(1,0,3) that is perpendicular to the plane $4x - y + 3z = 2$.

5. (a) Find the centre and the radius of the circle

$$x + 2y + 2z = 15,\ x^2 + y^2 + z^2 - 2y - 4z = 11.$$

(b) Prove that the tangent planes to the cone

$$x^2 - y^2 + 2z^2 - 5xy - 3yz + 4zx = 0$$

are perpendicular to the generators of the cone

$$17x^2 + 8y^2 + 29z^2 - 16xy + 28yz - 46zx = 0.$$

(c) Find the equation of the right circular cylinder of radius 2 whose axis is the line $\frac{x-1}{2}=\frac{y-2}{2}=\frac{z-2}{2}$.

6. (a) Show that the plane $2x - 2y + z + 12 = 0$ touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z = 3$ and find the point of contact.

(b) Show that the equation of the right circular cone with vertex (2, 3, 1), axis parallel to the line $-x=\frac{y}{2}=z$ one of its generators having direction cosines proportional to (1, –1, 1) is

$x^2 - 8y^2 + z^2 + 12xy - 12yz + 6zx - 46x + 36y + 22z - 19 = 0$.

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