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SEAT No. :

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F.Y. B.Sc.

MATHEMATICS

MT - 121 : ANALYTICAL GEOMETRY

(2019 Pattern) (Semester - II) (Paper - I) (12111)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

Q1) Attempt any five of the following : **[5]**

- a) If the origin is shifted to the point $(-4, -7)$, the axes remaining parallel to the original set of axes, find the co-ordinates of the point $(-2, 5)$ with reference to the new set of axes.
- b) If the axes are rotated through an angle 60° then write down equations of rotation.
- c) If direction ratios of the line are 1, 2, 2 then find its direction cosines.
- d) Write equation of a plane parallel to XY-plane.
- e) Find equations of the line passing through $(2, -3, 5)$ and whose direction ratios are 1, -2 , 2.
- f) Find the centre of the sphere
 $x^2 + y^2 + z^2 + 2x + 2y - 2z + 3 = 0$.

Q2) a) Attempt any one of the following : **[6]**

- i) Reduce the equation $5x^2 + 6xy + 5y^2 - 10x - 6y - 3 = 0$ to its standard form.
- ii) Show that the equation
 $(ax + by + cz + d) + \lambda (a_1x + b_1y + c_1z + d_1) = 0$ represents the system of planes through the line of intersection of the planes $ax + by + cz + d = 0$ and $a_1x + b_1y + c_1z + d_1 = 0$.

b) Attempt any one of the following : **[4]**

- i) Discuss nature of the conic
 $5x^2 + 4xy + 3y^2 + 2x + y = 0$. Also find its centre if it is a central conic.
- ii) Show that every equation of first degree in x, y, z represents a plane.

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Q3) a) Attempt any one of the following : **[6]**

- i) Let the axes be rotated through an angle θ without shifting origin. Let $p(x,y)$ and $p(x', y')$ be the points with respect to original axes and new axes respectively. Show that

$$x = x' \cos \theta - y' \sin \theta, y = x' \sin \theta + y' \cos \theta.$$

- ii) Show that equation of a plane which makes intercepts a, b, c on the co-ordinate axes is given by $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$.

b) Attempt any one of the following : **[4]**

- i) Find the co-ordinates of the point of intersection of the line

$$\frac{x+1}{1} = \frac{y+3}{3} = \frac{z-2}{-2} \text{ with the plane } 3x + 4y + 5z = 5.$$

- ii) Find equation of the sphere through the circle $x^2 + y^2 + z^2 = 9$, $2x + 3y + 4z = 5$ and the point $(1, 2, 3)$.

Q4) a) Attempt any one of the following : **[6]**

- i) Find length of the perpendicular from the point $(1, 2, 3)$ to the line

$$\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}.$$

- ii) Prove that the plane section of a sphere is a circle.

b) Attempt any one of the following : **[4]**

- i) Find direction ratios of the line

$$ax + by + cz + d = 0$$

$$a_1x + b_1y + c_1z + d_1 = 0.$$

- ii) Find the value of 'a' for which the plane $x + y + z = a\sqrt{3}$ touches the sphere $x^2 + y^2 + z^2 - 2x - 2y - 2z - 6 = 0$.

