Nov-2016

Seat Number

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कठोर - 031 / 032

MATHEMATICS PAPER - III : MTH - 113
A) Geometry (111103) /
B) Discrete Mathematics (111104)

P. Pages : 8

A) Geometry (111103)

Time : Two Hours **Max. Marks : 60**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory.
5. Figures to the right indicate full marks.

1. a) Attempt **any six.** **6**

i) If the origin is shifted to the point (2 , 1), the directions of the axes remains the same then the equations of translation are ------

a) $x = 2 - x', y = 1 - y'$ b) $x = 1 - x', y = 2 - y'$

c) $x = 2 + x', y = 1 + y'$ d) $x = 1 + x', y = 2 + y'$

ii) The equation $11x^2 + 4xy + 14y^2 - 4x - 28y - 16 = 0$ represents ------

a) Ellipse b) Hyperbola

c) Parabola d) Circle

iii) If the equation $S + \lambda S^1 = 0$ represents a radical plane then $\lambda =$ .....

a) $\lambda = 1$ b) $\lambda = -1$

c) $\lambda = 0$ d) none of these

iv) The general equation of the sphere is ------

a) Linear b) Second degree

c) Third degree d) None of these

v) The equation of a cone with vertex at origin is -------

a) Linear b) Cubic

c) Non – homogeneous d) Homogeneous

vi) The constant angle between the axes and the ------ of a right circular cone is semi – vertical.

a) generator b) tangent
c) normal d) none of these

vii) The section of a right circular cylinder by plane perpendicular to its axis is -----

a) ellipse b) circle
c) straight line d) none of these

viii) In enveloping cylinder generators touch a given surface and are ----- to a given straight line.

a) intersect b) parallel
c) perpendicular d) none of these

b) Attempt **any six.** 6

i) State whether true or false.

Parabola is a central conic.

ii) What is the centre of the conic
$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$?

iii) Find the centre of the sphere
$2x^2 + 2y^2 + 2z^2 - 8x - 4y + 7 = 0$.

iv) Write the equation of a sphere with centre at (a, b, c) and radius r.

v) If the number a, b, c satisfy equation of the cone with vertex origin then a, b, c are the d.r.s. of some generator of that cone. State whether true or false.

vi) Define Cone.

vii) Define Enveloping cylinder of a sphere.

viii) State whether true or false.

The guiding curve of a right circular cylinder is a circle.

2. Attempt **any six.** 12

i) Write the equations of rotation of axes when the axes are rotated through an angle $\theta = \tan^{-1}\left(-\frac{1}{2}\right)$.

ii) Find the angle θ through which the axes should be rotated to remove the xy – term from the equation $5x^2+6xy+5y^2=8$.

iii) Identify the conic $14x^2-4xy+11y^2-44x-58y+71=0$ and find its centre.

iv) For the two spheres with centres C_1, C_2 and radii r_1, r_2 respectively. State the conditions that the two spheres are (i) Non – intersecting (ii) Intersecting.

v) Find the equation of a sphere with centre at (–1, 2, 3) and passing through the point (1, –1, 2).

vi) State the condition that the general equation of second degree $ax^2+by^2+cz^2+2fyz+2gzx+2hxy+2ux+2vy+2wz+d=0$ should represent a cone.

vii) Find the equation of the cone with vertex at (0, 0, 0) and which passes through the curve given by $2x^2+3y^2=z;\ x+y=1$.

viii) Find the equation of the right circular cylinder of radius 2, whose axis passes through (1, 2, 3) and has d.r.s. 2, -3, 6

ix) Find the equation of the cylinder whose generators have d.c.s. l, m, n and which passes through the fixed circle $x^2+z^2=1$ in the z ox plane.

3. Attempt **any four.** **12**

i) The origin is shifted to the point (–2, k), find the value of k so that the new equation of the locus given by $2y^2+3x+4y-7=0$ will not contain the first degree term in y.

ii) If by change of axes, without change of origin, the expression $ax^2+2hxy+by^2$ becomes $a'x'^2+2h'x'y'+b'y'^2$ then prove that $a+b=a'+b'$.

iii) Show that the spheres $x^2+y^2+z^2=64$ and $x^2+y^2+z^2-12x+4y-6z+48=0$ touch internally.

iv) Show that the plane $2x-2y+z+16=0$ touches the sphere $x^2+y^2+z^2+2x-4y+2z-3=0$.

v) Derive the equation of the right circular cone with semi - vertical angle θ, vertex (α,β,γ) and having axis whose d.r.s. are a, b, c.

vi) Find the equation of the cylinder whose generators are parallel to the z-axis and which intersect the curve
$ax^2+by^2+cz^2=1,\ lx+my+nz=p$.

4. Attempt **any three.** 12

i) Change the origin to (1, 2) and transform
$3x^2-10xy+3y^2+14x-2y+3=0$. Further rotate the axes through $\theta=\frac{\pi}{4}$ and find the final transform of the equation.

ii) Reduce the equation $x^2-4xy-2y^2+10x+4y=0$ to its standard form.

iii) Find the equation of the sphere passing through the circle $x^2+y^2+z^2-4=0,\ 2x+4y+6z-1=0$ and having its centre on the plane $x+y+z=12$.

iv) Find the equation of the cone with vertex $V(\alpha,\beta,\gamma)$ and a plane curve $f(x,y,z)=0,\ ax+by+cz+d=0$ as the guiding curve.

v) Find the equation of the enveloping cylinder of the sphere $x^2+y^2+z^2-2x+4y-1=0$ having its generator parallel to $x=y=z$.

5. Attempt **any two.** 12

i) Find the equation of the sphere passing through the four non coplanar points $A(x_1,y_1,z_1)$, $B(x_2,y_2,z_2)$, $C(x_3,y_3,z_3)$ and $D(x_4,y_4,z_4)$.

ii) Find the equation of enveloping cone of the sphere $x^2+y^2+z^2-2x+4z-1=0$ with its vertex at (1, 1, 1).

iii) Find the equation of the cylinder whose generator intersect the guiding plane curve $f(x,y,z)=0,\ ax+by+cz+d=0$.

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