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B.Sc. (Hons.) Mathematics (Semester –3rd)

ANALYTICAL GEOMETRY

Subject Code: BMATS1324

Paper ID: [22131213]

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a) Transform to parallel axes through the point (1,-3) the equation $2x^2+y^2-4x+4y=0$
- b) Show that $2x + 8y + 2z = 1$, $4x - 2y - 5z = 2$ and $5x + 2y - 4z = -2$ form a triangular prism.
- c) Find the equation of the cone whose vertex is at the origin and which intersects the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $z = c$.
- d) What is the standard form of right circular cone?
- e) Find the general equation of cone of the second degree which passes through the axes.
- f) Prove that section of a right circular cylinder by any plane perpendicular to its axis is a circle.
- g) Discuss special types of cylinders.
- h) Find the angle of intersection of the spheres of the spheres $x^2 + y^2 + z^2 = 4$ and $x^2 + y^2 + z^2 = 2x + 2y$.
- i) Find the equation of the sphere which passes through (1,-1,2) and whose centre is (-1,2,3).
- j) Prove that centres of a coaxial system of spheres are collinear.

Section – B

(5 marks each)

- Q2. Eliminate the mixed terms in $8(x - y + z)^2 - 9(x + y)^2 - 4(x - y - 2z)^2 + 13 = 0$ by suitable rotation of axes. Also find the direction cosines of new axes.
- Q3. Find the equation of the enveloping cone from the point (x_1, y_1, z_1) to the sphere $x^2 + y^2 + z^2 = a^2$
- Q4. Find the equation of right circular cylinder whose axis is $\frac{x-2}{2} = \frac{y-1}{1} = \frac{z}{3}$ and passes through point (0, 0, 3).
- Q5. Find the equation of the sphere which passes through the points (1,0,0), (0,1,0) and (0,0,1) and has its radius as small as possible.
- Q6. Show that the spheres $x^2 + y^2 + z^2 = 25$ and $x^2 + y^2 + z^2 - 24x - 40y - 18z + 225 = 0$ touch externally and find the point of contact.

Section – C

(10 marks each)

- Q7. Prove that $\sqrt{fx} + \sqrt{gy} + \sqrt{hz} = 0$ represents a cone which touches the coordinates planes and also find the equation of the reciprocal cone.

- Q8. Find the equation of the enveloping cylinder of the sphere $x^2 + y^2 + z^2 = a^2$, whose generators are parallel to the line $\frac{x}{l} = \frac{y}{m} = \frac{z}{n}$.
- Q9. Prove that the planes $x = cy + bz$, $y = az + cx$, $z = bx + ay$ pass through the line if $a^2 + b^2 + c^2 + 2abc = 1$. Also find line of intersection.