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NA—76—2023

FACULTY OF SCIENCE

B.Sc. (Second Semester) EXAMINATION

NOVEMBER/DECEMBER, 2023

(New Pattern)

MATHEMATICS

(Geometry—IV)

(Saturday, 16-12-2023)

Time : 10.00 a.m. to 12.00 noon

Time—2 Hours

Maximum Marks—40

N.B. :— (i) All questions are compulsory.

(ii) Figures to the right indicate full marks.

1. If l, m, n are the direction cosines of a line then prove that $l^2 + m^2 + n^2 = 1$ and also show that if α, β, γ be the angles which a line makes with the positive direction of the axes, then :

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$$\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$$

Or

- (a) To find the equation of a plane in terms of the intercepts a, b, c which it makes on the axes. 8

- (b) Find the equation of the plane through the points $(2, 2, 1)$ and $(9, 3, 6)$ and perpendicular to the plane : 7

$$2x + 6y + 6z = 9$$

P.T.O.

2. Show that the shortest distance between two lines lies along the line meeting them both at right angles. 15

Also find the magnitude and the equations of the line of shortest distance between the lines :

$$\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7}$$

and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$.

Or

- (a) Find the equation of the cone whose vertex is the point (α, β, γ) are whose generators intersect the conic :

$$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0, z = 0. \quad 8$$

- (b) Find the equations of the sphere through the circle : 7

$$x^2 + y^2 + z^2 = 1,$$

$$2x + 4y + 5z = 6$$

and touching the plane, $z = 0$.

3. Attempt any *two* of the following : 5 marks each

- (a) If 6, 2, 3 are direction ratios of a line, then find the direction cosines of a line.

- (b) Find the angle between the planes

$$3x - 4y + 5z = 0$$

and $2x - y - 2z = 5$.

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(3)

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(c) Show that the line $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ is parallel to the plane

$$2x + y - 2z = 3$$

(d) Find the radius and centre of the sphere

$$x^2 + y^2 + z^2 + 2x - 4y - 6z + 5 = 0.$$

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