2021

B.A./B.Sc.

Third Semester

GENERIC ELECTIVE

MATHEMATICS

Course Code: MAG 3.11

(Vectors & Analytical Geometry)

PART–B

Total Mark: 30

Answer the following questions.

1. (a) The acceleration of a particle at any time t is $e^t\,\hat{i} + e^{2t}\,\hat{j} + \hat{k}$. Find v, given that $v = \hat{i} + \hat{j}$ at $t = 0$. 2

   (b) If $u = x + y + z$, $v = x^2 + y^2 + z^2$, $w = yz + zx + xy$, prove that
   $(grad\, u)\cdot\left[(grad\, v)\times(grad\, w)\right] = 0$ 4

2. (a) Evaluate $\int_C F \cdot dr$ where F is $x^2y^2\,\hat{i} + y\,\hat{j}$ and C is $y^2 = 4x$ in the xy-plane from (0,0) to (4,4). 3

   (b) Evaluate by Green's theorem in plane: $\int_C \left(e^{-x}\sin y dx + e^{-x}\cos y dy\right)$ where C is the rectangle with vertices $(0,0),(\pi,0),\left(\pi,\frac{1}{2}\pi\right),\left(0,\frac{1}{2}\pi\right)$. 3

3. Verify Stoke's theorem for $F = 2y\hat{i} + 3x\hat{j} - z^2\hat{k}$, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 9$ and C is its boundary. 6

4. (a) Choose a new origin (h,k) without changing the direction of the axes, such that the equation $5x^2 - 2y^2 - 30x + 8y = 0$ may reduce to the form $Ax'^2 + By'^2 = 1$. 4

   (b) Transform the equation of the curve $5x + 3y = 3$ to parallel axes through the new origin (2, –1). 2

5. (a) Find the equation of the plane passing through (2, 2, 1) and (9, 3, 6) and perpendicular to the plane $2x + 6y + 6z = 9$. 4

   (b) Write parametric equation for the line through the point (2, –1, –3) and parallel to $\frac{x}{3} = \frac{y+7}{-1} = \frac{z-3}{6}$. 2