[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 7811 **F–2** **Your Roll No.....**

Unique Paper Code : 2511204

Name of the Course : **B. Tech. Electronics** [DC–1.4]

Name of the Paper : Engineering Mathematics – I

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** is compulsory.
3. Attempt **Five** questions in all.

1. Compulsory Question : (5×3=15)

   (a) Find an equation for the plane determined by the points $P_1(2, -1, 1)$, $P_2(3, 2, -1)$, $P_3(-1, 3, 2)$.

   (b) Show that $\vec{\nabla} r^n = n\, r^{n-2}\, r$.

   (c) Show that matrix A is a Unitary matrix. Given $A = 1/\sqrt{3}\begin{pmatrix} 1 & 1+i \\ 1-i & -1 \end{pmatrix}$.

   (d) Find $|z|$, where $z = \dfrac{(2-3i)\overline{(1-i)}}{2+i}$.

   (e) Test the nature of series

$$\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}+\sqrt{n+1}}$$

P.T.O.

2. (a) Evaluate the surface integral $\iint_S$ A.n ds, where A = 18zi – 12j + 3yk and S is that part of the plane 2x + 3y + 6z = 12, which is located in the first octant. (5)

(b) Find the unit vectors $\hat{e}_\rho$, $\hat{e}_\phi$, and $\hat{e}_z$ for a cylindrical co-ordinate system. Show that cylindrical coordinate system is orthogonal. (5)

(c) Find Divergence of a vector in orthogonal curvilinear coordinates. (5)

3. (a) Solve the system of equations using LU decomposition method.

$$x + y - z = 4$$

$$x - 2y + 3z = -6$$

$$2x + 3y + z = 7$$ (5)

(b) Diagonalize the matrix $A = \begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{pmatrix}$ to obtain a diagonal matrix D. (5)

(c) Compute A^4 for the above matrix using the diagonal matrix D obtained in prob. (b). (5)

4. (a) Use Cauchy's nth root test for x > 0 (5)

$$\sum \frac{x^{2n}}{2^n}$$

(b) Test the convergence of series $\sum_{n+1}^{\infty} \sqrt{n^4+1} - \sqrt{n^4-1}$. (5)

(c) For alternating series find convergence

$$\frac{x}{1+x} - \frac{x^2}{1+x^2} + \frac{x^3}{1+x^3} - \ldots\ldots\ldots \quad (5)$$

5. (a) Show that the function $f(z) = z^2$ is continuous. (5)

(b) Find the value of a, b,c such that the function f(z) is analytical.

$f(z) = -x^2 + xy + y^2 + i(ax^2 + bxy + cy^2)$ (5)

(c) Check whether Cauchy integral theorem can be applied and evaluate the integral

$$\int \frac{e^z}{(z+3)(z+2)} + 3\bar{z}\, dz,\ C:|z| = 1 \quad (5)$$

6. (a) Verify the Green's theorem in plane to evaluate $\oint_c A.dr$, given vector

$A = (x-y)i + (x+y)j$, and C is the closed curve of the region bounded by $y = x^2$ and $y^2 = x$. (5)

(b) Prove that any symmetric matrix is a sum of symmetric and skew symmetric matrix. (5)

(c) Show that $\vec{\nabla} \times \vec{\nabla}\Phi = \vec{0}$. (5)

7. (a) Compute the residue $f(z) = \frac{1}{z^3 + z^5}$. (5)

(b) Test for the convergence $1-\frac{1}{2}+\frac{1}{4}-\frac{1}{8}\ldots\ldots$. (5)

(c) Evaluate $\int \frac{2z-1}{z^2-z}dz$, $C:|z|=2$. (5)