

B0-R4 : BASIC MATHEMATICS**NOTE :**

1. Answer question 1 and any FOUR questions from 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

Time : 3 Hours**Total Marks : 100**

1. (a) Express $\frac{(6+i)(2-i)}{(4+3i)(1-2i)}$ in the form of $a+ib$.
- (b) Evaluate $\lim_{x \rightarrow 0} \frac{\tan x - x}{x^2 \tan x}$.
- (c) Prove that given matrix $A = \begin{bmatrix} 3 & 1+2i \\ 1-2i & 1 \end{bmatrix}$ is hermitian matrix.
- (d) Test the convergence of the following series
- $$\frac{1}{\sqrt{1} + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{4}} + \dots$$
- (e) Solve the differential equation $\frac{dy}{x(2 \log x + 1)} = \frac{dx}{\sin y + y \cos y}$.
- (f) Find $u \times v$ and $v \times u$ if $u = 2\vec{i} + \vec{j} + \vec{k}$ and $v = -4\vec{i} + 3\vec{j} + \vec{k}$.
- (g) Find the length of the graph of $f(x) = \frac{x^3}{12} + \frac{1}{x}$, $1 \leq x \leq 4$. (7x4)
2. (a) Solve the system of linear equations
 $x_1 + 2x_2 - x_3 = 1$, $3x_1 - 2x_2 + 2x_3 = 2$, $7x_1 - 2x_2 + 3x_3 = 5$
 Using Gauss Eliminations Method.
- (b) Find the volume of the solid generated by revolving the region between the parabola $x = y^2 + 1$ and the line $x = 3$ about the line $x = 3$. (10+8)
3. (a) Find the area of the region in the plane enclosed by the cardioids $r = 2(1 + \cos\theta)$.
- (b) Find the expansion of $\tan\left(x + \frac{\pi}{4}\right)$ in ascending powers of x upto terms in x^3 and find approximately the value of $\tan 43^\circ$. (9+9)

4. (a) Find the horizontal asymptotes of the graph of $f(x) = \frac{x^3 - 2}{|x|^3 + 1}$.
- (b) Find the length of the circle of radius r defined parametrically by $x = r \cos t$ and $y = r \sin t$, $0 \leq t \leq 2\pi$.
- (c) Does the following series $\frac{3}{1^2-3} + \frac{3}{2^2-3} + \frac{3}{3^2-3} + \dots$ converges? (6+6+6)
5. (a) Find a value of c for $f(x) = x^2 + 2x - 1$ on the interval $[0, 1]$ using mean value theorem.
- (b) Evaluate $\lim_{x \rightarrow 0} (2-x)^{\tan \frac{\pi x}{2}}$. (9+9)
6. (a) Using determinants, find the area of the triangle with vertices $(-2, -3)$, $(3, 2)$ and $(-1, -8)$.
- (b) Evaluate $\int_1^e \frac{\log x}{x} dx$.
- (c) Find the center, radius, foci and asymptotes, vertices of the equation $x^2 + 4x + y^2 = 12$. (6+6+6)
7. (a) Solve the differential equation $ye^y dx = (y^3 + 2xe^y)dy$.
- (b) Find all the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. (8+10)

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