No. of Printed Pages : **2**

Sl. No.

B0-R4 : BASIC MATHEMATICS

NOTE :
1. **Answer question 1 and any FOUR from questions 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) Find an equation of the tangent line to the curve $y = \frac{2}{x}$ at the point (2, 1) on this curve.

(b) Find the Rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 8 & 7 & 0 & 5 \end{bmatrix}$.

(c) Find all the asymptotes of the curve $x^2y^2 - xy^2 - x^2y + x + y + 1 = 0$ parallel to the axis.

(d) Test the convergence of the series $\sum \frac{(n - \log n)^n}{2^n n^n}$.

(e) Find a formula for the inverse of $f(x) = \sqrt{3x - 2}$ with x as the independent variable, and state the domain of f^{-1}.

(f) Solve the differential equation $\left(1 + y^2\right)\frac{dx}{dy} = \tan^{-1} y - x$.

(g) Find all the values of $\sqrt[3]{\frac{1+i}{\sqrt{2}}} + \sqrt[3]{\frac{1-i}{\sqrt{2}}}$. **(7x4)**

2. (a) Find the area of the region that is enclosed between the curves $y = x^2$ and $y = x + 6$.

(b) Find the solution of the system of equation

$x + 3y - 2z = 0,$
$2x - y + 4z = 0,$
$x - 11y + 14z = 0$

Using Gauss elimination method. **(8+10)**

3. (a) Test the convergence of the series $\left(\frac{1}{2}\right)^2+\left(\frac{1\cdot 2}{3\cdot 5}\right)^2+\left(\frac{1\cdot 2\cdot 3}{3\cdot 5\cdot 7}\right)^2+\ldots\infty$.

(b) If $2\cos\theta = x+\frac{1}{x}$ and $2\cos\phi = y+\frac{1}{y}$ then prove that

$$x^p y^q + \frac{1}{x^p y^q} = 2\cos(p\theta + q\phi).$$

(9+9)

4. (a) Evaluate $\int \frac{x}{x^2-4x+8}\,dx$.

(b) Find the angle between a diagonal of a cube and one of its edges.

(c) Find the area of the surface that is generated by revolving the portion of the curve $y=x^3$ between $x=0$ and $x=1$ about the x-axis.

(6+6+6)

5. (a) Find $\frac{dy}{dx}$ if $y = \frac{\sin x}{1+\cos x}$.

(b) Find the value of K for which the following function

$$f(x) = \begin{cases} x^{k\sin\frac{1}{x}}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

as (i) Continues at $x=0$
(ii) Derivable at $x=0$

(c) Suppose that $f(x)$ is continuous and differentiable on the interval $[-7, 0]$, that $f(-7) = -3$ and $f'(x) \le 2$. What is the largest possible value for $f(0)$?

(6+6+6)

6. (a) Find parametric equations of the line L passing through the points $P_1(2, 4, -1)$ and $P_2(5, 0, 7)$. Where does the line intersect the xy-plane ?

(b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}$.

(9+9)

7. (a) Expand 5^x upto the first three non-zero terms of the series.

(b) Solve the differential equation $y'' + y' - 2y = 0, y(0) = 4, y'(0) = -5$.

(c) Find an equation for the ellipse with foci $(0, \pm 2)$ and major axis with endpoints $(0, \pm 4)$.

(6+6+6)

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