6. Show that the conic $8x^2 - 24xy + 15y^2 + 48x - 48y = 0$ represents a hyperbola and hence find its eccentricity, lengths and equation of axes and foci. **16**

Unit IV

7. (a) The series $\sum_{n=1}^{\infty} \frac{1}{np}$ converger if $p > 1$ and diverges if $p \leq 1$. Prove it. **8**

(b) Test the series $\sum_{n=1}^{\infty} \frac{n!}{5^n}$ for convergence. **8**

8. (a) Examine the continuity of function. Also check the differentiability :

$$f(x) = \begin{cases} x \sin \frac{1}{x} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}. \quad \textbf{8}$$

(b) Find $\lim_{x \to \infty} x\left(\sqrt{x^2+1} - x\right)$. **8**

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B.EL.Ed. (Second Year)

EXAMINATION, 2026

(Regular & Re-appear)

MATHEMATICS-I

Time : 3 *Hours*] [*Maximum Marks :* 80

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Prove that :

$$(A \cap B) \cap C = A \cap (B \cap C).$$ **8**

(b) Prove that :

$$(n+1)^n p_r = (n-r+1).^{n+1}P_r.$$ **8**

2. (a) Construct truth table for :

$$(\sim (p \vee q) \vee \sim r) \vee ((\sim p \wedge q) \vee \sim r).$$ **8**

(b) Prove that

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

where A, B, C are some sets. **8**

Unit II

3. (a) Solve the equation $x^5 + x^4 - 7x^3 + 11x^2 - 4x - 2 = 0$, it being given that one of its root is $-2+\sqrt{3}$. **8**

(b) Find all the values of $\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^{3/4}$ and show that the continued product of all the values is 1. **8**

4. (a) Find the characteristics vectors of matrix :

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}.$$ **8**

(b) Solve the system of equations : **8**

$$2x + y + 4z = 12$$

$$4x + 11y - z = 33$$

$$8x - 3y + 2z = 20.$$

Unit III

5. (a) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $r = |r| = \sqrt{x^2+y^2+z^2}$, prove that $div\left(\frac{\vec{r}}{r^3}\right) = 0$. **8**

(b) Prove that the equation $7x^2 + 2y^2 + 2z^2 - 10zx + 10xy + 26x - 2y + 2z - 17 = 0$ represents a cone whose vertex is $(1, -2, 2)$. **8**

Unit V

9. (a) If $x = a \cos \theta$, $y = b \sin \theta$ find $\frac{d^2y}{dx^2}$. **8**

(b) Find the asymptote parallel to the co-ordinate axes of the curve $y = \frac{x}{x^2 - 1}$. **8**

10. (a) Examine the maximum and minimum values of the following function : **8**

$$x^2y + xy^2 + 12xy.$$

(b) Show that the function : **8**

$$f(x,y) = \begin{cases} \frac{x^2y^2}{x^4 + y^4} & \text{for } (x,y) \neq (0,0) \\ 0 & \text{for } (x,y) = (0,0) \end{cases}$$

is not differentiable at the origin.

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