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II

Total No. of Questions – 15 **Regd. No.**

Total No. of Printed Pages – 2

MATHEMATICS (Bridge Course) for Bi. P. C. Candidates, Paper-I
(English Version)

Time : 3 Hours] **[Max. Marks : 75**

Note : This question paper consists of **two** sections **A** and **B**.

SECTION – A

$10 \times 3 = 30$

I. Short answer type questions :

(i) Answer **all** the questions.

(ii) Each question carries **three** marks.

1. If $A = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 4 & 0 \\ 4 & -2 & -1 \end{bmatrix}$, then Verify that $(A + B)^T = A^T + B^T$.

2. Let $\bar{a} = \bar{i} + 2\bar{j} + 3\bar{k}$ and $\bar{b} = 3\bar{i} + \bar{j}$, find the unit vector in the direction of $\bar{a} + \bar{b}$.

3. If $\bar{a} = 6\bar{i} + 2\bar{j} + 3\bar{k}$ and $\bar{b} = 2\bar{i} - 9\bar{j} + 6\bar{k}$, then find $\bar{a} \cdot \bar{b}$ and the angle between $\bar{a}$ and $\bar{b}$.

4. Evaluate $\cos^2 45° + \cos^2 135° + \cos^2 225° + \cos^2 315°$.

5. Find the minimum and maximum values of $3 \cos x + 4 \sin x$.

6. Transform the equation $3x + 4y + 12 = 0$ into slope intercept form and intercept form.

7. Find the distance between the parallel straight lines $3x + 4y - 3 = 0$ and $6x + 8y - 1 = 0$.

8. Find the distance between the mid-point of the line segment $\overline{AB}$ and the point $(3, -1, 2)$ Where $A = (6, 3, -4)$ and $B = (-2, -1, 2)$.

9. Compute : $\lim_{x \to 0} \frac{\sin(a + bx) - \sin(a - bx)}{x}$

10. If $f(x) = (x^2 - 3)(4x^3 + 1)$, find $f'(x)$.

SECTION – B

$3 \times 15 = 45$

II. Long Answer Type questions :

(i) Answer any **three** questions.

(ii) Each question carries **fifteen** marks.

11. (a) Solve $x + y + z = 9$, $2x + 5y + 7z = 52$ and $2x + y - z = 0$ by using Cramer's Method.

(b) Show that $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix} = abc(a - b)(b - c)(c - a)$

12. (a) Show that the points (5, –1, 1); (7, –4, 7); (1, –6, 10) and (–1, –3, 4) are the vertices of a rhombus.

(b) If $\bar{a} = \bar{i} - 2\bar{j} - 3\bar{k}$, $\bar{b} = 2\bar{i} + \bar{j} - \bar{k}$ and $\bar{c} = \bar{i} + 3\bar{j} - 2\bar{k}$, verify that $\bar{a} \times (\bar{b} \times \bar{c}) \neq (\bar{a} \times \bar{b}) \times \bar{c}$.

13. (a) Show that : $\cos\frac{\pi}{11} \cos\frac{2\pi}{11} \cos\frac{3\pi}{11} \cos\frac{4\pi}{11} \cos\frac{5\pi}{11} = \frac{1}{32}$

(b) If A, B, C are angles in a triangle, then show that

$$\cos A + \cos B + \cos C = 1 + 4 \sin\frac{A}{2} \sin\frac{B}{2} \sin\frac{C}{2}.$$

14. (a) Find the orthocentre of the triangle whose vertices are (–2, –1); (6, –1) and (2, 5).

(b) Find the angles of the triangle whose sides are $x + y - 4 = 0$, $2x + y - 6 = 0$ and $5x + 3y - 15 = 0$.

15. (a) If $x^y = y^x$, then show that $\frac{dy}{dx} = \frac{y(x \log y - y)}{x(y \log x - x)}$

(b) Find the angle between the curves $y^2 = 4x$ and $x^2 + y^2 = 5$.
