(i) Printed Pages : 3 Roll No. ....

(ii) Questions : 8

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Exam. Code : | 0 | 0 | 0 | 1 |

B.A./B.Sc. (General) 1st Semester

(2123)

MATHEMATICS

Paper–III : Trigonometry & Matrices

Time Allowed : Three Hours] **[Maximum Marks : 30**

Note :— Attempt **five** questions in all, selecting at least **two** questions from each Unit.

UNIT—I

1\. (a) Apply De Moivre's theorem to find an equation whose roots are the n^{th} powers of the roots of the equation $x^2 - 2x\cos\theta + 1 = 0$.

(b) If $x + \frac{1}{x} = 2\cos\theta$, prove that $x^n + \frac{1}{x^n} = 2\cos n\theta$. 3,3

2\. (a) Prove that the n^{th} roots of unity form a series in G.P. Also show that their sum is zero and product is equal to $(-1)^{n-1}$.

(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. 3,3

3. (a) Show that each primitive 6^{th} root of unity satisfies $z^2 - z + 1 = 0$.

(b) Solve $x^9 - x^5 + x^4 - 1 = 0$. 3,3

4. (a) Expand $\cos^5\theta \sin^7\theta$ in a series of sines of multiples of θ.

(b) If $i^{i^{\cdot^{\cdot^{\infty}}}} = A + iB$ and only principal values are considered, prove that :

$$\tan \frac{\pi A}{2} = \frac{B}{A}.$$ 3,3

UNIT—II

5. (a) Express the matrix $A = \begin{bmatrix} 2-i & 3 & 1+i \\ -5 & 0 & -6i \\ 7 & i & -3+2i \end{bmatrix}$ as the sum of a hermitian and a skew-hermitian matrix.

(b) Show that rank of $\begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$ is less than 3, iff either $a + b + c = 0$ or $a = b = c$. 3,3

6. Find the matrices P and Q such that PAQ is in the normal form, when A is the matrix :

$$A = \begin{bmatrix} 1 & -1 & 2 & 1 \\ 4 & 2 & -1 & 2 \\ 2 & 2 & -2 & 0 \end{bmatrix}$$ 6

7. Examine the consistency of the following equation and if consistent, final the complete solution :

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

$$3x - y + 2z = 1$$

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

6

8. (a) Prove that characteristic roots of a unity matrix are of unit modulus.

(b) State and prove Cayley-Hamilton theorem. 3,3