Note: Section-I is compulsory. Attempt any three (3) questions from Section-II.

SECTION-I

2. Write short answers to any EIGHT questions: **(2 x 8 = 16)**

i- Check the closure property with respect to multiplication on the set $\{-1, 1\}$

ii- Simplify the complex numbers $(5, -4)(-3, -2)$

iii- Write down the descriptive and tabular form of $\{x \mid x \in P \wedge x < 12\}$

iv- Verify commutative property of union and intersection for sets $A = \{1,2,3,4,5\}$, $B = \{4,6,8,10\}$

v- Write down the inverse and contrapositive of the conditional $\sim p \rightarrow q$

vi- Find x and y if $\begin{bmatrix} x+3 & 1 \\ -3 & 3y-4 \end{bmatrix} = \begin{bmatrix} y & 1 \\ -3 & 2x \end{bmatrix}$

vii- If A and B are non-singular matrices. Then show that $(AB)^{-1} = B^{-1}A^{-1}$

viii- Without expansion show that $\begin{vmatrix} \alpha & \beta+\gamma & 1 \\ \beta & \gamma+\alpha & 1 \\ \gamma & \alpha+\beta & 1 \end{vmatrix} = 0$

ix- Solve the equation $x^2 - 7x + 10 = 0$ by factorization.

x- Reduce $2x^4 - 3x^3 - x^2 - 3x + 2 = 0$ into quadratic form.

xi- Solve the equation $x^{1/2} - x^{1/4} - 6 = 0$

xii- Define reciprocal equation.

3. Write short answers to any EIGHT questions: **(2 x 8 = 16)**

i- Resolve into partial fractions of $\frac{x^2+1}{(x-1)(x+1)}$ without finding values of constants.

ii- Write down next two terms of sequence $-1, 2, 12, 40, \ldots\ldots$

iii- Insert two G.Ms. between 1 and 8

iv- Find n^{th} term of $\frac{1}{2}, \frac{1}{5}, \frac{1}{8}, \ldots\ldots$

v- Prove that $\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$

vi- If 5 , 8 are two A.Ms. between a and b. Find a and b.

vii- Find the value of n^{-1} when ${}^{n}P_4 : {}^{n-1}P_3 = 9:1$

viii- How many arrangements of letters of word PAKPATTAN, taken all together, can be made ?

ix- Two dice are thrown twice. What is probability that sum of dots shown in first throw is 7 and that of second throw is 11 ?

x- Show that in-equality $4^n > 3^n + 4$ holds for $n = 2$, $n = 3$

xi- Using binomial theorem, expand $(a+2b)^5$

xii- Expand up to 4 terms, taking the value of x such that expansion is valid: $(8-2x)^{-1}$

4. Write short answers to any NINE questions: **(2 x 9 = 18)**

i- What is the length of the arc intercepted on a circle of radius 14cm by the arms of central angle of 45° ?

ii- Verify that $\text{Sin}^2\frac{\pi}{6} : \text{Sin}^2\frac{\pi}{4} : \text{Sin}^2\frac{\pi}{3} : \text{Sin}^2\frac{\pi}{2} = 1:2:3:4$

iii- Prove that $\frac{\text{Sin}\theta}{1+\text{Cos}\theta} + \text{Cot}\theta = \text{Cosec}\theta$

iv- Without using table, find the value of $\tan(-135^\circ)$

v- Prove that $\text{Cos}(\alpha+45^\circ)=\frac{1}{\sqrt{2}}(\text{Cos}\alpha-\text{Sin}\alpha)$

vi- Prove that $\frac{1-\text{Cos}\alpha}{\text{Sin}\alpha}=\tan\frac{\alpha}{2}$

vii- Find the period of $\text{Cot}\,8x$

viii- When the angle between the ground and the sun in 30°, flag pole casts a shadow of 40 m long. Find the height of the top of the flag.

ix- Find the smallest angle of the triangle ABC when $a=37.34$, $b=3.24$, $c=35.06$

x- Find the area of the triangle ABC when $a=200$, $b=120$, $\gamma=150^\circ$

xi- Show that $\text{Sin}(2\text{Cos}^{-1}x)=2x\sqrt{1-x^2}$

xii- Find the solution set of $\text{Sin}x.\text{Cos}x=\frac{\sqrt{3}}{4}$

xiii- Find the solution of $\text{Sin}x=\frac{1}{2}$ in $[0\,,\,2\pi]$

SECTION-II

Note: Attempt any three (3) questions.

5- (a) Use matrices to solve the system of equations 5

$$2x_1+x_2+3x_3=3$$
$$x_1+x_2-2x_3=0$$
$$-3x_1-x_2+2x_3=-4$$

(b) Solve the equation $\left(x-\frac{1}{x}\right)^2+3\left(x+\frac{1}{x}\right)=0$ 5

6- (a) Resolve $\frac{x^2+1}{x^3+1}$ into partial fraction. 5

(b) A die is thrown. Find the probability that the dots on the top are prime numbers or odd numbers. 5

7- (a) For what value of n , $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ is the positive geometric mean between a and b ? 5

(b) If $y=\frac{2}{5}+\frac{1\cdot3}{2!}\left(\frac{2}{5}\right)^2+\frac{1\cdot3\cdot5}{3!}\left(\frac{2}{5}\right)^3+\ldots\ldots$ then prove that $y^2+2y-4=0$ 5

8- (a) Prove that $\sqrt{\frac{1-\text{Sin}\theta}{1+\text{Sin}\theta}}=\text{Sec}\theta-\tan\theta$, where θ is not an odd multiple of $\frac{\pi}{2}$ 5

(b) If $\alpha+\beta+\gamma=180^\circ$, show that $\cot\alpha\cot\beta+\cot\beta\cot\gamma+\cot\gamma\cot\alpha=1$ 5

9- (a) Using law of tangents , solve the ΔABC in which $a=36.21$, $b=42.09$ and $\gamma=44^\circ29'$ 5

(b) Prove that $2\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{1}{7}\right)=\frac{\pi}{4}$ 5