Mathematics (Subjective)

(GROUP-I)

SECTION-I   RWP-1-24

(8x2=16)

2. **Write short answers of any eight parts from the following:**

   i. Define a complex number. Is 0 a complex number?

   ii. Whether the set $\{0, -1\}$ is closed or not $w. r. t$ addition and multiplication.

   iii. Factorize: $3x^2 + 3y^2$

   iv. Find multiplicative inverse of $-3 - 5i$

   v. Construct truth table of $\sim(p \rightarrow q) \rightarrow p$

   vi. Define monoid.

   vii. Find the matrix X if: $X \begin{bmatrix} 5 & 2 \\ -2 & 1 \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 12 & 3 \end{bmatrix}$

   viii. If A and B are square matrices of the same order, then explain why in general $(A + B)^2 \neq A^2 + 2AB + B^2$

   ix. If $A = \begin{bmatrix} 1 \\ 1 + i \\ i \end{bmatrix}$, find $A(\bar{A})^t$

   x. Find four fourth roots of 81

   xi. Use the remainder theorem to find the remainder when $x^3 - 2x^2 + 3x + 3$ is divided by $x - 3$

   xii. If α, β are the roots of $3x^2 - 2x + 4 = 0$, find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$

(8x2=16)

3. **Write short answers of any eight parts from the following:**

   i. Define conditional equation.

   ii. Resolve $\frac{x^2+15}{(x^4+2x+5)(x-1)}$ into partial fraction without finding constants.

   iii. Find the first four terms of the sequence $a_n = \frac{n}{2n+1}$

   iv. Determine whether -19 is a term of $17, 13, 9, \ldots$

   v. Find the 5th term of the G.P $3, 6, 12, \ldots$

   vi. Sum the series $\frac{3}{\sqrt{2}} + 2\sqrt{2} + \frac{5}{\sqrt{2}} + \cdots + a_{13}$

   vii. Prove from the first principle that $^nP_r = n \cdot {}^{n-1}P_{r-1}$

   viii. Find the value of n when $^nC_{12} = {}^nC_6$

   ix. Determine the probability of getting dots less than 5 when a die is rolled.

   x. Prove that $n! > 2^n - 1$ for $n = 4, 5$

   xi. Calculate $(2.02)^4$ by means of binomial theorem.

   xii. Expand $(1 + 2x)^{-1}$ up to 4 terms.

(9x2=18)

4. **Write short answers of any nine parts from the following:**

   i. Write values of trigonometric functions for $\theta = \frac{-9}{2}\pi$.

   ii. Prove that $t^2\theta - \cos^2\theta = \cot^2\theta \cos^2\theta$.

iii. Prove that $sin(\theta + 270) = -cos\theta$.

iv. Prove that $sin2\theta = 2sin\theta \, cos\theta$.

v. Express $sin12° \, sin46°$ as sum or difference.

vi. Write domain and range of $cos \, x$.

vii. Find period of $sin \frac{x}{3}$.

viii. Draw the graph of $tanx$ for $x \in (0, \pi)$

ix. Prove that $r = (s - b)tan\frac{\beta}{2}$.

x. Write any two half angle formulae.

xi. When angle between ground and sun is $30°$, flag pole casts a shadow of $40m$ long. Find height of top of flag.

xii. Show that $cos(sin^{-1}x) = \sqrt{1 - x^2}$.

xiii. Solve the equation $4 \, cos^2x - 3 = 0$

SECTION-II

(10x3=30)

Note: **Attempt any three questions. Each question carries equal marks:**

5.(a) If α and β are the roots of $x^2 - 3x + 5 = 0$, form the equation whose roots are $\frac{1-\alpha}{1+\alpha}$ and $\frac{1-\beta}{1+\beta}$.

(b) Find the rank of matrix $\begin{bmatrix} 1 & -1 & 2 & 1 \\ 2 & -6 & 5 & 1 \\ 3 & 5 & 4 & -3 \end{bmatrix}$

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

(b) Find six arithmetic means between 2 and 5.

7. (a) A die is thrown. Find the probability that the no. of dots on the top are prime numbers or odd numbers.

(b) If x is so small that its cube or higher powers can be neglected, show that $\sqrt{\frac{1-x}{1+x}} \approx 1 - x + \frac{1}{2}x^2$

8. (a) Solve the triangle ABC, given that $\alpha = 35° \, 17$ $\beta = 45° \, 13$, $b = 421$.

(b) Reduce $cos^4\theta$ to an expression involving only function of multiples of θ, raised to the first power.

9. (a) A circular wire of radius $6 \, cm$ is cut straightened and then bent so as to lie along the circumference of a hoop of radius $24 \, cm$. Find the measure of the angle which it subtends at the center of the hoop.

(b) Prove that: $tan^{-1}\frac{1}{4} + tan^{-1}\frac{1}{5} = tan^{-1}\frac{9}{19}$