Note: This Question paper consists of three sections A. B and

Time:3 Hrs   **Max**.Marks:75

SECTION – A

I.   **Very Short Answer type Questions**

       (i) Answer all Questions

       (ii) Each Question carries 2 marks   10 x 2 = 20

1. Find the square root of $-5 + 12i$.

2. If $z_1 = -1$, $z_2 = i$ then find $\text{Arg}\left(\dfrac{z_1}{z_2}\right)$.

3. Find the value of $(1+i)^{16}$.

4. If α, β are the roots of the equation $ax^2 + bx + c = 0$, then find the value of $\dfrac{1}{\alpha^2} + \dfrac{1}{\beta^2}$.

5. Find the algebraic equation whose roots are two times the roots of $x^5 - 2x^4 + 3x^3 - 2x^2 + 4x + 3 = 0$.

6. Find the number of ways of arranging the letters of the word "**INTERMEDIATE**".

7. If $^n\text{P}_r = 5040$ and $^n\text{C}_r = 210$ find n and r.

8. If $(1 + x + x^2)^n = a_0 + a_1x + a_2x^2 + \dots + a_{2n}x^{2n}$ then find the value of $a_0 + a_2 + a_4 + \dots + a_{2n}$.

9. The variance of 20 observations is 5. If each observation is multiplied by 2, then find the new variance of the resulting observations.

10. A poisson variable satisfies $P(x = 1) = P(x = 2)$ Find $P(x = 5)$.

SECTION – B

II.   **Short Answer type Questions**

       (i) Answer any five Questions

       (ii) Each Question carries 4 marks   5 x 4 = 20

11. If $z = x + iy$ and if the point P in the Argand plane represents z, find the locus of z satisfying the equation $\left|z - 2 - 3i\right| = 5$.

12. Find the range of $\dfrac{x+2}{2x^2 + 3x + 6}$.

13. If the letters of the word MASTER are permuted in all possible ways and the words thus formed are arranged in the dictionary order, then find the rank of the word "**REMAST**".

14. Find the number of ways of selecting a cricket team of 11 players from 7 batsmen and 6 bowlers such that there will be at least 5 bowlers in the team.

15. Resolve $\dfrac{x^2 - 3}{(x+2)(x^2+1)}$ into partial fractions.

16. Two persons A and B are rolling a die on the condition that the person who gets 3 will win the game. If A starts the game, then find the probabilities of A and B respectively to win the game.

17. A problem in calculus is given to two students A and B whose chances of solving it are $\dfrac{1}{3}$ and $\dfrac{1}{4}$ respectively. Find the probability of the problem being solved if both of them try independently.

SECTION – C

III. **Long Answer type Questions**
   (i) Answer any five Questions
   (ii) Each Question carries 7 marks   5 x 7 = 35

18. Find all the roots of the equation $x^{11} - x^7 + x^4 - 1 = 0$.

19. Solve: $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$.

20. If n is a positive integer and x is any nonzero real number, then prove that

$$C_0 + C_1 \frac{x}{2} + C_2 \cdot \frac{x^2}{3} + C_3 \cdot \frac{x^3}{4} + \dots + C_n \cdot \frac{x^n}{n+1} = \frac{(1+x)^{n+1} - 1}{(n+1)x}.$$

21. If $x = \dfrac{1.3}{3.6} + \dfrac{1.3.5}{3.6.9} + \dfrac{1.3.5.7}{3.6.9.12} + \dots$ then prove that $9x^2 + 24x = 11$.

22. Calculate the variance and standard deviation for the following distribution :

Class	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

23. The probabilities of three events A, B, C are such that P (A) = 0.3, P(B) = 0.4, P(C) = 0.8, P(A ∩ B) = 0.08, P (A ∩ C) = 0.28, P (A ∩ B ∩ C) = 0.09, and P (A ∪ B ∪ C) ≥ 0.75, show that P (B ∩ C) lies in the interval [0.23, 0.48].

24. A random variable x has the following probability distribution :

$X = x_i$	0	1	2	3	4	5	6	7
$P(X = x_i)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

Find (i) k (ii) the mean (iii) $P(0 < X < 5)$.

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