

MATHEMATICS, Paper – II A**(English Version)****MODEL QUESTION PAPER****(For the Academic year 2021 – 2022 only)****Time : 3 Hours****Max. Marks : 75****NOTE:** This question paper consists of three sections A, B and C

SECTION – A**Very short answer type questions.****(i) Answer ANY TEN questions.****(ii) Each question carries 2 marks.****10 × 2 = 20**

1. Write the multiplicative inverse of the complex number $(\sin \theta, \cos \theta)$.
2. If $(a + ib) = x + iy$, find $x^2 + y^2$
3. If $Z_1 = (2, -1), Z_2 = (6, 3)$ find $Z_1 - Z_2$
4. If $x = \text{cis } \theta$, then find the value of $\left(x^6 + \frac{1}{x^6}\right)$.
5. If α, β are the roots of the equation $ax^2 + bx + c = 0$, then find the value of the expression $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ in terms of a, b, c
6. If the equation $x^2 - 15 - m(2x - 8) = 0$ has equal roots find value of m .
7. Find the algebraic equation whose roots are three times the roots of $x^3 + 2x^2 - 4x + 1 = 0$
8. Find the transformed equation whose roots are the reciprocals of the roots of $x^4 - 3x^3 + 7x^2 + 5x - 2 = 0$

9. Find the number of ways of arranging 5 different maths books, 4 different physics books and 3 different chemistry books such that the books of the same subject are together
10. Find the number of diagonals of a polygon with 2 sides.
11. If $(n + 1)P_3 : nP_6 = 2 : 7$ find n
12. Find the 7th term in the expansion of $\left(1 - \frac{x^2}{3}\right)^{-4}$
13. Find the mean deviation from the mean of the following data 6, 7, 10, 12, 13, 4, 12, 16
14. The probability that a person chosen at random is left handed in hand writing is 0.1.
What is the probability that in a group of 10 people, there is one who is left handed ?
15. If the mean and variance of binomial variable X are 2.4 and 1.44 respectively find
 $P(1 < x \leq 4)$

SECTION - B

Short answer type questions .

5 × 4 = 20

(iii) Answer ANY FIVE questions.

(iv) Each question carries 4 marks.

16. If x and y are real number, such that $\frac{(1+i)x-2i}{3+i} + \frac{(2-3i)y+i}{3-i} = i$, then determine the values of x and y
17. If $x + iy = \frac{3}{2 + \cos \theta + i \sin \theta}$ then, show that $x^2 + y^2 = 4x - 3$
18. If 1, ω , ω^2 are the cube roots of unity, then prove that
 $(2 - \omega)(2 - \omega^2)(2 - \omega^{10})(2 - \omega^{11}) = 49$.
19. Find the range of the expression $\frac{x+2}{2x^2+3x+6}$.

20. Solve $x^3 - 7x^2 + 14x - 8 = 0$, given that the roots are in geometric progression.
21. Find the sum of all 4 digit numbers that can be formed using the digits 0, 2, 4, 7, 8 without repetition.
22. Simplify : $35C_5 + \sum_{r=0}^4 (38 - r)C_4$
23. Resolve $\frac{3x^3 - 8x^2 + 10}{(x-1)^4}$ into partial fractions.
24. Resolve $\frac{x^3}{(x-a)(x-b)(x-c)}$ into partial fractions.
25. Resolve $\frac{x^2 - 3}{(x^2 + 1)(x + 2)}$ into partial fractions.
26. A and B are events with $P(A) = 0.5$, $P(B) = 0.4$ and $P(A \cap B) = 0.3$. Find the probability that (i) A does not occur (ii) neither A nor B occurs.
27. State and prove Multiplication Theorem of Probability.

SECTION – C

Long Answer type questions .

5 × 7 = 35

(v) Answer ANY FIVE questions.

(vi) Each question carries 7 marks.

28. If α, β are the roots of the equation $x^2 - 2x + 4 = 0$, then for any $n \in \mathbb{N}$, show that

$$\alpha^n + \beta^n = 2^{n+1} \cos\left(\frac{n\pi}{3}\right).$$

29. Let $a, b, c \in \mathbb{R}$ and $a \neq 0$ such that the equation $ax^2 + bx + c = 0$ has real roots, α, β with $\alpha < \beta$ Prove that the expression $ax^2 + bx + c = 0$ and 'a' have same sign when $x < \alpha$ or $x > \beta$.

30. Solve $x^4 - 4x^2 + 8x + 35 = 0$, given that $2 + i\sqrt{3}$ is a root.

- 31.** Find the polynomial equation whose roots are the translates of the roots of the equation $x^4 - 5x^3 + 7x^2 - 17x + 11 = 0$ by -2 .
- 32.** If the letters of the word MASTER are permuted in all possible ways and the words thus formed are arranged in dictionary order, then find the rank of the word REMAST.
- 33.** Find the numerically greatest term in the expansion of $(3x - 4y)^{14}$ when $x = 8, y = 3$.
- 34.** In a box containing 15 bulbs, 5 defective. If 5 bulbs are selected at random from the box., then find the probability of the event that
- (i) None of them is defective
 - (ii) Only one of them is defective.
 - (iii) At least one of them is defective.
- 35.** If A, B, C are three independent events of a random experiment such that $P(A \cap \bar{B} \cap \bar{C}) = \frac{1}{4}, P(\bar{A} \cap B \cap \bar{C}) = \frac{1}{8}, P(\bar{A} \cap \bar{B} \cap \bar{C}) = \frac{1}{4}$ then find P(A), P(B) and P(C).
- 36.** A Random variable X has the following probability distribution.

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

Find (i) k (ii) Mean of x (iii) $P(0 < x < 5)$

- 37.** If the difference between the mean and variance of a binomial variate is $\frac{5}{9}$, then find the probability for the event of 2 successes when the experiment is conducted five times.