

Total No. of Questions : 24
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Part-III**MATHEMATICS, Paper - II(A)**

(English version)

Time : 3 Hours]**[Max. Marks : 75**

Note : This question paper contains **three** Sections **A, B** and **C**.

SECTION - A**10×2=20**

I . Very short answer type questions.

- (i) Answer **all** questions.
(ii) Each question carries **TWO** marks.

1. Find the extreme value of the Quadratic expression $2x - 7 - 5x^2$. Also state whether it is maximum or minimum with reason.

2. If 1, 1, α are the roots of the equation $x^3 - 6x^2 + 9x - 4 = 0$, then find the value of α .

3. If $A = \begin{bmatrix} 2 & 4 \\ -1 & k \end{bmatrix}$ and $A^2 = O$ (null matrix), then find the value of k .

4. Find the adjoint matrix and inverse matrix

of the matrix $\begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$

5. Find the number of ways of permuting the letters of the word PICTURE so that all the vowels come together.
6. Find the number of ways of forming a committee of 5 members from 6 men and 3 women.
7. If ${}^{22}C_r$ is the largest binomial coefficient in the expansion of $(1+x)^{22}$, find the value of ${}^{13}C_r$.
8. Find the sum of the infinite series $1 + \frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \dots$
9. When two dice are thrown, the sum on the two dice happened to be 7. Find the probability that none of the dice shows a number 2.
10. The mean and variance of a Binomial distribution is 4 and 3 respectively. Find its parameters.

SECTION - B

5×4=20

II. *Short answer type questions.*

- (i) Attempt **ANY FIVE** questions.
- (ii) Each question carries **FOUR** marks.

11. Find the range of the expression $\frac{x^2 + x + 1}{x^2 - x + 1}$

12. If $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$, then find A^{-1} .

13. Find the sum of all four digit numbers that can be formed using the digits 1, 3, 5, 7, 9.

14. If $1 \leq r \leq n$, then prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$.

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

16. Find the sum of the infinite series

$$\frac{4}{1!} + \frac{11}{2!} + \frac{22}{3!} + \frac{37}{4!} + \frac{56}{5!} + \dots$$

17. Three boxes B_1, B_2, B_3 contain balls with different colours as follows.

	White	Black	Red
B_1	2	1	2
B_2	3	2	4
B_3	4	3	2

A dice is thrown. If 1 or 2 turns up on the dice, box B_1 is selected; if 3 or 4 turns up, B_2 is selected; if 5 or 6 turns up, then B_3 is selected. If a box is selected like this, a ball is drawn from that box. If the ball is red, then find the probability that it was drawn from B_2 .

SECTION - C

5×7=35

III. Long answer type questions.

(i) Attempt **ANY FIVE** questions.

(ii) Each question carries **SEVEN** marks.

18. If the equation $x^4 + 4x^3 - 2x^2 - 12x + 9 = 0$ has two pairs of equal roots, find the roots of the equation.

19. $3x + 4y + 5z = 18$, $2x - y + 8z = 13$, $5x - 2y + 7z = 20$,

Solve the above system of equations by Cramer's method.

20. Prove that

$$\begin{bmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{bmatrix} = (a+b+c)^3$$

21. Prove that

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

22. Find the sum of the infinite series

$$1 + \frac{1}{3} + \frac{1 \cdot 3}{3 \cdot 6} + \frac{1 \cdot 3 \cdot 5}{3 \cdot 6 \cdot 9} + \dots$$

23. In a race, 3 horses A, B, C are participating. The probability of A winning is twice the probability of B. The probability of winning B is twice the probability of winning C. Then find the probabilities of winning A, B and C.

24. The range of a random variable X is $\{0, 1, 2\}$.

Given that $P(X = 0) = 3c^3$; $P(X = 1) = 4c - 10c^2$; $P(X = 2) = 5c - 1$,

then (i) find the value of c,

(ii) $P(X < 1)$, (iii) $P(1 < X \leq 2)$, and (iv) $P(0 < X \leq 3)$.
