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B

Total No. of Questions - 24
Total No. of Printed Pages - 4

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Part - III

MATHEMATICS, Paper - II (A)

(Algebra and Probability)

(English Version)

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

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

SECTION A

$10 \times 2 = 20$

I. Very Short Answer Type Questions.

i) Answer **all** questions.

ii) Each question carries **two** marks.

1. If $z = 2 - 3i$, then show that, $z^2 - 4z + 13 = 0$.

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

3. If $x = Cis\,\theta$, then find the value of $\left(x^6 + \frac{1}{x^6}\right)$.

4. Form a quadratic equation whose roots are $7 \pm 2\sqrt{5}$.

5. If $-1, 2$ and α are the roots of $2x^3 + x^2 - 7x - 6 = 0$, then find α.

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6. Find the number of ways of arranging the letters of the word MATHEMATICS.

7. If ${}^{n}C_5 = {}^{n}C_6$, then find ${}^{13}C_n$.

8. Prove that $C_0 + 2 \cdot C_1 + 4 \cdot C_2 + 8 \cdot C_3 + \ldots\ldots + 2^n \cdot C_n = 3^n$.

9. Find the mean deviation about the median for the following data :
4, 6, 9, 3, 10, 13, 2.

10. A Poisson variable satisfies $P(X=1) = P(X=2)$. Find $P(X=5)$.

SECTION B

5 × 4 = 20

II. Short Answer Type Questions.

i) Attempt **any five** questions.

ii) Each question carries **four** marks.

11. Show that the points in the Argand diagram represented by the complex numbers $2 + 2i, -2 - 2i, -2\sqrt{3} + 2\sqrt{3}\,i$ are the vertices of an equilateral triangle.

12. Prove that $\frac{1}{3x+1} + \frac{1}{x+1} - \frac{1}{(3x+1)(x+1)}$ does not lie between 1 and 4, if x is real.

13. Find the sum of all 4 digit numbers that can be formed using the digits 1, 3, 5, 7, 9.

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

15. Resolve the fraction $\frac{2x^2+3x+4}{(x-1)(x^2+2)}$ into partial fraction.

16. Suppose A and B are independent events with $P(A)=0.6,\ P(B)=0.7$. Then compute :

i) $P(A \cap B)$ ii) $P(A \cup B)$

iii) $P(B/A)$ iv) $P(A^c \cap B^c)$

17. A, B, C are three horses in a race. The probability of A to win the race is twice that of B and probability of B is twice that of C. What are the probabilities of A, B and C to win the race?

SECTION C

5 × 7 = 35

III. Long Answer Type Questions.

i) Attempt **any five** questions.

ii) Each question carries **seven** marks.

18. If $Cos\alpha + Cos\beta + Cos\gamma = 0 = Sin\alpha + Sin\beta + Sin\gamma$, then prove that $Cos^2\alpha + Cos^2\beta + Cos^2\gamma = \frac{3}{2} = Sin^2\alpha + Sin^2\beta + Sin^2\gamma$.

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

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20. If the coefficients of r^{th}, $(r+1)^{th}$ and $(r+2)^{nd}$ terms in the expansion of $(1+x)^n$ are in A.P. Then show that $n^2-(4r+1)n+4r^2-2=0$

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

22. Find the mean deviation about the mean for the following data :

Marks obtained	0–10	10–20	20–30	30–40	40–50
No. of students	5	8	15	16	6

23. State and prove the addition theorem on probability.

24. 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

iii) $P(0<X<5)$

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