Total No. of Questions-24

Total No. of Printed Pages 4

Regd. No.

Part III

MATHEMATICS

Paper II(A)

(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. Find the multiplicative inverse of:

$$7 + 24i$$
.

- 2. Simplify $i^2 + i^4 + i^6 + \dots$ up to (2n + 1) terms.
- 3. If $x = cis \theta$, then find the value of $x^6 + \frac{1}{x^6}$.
- 4. Form the quadratic equation whose roots are:

$$\frac{p-q}{p+q}$$
 and $\frac{-(p+q)}{p-q}(p \neq \pm q)$

- 5. Find the algebraic equation whose roots are 2 times the roots of $x^5 2x^4 + 3x^3 2x^2 + 4x + 3 = 0$.
- 6. Find the number of functions from a set A containing 5 elements into a set B containing 4 elements.
- 7. If ${}^{15}C_{2r-1} = {}^{15}C_{2r+4}$, find r.
- 8. If ${}^{22}C_r$ is the largest binomial coefficient in the expansion of $(1 + x)^{22}$, find the value of ${}^{13}C_r$.
- 9. Find the mean deviation from the mean of the following discrete data
 - 6, 7, 10, 12, 13, 4, 12, 16.

10. For a binomial distribution with mean 6 and variance 2, find the first two terms of the distribution.

SECTION B

 $5 \times 4 = 20$

- II. Short Answer Type Questions :
 - Answer ANY FIVE questions.
 - (ii) Each question carries FOUR marks.
- 11. If the real part of $\left(\frac{z+1}{z+i}\right)$ is 1, then find the locus of z where z=x+iy.
- 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 number of 4-letter words that can be formed using the letters of the word MIRACLE. How many of them:
 - (i) Begin with a vowel
 - (ii) Begin and end with vowels
 - (iii) End with a consonant.
- 14. Prove that:

$$\frac{{}^{4n}C_{2n}}{{}^{2n}C_n} = \frac{1.3.5....(4n-1)}{\{1.3.5....(2n-1)\}^2}.$$

- 15. Resolve $\frac{3x^3 2x^2 1}{x^4 + x^2 + 1}$ into partial fractions.
- 16. The probabilities of three mutually exclusive events are respectively given as $\frac{1+3P}{3}$, $\frac{1-P}{4}$, $\frac{1-2P}{2}$. Prove that $\frac{1}{3} \le P \le \frac{1}{2}$.
- 17. If A and B are independent events of a random experiment, show that A^C and B^C are also independent.

- III. Long Answer Type Questions :
 - (i) Answer ANY FIVE questions.
 - (ii) Each question carries SEVEN marks.
- 18. If α , β are the roots of the equation $x^2 2x + 4 = 0$, then for any $n \in \mathbb{N}$ show that:

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

19. Find the polynomial equation whose roots are the translates of those of the equation :

$$x^4 - 5x^3 + 7x^2 - 17x + 11 = 0$$
 by -2 .

20. If the coefficients of x^9 , x^{10} , x^{11} in the expansion of $(1 + x)^n$ are in A.P., then prove that:

$$n^2 - 41n + 398 = 0$$
.

21. If

$$x = \frac{1.3}{3.6} + \frac{1.3.5}{3.6.9} + \frac{1.3.5.7}{3.6.9.12} + \dots,$$

then prove that :

$$9x^2 + 24x = 11.$$

22. Find the mean deviation about median for the following continuous distribution:

Marks Obtained	No. of Boys
0—10	6
10—20	8
20—30	14
30-40	16
40—50	4
50-60	2

- 23. Suppose that an urn B₁ contains 2 white and 3 black balls and another urn B₂ contains 3 white and 4 black balls. One urn is selected at random and a ball is drawn from it. If the ball drawn is found black, find the probability that the urn chosen was B₁.
- 24. A random variable X has the following probability distribution :

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

Find:

- (i) k
- (ii) the mean and
- (iii) p(0 < X < 5).