Student's Copy

2025

(NEP—2020)

(2nd Semester)

MATHEMATICS

(Major/Minor)

(Algebra)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. If $f(x)$ is divided by $ax+b$, then the remainder is

(a) $f\left(\frac{b}{a}\right)$ ( )

(b) $f\left(-\frac{b}{a}\right)$ ( )

(c) $f\left(\frac{a}{b}\right)$ ( )

(d) 0 ( )

2. If the expression $x^5 - 61x + p$ is divisible by $(x+1)$, then the value of p is

(a) 62 ( ) (b) 60 ( )

(c) –60 ( ) (d) 6 ( )

3. If a polynomial $f(x)$ of degree $n \geq 2$ is divisible by $(x-\alpha)^2$, then the remainder is

(a) $(x-\alpha)f(\alpha) + f'(\alpha)$ ( )

(b) $(x-\alpha)f'(\alpha) + f(x)$ ( )

(c) $(x-\alpha)f'(\alpha) + f(\alpha)$ ( )

(d) $(x-\alpha)f(\alpha)$ ( )

4. For the equation $x^3 - 7x^2 + 15x - 9 = 0$

(a) 2 is a root of multiplicity 2 ( )

(b) 3 is a root of multiplicity 1 ( )

(c) 2 is a root of multiplicity 3 ( )

(d) 3 is a root of multiplicity 2 ( )

5. Every equation of an odd degree has at least

(a) 1 real root ( )

(b) 2 real roots ( )

(c) 3 real roots ( )

(d) None of the above ( )

6. The equation $4x^3 - 13x^2 - 31x + 41 = 0$ has

(a) three positive roots ( )

(b) one positive root which lies between 0 and 1 ( )

(c) no positive root ( )

(d) only one positive root which lies between 1 and 2 ( )

7. The equation $x^4 - 2x^3 - 1 = 0$ has

(a) at least two imaginary roots ( )

(b) more than one positive root ( )

(c) more than one negative root ( )

(d) four real roots ( )

8. The sum of two roots of the equation $x^3 - px^2 + qx + r = 0$ is zero, then

(a) $p = q$ ( )

(b) $pr = q$ ( )

(c) $pq = r$ ( )

(d) $pq + r = 0$ ( )

9. The cube roots of unity are

(a) $2, 2\omega, 2\omega^2$ ( )

(b) $1, \omega, \omega^2$ ( )

(c) $-2, -2\omega, -2\omega^2$ ( )

(d) None of the above ( )

10. The complex number $(3 - 4i)$ in De Moivre's form is

(a) $5(\cos\theta + i\sin\theta)$ ( )

(b) $5(\cos\theta - i\sin\theta)$ ( )

(c) $3(\cos\theta + i\sin\theta)$ ( )

(d) $4(\cos\theta - i\sin\theta)$ ( )

UNIT—III

5. *(a)* Find the necessary condition for the roots of the equation $x^3 - px^2 + qx - r = 0$ to be in—

   (i) arithmetic progression;

   (ii) geometric progression;

   (iii) harmonic progression. 6

   (b) Diminish the roots of the equation $x^4 - 4x^3 + 3x^2 + 3x + 7 = 0$ by 1. 4

6. *(a)* If the polynomial $x^4 + px^2 + qx + r$ has a factor of the form $(x - \alpha)^3$, then show that $8p^3 + 27q^2 = 0$. 4

   (b) If α, β, γ are the roots of $x^3 - px^2 + qx - r = 0$, then find the equation whose roots are $\beta\gamma + \frac{1}{\alpha}, \gamma\alpha + \frac{1}{\beta}, \alpha\beta + \frac{1}{\gamma}$. 6

UNIT—IV

7. *(a)* Express

$$\frac{(\cos 3\theta + i \sin 3\theta)^5}{(\cos \theta + i \sin \theta)^6}$$

   in the form $(a + ib)$. 3

   (b) Using Cardan's method, solve the equation $x^3 + 6x - 2 = 0$. 7

8. *(a)* Solve $z^5 + 1 = 0$ by De Moivre's theorem. 4

   (b) Deduce Cardan's method of solution of cubic equation. 6

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