Time: 1.5 Hours   **Max. Marks: 40**

GENERAL INSTRUCTIONS

– All questions are compulsory.

– The question paper consists of **five sections: A, B, C, D, and E**.

– Section A contains **8 Multiple Choice Questions (MCQs)** of **1 mark each**.

– Section B contains **4 Very Short Answer questions** of **2 marks each**.

– Section C contains **3 Short Answer questions** of **3 marks each**.

– Section D contains **2 Long Answer questions** of **5 marks each**.

– Section E contains **1 Case Study–based question** of **5 marks**.

– Use of calculators or any electronic devices is **not permitted**, unless stated otherwise.

– All necessary working steps must be clearly shown for full marks.

– The use of appropriate units and correct mathematical symbols is compulsory.

Section A (Multiple Choice Questions)

1. If $p(x) = x^2 - x + 1$, then the value of $p(0) \times p(1)$ is:

    (a) 0

    (b) 1

    (c) -1

    (d) 2

2. The degree of the zero polynomial is:

    (a) 0

    (b) 1

    (c) Any natural number

    (d) Not defined

3. Which of the following is a binomial of degree 100?

    (a) x^{100}

    (b) $100x + 1$

    (c) $x^{100} + x^{99}$

    (d) $x^{50} + x^{50}$

4. If $x + 2$ is a factor of $x^2 + mx + 14$, then the value of m is:

   (a) 7

   (b) 9

   (c) -9

   (d) -7

5. The zeroes of the polynomial $p(x) = (x - 3)(x + 4)$ are:

   (a) $3, 4$

   (b) $-3, 4$

   (c) $3, -4$

   (d) $-3, -4$

6. The product $(x - 1/x)(x + 1/x)(x^2 + 1/x^2)$ results in:

   (a) $x^4 + 1/x^4$

   (b) $x^4 - 1/x^4$

   (c) $x^2 - 1/x^2$

   (d) $x^8 - 1/x^8$

7. If the graph of a polynomial $p(x)$ is a straight line passing through the origin, then $p(x)$ is of the form:

   (a) ax^2

   (b) $ax + b$

   (c) ax

   (d) c

8. $(10.1)^2$ can be evaluated most efficiently using the identity:

   (a) $(a - b)^2$

   (b) $(a + b)^2$

   (c) $(a + b)(a - b)$

   (d) $x^2 - y^2$

Section B (Very Short Answer Questions)

1. Give an example of a trinomial of degree 3 and a monomial of degree 0. (2)

2. Check whether $q(t) = 4t^3 + 4t^2 - t - 1$ is a multiple of $2t + 1$. (2)

3. Evaluate $(105) \times (95)$ using the identity $(a + b)(a - b)$. (2)

4. Find the value of the polynomial $f(z) = 3z^2 - 4z + \sqrt{11}$ at $z = 2$. (2)

Section C (Short Answer Questions)

1. If $x^2 + \frac{1}{x^2} = 23$, find the value of $x + \frac{1}{x}$ (take only positive value). (3)

2. Draw a rough graph of the polynomial $p(x) = 3 - x$. Clearly mark the points where it intersects the X and Y axes. What is the zero of this polynomial? (3)

3. Expand $(2a - 3b + 4c)^2$ using the identity $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$. (3)

Section D (Long Answer Questions)

1. (i) Factorize $x^2 + 9x + 18$ using the identity $(x + a)(x + b)$. (ii) If $(x - k)$ is a common factor of $x^2 + ax + b$ and $x^2 + mx + n$, prove that $k = \frac{n-b}{a-m}$. (5)

2. (i) Find the value of $x^2 + y^2$ if $x + y = 10$ and $x - y = 2$. (ii) Represent the polynomial $f(x) = 2x + 3$ on a Cartesian plane. (iii) Explain how the degree of $f(x)$ influences the shape of the graph. (5)

Section E (Case Study Based Question)

A start-up company "Tech-Edu" analyzes its daily revenue using mathematical modeling. The revenue R (in thousands of rupees) generated by selling x units of a digital course is given by the polynomial $R(x) = -x^2 + 10x - 16$. The management wants to find the "Break-even points," which are the number of units sold where the revenue is zero. They also want to calculate the revenue when 5 units are sold. The lead analyst explains that the "degree" of the revenue polynomial is 2, indicating that the revenue increases to a certain point and then starts decreasing, forming a parabolic curve. For a different product, the cost $C(x)$ is a linear polynomial $C(x) = 2x + 4$. Understanding these polynomials helps the company predict profits and set production targets efficiently.

Based on the above information, answer the following questions:

1. What is the revenue $R(x)$ when the company sells $x = 5$ units?

   (a) 5 thousand
   (b) 9 thousand
   (c) 16 thousand
   (d) 0 thousand

2. The break-even points (zeroes of $R(x) = -x^2 + 10x - 16$) are:

   (a) $x = 2$ and $x = 8$
   (b) $x = 4$ and $x = 4$
   (c) $x = -2$ and $x = -8$
   (d) $x = 1$ and $x = 16$

3. What is the degree of the cost polynomial $C(x) = 2x + 4$?

   (a) 0

(b) 1

(c) 2

(d) Not defined

4. The coefficient of x^2 in the revenue polynomial $R(x)$ is:

(a) 1

(b) -1

(c) 10

(d) -16

5. If the company sells 0 units, what is the revenue (represented by $R(0)$)?

(a) 16 thousand

(b) -16 thousand

(c) 0 thousand

(d) 10 thousand

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