Code No: 181AC **R22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year I Semester Examinations, September - 2023
BASIC MATHEMATICS
(Bio-Technology)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a) Compute A^2 for the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ 2 & 3 & 0 \\ 4 & 3 & 2 \end{bmatrix}$. [1]

b) Find the sum of all the non-real roots of the equation $(x^2 + x - 3)(x^2 + x - 4) = 20$. [1]

c) Find the real numbers α and β such that $(\alpha + i\beta)(1 + i) = 10i - 4$. [1]

d) Find the distances of the point $P(-3,5,7)$ from the coordinate axes. [1]

e) Let x lies in the second quadrant. If $\sin x = \frac{12}{13}$, find the value of $\sec x + \tan x$. [1]

f) Find the partial fraction decompose of the function $\frac{2x+5}{x^2+5x+6}$. [1]

g) Evaluate the integral $\int_2^3 3^x dx$. [1]

h) Find $\lim_{x \to 0} \frac{\sin x + e^x - 1}{x}$. [1]

i) Determine the order and degree of the differential equation $y' + 3y = 5e^x$ [1]

j) In a single throw of two dice, find the probability of getting a total of 10. [1]

PART - B

(50 Marks)

2. Consider the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$. Show that $\det(A) \neq 0$, and hence find A^{-1}. [10]

OR

3.a) Let A$= \begin{bmatrix} 3 & 7-4i & -2+5i \\ 7+4i & -2 & 3+i \\ -2-5i & 3-i & 4 \end{bmatrix}$. Prove or disprove that A is a Hermitian matrix.

b) Solve the equation $x^4 - 2x^3 - 21x^2 + 22x + 40 = 0$ whose roots are in arithmetic progression. [5+5]

4.a) Find the square root of the complex number $-8-6i$.

b) Let $\omega = e^{\frac{2\pi i}{3}}, \alpha = \omega + \omega^2 + \omega^4$ and $\beta = \omega^3 + \omega^5 + \omega^6$. Find the quadratic equation whose roots are α and β. [5+5]

OR

5.a) Prove or disprove that the points $P(3,3,3), Q(0,6,3), R(1,7,7)$ and $S(4,4,7)$ are the vertices of a square.

b) Find the equation of the locus of a point which moves such that the ratio of its distance from $(0,2)$ and $(0,-2)$ is 6. [5+5]

6.a) Prove that $\cot x \cot 2x - \cot 2x \cot 3x - \cot 3x \cot x = 1$.

b) Consider the triangle $\Delta\, ABC$. If the sides of the triangle are $a = 18, b = 24, and\ \ c = 30$ and the $\angle C = 90°$, find $\sin A$, $\sin B$, $and\ \sin C$. [5+5]

OR

7.a) Find the partial fraction decompose of the fraction $\frac{x^2+3}{x^3+x^2+3x+2}$.

b) Find the partial fraction decompose of the fraction $\frac{x^4+2x^3-2x^2+4x-1}{x^2+2x-3}$. [5+5]

8.a) Find the derivative of the function $\sin\left(\frac{1+x^2}{1-x^2}\right)$.

b) Discuss the continuity and differentiability of the function $f(x) = \begin{cases} 3x-2, & 0 < x \le 1 \\ 2x^2 - x, & 1 < x \le 2 \\ 5x-4, & x > 2 \end{cases}$ at $x = 2$. [5+5]

OR

9.a) Evaluate the integral $\int \frac{x-1}{\sqrt{x+4}}\, dx$.

b) Evaluate the integral $\int_{-\pi}^{\pi} \sin^5 x\, dx$. [5+5]

10.a) Form the differential equation of the family of ellipses having foci on y-axis and centre at origin.

b) Find the general solution of the differential equation $2ye^{\frac{x}{y}}dx + \left(y - 2xe^{\frac{x}{y}}\right)dy = 0$. [5+5]

OR

11.a) If A and B are two events associated with a random experiment such that $P(A) = 0.6$, $P(B) = 0.3$ and $P(A \cap B) = 0.2$, find $P(A \cup B)$.

b) One number is chosen from numbers 1 to 100. Find the probability that it is divisible by 4 or 6. [5+5]

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