

BT-2/M-20**32025****APPLIED MATHEMATICS-II****Paper-AS-104 N****Opt. (I)**

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Solve $6x^5 - 41x^4 + 97x^3 - 97x^2 + 41x - 6 = 0$.
(b) Solve the equation $x^3 + 6x + 20 = 0$, one root being $1 + 3i$.
2. (a) State and prove the relation between beta and gamma functions.
(b) Using Leibnitz Rule for differentiation, solve

$$\int_0^{\infty} e^{-x} \frac{\sin ax}{x} dx.$$

UNIT-II

3. (a) Find the Laplace transform of $e^{2+} \cos^2 t$.
(b) Find $L[t^2 \cdot \sin at]$.

4. (a) Find the inverse transform of $\frac{s+2}{s^2-4s+13}$.

(b) Solve, using transform method

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{-x}, \quad y(0) = 1, \quad y'(0) = 1.$$

UNIT-III

5. (a) Solve $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$.

(b) If the temperature of the air is 30°C and the substance cools from 100°C to 70°C in 15 minutes, find when the temperature will be 40°C .

6. (a) Find the solution of DE,

$$\frac{d^3y}{dx^3} + 4\frac{dy}{dx} = \sin 2x.$$

(b) Using method variation of parameters solve

$$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x.$$

UNIT-IV

7. (a) Find the unit vector normal to the surface $xy^2z^3 = 4$ at the point $(1, 2, 3)$.

(b) Give the Physical interpretation of divergence.

8. (a) If $\mathbf{F} = 3xy\hat{i} - y^2\hat{j}$, evaluate $\int_C \mathbf{F} \cdot d\mathbf{R}$, where C is the curve in the xy -plane $y = 2x^2$ from $(0, 0)$ to $(1, 2)$.
- (b) Evaluate $\int_C (x^2 + xy)dx + (x^2 + y^2)dy$, using Green's theorem, where C is the square formed by the lines $x = \pm 1, y = \pm 1$.
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