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II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

First Semester

CE / EC / EE

MATHEMATICS - III

Time : **Three Hours** Maximum : **70** Marks

Answer ONE Question from each Unit. 5x14=70 M

All Questions carry equal marks.

UNIT - I

1. a) Derive the relation between Beta and Gamma functions.

   b) Evaluate $\int_0^1 x^4 \left(\log\frac{1}{x}\right)^3 dx$.

(OR)

2. a) Show that $\int_5^7 (x-5)^6 (7-x)^3 dx = 2^{10}\,\beta\,(7,4)$.

   b) When n is a positive integer, prove that $2^n \Gamma\left(n+\frac{1}{2}\right) = 1.3.5.7.---(2n-1)\sqrt{\pi}$.

UNIT - II

3. a) Obtain the Fourier series for $f(x) = x + x^2$ in the interval $-\pi < x < \pi$.

   b) Find half - range cosine series for the function $f(x) = (x\text{-}1)^2$ in the interval $0 < x < 1$.

(OR)

4. Expand $f(x) = x\text{Sin}x$ as a Fourier series in the interval $0 < x < 2\pi$.

UNIT - III

5. a) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2 & for \quad |x| \le 1, \\ 0 & for \quad |x| > 1 \end{cases}$.

   b) Find the Fourier transform of $e^{-x^2} Cos3x$.

(OR)

P.T.O.

6. a) Find the Fourier Cosine transform of $f(x) = \frac{1}{1+x^2}$.

   b) Using Parseval's identity, prove that $\int_0^\infty \frac{dt}{(a^2+t^2)(b^2+t^2)} = \frac{\pi}{2ab(a+b)}$.

UNIT - IV

7. a) Find a root of the equation $x^3 - 5x + 1 = 0$, using the bisection method in 5 stages.

   b) Explain Newton-Raphson method write the merits and demerits of Newton-Raphson method.

(OR)

8. Apply Gauss - Seidel iteration method to solve the equations

   $27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$.

UNIT - V

9. a) Show that (i) $\nabla\Delta = \Delta - \nabla = \delta^2$ (ii) Evaluate $\Delta^2(\text{Cos}2x)$.

   b) Find y (55) given that y (50) = 205, y (60) = 225, y (70) = 248, y (80) = 274, using Newton's forward difference formula.

(OR)

10. a) Using Stirling's formula find y_{35} given $y_{20} = 512$, $y_{30} = 439$, $y_{40} = 346$, $y_{50} = 243$, where y_x represent the number of persons at age x years in a life table.

    b) Find the interpolation polynomial $f(x)$ to the following table.

x	0	1	4	5
$f(x)$	4	3	24	39