This question paper contains 3 printed pages.

3306 *Your Roll No.....*

B.Tech (C) / I

J

ECE - 101
Paper - MATHEMATICS - I

Time : 3 hours *Maximum Marks :70*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any five questions. Assume missing data, if any. All questions carry equal marks.

1 a) Find Fourier series for the function f(x) given by

$$f(x) = \begin{cases} 1 + \dfrac{2x}{\pi}, & -\pi \le x \le 0 \\ 1 - \dfrac{2x}{\pi}, & 0 \le x \le \pi \end{cases}$$ *07*

b) Find half range cosine series for $f(x) = 2x - 1$ in the interval $0 < x < 1$. Hence show that

$$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots\ldots\ldots$$ *07*

2 a) Find the critical points for the function $f(x, y) = x^3 + y^3 - 3xy + 1$ and test their nature. *07*

b) Change the order of integration and evaluate

$$\int_0^2 \int_{x^2}^1 (x^2 + y^2)\, dy dx$$ *07*

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3 a) Find the eigen values and eigen vectors of the matrix

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$$ *07*

b) If $\cosh(u + iv) = x + iy$, prove that

$$\frac{x^2}{\cosh^2 u} + \frac{y^2}{\sinh^2 u} = 1 \text{ and } \frac{x^2}{\cos^2 v} - \frac{y^2}{\sin^2 v} = 1$$ *07*

4 Solve the following differential equations

a) $\frac{d^2y}{dx^2} + 4y = x^2 + \sin 2x$ *07*

b) $$\begin{cases} \frac{dx}{dt} + 2x + 3y = 0 \\ 3x + \frac{dy}{dt} + 2y = 2e^{2t} \end{cases}$$ *07*

5 a) Show that the following system of equations is consistent, and find its solution.

$$x + 2y - 2z = 1$$
$$2x - 3y + z = 0$$
$$5x + y - 5z = 1$$
$$3x + 14y - 12z = 5.$$ *07*

b) Test for convergence the series

$$1 + 3x + 5x^2 + 7x^3 + \cdots\cdots\cdots (x > 0)$$ *07*

6 a) Find the Laplace transform of the function

$$f(t) = \begin{cases} 1 , & 0 \le t < 1 \\ t & 1 \le t < 2 \\ t^2 & 2 \le t < \infty \end{cases}$$ *07*

b) If $L\{\cos at\} = \frac{s}{s^2 + a^2}$ using this result find $L\{\sin at\}$ *07*

7 a) Expand $\sin x \cos y$ in powers of x and y as far as terms of third degree. *07*

b) For the matrix

$$A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$$

verify that $[\text{Adj } (A)]^T = \text{adj } (A^T)$ *07*

8 a) Is the vector $\vec{V} = (e^x \sin y)\, i + (e^x \cos y)\, j$ irrotational ? *07*

b) Using Laplace transform to solve the differential equation

$$\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^{-t}$$

with $x = 2, \frac{dx}{dt} = -1$ at $t = 0$. *07*