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**EY-69****B.Tech. I<sup>st</sup> Semester (CSE, IT & Elect.)****Examination, 2023-24****Engineering Mathematics-I****Paper - BE - 101****Time : 3 Hours]****[Maximum Marks : 60****Note : -** Attempt all questions. All question carry equal marks.

Attempt any two from each questions.

1. (a) Find  $\int_0^2 (x^2 + 1) dx$  as the limit of a sum.

(b) Evaluate  $\int_0^{\infty} x^{1/4} e^{-\sqrt{x}} dx$

(c) Find the volume of the solid generated by revolving

ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  about the major axis.

2. (a) Verify Rolle's theorem for  $f(x) = x^3 - 9x^2 + 26x - 24$  in  $[4]$

(b) Evaluate : -  $\lim_{x \rightarrow 0} (\cos x)^{1/x^2}$

(c) Find local maximum and local minimum value of the function  $f$ , given by  $f(x) = x^5 - 5x^4 + 5x^3 + 10$ ,  $x \in \mathbb{R}$

3. (a) Find the envelope of the family of straight line.

$$y = mx + \sqrt{a^2 m^2 + b^2}, m \text{ is the parameter.}$$

(b) Define the following with examples -

(i) Convergent, divergent and oscillatory series.

(ii) Power series

(iii) Taylor series

(c) Find the Fourier series representing  $f(x) = x$ ,  $0 < x < 2\pi$  and sketch its graph from  $x = -4\pi$  to  $x = 4\pi$ .

4. (a) Define the following with examples.

(i) Vector spaces

(ii) Linear transformations

(b) Test for the convergence of the series whose  $n^{\text{th}}$  term is

$$u_n = \frac{x^{2n-2}}{(n+1)\sqrt{n}}$$

(c) Show that the function.

$T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$  defined by  $T(x, y, z) = (3x - y, x + y - 2z)$  is a linear transformation.

5. (a) Find the rank of the matrix

$$A = \begin{bmatrix} 1 & 3 & 4 & 2 \\ 2 & -1 & 3 & 2 \\ 3 & -5 & 2 & 2 \\ 6 & -3 & 8 & 6 \end{bmatrix}$$

(b) Investigate the values of  $\lambda$  and  $\mu$  so that the equations.

$$2x + 3y + 5z = 9$$

$$7x + 3y - 2z = 8$$

$$2x + 3y + \lambda z = \mu$$

have

- (i) No solution
  - (ii) a unique solution
  - (iii) an infinite no. of solution
- (c) Define or state the following :-
- (i) Half range sine and cosine series
  - (ii) Parseval's theorem
  - (iii) L'Hospital's rule
  - (iv) Evolutes
  - (v) Involutives

**AJEET SONI**

