Seat No.	

SQ - 10

Total No. of Pages : 4

S.Y.B.Tech. (CBCS) (Semester – III)
Examination – May 2025
ELECTRONICS AND TELECOMMUNICATION ENGINEERING
Engineering Mathematics - III
Sub. Code : 73245/63460/77807

Day and Date : Monday, 05/05/2025 **Total Marks : 70**

Time : 10.30 am to 01.00 pm

Instructions : 1) Attempt all questions compulsory.
2) Use of nonprogrammable calculator is allowed.
3) Figures to the right indicate full marks.

Q. 1. Choose the correct alternative from the following (2 marks each) [14]

1) P. I for $(D^3 - 3D^2 + 4)\, y = e^{3x}$ is .....

A) $\frac{e^{-3x}}{4}$ B) $\frac{e^{3x}}{4}$ C) $\frac{e^{4x}}{4}$ D) $\frac{e^{-4x}}{4}$

2) Divergence of $\bar{F} = xyzi + 3x^2yj + (xz^2 - y^2z)k$ at (2, –1, 1) is

A) 12 B) 16 C) 19 D) 14

3) If $A(x) = \frac{x}{x+2}$; $x \in \{0, 1, 2, 3, 4\}$, then 0.5_A is .....

A) {2, 3, 4} B) {1, 2, 3} C) {2, 4} D) {0, 1, 2}

4) In Fourier expansion of $f(x) = 2 - \frac{x^2}{2}$; $0 \le x \le 2$, the value of constant a_0 is .....

A) $\frac{1}{2}$ B) $\frac{-1}{2}$ C) $\frac{-4}{3}$ D) $\frac{4}{3}$

5) 10% of the tools produced in a certain manufacturing process turned out to be defective. Find the probabilities that out of 20 selected at random there are exactly 2 defective.

A) 0.2345 B) 0.2020 C) 0.2852 D) 0.1923

6) $L\left[\frac{1}{t}(1-\cos t)\right]$ is

A) $\frac{1}{2}\log\left(\frac{s^2+1}{s^2}\right)$ B) $\frac{1}{4}\log\left(\frac{s^4+1}{s^4}\right)$

C) $\frac{1}{2}\log\left(\frac{s+1}{s}\right)$ D) $\frac{1}{3}\log\left(\frac{s^3+1}{s^3}\right)$

7) If the function f(x) is odd, then which of the only coefficient is present?

A) a_0 B) b_n

C) a_n D) nothing is zero

Q. 2. Attempt any two.

a) Solve. $(D^3 - 3D^2 + 3D - 1)\,y = e^x + xe^x$. **[7]**

b) Show that, $\nabla\left[\frac{\bar{a},\bar{r}}{r^n}\right] = \frac{\bar{a}}{r^n} - \frac{n(\bar{a},\bar{r})\,\bar{r}}{r^{n+2}}$ **[7]**

c) Find S (A, B) and S(B, A), for A and B denoted by **[7]**
$A(x) = \frac{x}{x+2}$ and $B(x) = \frac{x}{x+5}; x \in \{0, 1, 2, \ldots 10\}$. Also find height of fuzzy set A and B.

Q. 3. Attempt any two.

a) Solve $x^3\frac{d^3y}{dx^3} - x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 2y = x^3 + 3x$. **[7]**

b) A vector field is given by $\bar{F} = (x^2 + xy^2)i + (y^2 + x^2y)j$. Show that $\bar{F}$ is irrotational and find its scalar potential. **[7]**

c) If the fuzzy sets C and D are denoted by the following membership function. **[7]**

$$C = \frac{0.1}{x_1} + \frac{0.6}{x_2} + \frac{0.8}{x_3} + \frac{0.9}{x_4} + \frac{0.7}{x_5} + \frac{0.1}{x_6}$$

$$D = \frac{0.9}{x_1} + \frac{0.7}{x_2} + \frac{0.5}{x_3} + \frac{0.2}{x_4} + \frac{0.1}{x_5} + \frac{0}{x_6}$$

Find (i) $\bar{C}$ (ii) $\bar{D}$ (iii) $\bar{C} \cap D$ (iv) $C \cap \bar{D}$ (v) $C \cup \bar{C}$.

Q. 4. Attempt any two.

a) Find Fourier expansion of $f(x) = 4 - x^2$ in the interval (0, 2). **[7]**

b) Using convolution theorem, find $L^{-1}\left[\frac{1}{(s-2)(s+2)^2}\right]$ and verify the result by taking Laplace Transform. **[7]**

c) i) Find the value of k if the following function is probability density function. **[3]**

$$F(x) = \begin{cases} k(x-1)^2 & ; 1 \le x \le 3 \\ 0 & ; otherwise \end{cases}$$

ii) A random variable x has the following probability distribution. **[4]**

X	1	2	3	4	5	6	7
P(x)	k	2k	3k	k^2	$k^2 + k$	$2k^2$	$4k^2$

Find i) k ii) p > 5

Q. 5. Attempt any two.

a) Obtain Fourier half range sine series for **[7]**

$$f(x) = \begin{cases} x, & ; 0 \le x \le 1 \\ 2 - x, & 1 \le x \le 2 \end{cases}$$

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$

b) Use Laplace Transform to solve $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 1$ where, y(0) = 0 and y′(0) = 1. **[7]**

c) i) Assuming that half the population in a city is vegetarian so that the chance of an individual being vegetarian is ½ and assuming that 100 investigators take a sample of 10 individuals to see whether they are vegetarian, how many investigators would you expect to report that three people or less were vegetarians? **[4]**

ii) Between 2 and 4 p.m., the average number of phone calls per minute coming to a switchboard of a company is 2.5. Use Poisson's distribution to find the probability during a minute there will be no phone calls and exactly 3 calls. **[3]**