

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May, 2019
B. Tech. (All branches) , Semester ...IV, VI

Roll No.....

MA401 : Integral Transforms

Time: 2.5 hours

Max. Marks: 60

Instructions to students:

1. Do not write anything other than your roll number on question paper.

Q1. A periodic wave is given by the following mathematical function (5)

$$f(t) = \frac{k}{p}t, \quad 0 < t < p,$$

Identify the wave form and check whether the function is continuous or piece wise continuous. Also check whether this function is of exponential order or not.

Q2. Write Legendre and Chebyshev series expansions for the function (5)

$$f(x) = 2x^3 + 5x^2 + 7x - 21$$

Q3. Write the cosine series of $f(x) = e^x$ in the interval $0 < x < 1$ and quarter range (10)

Fourier sine series expansion of $f(x) = x$ in the interval $0 < x < \pi$.

Q4. Suppose in discrete domain the function $f(t)$ is defined as follows: (10)

t :	0	1	2	3
f(t) :	3	4	5	5

Compute the discrete Fourier transform.

Q5(a). A bar AB of length 10 cm has its ends A and B kept at 30 degrees and 100 degree temperatures respectively, until steady state condition is reached. Then the temperature at A is lowered to 20 degree and that at B to 40 degree and these temperatures are maintained. (10)

- (i) Write the mathematical model of the above problem.
- (ii) Which integral transform can be applied to solve this problem?
- (iii) Find the subsequent temperature distribution in the bar.

OR

Q5(b). Calculate the discrete cosine transform of $f(t) = \{1, 2, 4, 7\}$. (10)

Q5. Construct the Kernel for the following one dimensional Semi-infinite vibrating string with a boundary condition at the finite end (20)

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < \infty, 0 < t < \infty$$

$$\left. \frac{\partial u}{\partial x} \right|_{x=0} = v(t) \quad u, \frac{\partial u}{\partial x} \rightarrow 0 \text{ as } x \rightarrow \infty,$$

$$u|_{t=0} = \phi(x) \quad \left. \frac{\partial u}{\partial t} \right|_{t=0} = \psi(x).$$

Which describes the motion of a semi-infinite vibrating string without external force. Also find the solution of the problem.