

Printed Pages : 4

TEE301

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2047

Roll No.

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B.Tech

(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10
BASIC SYSTEM ANALYSIS

Time : 3 Hours]

[Total Marks : 100

1 Attempt any **four** parts of the following : **5×4**

- What is difference between continuous and discrete time signals ? Explain with examples.
- Define unit step and unit impulse functions.
- Determine whether or not each of the following signals is periodic.

(i) $x_1(t) = 2e^{j(t+\pi/4)}u(t)$

(ii) $x_2[n] = u[n] + u[-n]$

- Show that if $x_1[n]$ is an odd signal and $x_2[n]$ is an even signal, then $x_1[n] x_2[n]$ is an odd signal.
- Develop an analogous mechanical system for a series RLC circuit using Force-Voltage analogy.

2 Attempt any **two** parts of the following : **10×2=20**

- Let $x(t) = \begin{cases} t, & 0 \leq t \leq 1 \\ 2-t, & 1 \leq t \leq 2 \end{cases}$ be a periodic signal with fundamental period $T=2$ and Fourier coefficients a_k .

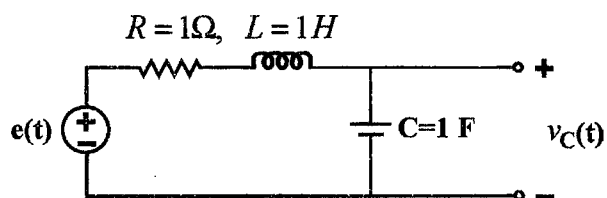


- (i) Determine the value of a_0 .
 (ii) Determine the Fourier series

representation of $\frac{dx(t)}{dt}$.

- (iii) Use the result of part (ii) and the differentiation property of the continuous-time Fourier series to help determine the Fourier series coefficients of $x(t)$.

- (b) Consider a causal LTI system implemented as the RLC circuit shown in the following figure. In this circuit, $e(t)$ is input voltage and $v_c(t)$ is considered as output.



- (i) Find the differential equation relating $e(t)$ and $v_c(t)$.
 (ii) Determine the $v_c(t)$ if $e(t) = \sin(t)$.
 (c) What do you mean by Fourier analysis? What is Fourier transform? Explain the development of continuous time Fourier transform.

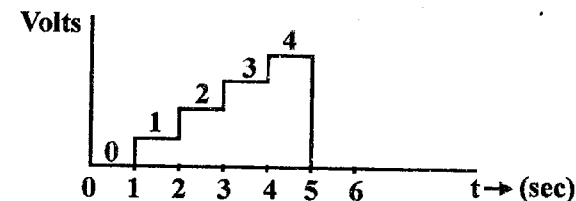
3 Attempt any two parts of the following : 10×2

- (a) What do you understand by Laplace transform? Distinguish between Laplace transform and continuous time Fourier transform. Discuss important properties of Laplace transform.

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- (b) The figure shows a staircase waveform



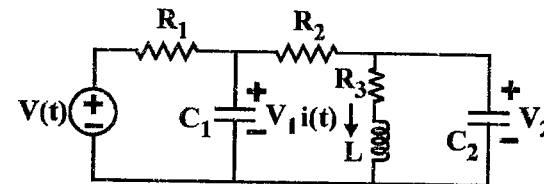
- (i) Write an equation for the waveform in terms of unit step functions.
 (ii) If this voltage is applied to an RL series circuit with $R = 1\Omega$ and $L = 1H$, find the current $i(t)$ and sketch its waveform.
 (c) Determine inverse Fourier transform of $F_1(s)F_2(s)$ by using convolution for the following functions :

(i) $F_1 = \frac{1}{(s-a)}, F_2 = \frac{1}{(s-a)}$

(ii) $F_1 = \frac{1}{s+1}, F_2 = \frac{2}{s+2}$

4 Attempt any two parts of the following : 10×2

- (a) Develop a state model for the circuit shown in the figure. The output is taken as the voltage across C_2 .



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- (b) The differential equation of a certain electromechanical system is $\ddot{y} + 3\dot{y} + 2y = u(t)$, initial conditions $y(0^+) = 0$, $\dot{y}(0^+) = 0$. Use the state variable method to obtain the complete response of the system.
- (c) Discuss the state variable analysis approach. Establish the relation between transfer function of a system and state variables.

5. Attempt any **two** parts of the following :

- (a) Find the inverse Z-transform of the following :

$$(i) \quad x(z) = \frac{1}{1024} \left[\frac{1024 - z^{-10}}{1 - \frac{1}{2}z^{-1}} \right], |z| > 0$$

$$(ii) \quad x(z) = \frac{1 - \frac{1}{3}z^{-1}}{(1 - z^{-1})(1 + 2z^{-1})}, |z| > 2$$

- (b) Define Z-transform. Give relationship between Z-transform and discrete-time Fourier transform. Discuss the important properties of ROCs for Z-transform.
- (c) (i) Determine the system function for causal LTI system with difference equation

$$y[n] = \frac{1}{2}y[n-1] + \frac{1}{4}y[n-2] = x[n]$$

- (ii) Using Z-transform, determine $y[n]$ if

$$x[n] = \left(\frac{1}{2}\right)^n u[n].$$