

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

**PAPER ID : 0208**

Roll No.

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**B.Tech.**

(SEM. III) ODD SEMESTER THEORY

EXAMINATION 2012-13

**BASIC SYSTEM ANALYSIS**

Time : 3 Hours

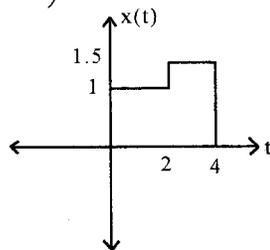
Total Marks : 100

**Note** :- This paper contains five questions. Attempt all questions.

1. Answer any four parts : (5×4=20)

- Explain the concepts of Stability and time invariance taking suitable examples.
- Explain what are power and energy signals. Explain their relationship with periodicity.
- A  $x(t)$  signal is given by the figure 1. Draw and explain the

$$\text{signal } \phi(t) = x\left(\frac{t}{2} + 6\right).$$

**Figure 1**

- Explain the Force-voltage and Force-current analogies.
- Draw the mechanical equivalent of the system shown in figure 2. Obtain the electrical analog system using the Force-

Current analogy.

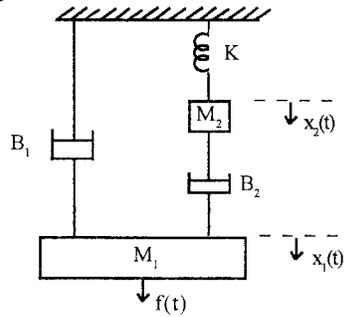


Figure 2

- (f) An R-L-C series circuit is as shown in figure 3. The switch is moved from position 1 to 2 at  $t = 0$  after it remained in position 1 for a long time. The initial current at  $(t = 0^-)$  in the inductor is 2 A and the voltage across the capacitor at that instant is = 4 volts.

Find the expression for the inductor current  $i(t)$  for  $t > 0$

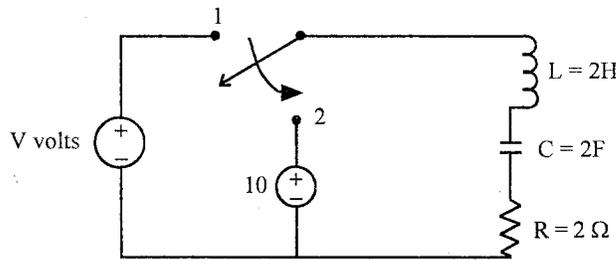


Figure 3

2. Answer any two parts : (10×2=20)
- (a) Explain the three forms of Fourier series. Derive the exponential form of Fourier series. Find the exponential form of Fourier series for a triangular wave of maximum value 1 and time period 2 seconds.
- (b) Derive the Fourier transforms of the following functions :
- (i) Unit impulse function
  - (ii)  $\text{rect}(t)$
  - (iii)  $e^{-2|t|}$
  - (iv)  $\sin 2t$ .



4. Answer any **two** parts : (10×2=20)

- (a) What is the state transition matrix ? What are its properties ?  
Find the state transition matrix for a system matrix

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

- (b) What are homogeneous and non-homogeneous systems ?  
Derive the solution of the two systems in terms of the state variables.

- (c) Obtain the response of the system :

$$\dot{\mathbf{X}} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \mathbf{X} + \begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix} \mathbf{U}(t), \quad \mathbf{X}(0) = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\text{and } \mathbf{Y}(t) = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \mathbf{X}$$

$$\text{to the following input } \mathbf{U}(t) = \begin{bmatrix} U_1(t) \\ U_2(t) \end{bmatrix} = \begin{bmatrix} U(t) \\ e^{-3t}U(t) \end{bmatrix}$$

where  $U(t)$  is a unit step function.

5. Answer any **four** parts : (5×4=20)

- (a) What is the difference between the Z-transform and the Laplace transform ? Explain.

- (b) Define the properties of Z-transform.

- (c) Find the Z-transform of the following sequences :

(i)  $Y_1[n] = \{2, 0, 3, \underset{\uparrow}{6}, 8\}$

(ii)  $u[n]$ .

- (d) Find the inverse Z-transform of the following function :

$$X[z] = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

for ROC (i)  $|z| > 1$ , (ii)  $|z| < 0.5$  and (iii)  $0.5 < |z| < 1$   
draw the various ROCs.

- (e) Enlist the properties of the ROC in Z-transform.

- (f) Find the Z-transform of  $x[n] = na^n u[n]$ .