



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

PAPER ID : 121314

Roll No.

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**B. Tech.**

**(SEM. III) (ODD SEM.) THEORY  
EXAMINATION, 2014-15  
BASIC SYSTEM ANALYSIS**

Time : 2 Hours]

[Total Marks : 50

1 Attempt any four parts of the following : **3.5×4=14**

a) Sketch the signals

$$y(t) = r(t+2) - r(t) + r(t-2)$$

$$y(t) = u(t) + 5u(t-1) - 2u(t-2)$$

b) Define various elementary continuous time signals. Indicate them graphically.

c) Find the Fourier transform of  $e^{2t}u(-t)$  along with amplitude.

d) Define Laplace transform and write its properties.

e) What do you mean by STM? Also mention its properties.

f) What do you understand by analogous systems? Also mention the f-v and f-i analogy in analogous systems.

2 Attempt any two parts of the following :  $6 \times 2 = 12$

a) Obtain the trigonometric Fourier series for the waveform shown in figure 1.

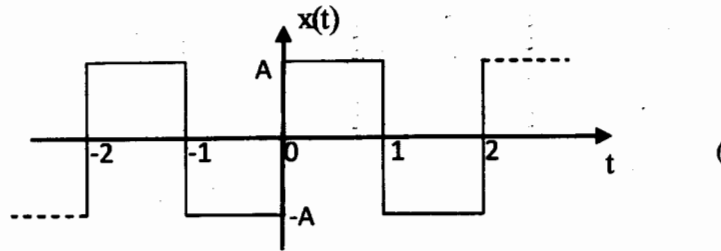


Figure 1

b) Determine the inverse Z-transform of  $X(z) = \frac{x}{(3z^2 - 4z + 1)}$

if region of convergence are

(i)  $|z| > 1$       (ii)  $|z| < \frac{1}{3}$       (iii)  $\frac{1}{3} < |z| < 1$

c) A system is described by the differential equation

$$\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = x(t)$$

For the initial conditions,  $\frac{dy(0)}{dt} = 2$  and  $y(0) = 1$  and

input  $x(t) = u(t)$ , find the free and forced response of the system.

3 Attempt any two parts of the following :  $6 \times 2 = 12$

a) Define ROC of Z-transform. Determine Z-transform of  $x_1(n) = a^n u(n)$  and  $x_2(n) = -a^n u(-n-1)$  and also indicate their region of convergence.

b) State convolution property of LT. Also find the inverse Laplace transform of the function using it.

$$X(s) = \frac{1}{s^2(s+1)}$$

c) Find the response of the system

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix} u(t), \quad x(0) = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \quad \text{and} \quad y(t) = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} x$$

$$\text{where } u(t) = \begin{bmatrix} u(t) \\ e^{-2t} u(t) \end{bmatrix}$$

4 Attempt any two parts of the following :  $6 \times 2 = 12$

a) In the circuit shown in figure 2, determine the current  $i(t)$  when the switch is at position 2. The switch  $S$  is moved from position 1 to position 2 at  $t = 0$ . Initially the switch has been at position 1 for a long time.

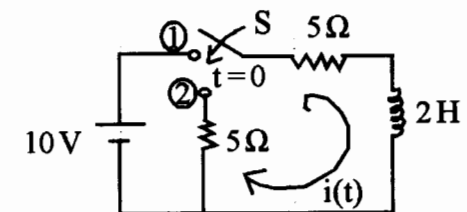
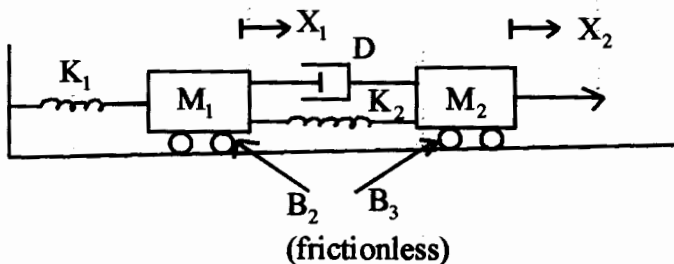


Figure 2

- b) Obtain the f-v and f-i analogous system of the mechanical system shown in figure 3



**Figure 3**

- c) Check whether the following properties hold good for the system  $y(t) = atx(t) + bt^2x(t-2)$
- (i) Static or dynamic
  - (ii) Linear or non linear
  - (iii) Causal or non causal
  - (iv) Time variant or invariant.