**Printed pages: 02** **Sub Code:** REE303

**Paper Id: 2004** **Roll No.** | | | | | | | | | | |

**B.Tech**

**(SEM III) THEORY EXAMINATION 2017-18**

**BASIC SIGNALS & SYSTEMS**

**Time: 3 Hours** **Total Marks: 70**

**Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

## SECTION A

**1. Attempt all questions in brief.** **2 x 7 = 14**

a. Explain continuous time and discrete time system.

b. Explain linearity property of continuous time Fourier series.

c. Determine the Laplace transform of r(t-a).

d. What are the advantages of state space analysis?

e. Find the z transform of $f(nT) = e^{-anT}$ ; $a>0$ , $n \geq 0$

f. What do you mean by power and energy signal?

g. Explain gate function.

## SECTION B

**2. Attempt any three of the following:** **7 x 3 = 21**

a. Explain d'Alembert principle with the help of a translational and rotational mechanical system and give the analogy between electrical and mechanical system.

b. Find the inverse Fourier transform of

$$X(j\omega) = \begin{cases} 2cos\omega, & |\omega| < \pi \\ 0, & |\omega| > \pi \end{cases}$$

c. Consider a series R-L circuit with R= 8ohm and L = 2 mH excited by a 24 V d.c. supply connected through a initially open switch. Initial current through the inductor is 2.5 amp. By using Laplace transform determine the current i(t) ; $t \geq 0$. Also draw the s- domain representation of the circuit.

d. Explain state transition matrix its physical significance and properties

e. Find impulse response of the system with system function is given by

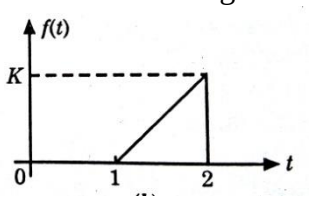
$$H(z) = \frac{(2 - 2.5z^{-1})}{(1 - 0.5z^{-1})(1 - 2z^{-1})} \quad ; \quad |z| > 2$$

## SECTION C

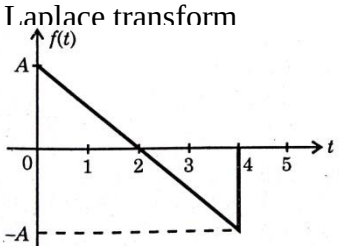
**3. Attempt any one part of the following:** **7 x 1 = 7**

(a) Synthesize the following wave forms using Laplace transform

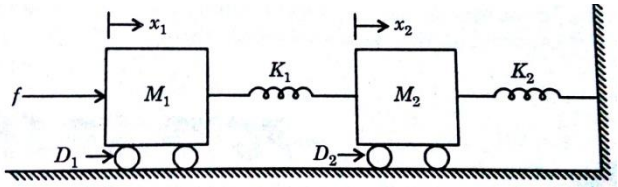
(i)




(ii)




(b) Find the transfer function X2(s)/ F(s) of the given mechanical system




**4. Attempt any one part of the following: 7 x 1 = 7**

(a) A continuous time periodic signal is given as
x(t) = 2 + cos (2πt/3) + 4sin (5πt/3)
calculate the fundamental frequency ω0 and the Fourier series coefficients $a_k$ that $x(t) = \sum_{k=0}^{\alpha} A_k Cos(\omega_k t + \phi_k)$

(b) For a series RLC circuit having R = 25Ω , L = 15 Ω , C = 0.5 f supplied by a source of 10δ(t) V . find the voltage across capacitor ($v_c$(t)) using inverse Fourier transform

**5. Attempt any one part of the following: 7 x 1 = 7**

(a) Explain time differentiation and time integration properties of Laplace transform

(b) Find the response of the system having transfer function

$$H(s) = \frac{Y(s)}{X(s)} = \frac{s^2 + 3s + 5}{(s+1)(s+2)}$$ for the input

(i) X(t) =δ(t)
(ii) X(t) = $e^{-2t}$

**6. Attempt any one part of the following: 7 x 1 = 7**

(a) A system is described by the state model

$$\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \\ \dot{x}3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 6 \end{bmatrix} [u]$$

And the output = $\begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix}$

Transform it into the diagonal form of representation and check for the invariance of eigen values.

(b) Write a state space model of parallel RLC circuit supplied by a current source of $I_0 \sin\omega t$ . Take output across capacitor as Vc.

**7. Attempt any one part of the following: 7 x 1 = 7**

(a) State and prove convolution theorem for z transform
Calculate the convolution of y[n] of x[n] =$a^n$ ; 0 ≤ n ≤ N-1 and
h[n] = $b^n$ ; 0 ≤ n ≤ M-1 using z transform

(b) For a causal and stable LTI system whose input x[n] and output y[n] are related through the second order difference equation.
y[n]- $\frac{1}{6}$y[n-1] - $\frac{1}{6}$y[n-2] = x[n]
calculate (a) the system function H(z)
(b) the impulse response h[n] of the system.