B TECH
(SEM-III) THEORY EXAMINATION 2018-19
BASIC SIGNALS AND 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.   What do you mean by signals? Explain periodic and Aperiodic signal with examples.

   b.   What do you mean by time invariant and time invariant system?

   c.   State and prove time shifting property of Fourier Series.

   d.   Find the Laplace transform of e^{-at} for $t \geq 0$?

   e.   Determine the initial value $x(0^+)$ of the following Laplace transform

   $$X(s) = \frac{(2s+5)}{s(s^2 + 4s + 3)}$$

   f.   Explain the properties of ROC of Z transform.

   g.   What do you mean by state of system? Also explain state variables.

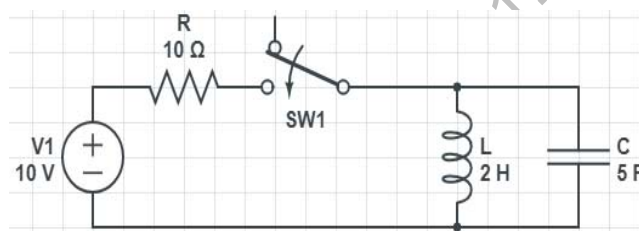## SECTION B

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

   a.   Explain Modelling of mechanical system and electrical system and then give the analogy between electrical and mechanical system.

   b.   Find trigonometric Fourier series of the given waveform
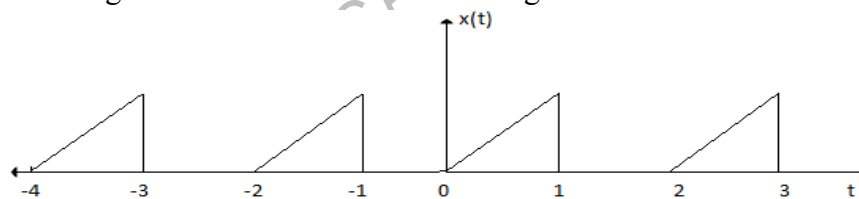
   c.   Initially switch is closed for a long time and steady state condition has reached. At t =0 switch is opened. Find the expression of current through inductor.
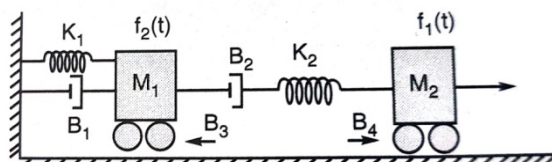

   d.   What do you mean by state transition matrix? State and prove its properties.

   e.   State and prove time shifting and differentiation properties of Z transform.

SECTION C

3.   **Attempt any one part of the following:**   **7 x 1 = 7**
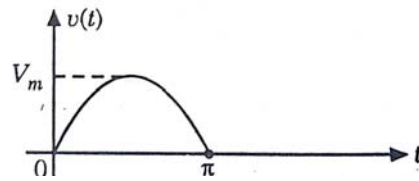
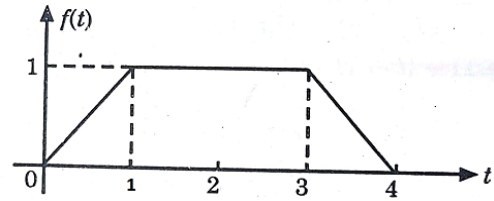   (a) For the given mechanical system draw the equivalent circuit using F-V and F-I analogy.

(b) Express the given waveforms using standard signals.

(i)

(ii)

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

(a) What do you mean by the existence of Fourier series? And explain properties of Fourier series.

(b) Obtain the trigonometric Fourier series for the half wave rectified sine wave.

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

(a) State and prove convolution property of Laplace transform and then using this property find Laplace transform of $\dfrac{s}{(s+1)(s+2)}$

(b) A signal has Laplace transform

$$X(s) = \frac{(s+2)}{(s^2+4s+5)}$$

Find the Laplace transform Y(s), of the following signals
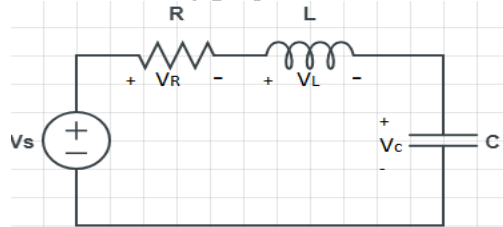
(i) $y(t) = t\, x(t)$ (ii) $y(t) = e^{-t} x(t)$

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

(a) Obtain the state model for the given transfer function

$T(s) = Y(s) / U(s) = K\, (b_1s + b_2) / (s^3 + a_1s^2 + a_2s + a_3)$

(b) Obtain the state model for the electric network shown in figure. Select $\dot{i}_L$ and V_c as state variables.

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

(a) Consider the system

$$H(z) = \frac{z^{-1} + \dfrac{1}{2} z^{-2}}{1 - \dfrac{3}{5} z^{-1} + \dfrac{2}{25} z^{-2}}$$

Determine (i) the impulse response (ii) the zero state step response

(b) Explain the properties of z transform and find z transform of

x(nT) = nT U(nT) = r(nT)

y[n]- $\frac{1}{5}$y[n-1] - $\frac{1}{6}$y[n-2] = x[n]

calculate (i) the system function H(z)

(ii) the impulse response h[n] of the system.