

**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  

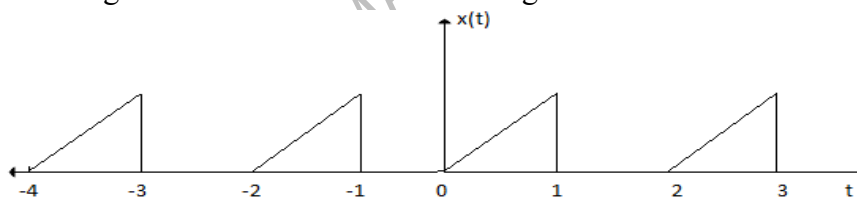
$$X(s) = \frac{(2s + 5)}{s(s^2 + 4s + 3)}$$
- f. Explain the properties of ROC of Z transform.
- g. What do you mean by state of system? Also explain state variables.

**SECTION B**

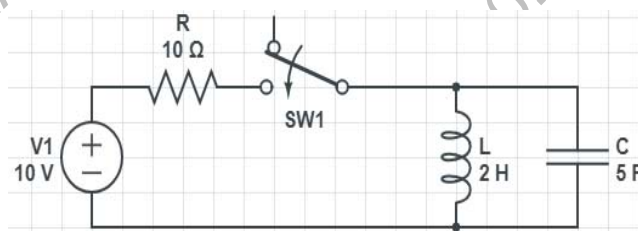
2. Attempt any three of the following:

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.



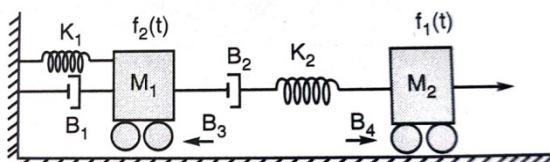
- d. What do you mean by state transition matrix? State and prove its properties.
- e. State and prove time shifting and differentiation properties of Z transform.

**SECTION C**

3. Attempt any one part of the following:

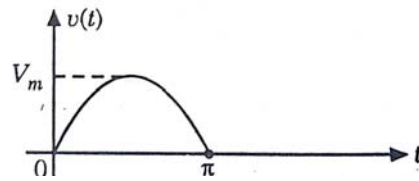
7 x 1 = 7

- (a) For the given mechanical system draw the equivalent circuit using F-V and F-I analogy.

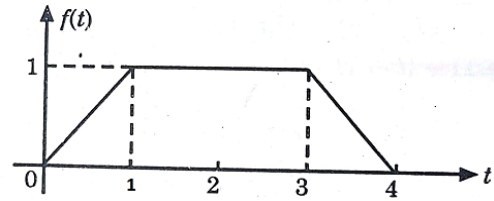


(b) Express the given waveforms using standard signals.

(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  $\frac{s}{(s+1)(s+2)}$

- (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)  $y(t) = e^{-t} x(t)$

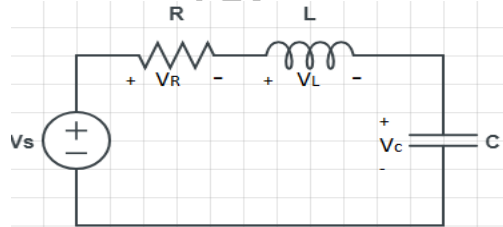
6. Attempt any one part of the following:

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  $i_L$  and  $V_c$  as state variables.



7. Attempt any one part of the following:

7 x 1 = 7

- (a) Consider the system

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

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

- (b) Explain the properties of z transform and find z transform of  $x(nT) = nT U(nT) = r(nT)$

$$y[n] - \frac{1}{5}y[n-1] - \frac{2}{25}y[n-2] = x[n]$$

calculate (i) the system function H(z)

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