Code No: RR320201 **Set No. 1**

III B.Tech II Semester Regular Examinations, Apr/May 2006
ANALYSIS OF LINEAR SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Distinguish between static and dynamic systems with suitable examples
   (b) Develop the force. Voltage analogous network for the system shown in figure 1 and hence develop the loop equations.

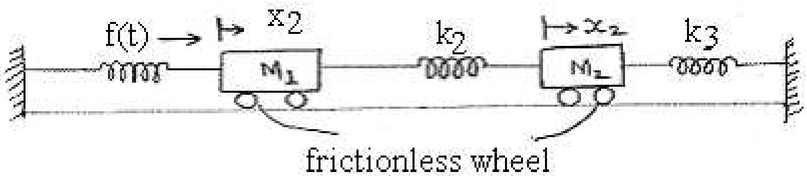

Figure 1:

   (c) Obtain the state equations of the mechanical system shown in figure 2[4+6+6]

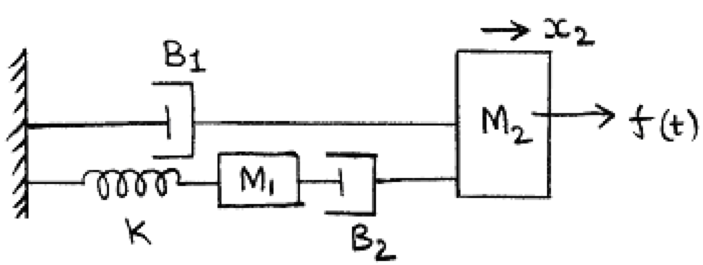

Figure 2:

2. (a) Obtain the state equations for the network shown in figure. 3 Where $i_1(t)$ *and* i_2 (t) are loop currents.
   (b) Evaluate the complete state response of the system characterized by $A = \begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ with initial state vector $X(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ [8+8]

3. (a) Distinguish between unit impulse function and unit doublet function and hence develop the Laplace transform of these functions.
   (b) Find the expressions for the current i(t) in a series R-L-C circuit, with R=5Ω, L=1H, C=$\frac{1}{4}$ F, when it is fed by a ramp voltage of 12 r(t-2). [3+3+10]

4. (a) Assuming stair case function shown in figure,4 is not repeated, and is applied to an R-L series circuit with R=1Ω, L=1H, find the current i(t).

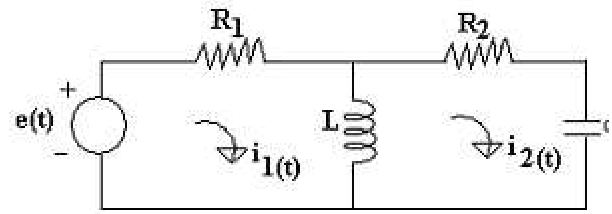

Figure 3:

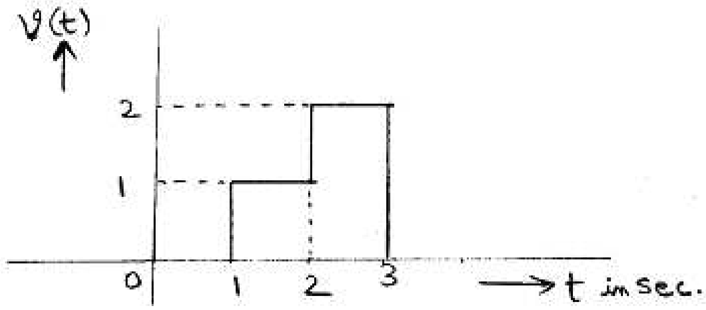

Figure 4:

(b) Find inverse Laplace transform of $F(s) = \frac{s}{(s+1)(s+2)(s+3)}$ using convolution theorem. [8+8]

5. (a) Derive the expression for RMS value of a complex (of voltage) wave which is expressed in terms of fourier series.

   (b) A complex voltage e(t) = 100 sin w t + 30 sin 3wt + 20 sin 5 wt where w = 100t. If this voltage is applied to a load of 10 ohms in series with 0.01H, find the current, average power and power factor of the circuit. [6+10]

6. (a) Find the Fourier transform of a gate function

$$\begin{aligned} G(t) &= 1 \quad for \quad -\tfrac{T}{2} < t < \tfrac{T}{2} \\ &= 0 \qquad\qquad otherwise \end{aligned}$$

   (b) Find the Fourier transform of the constant signal f(t) = $A(-\infty < t < \infty)$ [8+8]

7. (a) Check whether the following polynomial is Hurwitz or not?
   $H(s) = s^4 + 2s^2 + 3s + 6$

   (b) Find the range of values of ‘a’ so that $H(s) = s^4 + s^3 + as^2 + s + 3$ is Hurwitz. [7+9]

8. (a) Explain how the removal of pole at infinity of an impedance Z(s) can realize an element in the network.

   (b) Realize the network with the following driving point impedance function using first Foster form.
   Z(s) = (s+2) / s(2s+5) [8+8]

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Code No: RR320201 **Set No. 2**

III B.Tech II Semester Regular Examinations, Apr/May 2006
ANALYSIS OF LINEAR SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. For the mechanical system shown in figure 1.
   (a) Draw the mechanical network
   (b) Develop the electric analogous circuits and the corresponding state-variable models. [4+6+6]

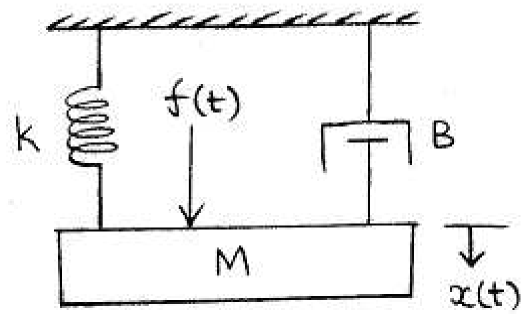

Figure 1:

2. (a) Write matrix state equation for the circuit shown in figure.2

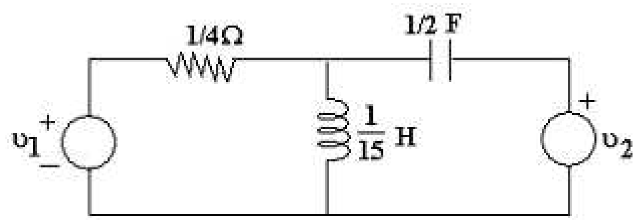

Figure 2:

   (b) Find the complete state response of the system
$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t) \text{ and } \begin{bmatrix} x_1 & (0) \\ x_2 & (0) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$ [8+8]

3. A series R-C ckt. With R = 1W, F is fed by a voltage of non-periodic waveform shown in figure 3. Find the response i(t) using Laplace transform approach. [16]

4. (a) Determine the current in a series R-L circuit driven by a square wave, periodic function shown in figure 4 With R=1Ω, L=1H.

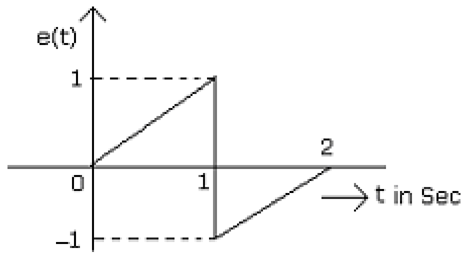

Figure 3:

(b) Find the convolution of h(t)=t, and f(t)=$e^{-\alpha t}$ for t> 0, using the inverse Laplace transform of H(s) F(s). [8+8]

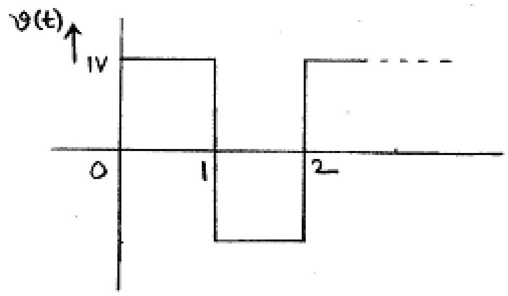

Figure 4:

5. (a) Derive the expression for RMS value of a complex (of voltage) wave which is expressed in terms of fourier series.

   (b) A complex voltage e(t) = 100 sin w t + 30 sin 3wt + 20 sin 5 wt where w = 100t. If this voltage is applied to a load of 10 ohms in series with 0.01H, find the current, average power and power factor of the circuit. [6+10]

6. (a) State and explain Parseval's theorem.

   (b) Derive the expression for Fourier transform of unit step function. [7+9]

7. (a) Check whether the following polynomial is Hurwitz or not?
   $P(s) = 2s^4 + 5s^3 + 6s^2 + 2s + 1$

   (b) " All driving point immittances of passive networks are positive real functions". Substantiate the statement.

   (c) State the analytical tests to be considered for a polynomial to check whether it is a positive real function or not? [7+5+4]

8. (a) Explain how the removal of pole at infinity of an impedance Z(s) can realize an element in the network.

   (b) Realize the network with the following driving point impedance function using first Foster form.
   Z(s) = (s+2) / s(2s+5) [8+8]

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Code No: RR320201 **Set No. 3**

III B.Tech II Semester Regular Examinations, Apr/May 2006

ANALYSIS OF LINEAR SYSTEMS

(Electrical & Electronic Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) For the figure 1 shown below , draw the mechanical system. And hence write the equilibrium equations
   (b) Draw the electrical analogous circuits for the mechanical system shown in figure2 [8+8]

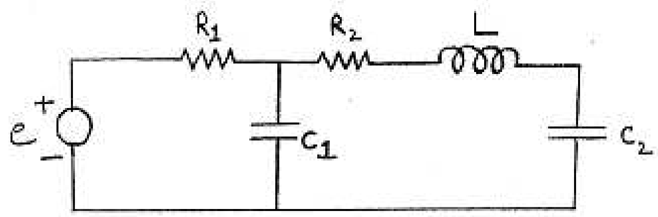

Figure 1:

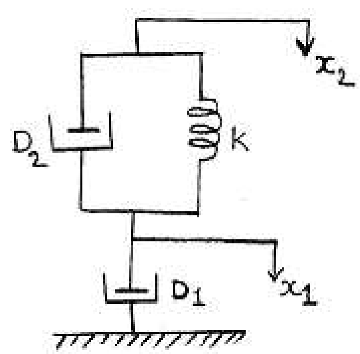

Figure 2:

2. (a) Evaluate the state transition matrix for the system characterized by $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$
   (b) Develop the state equations of the following network. figure3 [8+8]

3. (a) A pulse voltage of 3V between 1 to 2 sec. is applied to a series R-L circuit with R=3 Ω, L=1H, Find the current i(t).
   (b) Find the current is i(t) in a series R-L-C circuit with R=3 Ω, L=1H, C=$\frac{1}{2}$F when it is driven by an impulse voltage of δ (t-2). [6+10]

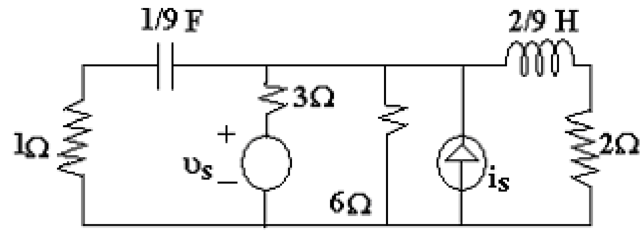

Figure 3:

4. (a) Find the inverse Laplace transform of the periodic signal shown in figure 4.
   (b) When an unit impulse voltage is applied to a certain network, the output voltage is V_o (t) = 4 u(t)-4u(t-2) Volts. Find and sketch V_o (t) if the input voltage is 2u(t-1) Volts. [8+8]

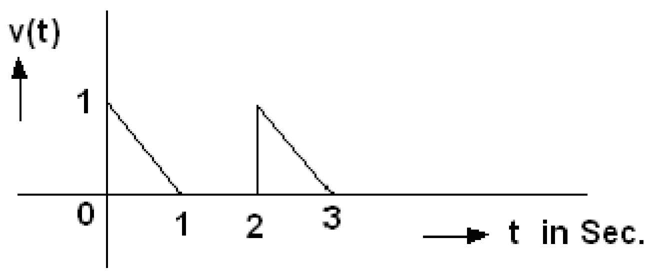

Figure 4:

5. (a) Derive the expression for Average power of a complex wave which is expressed in terms of fourier series.
   (b) The current waveform shown in figure 5 is applied to a circuit containing 0.01 micro-farads in parallel with 1 kilo ohm with a range of frequency 13 to 14 kHz. Find the average power delivered to the resistor. [6+10]

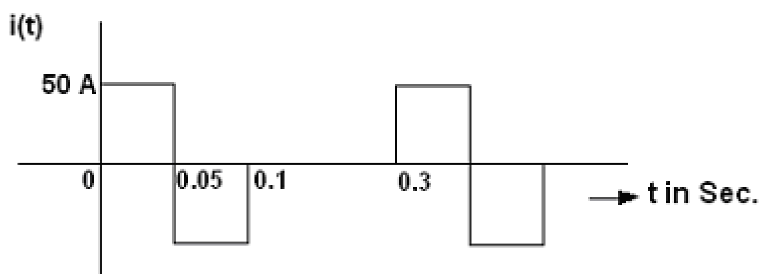

Figure 5:

6. (a) State and explain Parseval's theorem.
   (b) Derive the expression for Fourier transform of unit step function. [7+9]

7. (a) Check whether the following polynomial is Hurwitz or not?
   $P(s) = 2s^4 + 5s^3 + 6s^2 + 2s + 1$

(b) " All driving point immittances of passive networks are positive real functions". Substantiate the statement.

(c) State the analytical tests to be considered for a polynomial to check whether it is a positive real function or not? [7+5+4]

8. (a) Explain how the removal of pole at infinity of an impedance Z(s) can realize an element in the network.

(b) Realize the network with the following driving point impedance function using first Foster form.
$Z(s) = (s+2) / s(2s+5)$ [8+8]

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Code No: RR320201 **Set No. 4**

III B.Tech II Semester Regular Examinations, Apr/May 2006
ANALYSIS OF LINEAR SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. For the following mechanical rotational system, shown in figure1.
   (a) Draw the mechanical network and write the equilibrium equations.
   (b) Develop electric analogous circuits and write the corresponding equations. [8+8]

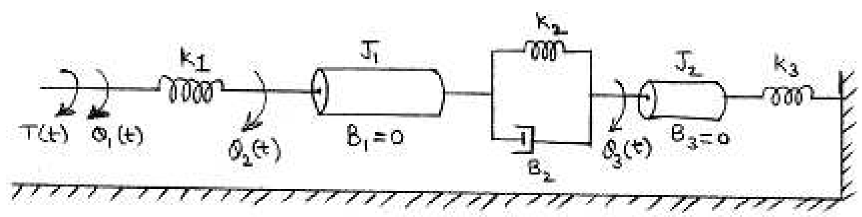

Figure 1:

2. (a) Develop the state equations of the following network: figure 2
   (b) Derive the expression to find the solution of the state equations X(t) = A x(t) + B u(t) with x (0) = x_0 using state Transition Matrix approach. [8+8]

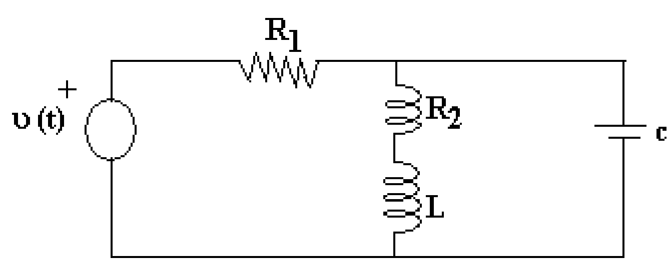

Figure 2:

3. (a) The transfer function of an armature controlled d.c. motor relating the output speed to the input armature voltage is given by. $H(s) = \frac{0.03}{(s+0.06)}$
   Determine the output speed as a functions of time when the armature is to a step voltage of 240V.
   (b) State and explain what is meant by Gate functions and hence develop the Laplace transforms of it. [8+8]

4. (a) Assuming stair case function shown in figure,3 is not repeated, and is applied to an R-L series circuit with R=1Ω, L=1H, find the current i(t).
   (b) Find inverse Laplace transform of $F(s) = \frac{s}{(s+1)(s+2)(s+3)}$ using convolution theorem. [8+8]

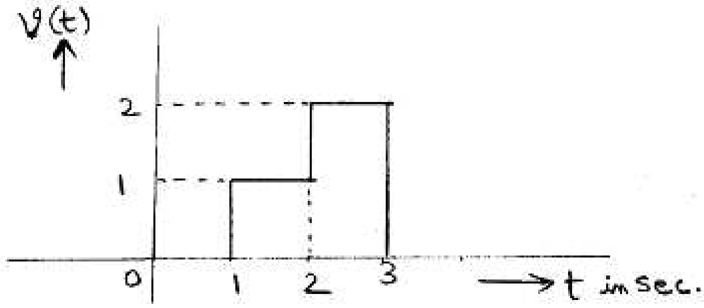

Figure 3:

5. (a) Obtain the trigonometric Fourier series representation of voltage waveform shown in figure. 4

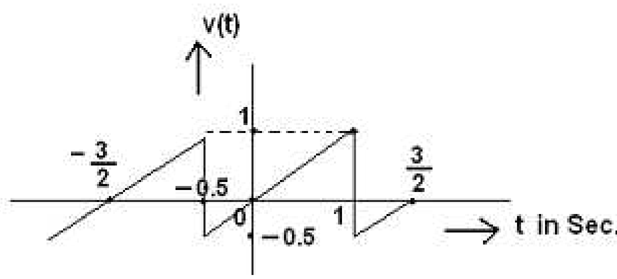

Figure 4:

   (b) Find the exponential form of the Fourier series for the following waveform shown in figure. 5 [8+8]

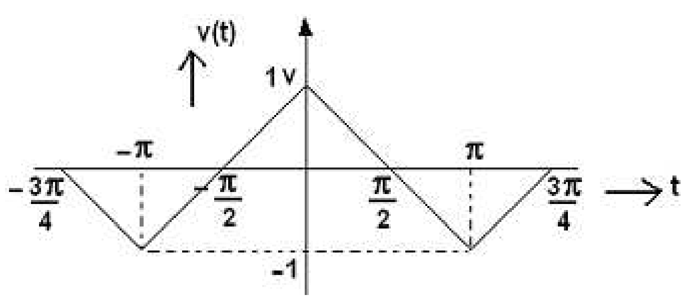

Figure 5:

6. (a) State and explain the properties of Fourier Transform.
   (b) Define Signum function and hence develop the expression for Fourier transform of it. [8+8]

7. (a) Check whether the following polynomial is Hurwitz or not?
$H(s) = s^4 + 2s^2 + 3s + 6$

(b) Find the range of values of 'a' so that $H(s) = s^4 + s^3 + as^2 + s + 3$ is Hurwitz. [7+9]

8. The driving point impedance of a one port L- C network is given by
$Z(s) = 5s(s^2 + 4)/(s^2 + 1)(s^2 + 9)$
Obtain the first and second Foster form of equivalent networks. [8+8]

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