Code No: V3107 **R07** **Set No: 1**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

LINEAR SYSTEMS ANALYSIS

(Electrical and Electronics Engineering)

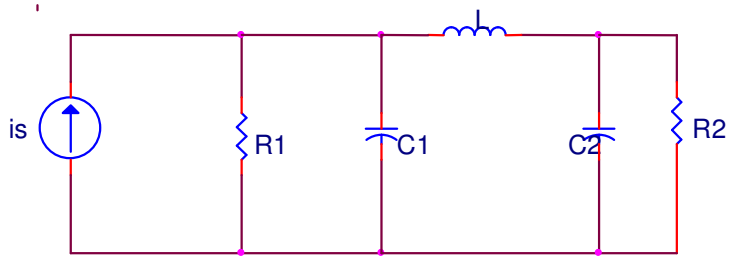
Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

*****

1. a) Write state equations for the network shown using graph theory. [8M]



b) What is state transition matrix? Discuss about its properties. [8M]

2. a) Determine the Fourier transform of the unit step, ramp and sinusoidal signals. [12M]

b) State and Prove Parseval's Theorem. [4M]

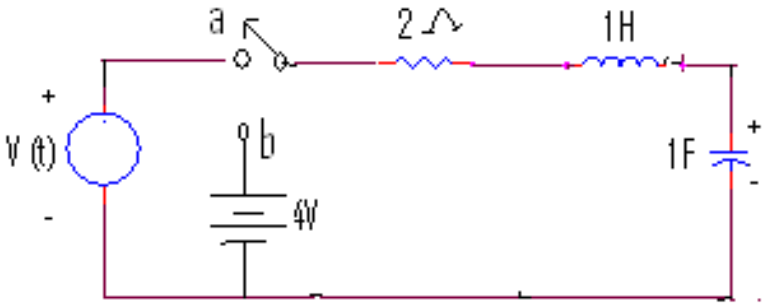
3. a) Determine the Fourier transform for the following functions of.

(i) $f(t) = t^2 e^{-2t}\, u(t)$ (ii) $f(t) = e^{-at^2}$

(iii) $f(t) = \dfrac{2a}{a^2 + t^2}$ (iv) $f(t) = \dfrac{t^{n-1}}{(n-1)!} e^{-at}\, u(t)$ [8M]

b) Explain about the power spectrum of the series? [8M]

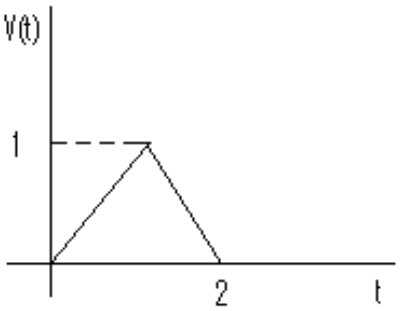
4. a) In the figure shown below the switch is initially at position 'a'. After steady state condition is reached when i(0)=2A and $v_c(0)$= 2V. The switch is now thrown to position 'b'.Determine the current in the circuit? [8M]



*****

Code No: V3107 **R07** **Set No: 1**

b) A triangular wave shown below is applied to a series RL circuit with R= 1 ohm L= 1H. Determine the current i(t) through the circuit. [8M]



5. a) Find the range of 'a' so that H(s)=S^4 +S^3 +aS^2 +2S+3 is Hurwitz . [8M]
   b) Test whether the following function is positive real or not? [8M]

$$N(s) = \frac{(S+2)}{(S^2+3S+2)}$$

6. a) Synthesize the Foster II form network when its admittance function is given as. [8M]

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

   b) State and explain the properties of LC impedance function. [8M]

7. a) Consider a filter with $H(\omega) = \frac{1}{1+j\omega}$ and input x(t) =e^{-2t} u (t). Find the energy spectral density of the output. [8M]
   b) Explain about power spectral density. [8M]

8. a) Determine the inverse transform of. [8M]

$$X(z) = \frac{3Z^4 - 10Z^3 - 5.75Z^2}{(Z-1)(Z-0.5)(Z^2+0.25)}$$

   b) Define Z-Transform & discuss about the properties of Z- transform. [8M]

*****

Code No: V3107 **R07** **Set No: 2**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

LINEAR SYSTEMS ANALYSIS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

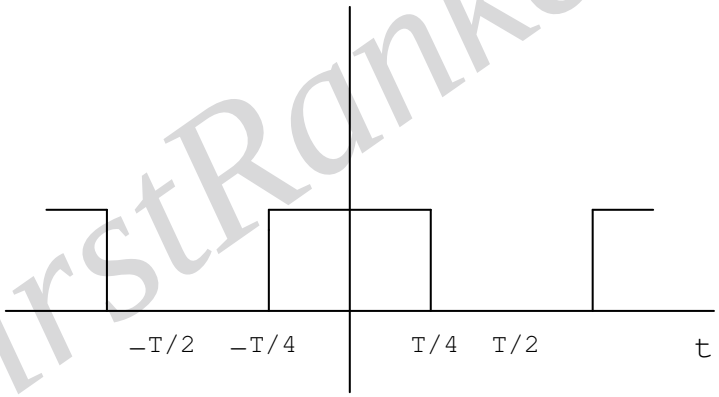
All Questions carry equal marks

*****

1. a) A system is described by a third order differential equation $\dddot{x} + 9\ddot{x} + 26\dot{x} + 24x = 12u(t)$. Where x is the output and u (t) is the input. Obtain the state space representation of the system. [8M]

   b) Determine the state transition matrix for the matrix $A = \begin{bmatrix} 3 & 0 & 0 \\ 0 & -2 & 1 \\ 0 & 4 & 1 \end{bmatrix}$ [8M]

2. a) Determine the Fourier coefficients a_n & b_n of the waveform shown in the fig. having an 'ON' period = 'OFF' period =T/2. The waveform is a rectangular pulse train with 50% duty cycle. [8M]



   b) Determine the Fourier transform of the Signum function. [8M]

3. A 2Ω resistive load is supplied from a full wave rectifier connected to 230 V, 50 Hz single phase supply. Determine the average and RMS values of load current. Hence determine the proportion of DC power & AC power to the total power in the load. Investigate the effect of adding an inductance in series with the load. [16M]

4. a) A series RL circuit experiences an exponential voltage v = $10e^{-100t}$ after closing a switch at t=0 assume R=1Ω L=0.1 H [8M]

   b) Current I(s) in a network is given by $I(s) = \frac{2S+3}{S^2+3S}$. Find i(t), the current at any time t. [8M]

*****

Code No: V3107 **R07** **Set No: 2**

5. a) Check whether the polynomial $S^4 + S^3 + 5S^2 + 3S + 4$ is Hurwitz or not [10M]
   b) State and explain the properties of positive real function. [6M]

6. An impedance function is given by $Z(s) = \frac{(S+1)(S+4)}{S(S+2)(S+5)}$. Find the R-C representation of Cauer-I and II forms. [16M]

7. a) Compare energy spectral density with power spectral density function. [8M]
   b) Define cross-correlation function and explain the properties of it. [8M]

8. a) What are the differences between continuous time signal & discrete time signal? [8M]
   b) Determine Z-Transform of functions x (t) =sinωt and x (t) =cosωt. [8M]

*****

Code No: V3107 **R07** **Set No: 3**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

LINEAR SYSTEMS ANALYSIS

(Electrical and Electronics Engineering)

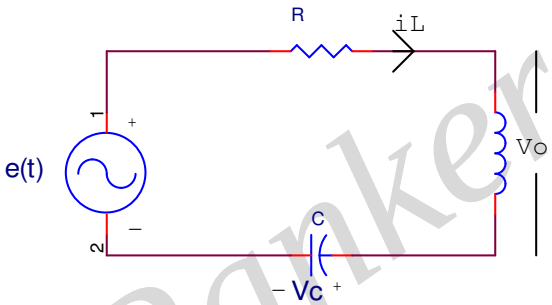
Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

*****

1. For the R-L-C circuit shown in fig. the output is the voltage across the inductance. Determine the output for [16M]
   (i) i(0)=0,v_c(0)=10 and e(t)=0
   (ii) i(0)=1,v_c(0)=0 and e(t)= unit step
   (iii) i(0)= v_c(0)=0 and e(t)= unit impulse



2. a) State the relation between the trigonometric & the exponential Fourier series. [8M]
   b) Sketch the waveform of a periodic function whose Fourier series has.
   (i) Only odd harmonics but both sine & cosine terms are present.
   (ii) Only even harmonics but both sine & cosine terms are present.
   (iii) Only sine terms but all harmonics are present.
   (iv) Only cosine terms but all harmonics are present. [8M]

3. A periodic voltage v (t) is applied to the input terminal of a series RLC circuit shown in the figure ***a***. Determine the current i(t) & sketch the line spectra and power spectra. [16M]
   (i) A triangular periodic signal as shown in fig. ***b*** but with 1 sec
   (ii) A rectified sine wave in fig. ***c***

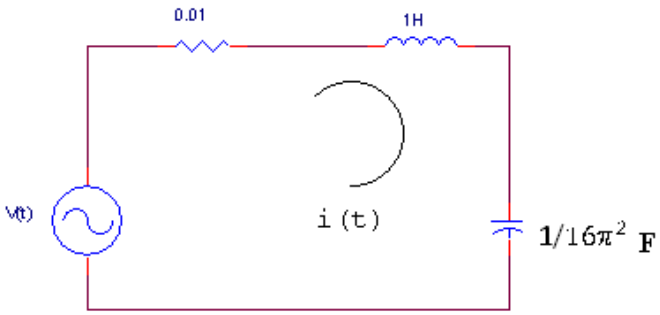


Fig. a

Code No: V3107 **R07** **Set No: 3**

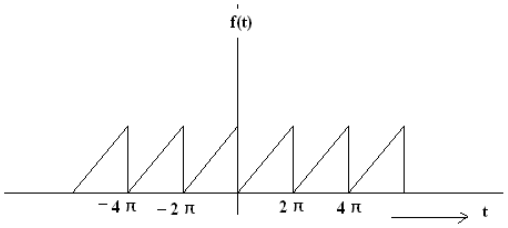


Fig. b

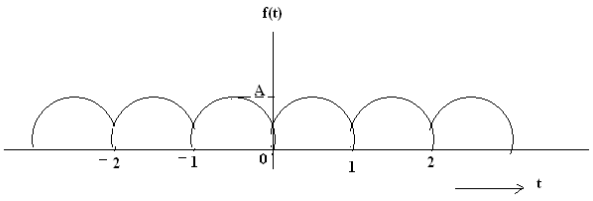


fig. ci

4. a) The current through a circuit element is $\frac{4S^2}{S+7}$ Find the current in t- domine as $S \to 0, S \to \infty$. Discuss about the nature of circuit elements. [8M]

   b) A step voltage of 10 volts is applied at t=0 in a series RC circuit where R= 1 Ω and C=2 Farads. Initial charge of a capacitor is nil. Using Laplace transform find i(t). [8M]

5. a) State and explain the properties of Hurwitz polynomial. [8M]

   b) Check whether the function $N(s) = \frac{(S+2)(S+4)}{(S+1)(S+3)}$ is positive real or not. [8M]

6. a) Synthesize the network whose driving impedance is given by $Z(s) = \frac{6S^2 + 3S^2 + 2S + 1}{6S^3 + 3S}$

   b) An impedance function is given by $Z(s) = \frac{(S+1)(S+4)}{S(S+2)(S+5)}$

   Find R-L representation of Foster-I and II forms [8M+8M]

7. a) Discuss about the principle of flat top sampling with neat schematics. [8M]

   b) Find the auto-correlation function of the sine signal expressed as below

   x(t)=A sin(ωt+φ), where ω=2π/T [8M]

8. a) Find inverse Z-transform of the following function $H(Z) = \frac{-4 + 8Z^{-1}}{1 + 6Z^{-1} + 8Z^{-2}}$ using partial fraction method. [8M]

   b) Determine the Z-transform of the ramp sequence x(n)=An and the sequence $x(n) = Anr^n$. [8M]

*****

Code No: V3107 **R07** **Set No: 4**

III B.Tech. I Semester Supplementary Examinations, April/May - 2013

LINEAR SYSTEMS ANALYSIS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

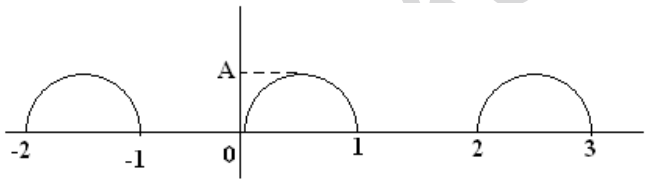
Answer any FIVE Questions

All Questions carry equal marks

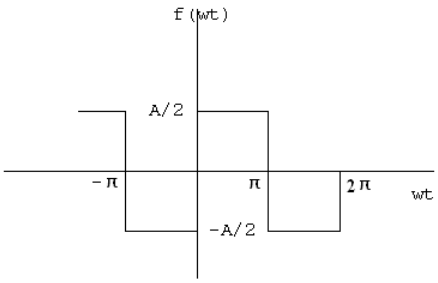
*****

1. a) Explain the modeling process of linear systems by means of a specific example. [8M]
   b) A system is described by a third order differential equation $\dddot{x}+7\ddot{x}+14\dot{x}+8x=u(t)$. Develop state space representation where the system matrix is a diagonal one. [8M]

2. a) Explain the exponential form of Fourier series. [8M]
   b) Find the complex Fourier coefficients for the half wave rectified signal shown in the fig. Function f(t) has a period T= 2 sec & frequency, ω=2π/T=π [8M]



3. Determine the Fourier coefficients for the rectangular waveform shown in fig using graphical method. [16M]



4. a) Determine the laplace transform expressions for the following
   (i) A voltage defined by v(t) =10 u(t)-10 u(t-2)
   (ii) Current defined by i(t) =$e^{-(t-2)}$
   If the above quantities refer to a circuit determine its components. [8M]
   b) A 10 V step voltage is applied across a RC series circuit at t=0. Find i(t) at t=0^+ and obtain the value of di/dt at t=0^+. Assume R= 100 Ω C=100 μF. [8M]

*****

Code No: V3107 **R07** **Set No: 4**

5. a) Test the function $Z(s) = \frac{S^2 + 7}{(S+1)^3}$ for positive realness. [8M]

   b) Check whether the polynomial $S^4 + S^3 + 7S^2 + 4S + 6$ is Hurwitz or not [8M]

6. The driving point impedance of a one port reactive network is given by $Z(s) = \frac{4S(s^2+4)}{(S^2+1)(S^2+16)}$. Obtain the Foster forms of LC network realization. [16M]

7. a) Define auto-correlation. Explain the auto correlation of a periodic waveform. [8M]

   b) State & explain the Sampling theorem. [8M]

8. a) The Z-transfer function of a system is given as $H(Z) = \frac{1}{Z^2 - \frac{1}{2}Z + \frac{1}{8}}$. Detrmine its discreet unit step response assuming the system to be initially relaxed. [8M]

   b) Determine Z-transform of $X(s) = \frac{a}{(S^2 - a^2)}$. [8M]

*****