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Lecture Plan -1

Semester: **III** Class:-**EEE**

Course Code: **EE-203-F** Subject:-**Network Theory** Section:-A

S. No.	Topic :- Signal analysis, complex frequency and network analysis	Time Allotted:-
1.	**Introduction** In electric network, excitation and response are given in terms of voltages and currents which are function of time t. In general these functions of time are called signals. The complex frequency $\alpha + j\omega$ is a generalized frequency variable where real part α describes the growth and decay of the amplitudes of signals and imaginary part $j\omega$ is angular frequency in the usual sense. Network analysis is concerned with determining the response given the excitation and the network. The network system could be linear, passive, reciprocal, and causal and time invariant.	10 min
2	**Division of the Topic** ➢ Description of signal in terms of frequency and time ➢ Amplitude spectrum and phase spectrum of signal ➢ Complex frequency ➢ General characteristics of signal processing ➢ Linear system (principles of superposition and proportionality) ➢ Passive network, reciprocal network ➢ Causal and time invariant system	30 min
3.	**Conclusion** Network analysis helps us to determine the response given the excitation to the network. The system/ network could be linear, passive, reciprocal and causal and time invariant	5 min
4	**Question /Answer** **Q.** Express s as complex frequency variable? **Ans.** $S= \alpha+j\omega$ where α real part describe amplitude and $j\omega$ is angular frequency. **Q**. When a system network is said to be linear. **Ans.** When a system/network satisfies principles of superposition and principle of proportionality.	5 min

Assignment to be given:- Nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -2

Semester: **III** Class:-**EEE**
Course Code: **EE-203-F** Subject:- **Network Theory** Section : A

S. No.	Topic: - General characteristics and description of signals	Time Allotted:-
1.	**Introduction** There are infinite varieties of signals. Certain signals can be explicitly characterized as function of time. These are called deterministic signals. They can be even or odd, periodic/ aperiodic. The continuous signal can be described by means of its time constant, rms value, dc (average) value, duty cycle and crest factor.	10 min
2	**Division of the Topic** ➢ Qualitative description (periodic, symmetric and continuity) ➢ Time domain description of signals (time constants, rms value, average value, duty cycle and crest factor	30 min
3.	**Conclusion** A signal can be periodic/ aperiodic, continuous/ discontinuous/odd/even. Time constant,rms value, average value, duty cycle and crest factor are often used to describe the signals.	5 min
4	**Question /Answer** **Q1**. Describe a periodic signal A1 S(t)= s(t +- KT) K=0,1,2.....T is the period of the signal **Q2**.What are even and odd signal function A. f(t)= f(-t) even signal function f (t)= -f(t) odd signal function **Q3**. In which type of signal, time constant is used? A. In exponential type of signals. **Q4**.What is dc value of the waveform? A. It is the average value of the waveform over one period	5 min

Assignment to be given:- nil
Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -3

Semester: **III** Class:-**EEE**

Course Code: **EE-203-F** Subject:- Network Theory Section : A

S. No.	Topic: - Step Function and Associated waveforms, unit impulse	Time Allotted:-
1.	**Introduction** Step and unit impulse functions are basic signal functions. They are also called singularity functions. They are used to find the response of network and system. The unit step function is expressed as u(t) and unit impulse function is also known as Dirac Delta function expressed as δ(t).	10 min
2	**Division of the Topic** ➢ Importance and types of test signals ➢ Step function , ramp function and impulse function ➢ Shifting property of step function ➢ Expression of pulse & staircase and triangular pulse in terms of basic function. ➢ Doublet function ➢ Derivative & integral of impulse, step and ramp function.	30 min
3.	**Conclusion** Step and unit impulse functions are basic signal functions. They are also called singularity functions. They are used to find the response of network/system. The derivative of ramp, step & impulse yield step, impulse & doublet whereas integral of doublet, impulse & step yield impulse, step & ramp respectively. Any periodic/ non-periodic signal like square pulse, square wave, triangular pulse, saw tooth wave, trapezoidal wave & staircase signal can be expressed in terms of singularity functions.	5 min
4	**Question /Answer** **Q1**. Define unit step signal. A1 . $u(t) = 1$ for $t>=0$ $= 0$ for $t<0$ **Q2.** What is the derivative of unit impulse function? A 2. Doublet function.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -4

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : A

S. No.	Topic: - Introduction to network analysis and network elements.	Time Allotted:-
1.	**Introduction** The network analysis involves determining voltage/current in various branches of the network when input is voltage / current. The steps involve making of differential equations, finding out initial condition and solving of differential equation. The elements of network will be mainly resistance, inductance and capacitance.	10 min
2	**Division of the Topic** ➢ What is network analysis. ➢ Network elements ➢ Steps involved in network analysis.	30 min
3.	**Conclusion** The network analysis involves determining the response of the network consisting of elements like resistance R , inductance L and capacitance C when excitation is applied at the input.	5 min
4	**Question /Answer** **Q1**. What are the basic network elements? A1. R,L and C Q2. What are the units of R,L and C ? A2. The units of R, L and C are Ohms, Henry and Farad respectively	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo

2. Circuit theory by A.Chakrabarty.

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Lecture Plan -5

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : A

S. No.	Topic: - Initial and final Condition	Time Allotted:-
1.	**Introduction** The network analysis involves finding out response due to excitation. The network has elements like R, L and C. The behavior of these elements varies with time. Current does not change in 'R' with time, L behaves like open circuit at t=o and short circuit in the steady state where as capacitor behaves exactly opposite to 'L'.	10 min
2	**Division of the Topic** ➢ Behavior of R. ➢ Behavior of L with time as current starts flowing in it after switch is closed. ➢ Behavior of 'C' with time as current starts flowing in it after switch is closed.	30 min
3.	**Conclusion** Voltage across R is always R i (t), voltage across L is L $\frac{di}{dt}$ and voltage across C is 1/C$\int i(t)dt$. L behaves open circuit at t = 0 and C is open circuit at steady state as it gets fully charged to the applied voltage.	5 min
4	**Question /Answer** **Q1** How does 'L' behaves at t = 0 and at t = ∞? A1 L acts as open circuit at t = 0 and short at t = ∞ . **Q2** How does C behave at t = 0 and at t = ∞? A2 C acts as short circuit at t = 0 and open circuit at t = ∞. **Q3** Why does 'C' act as open circuit at t = ∞? A3 It gets fully charged to the applied voltage. Hence net voltage in the circuit becomes zero and so no current, so it is like open circuit.	5 min

Assignment to be given:- First

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -6

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : A

S. No.	Topic: - Step and Impulse Response	Time Allotted:-
1.	**Introduction** Step and impulse response are time domain characteristics of the network. They help in analyzing the circuits.	10 min
2	**Division of the Topic** ➢ Review of step and impulse signal ➢ Physical analysis of step excitation and impulse excitation ➢ Analysis of RC parallel circuit with step current input	30 min
3.	**Conclusion** Step and impulse response are basic test signals. They are generally used to test the response of networks. It becomes easier to analyze the circuit.	5 min
4	**Question /Answer** **Q1.** What is the physical analogy of unit step signal? Ans: Switch closing at T=0 which connects a 1 volt battery to the circuit. **Q2.** What is the physical analogy of impulse signal? Ans: it is very short (compared to the time constant of the circuit) pulse with large amplitude.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -7

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : A

S. No.	Topic: - Solution of Network Equations.	Time Allotted:-
1.	**Introduction** Knowledge of differential equations is made use of in solving network equations. First equation involving differential and integrals are written .Then these are solved based on Kirchhoff's laws.Mesh equations or nodal equations are used.	10 min
2	**Division of the Topic** ➢ Important points in network Analysis. - Writing of network equations. Numerical practice on series circuit and parallel circuit having RC .RL and RLC elements .	30 min
3.	**Conclusion** Mesh equations or nodal equations are used to analyze / solve the equation. Differential equations are solved to find the constants using initial and final conditions.	5 min
4	**Question /Answer** Q1 What are the steps involved in solution of network equations? A1 (1) Mesh equation or nodal equations are written. They involve differential / integrals. (2)These differential equations are then solved, making use of initial and final conditions to determine constants.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -8

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : B

S. No.	Topic: - Review of laplace transforms	Time Allotted:-
1.	**Introduction** Laplace transform is one of the most versatile mathematical tool in solving circuits involving elements R,L and C. Iit eliminates the tedious method of solving equations involving differentials and integrals.	10 min
2	**Division of the Topic** ➢ Laplace transform ➢ Laplace transform of various functions ➢ inverse Laplace of function using partial fraction method and heavy side formula ➢ Laplace transform of electrical elements R,L and C	30 min
3.	**Conclusion** Laplace transform has been found to be very useful in solving circuits. It simplifies the circuit analysis. it eliminates the need of writing and finding out differential and integral equations. In one step complete solution is obtained as against of finding of C.F and P.I separately.	5 min
4	**Question /Answer** **Q1:** what is the laplace transform of R L and C? Ans: it is R, LS and 1/CS respectively. **Q2.** What is the Laplace transform of K and Kt? Ans: It is K/S and K/S^2	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

Doc. No.: DCE/0/15
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Lecture Plan -9

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : B

S. No.	Topic: - Poles and zeros, initial and final value theorems, the transform circuit	Time Allotted:-
1.	**Introduction** Any network functions H(s) can be written as N(s)/D(s) where N(s) and D(s) can be $a_0(S-Z_1)(S-Z_2)$……. and D(s) can be written as $b_0 (S-p_1)(S-p_2)$…….. The value of H(s) will become infinite or zero at points s=p or s=z respectively. These called poles and zero of the function. The initial and final value theorems helps us to determine the values of the function at time t=0 and at t=infinity	10 min 30 min
2	**Division of the Topic** ➢ representation of network function ➢ what are poles ➢ what are zeroes ➢ initial and final value theorems ➢ numerical practice on finding initial and final value of the function ➢ transform the circuit using laplace of R,C and L as R,1/CS and LS respectively	 5 min
3.	**Conclusion** At the poles the value of the function becomes infinite whereas at zero the value becomes zero. The initial and final value theorum helps to determine the value of the function at time t=0 & t=infinite without finding inverse laplace tranform. The transformation of circuit into laplace form simplifies the procedure for solving the complex circuits.	 5 min
4	**Question /Answer** **Q1**. What are poles and zeros of a transfer function? Ans: At pole the value of function is infinite and at zero the value is zero.	

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo

2. Circuit theory by A.Chakrabarty.

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Lecture Plan -10

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : B

S. No.	Topic: - Thevenins and Norton Theorems	Time Allotted:-
1.	**Introduction** Network theorems are used in simplifying the circuit and analyzing them. Thevenins and Nortons theorems are very important theorems. They can be used for analyzing the circuit compromising both dependant and independent sources.	10 min
2	**Division of the Topic** ➢ Statement of Thevenins theorem. ➢ Numerical using Thevenins theorem. ➢ Norton Theorem. ➢ Numerical on Norton Theorem.	30 min
3.	**Conclusion** Thevenins and Norton theorems help in analyzing complex circuits which contain number of loops and also have both dependent and independent sources. Norton theorem is current equivalent of the thevenins theorem	5 min
4	**Question /Answer** **Q1**.State Thevenin theorem. A1. A linear 2 terminal active network N can be replaced at any pair of terminals a-b by a simple equivalent network consisting of a voltage source V_{Th} in series with an impedance $Z_{Th.}$ The source voltage V_{Th} is the voltage across the terminals a-b when they are open circuited. The series mpedance Z_{Th} is the impedance looking back into the network at the open –circuited terminals a-b when all supply sources are replaced by their internal impedances. . Q2. What is the relation between Thevenins impedance and Norton Impedance? A2: Both are same	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis ----F F Kuo
2. Circuit theory by A.Chakabarty.

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Lecture Plan -11

Semester: **III** Class: - **EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section:B

S. No.	Topic: -System Function, step & Impulse response.	Time Allotted:-
1.	**Introduction** The relation between excitation E(S) and response R(s) is given by H(S) called system Function. When it is initially inert. This system function can assume many forms and have many special names such as driving point admittance, transfer impedance, voltage and current ratio transfer function.	10 min
2	**Division of the Topic** ➢ Driving point impedance ➢ Transfer admittance ➢ Voltage ratio transfer function ➢ Current ratio transfer & RC integrated circuits ➢ RC differentiation & RC integral circuits. ➢ Response of RC Circuit & step input & impulse input	30 min
3.	**Conclusion** The ratio of response to execution in Laplace transform of the circuit with zero initial condition is transfer function or system function. It can have many terms and name .The RC circuit whose time constant RC is very small compared to unity acts as a differentiator whereas if it is much larger then it behaves as an integrator.	5 min
4	**Question /Answer** **Q1.** When does a RC series circuit behave as a differentiator and integrator Ans. $\omega RC << 1$ Differentiator $\omega RC >> 1$ Integrator **Q.2** System transfer function is H(s).What is its response to unit impulse.? Ans. Inverse Laplace transform of H(s)	5 min

Assignment to be given:- nil

References Books: 1. Network Analysis & Systhesis-- FF Kuo.
2 Networka analysis by Valkenberg

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Lecture Plan -12

Semester: **III** Class: - **EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section: B

S. No.	Topic: Convolution Integral	Time Allotted:-
1.	**Introduction** A number of methods are there to find the system response. One is to take inverse Laplace of system function because Laplace of unit impulse function is 1. Convolution integral theorem helps in evaluating inverse Laplace of multiple of two transfer functions.	10 min
2	**Division of the Topic** ➢ Importance of Convolution integral. ➢ Statement of convolution integral. ➢ Numerical practice on convolution integral	30 min
3.	**Conclusion** Convolution integral theorem is very useful in finding out inverse Laplace transform when the given function can be made as multiple of two functions.	5 min
4	**Question /Answer** **Q. Explain Convolution Integral in brief.** **Ans.** Given two functions $f_1(t)$and $f_2(t)$ which are zero for $t<0$ The convolution theorem states that if transform of $f_1(t) = F_1(s)$ $f_2(t)=F_2(s)$ the transform of convolution is product of individual transform	5 min

Assignment to be given:- nil

Referrences :
1. Network Analysis & Systhesis --- FF Kuo.
2. Networka analysis by Valkenberg

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Lecture Plan -13

Semester: **III** Class: - **EEE** Course Code: **EE-203-F**

Subject:-Network Theory Section:B

S. No.	Topic: - Amplitude and phase response	Time Allotted:-
1.	**Introduction** The amplitude and phase response of a system provides valuable information in the analysis and design of transmission circuit especially filters and in stability of control system. Amplitude and phase response are better studied by drawing curves amplitude versus frequency and phase versus frequency	10 min
2	**Division of the Topic** ➢ Steady state response equation in terms of polar coordinates ➢ Procedure of drawing amplitude versus frequency curves ➢ Procedure of drawing and phase versus frequency curves	30 min
3.	**Conclusion** Amplitude and Phase plots assist in studying the response of filters and control system. By drawing these plots one can determine the relative stability of the system.	5 min
4	**Question /Answer** **Q1.**Write the Equation which gives the steady state response of system function. A1.$H(jw) = M(w)\, e^{j\Phi\omega}$ M(w)is the amplitude and $\Phi(\omega)$ is the phase **Q2.**What are the main application of amplitude and phase response. A2. They can be used to determine the stability of control system and also the behavior of filter among others	5 min

Assignment to be given:- nil
Reference Readings:- Network analysis & Synthesis by FF Kuo.

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Lecture Plan -14

Semester: **III** Class: - **EEE** Course Code: **EE-203-F**

Subject:-Network Theory Section: B

S. No.	Topic: - Network function	Time Allotted:-
1.	**Introduction** Network function exhibits the relationship between transform of the source to the transform of the response for a electrical network. One port means one pair of terminal. Two ports mean two pairs of terminals. Two port n/w function can be expressed in various types of parameters like Y, Z,T parameters.	10 min
2	**Division of the Topic** ➢ Types of network functions ➢ Driving point impedance & admittance. ➢ Transfer impedance & transfer admittance ➢ Voltage transfer ratio & current transfer ratio. ➢ Types of two port parameters and their equation.	30 min
3.	**Conclusion** There are various types of network functions. Network function relates the transform of source to transform of response. Two port network functions can be expressed in many types of parameters like Z,Y,h and,T. Driving point impedance and admittance and transfer impedance and admittance are examples of networks functions.	5 min
4	**Question /Answer** **Q1.**Write Z parameter Equation Ans: $V_1=Z_{11}I_1+Z_{12}I_2$ $V_2=Z_{21}I_1+Z_{22}I_2$	5 min

Assignment to be given:- nil
Reference Readings:- Network & Systhesis in FF Kuo.
Networka analysis by Valkenberg

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Lecture Plan -15

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : B

S. No.	Topic: -Relation between port parameters	Time Allotted:-
1.	**Introduction** Z, Y ,h and T are the main parameters in 2 port networks.At times it becomes easier to find one set of parameters and then express the other parameters iterms of same.	10 min
2	**Division of the Topic** ➢ Write Z parameters equations ➢ Write h parameters equations ➢ Express h parameters equations in Z parameters equations using elimination method for V_1, V_2, I_1 ,and I_2 as applicable ➢ Use of similar method for expressing any parameter in terms of other parameters	30 min
3.	**Conclusion** Any set of 2- port parameters i.e. Z, Y, h and T can be expressed in terms of other parameters by using basic equations and process of elimination.	5 min
4	**Question /Answer** **Q1** How Z and Y parameters are inter-related ? A1. $Z = Y^{-1}$ and $Y = Z^{-1}$. Q2. Why there is a need to express one parameter in terms of other ? A2. .At times it becomes easier to find one set of parameters.Circuit is such that use of other parameter will be helpful in solving the problem. So there is a need to express one parameter in terms of other.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -16

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : B

S. No.	Topic: - Transfer function using two port parameters	Time Allotted:-
1.	**Introduction** Driving point and transfer function of a two port network can be determined using two port parameters. It falls into 2 categories: one applies to two port network without load and source impedance. The second category includes source and load impedance.	10 min
2	**Division of the Topic** ➢ transfer function without load and source impedance ➢ open circuit voltage ratio using Z and Y parameter ➢ short circuit current ratio using Z and Y parameter ➢ Transfer function using load terminator Z_L ➢ Input impedance Z_{in} of Hybrid equivalent circuit with load Z_L	30 min
3.	**Conclusion** Transfer function of 2-port n/w is categorized into two types. The first one doesn't have load or source impedance whereas second type has output port terminated with load or input having source impedance	5 min
4	**Question /Answer** **Q1**: what are the two basic types of transfer function Ans: One terminated with load impedance and other without load impedance.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -17

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : B

S. No.	Topic: - Interconnection of 2 two- port networks	Time Allotted:-
1.	**Introduction** In order to achieve the desired performance from networks , the networks have to be interconnected. The combination can be series, parallel, cascade or hybrid i.e. series / parallel.	10 min
2	**Division of the Topic** ➢ Series – series interconnection. ➢ Derivation [Z] = [Za] + [Z_b] ➢ Parallel – parallel interconnection ➢ Derivation [Y] = [Ya] + [Y_b] ➢ Series – parallel interconnection ➢ Derivation [h] = [ha] + [h_b] ➢ Cascade interconnection ➢ Derivation [T] = [Ta] + [T_b]	30 min
3.	**Conclusion** The two port networks can be connected ins series, parallel, cascade of in hybrid manner. The overall Z, Y and h parameters of two 2-port networks connected in series, parallel and series-parallel mode are equal to addition of respective Z, Y and h parameters of networks where as T-parameters are equal to multiple of respective T- parameters of network connected is cascade.	5 min
4	**Question /Answer** **Q1** What do you mean by series connection of two 2 – port networks? A1 When both input ports and output ports of two 2 – port networks are connected in series, it is called series connected. Q2 How input and output ports are connection series- paralle mode? A2 The input ports are connected in series and output ports connected in parallel.	5 min

Assignment to be given : nil

Reference Readings:- 1. Network analysis and synthesis –F F Kuo
2 Circuit Theory -----A Chakrabarty

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Lecture Plan -18

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : C

S. No.	Topic: - Hurwitz Polynomials	Time Allotted:-
1.	**Introduction** A polynomial is said to be Hurwitz Polynomial P(s) real when s is real and the roots of the polynomials P(S) have real parts which are zero or negative. The network polynomial should be Hurwitz so that it can be realized.	10 min
2	**Division of the Topic** 1. Division of the topic ➢ Importance of Hurwitz polynomial ➢ Properties of Hurwitz Polynomial ➢ Procedure of testing a given polynomial to be Hurwitz. ➢ Numerical practice.	30 min
3.	**Conclusion** In physical testing of Hurwitz polynomial, the coefficients of all terms of the polynomial must be positive and real, In analytic testing, the quotients in the continued fraction expansion of even-odd or odd-even terms of polynomial must be real and positive.	5 min
4	**Question /Answer** **Q1**. Give two properties of Hurwitz polynomial. A1 1. Coefficients of all the s terms must be positive. 2. Both the odd and even part of the Hurwitz polynomial have roots on the imaginary axis only.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -19

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : C

S. No.	Topic: - Positive real function	Time Allotted:-
1.	**Introduction** Real functions are important because they represent physically realizable passive driving point immittances. This function must satisfy basic conditions namely f(s) is real for real s.The real part of F(s)>=0 when the real part of S is > 0 i.e Re F(s)>0 for Re S > =0.	10 min
2	**Division of the Topic** ➢ Importance of positive real functions prf ➢ Properties of Positive.Real. functions ➢ Numerical Practice	30 min
3.	**Conclusion** For passive driving point immitance function to be physically reliable, it is necessary that these functions should be positive real function. They must satisfy basic conditions and possess number of properties which come out from the basic conditions.	5 min
4	**Question /Answer** Q1 State two basic conditions for a function to be PRF. A1 F(s) is real for real S Re [F(S)] > 0 for Re S>0 Q2 State any Three properties of PRF. A1 (1) If F(s) is real than 1/ F(s) is also real (2) Sum of PRF is PRF (3) The poles and zeros of a PRF cannot have positive real part i.e they cannot be in the right half of S- plane.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -20

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : C

S. No.	Topic: -Properties of real immittance functions.	Time Allotted:-
1.	**Introduction** The network to be synthesized will have two types of elements L-C ,or R-C ,or R-L . The immittance function (impedance and admittance) can be realized only if they satisfy certain conditions / have certain properties like they are to be ratio of even to odd for $Y_{LC}(s)$ or odd to even for $Z_{LC}(s)$	10 min
2	**Division of the Topic** ➢ Types of network to be synthesized and elements ➢ Properties of LC immittance functions and their explainations	30 min
3.	**Conclusion** The L-C driving immittance functions must satisfy number of conditions / properties if they are to be realized. .For Z_{LC} it is the ratio of odd to even and vice versa for $Y_{LC}(s)$. Its poles and zeroes are simple and lie on jw axis and interlace on the jw axis.The highest and lowest powers of numerator and denominator differ by unity.It must have either a pole or a zero at the origin and infinity.	5 min
4	**Question /Answer** **Q1**.What is a $Z_{LC}(s)$ function ? A1 It is a ratio of odd to even polynomials. **Q2**. For immittance functions what is the nature of poles and zeroes ? A.2 They are simple and lie on the jw axis. **Q3**.Do poles and zeroes of LC immittance function interlace ? A3. Yes.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -21

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : C

S. No.	Topic: - Synthesis of LC driving point immittances.	Time Allotted:-
1.	**Introduction** LC driving point immittance function can be realized only if they are prf. They can be of two types ----Foster and Cauer networks .Each of them can be of again two types ---Type I or Type II	10 min
2	**Division of the Topic** ➢ Requirements to be met for LC driving point immittance function to be realizable. ➢ Types of networks to be realized --- Foster Type ---- Cauer Type ➢ Procedure of synthesis of Foster Type n/w both I & II ➢ Procedure of synthesis of Cauer Type n/w both I & II	30 min
3.	**Conclusion** . LC driving point immittance functions should be prf so as to be realizable.f. They can be Foster type or Cauer type. Foster I is a series combination of parallel LC n/w where as Foster II is a parallel combination of series LC networks . They are made by partial fraction methods. Cauer type is a ladder n/w and made by continued fraction expansion method.	5 min
4	**Question /Answer** Q1What is the primary condition to be satisfied by LC driving point immittances to be realizable ? A1. They should be prf. Q2. What is the method of making Foster type n/w ?. A2. By partial fraction method. Q3. How Cauer type n/w are made ? A3. By continued fraction expansion method.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakabarty.

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Lecture Plan -22

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : C

S. No.	Topic: Properties of RC driving point immitances	Time Allotted:-
1.	**Introduction** RL and RC network are called lump network as they contain resistance elements. RC network can be realized in both Foster and Cauer. The RC network immitance function must have certain properties ---- poles and zeroes lie on negative real axis and alternate.	10 min
2	**Division of the Topic** ➢ RC network and their topology ➢ Properties of RC driving point impedance ➢ Properties of RC driving point admittance	30 min
3.	**Conclusion** The RC driving point immitance function can be RC impedance or RC admittance. Both these functions have poles & zero on the negative real axis and they should alternate. In case of impedance, the residues of the pole should be real and positive whereas for the admittance function, the residues of the pole must be real and negative.	5 min
4	**Question /Answer** **Q1**. State one property for RC driving point immitance function. A1: The poles and zero should lie on negative real axis and alternate **Q2:** what is the nature of residues of poles in case of RC driving point immitance A2: They should be positive and real for impedance function and negative and real for admittance function	5 min

Assignment to be given:-Third

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -23

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : C

S. No.	Topic: - Synthesis of RC impedance or RL admittance	Time Allotted:-
1.	**Introduction** RC impedance or RC admittance can be in both foster & Cauer type of network. Foster network is synthesized by partial fraction method and Cauer network by continued fraction expansion.	10 min
2	**Division of the Topic** ➢ Foster & Cauer Network of RC & RL elements ➢ Method of synthesisof RC impedance network both foster & Cauer. ➢ Method of synthesis of RL admittance network both foster & Cauer. ➢ Numerical practice for the synthesis of RC impedance &RC admittance Network.	30 min
3.	**Conclusion** Partial expanson method & continued fraction expansion method aren be used for synthesis of foster & cauer network------ RC impedance or RL admittance networks.s	5 min
4	**Question /Answer** **Q1**. when numerator & denominator degree is same, then what is the first element in RC network A1: Pure resistor. **Q2.** How do you get Cauer network Ans: By continued fraction expansion method.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty

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Lecture Plan -24

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : C

S. No.	Topic: - Properties of RL impedance & RC admittance	Time Allotted:-
1.	**Introduction** Properties of RL impedance & RC admittance function can be derived in the same way as per the properties of RC impedance or the RC admittance function. The most important being the range that poles & zero are located on the –ve real axis & they alternate.	10 min
2	**Division of the Topic** ➢ RL impedance/RC admittance network topology ➢ Properties of RL impedance or RC admittance function ➢ Location of poles &zeroes ➢ Residues of the poles. ➢ Numerical examples practice.	30 min
3.	**Conclusion** Both foster and Cauer networks of RL impedance & RC admittance can be synthesized. The property is to be satisfied are poles & zero should be located on the negative real axis and alternate.	5 min
4	**Question /Answer** **Q1**. What is the nature of poles &zero for RL impedance & RC admittance function A1. They should be real and lie on –ve real axis & alternate. Q2 What is the nature of residues for RC impedance. Ans. Negative	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -25

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : D

S. No.	Topic: - Properties of transfer functions & zeroes of transmission	Time Allotted:-
1.	**Introduction** A transfer function is a function which relates current or voltage at one port to the current or voltage at another port. There are certain properties which apply to all transfer functions of passive linear networks with lumped element. zero of transmission is a zero of a transfer function.	10 min
2	**Division of the Topic** ➢ Definition of transfer function ➢ Types of transfer functions ➢ Properties of transfer function ➢ Zero of transmission ➢ Numerical on determining transfer function of a given network	30 min
3.	**Conclusion** Transfer function of a circuit is defined as ratio of o/p to i/p in Laplace transform with initial zero conditions .At zeroes of the transmission output of the system is zero .The important properties of a transfer function are that T(s) is real for real s. This has no poles on the right half of s - plane &no multiple poles on the jw axis.	5 min
4	**Question /Answer** **Q1** What relates the voltage /current at one port to the current or voltage at another port. Ans. Transfer function. **Q2** What do you understand by zero of a transmission Ans. At zero of the transmission ,the output is zero for the input of the same freq. **Q3** State any two properties of the transfer function Ans. a) Transfer Function T(s) is real for real s. b) It has no poles on the right half of S-plane	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.

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Lecture Plan -26

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- **Network Theory** Section : D

S. No.	Topic: - Synthesis of Z_{21} with 1 Ω termination	Time Allotted:-
1.	**Introduction** Synthesis of network of known Z_{21} with 1 Ω termination requires that two points be seen. First is that ratio of odd to even or even to odd powers of Hurwitz polynomial Q(s) is to be seen. The continued fraction expansion must yield all positive quotients.Then it is an LC driving point function.	10 min
2	**Division of the Topic** ➢ Circuit block diagram with 1 Ω terminal ➢ Derivation of Z_{21} ➢ Necessary condition of $Z_{21}(s)$ ➢ Show $Z_{21}(s)$ all zeroes at s equal to infinity is equivalent to specification of low pass filter with example ➢ Show Z_{21} (s) all zeroes at s equal to 0, is equivalent of a high pass filter, with example.	30 min 5 min
3.	**Conclusion** The synthesis of a network of a given Z_{21} depends on where its zeroes are located. If all zeroes are at infinity then it is equivalent of LP filter & on the other hand if all zeros are at s=zero then it is a HP filter.	
4	**Question /Answer** **Q1**. Which two conditions must be satisfied by the polynomial q(s)before it is to be synthesised with 1 -Ω terminal **Ans1** q(s)should be a L-C driving point function and open circuit transfer function z_{21} should be an odd system **Q2**. If Z_{21} (s) Has all zero at s=infinity ,then $Z_{21}(s)$is equivalent to specification of which type of filter ? **Ans** low Pass filter. **Q3** If Z_{21} (s) has all zeroes at s=0 then Z_{21} (s) is equivalent to specification of which type of filter ? Ans High Pass filter.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthesis
2 Circuit theory by A.Chakrabarty

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Lecture Plan -27

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- **Network Theory** Section : D

S. No.	Topic: - Synthesis of Y_{21} with 1 Ω terminal	Time Allotted:-
1.	**Introduction** Synthesis of network with known Y_{21} & with 1 -Ω terminal requires that two points be seen. First is that ratio of odd to even or even to odd parts of Hurwitz polynomial q(s) is to be seen. The continued fraction expantion must yield all positive quotients. That is, it is an LC driving point function. Second point is that short circuit transfer admittance Y_{21} of an LC circuit is an odd function.	10 min
2	**Division of the Topic** ➢ Circuit block diagram with 1 -Ω terminal ➢ Derivation of Y_{21} ➢ Necessary condition of Y_{21} (s) ➢ Numerical on synthesis of the network	30 min
3.	**Conclusion** The synthesis of a network of a given y21 depends on where its zeroes are located.	5 min
4	**Question /Answer** Q1 state any one condition to be satisfied by Y_{21} polynomial before it is to be synthesised with 1 -Ω terminal. Ans. Q(s) should be L-C driving point function and short circuit transfer function Y_{21} should be odd function.	5 min

Assignment to be given:- nil

Reference Readings:- 1. Network analysis and synthes

2. Circuit theory by A.Chakrabarty.

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Lecture Plan -28

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- **Network Theory** Section : D

S. No.	Topic: - Introduction to active network synthesis	Time Allotted:-
1.	**Introduction** A network generally consists of R, L& C elements. The passive network have invariably inductance. They are bulky .The active circuit for example filter is made of op-amplifier. The active networks have many advantages like less dissipative power, less costly, have much higher gain & high input impedance.	10 min
2	**Division of the Topic** ➢ Differences between active network &passive network ➢ Basic components of active network ➢ Realization of active low pass filter network and active high pass filter network	30 min
3.	**Conclusion** Active network is made up of ics, resisters &capacitors. They don't have bulky element like inductors. They consume less power. They are less costly &have high gain& high input impedance. Active low pass & active high pass filter are some of the examples of active network.	5 min
4	**Question /Answer** **Q.1** which component is generally not found in active network ? Ans. Inductor **Q2 G**ive some advantages of active networks used as a filter. Ans. They consume less power .They have high gain. They have high input impedance and are less costly. **Q3** what are the main components of active network Ans. Op- amplifier, resistor &capacitor.	5 min

Assignment to be given:- Fourth

Reference Readings:- 1. Network analysis and synthesis –FF Kuo

3. Circuit theory by A.Chakrabarty.

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Lecture Plan -29

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : D

S. No.	Topic: - Network Topology	Time Allotted:-
1.	**Introduction** When all the elements in a network are replaced by lines & dots of both ends , the configuration is called graph of the network. Dots are nodes and the lines are the branches. Which ever way the connections are made the topology is same. The topology or the graph helps to solve the complex circuit in a very simple way.	10 min
2	**Division of the Topic** ➢ Terminology Node tree Branch co-tree Loop Graph ➢ Incident matrix & Reduced incident matrix ➢ Drawing of oriented graph and incident matrix.	30 min 5 min
3.	**Conclusion** By the help of network topology a network can be solved easily	5 min
4	**Question /Answer** **Q1** What is a co tree Ans. It is that branch of a graph that does not belong to a particular tree. **Q2** Give the properties of incident matrix. Ans. 1) algebraic num of columns of an incident matrix is zero. 2) Determinant of the incident matrix of a closed loop is zero.	

Assignment to be given:- nil
Reference Readings:- 1. Network analysis and synthesis –FF Kuo

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Lecture Plan -30

Semester: **III** Class:-**EEE** Course Code: **EE-203-F**

Subject:- Network Theory Section : D

S. No.	Topic: - Graph theory – Tie set matrix & Cutset matrix	Time Allotted:-
1.	**Introduction** The tieset and cutset matrices are used to find branch current &branch voltage by applying Kirchhoff's low.	10 min
2	**Division of the Topic** ➢ Fundamental tie set matrix ➢ Procedure of obtaining fundamental tie set matrix ➢ Fundamental cut set matrix ➢ Procedure of writing cut set matrix ➢ Numerical practice	30 min
3.	**Conclusion** In the tie set, current in any branch of a graph can be found using branch current & its direction. Potential difference between any node (node pair voltage) can be expanded in terms of the branch voltage.	5 min
4	**Question /Answer** **Q1** Define fundamental tie-set Ans. It is with respect to a tree. It is a loop formed by one and only one link associated with other twigs. **Q2.** Define fundamentals cut set. Ans: It is with respect to a tree. It is a loop formed by one and only one twig and a set of links. **Q3**.The no. of fundamental tie- sets &cut- sets are equal to what ? Ans. No. of fundamental tie- sets are equal to number of links and no. of fundamental cut- sets equal to number of twigs of the tree.	5 min

Assignment to be given:- Nil

Reference Readings:- 1. Network analysis and synthesis –FF Kuo
2. Circuit theory by A.Chakrabarty.