EE242: CIRCUIT THEORY

3rd Semester and 2nd Year (Level II)

B.Tech. (Electrical Engineering)

A. Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

B. Course Objectives:

As electrical networks and circuits are the base of electrical engineering, the objectives of the course are:

1. To understand basics of network elements and their behavior.
2. To understand basics of network topologies and the tie set and cutest schedules.
3. To apply various circuit laws like Ohm's Law, KVL, KCL, etc.
4. To apply dot convention technique for analysis of transformer based circuits.
5. To apply node and mesh circuit analysis techniques.
6. To apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer.
7. To calculate two port parameters such as y, z, ABCD, etc. for the given two port network.
8. To analyze behavior of passive circuits such as RC, RL and RLC.
9. To apply the fundamental concepts in solving and analyzing different Electrical networks.
10. To apply Laplace Transform for circuit analysis.
11. To analyze circuit taking into account initial conditions.
12. To select appropriate and relevant technique for solving the Electrical network in different conditions.

C. Outline of the Course:

Sr. No.	Title of Units	Number of Hours

1.	Circuit elements and energy sources	3
2	Network Topology	7
3.	Network Equations	7
4	Network theorems and Impedance function	8
5	Two-Port Network Analysis	8
6	Laplace Transformation, its Application and Special Signal Waveforms	19
7	Initial conditions in networks	8

Total hours (Theory) :60 Hrs
Total hours (Lab) :30 Hrs
Total hours : 90 Hrs

D. Detailed Syllabus:

1	**Circuit elements and energy sources**	**05%**	**03 Hrs**
	Circuit Elements And Their Characteristics, Energy Sources, Source Transformation.		
2	**Network Topology**	**11.67%**	**07 Hrs**
	Concept Of Network Graph, Terminology Used In Network Graph, Number Of Trees In A Graph, Tie-Set Matrix, Fundamental Tie-Set Matrix, Fundamental Cut-Set, Cut-Set Matrix, The Dot Convention For Coupled Circuit, Principle Of Duality		
3	**Network Equations**	**11.67%**	**07 Hrs**
	Kirchhoff's laws, Current division, Voltage division in series circuits, Nodal and mesh analysis of electric circuits in DC and AC excitations.		
4	**Network theorems and Impedance function**	**13.33%**	**08 Hrs**
	Superposition theorem, Thevenin theorem, Norton Theorem, Reciprocity and Maximum power transfer theorem in Electrical Circuits with DC and AC excitations, Transform impedance and transform circuits		
5	**Two-Port Network Analysis**	**13.33%**	**08 Hrs**
	Network Elements, Classification of Network, Network Configuration, Recurrent Network, Z-parameters, Y-parameters, ABCD Parameters, Inverse ABCD Parameters, Interrelationship between parameters, Concept of Reciprocity & Symmetricity for network parameters		

6	**Laplace Transformation, its Application and Special Signal Waveforms**	**31.67%**	**19 Hrs**
	Basic Types Of Special Signals, Laplace Transformation Of Special Signal Waveforms, Step Response of R-L,R-C,R-L-C Series &Parallel Circuit, Transient Response of Series R-L , R-C, R-L-C With DC Excitation, Transient Response of Series R-L , R-C, R-L-C With AC Excitation.		
7	**Initial conditions in networks**	**13.33%**	**08 Hrs**
	Initial conditions in elements, Geometrical Interpretation of Derivatives, A Procedure of Evaluating Initial conditions, R-L , R-C & R-L-C Circuits analysis using Initial Conditions.		

E. Student Learning Outcomes:

Upon successful completion of this course, a student will be able to

1. Articulate in working of various components of a circuit.
2. Familiar with ac and dc circuits solving.
3. Ready with the most important concepts like mesh and nodal analysis.
4. Solve Circuits using Tree, Node, Branch, Cut set, Tie Set Methods.
5. Understand the electrical circuit in terms of A, B, C, D and Z, Y Parameter Model and solve the circuits.
6. Solve the differential equations of R, RL, RC, RLC network using Laplace approach.
7. Solve the circuits with initial conditions of the circuits.

F. Instructional Methods and Pedagogy

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries a 10% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.

- Assignments/Surprise tests/Quizzes/Seminar/Tutorials based on course content will be given to the students for each unit/topic and will be evaluated at regular interval. It carries a weightage of 5% in the overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

G. Recommended Study Material:

Text Book:

1. Circuit Theory by A. Chakrabarti , Dhanpat Rai Publications
2. Network Analysis by Van Valkenburg , Prentice Hall College
3. Network Analysis and Synthesis by Ravish R Singh, McGraw Hill Education Pvt. Ltd

Reference Book:

1. U. A. Patel, Network analysis and Synthesis, Mahajan Publisher
2. G. K. Mithal, Network analysis, Khanna publications
3. F. F. Kuo, Network Analysis, John Wiley
4. Electric Circuits and Networks :- By K. S. Suresh Kumar – Pearson Education
5. Linear Circuits Analysis 2nd edition :-By DeCarlo/ Lin – Oxford University Press(Indian edition)

Web Material:

- http://nptel.ac.in/courses/108102042/9
- http://freevideolectures.com/Course/2350/Networks-Signals-and-Systems