

**NIRMA UNIVERSITY**  
**Institute of Technology**  
**B.Tech. in Electrical Engineering**  
**Semester-III**

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<b>Course Code</b>	<b>2EE301</b>
<b>Course Title</b>	<b>Network Analysis and Synthesis</b>

**Course Learning Outcomes (CLO):**

At the end of the course, students will be able to-

1. understand the basic laws, theorems and the methods of analysing electrical circuits.
2. analyse the properties of coupled circuits and usage of network graph to solve circuits.
3. obtain the transient and steady-state response of electrical circuits.
4. understand two port network and network synthesis.

**Syllabus:**

**Teaching Hours: 45**

<b>Unit-0: Introduction to Course</b>	<b>01</b>
Need of network analysis and synthesis, Practical relevance, Discussion of course structure, Applications in the field of electrical engineering.	
<b>Unit-1: Basic Circuit Fundamentals</b>	<b>06</b>
Basic definitions, Nature of sources, Kirchoff's laws, Mesh and Nodal Analysis - Super-mesh and Super-Node Analysis, Source transformation, Duality.	
<b>Unit-2: Coupled Circuits</b>	<b>03</b>
Self and Mutual inductance, Coefficient of coupling, Dot convention, Tuned circuit, Single tuned circuits.	
<b>Unit-3: Network Topology</b>	<b>05</b>
Basic definitions, Formation of incidence, f-tie set and f-cut set matrix, relationship between matrices, Network equilibrium equations.	
<b>Unit-4: Network Theorems</b>	<b>06</b>
Superposition, Thevenin's, Norton's, Maximum power transfer, Tellegen's, Millman's and Reciprocity theorem in DC and AC circuits.	
<b>Unit-5: Time Domain Analysis</b>	<b>05</b>
Initial conditions, Procedure for evaluating initial conditions, Transient analysis of DC & AC circuits.	
<b>Unit-6: Frequency Domain Analysis</b>	<b>06</b>
Laplace transform of standard signals, Shifting theorem, initial and final value theorem, Solution of circuit equations by Laplace transform, Evaluation of circuit response for various signals.	

**Unit-7: Two Port Networks** **04**

Classification of networks, Two port parameters ( $Z, Y, ABCD, h$ ), Condition of Reciprocity and Symmetry, Interrelations between different parameters and Interconnections of various networks.

**Unit-8: Network Functions** **05**

Calculation of network functions, Poles and Zeros of network functions and their restriction, time domain behaviour from pole - zero plot.

**Unit-9: Network Synthesis** **04**

Hurwitz Polynomial, Properties of positive real function, necessary and sufficient conditions, basic synthesis procedure, synthesis of L-C, R-L and R-C driving point functions.

**Self-Study Component:**

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

**Tutorial:**

**Tutorial Hours: 15**

This shall consist of at least 8 tutorial based on the above syllabus.

**Suggested Readings:**

1. M E Van Valkenburg, Textbook of Network Analysis, Prentice Hall India.
2. A. Chakrabarti, Circuit Theory- Analysis and Synthesis, Dhanpat Rai & Co.
3. U. A. Patel, Textbook of Network Analysis and Synthesis, Mahajan Publishing House.
4. Akhilesh A. Nimje, Electrical Circuit Analysis and Synthesis, New Age International Publishers
5. William D. Stanley, Textbook of Network Analysis with Applications, Pearson Education (I) Ltd.
6. Franklin F. Kuo, Textbook of Network Analysis and Synthesis, Wiley India.
7. Charles A. Desoer and Ernest S. Kuh, Textbook of Basic Circuit Theory, Tata McGrawhill.
8. Lawrance P. Huelman, Textbook of Basic Circuit Theory, Prentice Hall of India.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2019-20 and onwards