

Network Analysis & Synthesis

1.1 Course Number: ECE201

1.2 Contact Hours: 3-1-0

Credits: 11

1.3 Semester-offered: 4th Year-Odd

1.4 Prerequisite: None

1.5 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Amarish Dubey, Dr. Sajal Agarwal, Dr. Abhishek Kumar Singh, and Dr. Shivanshu Shrivastava.

2. **Objective:** Objective of this course is to familiarize students about detailed analysis of a network (including multi-port networks) for different kinds of inputs utilizing the concept of complex frequency and impedance transform, the in-depth analysis of network is further extended to make students acquitted with design of passive and active filters. Finally, students are made to learn synthesis of passive electrical networks from a given impedance or admittance function. The course has been designed for analysis and synthesis of linear, time invariant networks. Analysis of non-linear, time varying network requires advanced studies.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Impedance functions and network analysis	Concept of complex frequency, Impedance transforms and transforms networks, Transform methods of network analysis, Loop and Nodal analysis, Analysis using Network Theorems, Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Maximum power transfer theorem, Milliman's theorem, and Tellegen's theorem.	8
2	Network Functions	Concept of driving point and transfer functions, Poles and zeros of network functions, Restrictions on pole and zero locations for driving point and transfer functions, Time domain response from pole-zero plots.	7
3	Two port networks	Concept of port: Single port, two port and multi-port networks, Y, Z, ABCD, inverse ABCD, h, and g parameters of a two-port network, Y, Z, ABCD, inverse ABCD, h, and g parameters of interconnected two port networks, Conditions for symmetry and reciprocity in terms of different parameters, Interrelationship between different parameters.	9
4	Attenuators and filters	Concept of attenuator, Image and scattering parameters, Insertion loss, various types of attenuators, Concept of filters,	7

		Design of passive filters – low pass, high pass, band pass and band elimination filter, Introduction to design of active filters.	
5	Network synthesis	Elements of reliability: Hurwitz polynomial, positive real functions, Synthesis of L-C, R-L, R-C and R-L-C networks.	9
		Total	40

4. Readings

4.1 Textbook:

- i. *M.E. Van Valkenberg: Network Analysis, Prentice Hall India.*
- ii. *M.E. Van Valkenberg: Introduction to Modern Network Synthesis, John Wiley & Sons.*
- iii. *D. Roy Choudhury: Networks and Systems, New Age International Publishers.*

4.2 Reference books:

- i. *Franklin F. Kuo: Network Analysis and Synthesis, Wiley.*
- ii. *V.K.Aatre: Network Analysis and Filter Design, New Age International Ltd.*

5. **Outcome of the Course:** A strong foundation for better understanding of Courses to be taught in subsequent semesters.