

Course Syllabi: UEE503 Network Analysis and Synthesis (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE503; Network Analysis and Synthesis

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

- *Hayt, W., Engineering Circuit Analysis, Tata McGraw–Hill (2006).*
- *Hussain, A., Networks and Systems, CBS Publications (2004).*
- *Valkenberg, Van, Network Analysis, Prentice–Hall of India Private Limited (2007).*
- *Chakarbarti, A., Circuit Theory, DhanpatRai and Co. (P) Ltd. (2006).*
- *RoyChowdhuary, D., Networks and Systems, New Age International (P) Limited, Publishers (2007).*
- *Sudhakar, A., Circuits and Networks, Tata McGraw–Hill (2006).*

a. Other supplemental materials

- Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Graph theory and Network equations: Graph, Tree and link branches, Network matrices, Incidence matrix, Basic loop and cut set matrices, Relation between network matrices, Choice of linearly independent network variables, Topological equations for loop current and topological equation for nodal voltage, Source transformation Tellegen's theorem and its applications.

Network Theorems and Two Port Network for AC circuits: Thevenin's theorem, Norton's theorem, Millman's theorem, Reciprocity Theorem and Maximum Power Transfer Theorem as applied to A.C. circuits, Two port network description in terms of open circuits impedance, Short circuit admittance, Hybrid and inverse hybrid, ABCD and inverse ABCD parameters, Image parameters, Inter-connection of two port network, Indefinite admittance matrix and its applications, Duality networks.

Inductively Coupled Circuits: Dot convention, Coefficient of coupling, mutual inductance in loop and nodal equations.

Filters : Classification of filters, Analysis of prototype filter section, Analysis of a prototype Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter, M–Derived Filter, Low Pass Filter with RC and RL Circuits, High Pass Filter with RC and RL Circuits, Low Pass Filter with RLC Circuit. Introduction of Different Types of Active Filters.

Attenuators: Attenuation, Types of attenuators, Symmetrical T–type attenuator, Symmetrical π –type attenuator, Symmetrical bridged T–type attenuator, Symmetrical lattice type attenuator, Asymmetrical L–type attenuator, Asymmetrical π –type attenuator.

Network Synthesis: Synthesis vs. analysis, Elements of circuit synthesis, LL FPB networks, Purpose and scope of network synthesis.

Positive Real Functions: Definition, Necessary and sufficient conditions for a function to be positive real, Testing of driving point functions for positive realness.

FOSTER and CAUER Forms: Foster and cauer forms of LC Networks, Synthesis of RC and RL networks.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Describe the underlying concepts of AC electric networks
- Solve electric circuits by applying various network laws and theorems.
- Represent complex network as two port network and can use it for impedance matching, transmission line modelling etc.
- Synthesise the RC, RL, LC networks for given function.
- Design the passive filter(s) and/or attenuator(s) for the various applications.

6. Brief list of topics to be covered

- Graph Theory and Network Equations
- Network Theorems and Two Port Network for AC Circuits
- Inductively Coupled Circuits
- Filters and Attenuators
- Network Synthesis
- Positive Real Functions