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| **EE3501** | **Network Analysis and Synthesis** | **L-T-P: 3-0-0; Total 42 Lectures** |

**Pre requisites:** knowledge of KCL, KVL, Network theorems, differential equations, Laplace transforms, matrix operation.

**Objective:** This course will cover Electrical circuit transient response and steady state response with different type of excitation, two port network representation, High pass and low pass filters and Passive and active circuit Synthesis.

Further Network analysis with application of graph theory has been included in the course to explain generalised approach of analysis..

**Outcome: Develop skill to analyze transient behavior of passive circuit elements and how it effects in real time. Circuit representation in two port and multiport form, and how complex circuits parameters can be determined without going to passive/ active circuit connections by simple test. How to realize a circuit from transfer function. Basics of using Different types of filters realization by passive and active circuit elements.**

**Syllabus:**

**Unit 1: Coupled circuit:** Coupled Inductor, Self and Mutual Inductance, Co-efficient of coupling, Dot convention, Tuned coupled Circuit 7 **- Lecture**

**Unit 2:** **Network Functions** for one port & two-port networks, poles and zeroes of network functions. Restrictions on poles and zeroes locations for driving point functions and transfer functions. Time domain behavior of electrical network from the pole- zeroes plot. 5 **- Lecture**

**Unit 3**: **Two Port Network:** Relationship of two port variables, short circuit admittance parameters, open circuit impendence parameters, transmission parameters, hybrid parameters, relationship between parameters sets, interconnections of two port networks. 5**- Lecture**

**Unit 4: Network graph theory:** Terminologies used in the graph theory, incidence matrix, cut-set matrix, loop-matrix, loop analysis using graph theory, cut set analysis using graph theory. 5**- Lecture**

**Unit 5:** **Filter fundamentals:** Derivation of expression for propagation constant, attenuation constant, phase shift constant, cut-off frequency, characteristics impedance etc. for constant K and m-derived, high-pass, low-pass, band-pass and band-stop L-C filters. 5 **- Lecture**

**Unit 6:** **Positive real function:** Definition, necessary and sufficient conditions, properties Synthesis of L-C, R-C and R-L Networks. 5**- Lecture**

**Unit 7: Introduction to Active Filters:** Op Ampand its application in realizing active Network, Open loop response and closed loop response, Input and output Impedance.

 **Dynamic OP Amp Limitations:** Open Loop response and Closed Loop response, Input and Output Impedance, Transient Response. Effect of Finite GBP on Integrator Circuit. Effect of finite GBP on Filters **5 - Lectures**

**Unit 8: Network Synthesis:** Concept of Stability of a system, Hurwitz Polynomial, Concept of network Synthesis, pole zero interpretations of LC networks, LC network synthesis, Foster Reactance theorem, Significance of elements in Foster form, Cauer Canonical form of reactive networks, Applications, Foster and Cauer form of synthesis of Lossy Networks. **7 - Lectures**

**Suggested Readings:**

1. Desoer and Kuo: Basic circuit theory, Mc Graw Hill
2. D Roy Choudhary: Network and systems, New Age International
3. Van Valkenburge: Network Analysis, PHI
4. F. F. Kuo: Network Analysis and Synthesis, John Wiley & Sons.
5. Circuit Theory by A Chakrabarty , Dhanpat Rai and Co.
6. Haytkemrlly and Durbin, Engineering Circuit Analysis, Tata Mc Graw hill
7. Sergis Franco: Design with Operational Amplifiers and Analog Circuits; Tata McGraw Hill
8. Govind Daryanani: Principals of Active Network Synthesis and Design; Wiley 1976
9. Tahira Parveen: A text Book of Operational Trans-conductance Amplifiers and Analog Integrated Circuits: LK International Publishing House Pvt Ltd, 2010