COURSE HANDOUT

NETWORK ANALYSIS AND SYNTHESIS (ECE-303)

ECE-3RD SEMESTER

ACADEMIC YEAR (2024-25)

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
ECE-303	Network Analysis And Synthesis (ECE-303)	Core	4	3	1	0	50	150	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Gain the knowledge of various laws governing electrical circuit design and networks.
CO2	Acquire knowledge about the application of differential equation method and Laplace transform in electrical circuits.
CO3	Explain the concept of pole-zero configuration and determine parameters of two port networks.
CO4	Design of K and M derived filters and analyze their operations.
CO5	Apply the concept for synthesis of circuits using Foster and Cauer forms.

Unit-I

Conventions for describing networks: Reference directions for currents and voltages, conventions for magnetically coupled circuits, circuit topology. First order differential equation: Differential equations as applied in solving networks, Application of initial conditions, evaluating initial conditions in networks.

(8 Hours)

Unit-II

Laplace Transformations: Solution of network problems with Laplace transformation, Heaviside's Expansion theorem. Waveform Analysis & Synthesis: The unit set up, ramp and impulse functions and their Laplace transforms, Initial and final value theorems, convolution integral, convolution as summation.

(9 Hours)

Unit-III

Network Functions-poles and zeros: Ports or terminal pairs, Network functions for one port and two port networks (ladder and general networks), Poles and Zeros of network functions, Restriction on pole and Zero locations for driving point and transfer functions. Time domain behaviour from pole Zero plot.

(9 Hours)

Unit- lV

Two port parameters: Admittance, impedance, transmission and hybrid parameters, Relationship between parameter sets, parallel series & Cascade connection of two port Networks, Characteristics impedance of two port networks. Filters: Filter fundamentals- pass and stop band, filter classification, constant K & m derived filters, Behavior of characteristics impedance over pass & stop bands, design of filters

(10 Hours)

Unit-V

Network Synthesis: Synthesis problem formulation, properties of positive real functions. Hurwitz polynomials properties of RC, LC and RL driving point functions. Foster and Cauer synthesis of LC, RL and RC circuits

(8 Hours)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Network Analysis and Synthesis of Things	Sudhakar Shyam Mohan	McGraw-Hill	5th (2017)
2.	Network Analysis and Synthesis	F.F. Kuo	Wiley	2nd (2006)
3	Network Analysis	Van Valkenberg	PHI	3rd (2002)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Fundamentals of Network Analysis and Synthesis	Perikari	Jaico	1st (2006)

COURSE PLAN

Unit-I Conventions for describing network

S.No	Topics	Recommended Books
1	Reference directions for currents and voltages	Book 1, Ch.1
2	conventions for magnetically coupled circuits	Book 1, Ch.10
3	circuit topology	Book 1, Ch.2
4	First order differential equation	Book 1, Ch.11
5	Differential equations as applied in solving networks.	Book 1, Ch.11
6	Application of initial	Book 1, Ch.13
7	Conditions evaluating initial conditions in networks	Book 1, Ch.13
8	Examples	Book 1, Ch.13

Unit-II   Laplace Transformations

S.No	Topics	Recommended Books
9	Laplace Transformations	Book 1, Ch.13
10	Solution of network problems with Laplace transformation	Book 1, Ch.13
11	Heaviside's Expansion theorem	Book 3, Ch.7
12	Waveform Analysis & Synthesis	Book 3, Ch.8
13	The unit set up, ramp and impulse functions	Book 3, Ch.8
14	Laplace transforms of unit set up, ramp and impulse functions	Book 3, Ch.7
15	Initial and final value theorems	Book 3, Ch.8
16	Convolution integral	Book 3, Ch.8
17	Convolution as summation.	Book 3, Ch.8

Unit- III   Network Functions-poles and zeros

S.No	Topics	Recommended Books
18	Network Functions-poles and zeros	Book 1, Ch.14
19	Ports or terminal pairs	Book 1, Ch.14
20	Network functions for one port and two port networks	Book 1, Ch.14, 15
21	Ladder and general networks	Book 3, Ch.2
22	Poles and Zeros of network functions	Book 1, Ch.14
23	Restriction on pole and Zero locations for driving point	Book 3, Ch.10
24	Transfer functions	Book 3, Ch.10
25	Time domain behavior from pole Zero plot	Book 3, Ch.10

Unit-IV   Two port parameters

S.No	Topics	Recommended Books
26	Two port parameters	Book 3, Ch.11
27	Admittance parameters	Book 3, Ch.11
28	Impedance parameters	Book 3, Ch.11
29	Transmission parameters	Book 3, Ch.11
30	hybrid parameters	Book 3, Ch.11
31	Relationship between parameter sets	Book 3, Ch.11

32	Parallel series & Cascade connection of two port Networks	Book 1, Ch.15
33	Characteristics impedance of two port networks	Book 1, Ch.15
34	Filters: Filter fundamentals- pass and stop band	Book 1, Ch.16
35	Filter classification	Book 1, Ch.16
Unit-V Network Synthesis		
37	Network Synthesis	Book 1, Ch.17
38	properties of positive real functions	Book 1, Ch.17
39	Hurwitz polynomials properties of RC driving point functions	Book 1, Ch.17
40	Hurwitz polynomials properties of LC driving point functions	Book 3, Ch.11
41	Hurwitz polynomials properties of RL driving point functions	Book 3, Ch. 11
42	Foster synthesis of LC circuits	Book 3, Ch.11
43	Foster synthesis of RC circuits	Book 3, Ch.11
44	Foster synthesis of RL circuits	Book 3, Ch. 11

ADDITIONAL WEB RESOURCES

1.	**MOOC:** Network synthesis https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysistopic/ee-resistor-circuits/a/ee-simplifying-resistor-networks
2.	**NPTEL:** NPTEL Video lectures on Network analysis & circuits https://nptel.ac.in/courses/117/106/117106108/ https://nptel.ac.in/courses/108/105/108105159/

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks

- **Assignment**: 20 marks

- **Attendance**: 10 marks

- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.

- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.

- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**
  Tuesday (12:05 PM - 12:55 PM)
  Thursday (12:05 PM - 12:55 PM)

- **Contact Information**
  satyendra.ece@mietjammu.in

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