GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma in Electronics and Communication Engineering		
Semester	III	Version	1.0.0.0
Effective from Academic Year	2026-27	Effective for the batch Admitted in	JULY 2025
Course code	1EC3103	Course Name	Network Analysis

I.TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code	Learning Scheme						Assessment Scheme										
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		Total Marks
		CL	TL	LL				FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
								MAX	MAX	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MIN	
SEC	1EC3103	3	-	2	3	8	4	40	60	100	40	30	20	50	20	20	8	170

Abbreviation:	**CL-** Classroom Learning	**TL -** Tutorial Learning	**LL -** Laboratory Learning
	SLH - Self Learning Hours	**NLH -** Notional Learning Hours	**SLA -** Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam +Attendance)		**SA -** Summative Assessment

II. PRE-REQUISITES

Basics of Electronics

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

Ability to analyze, simplify, and solve electrical networks using standard laws, theorems, and simulation tools. Competence in applying network analysis to real-world engineering problems with accuracy, efficiency, and professional documentation. Here's a structured list of expected outcomes.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

CO1: Understand the fundamental concepts of electrical networks and circuit laws.

CO2: Analyze DC and AC circuits using various theorems.

CO3: Apply network topology techniques in electrical circuits.

CO4: Understand transient and steady-state response analysis of circuits

CO5: Design and simulate electrical networks using modern tools.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours
Unit-1 Basics of Electrical Networks	**TLO 1.1** Understand basic electrical network elements such as R, L and C. **TLO 1.2** Understand independent and dependent sources. **TLO 1.3** Apply Ohm's Law for circuit analysis. **TLO 1.4** Apply Kirchhoff's Laws to electrical networks. **TLO 1.5** Calculate power and energy in electrical circuits.	**1.1** Resistors, Inductors, Capacitors **1.2** dependent & Dependent Sources **1.3** Ohm's Law **1.4** - KCL and KVL **1.5** Power and Energy in Circuits	**12**	**8**
Unit-2 Network Theorems	**TLO 2.1** Understand the need for network theorems. **TLO 2.2** Apply Superposition Theorem.	**2.1** Introduction to Network Theorems **2.2** Superposition Theorem **2.3** Thevenin's & Norton's	**12**	**8**

	TLO 2.3 Apply Thevenin's and Norton's Theorems. **TLO 2.4** Apply Maximum Power Transfer Theorem. **TLO 2.5** Understand Reciprocity and Millman's Theorem.	Theorem **2.4** Maximum Power Transfer Theorem **2.5** Reciprocity & Millman's Theorem		
Unit-3 AC Circuit Analysis	**TLO 3.1** Understand sinusoidal AC quantities. **TLO 3.2** Represent AC quantities using phasors. **TLO 3.3** Analyze series and parallel AC circuits. **TLO 3.4** Understand resonance in AC circuits. **TLO 3.5** Evaluate power factor and improvement methods.	**3.1** Sinusoidal Waveforms **3.2** Phasor Representation **3.3** Series & Parallel AC Circuits **3.4** Series & Parallel Resonance **3.5** Power Factor & Improvement	**10**	**8**
Unit-4 Transient Analysis	**TLO 4.1** Understand transient behavior of electrical circuits. **TLO 4.2** Analyze RL and RC circuits for step response. **TLO 4.3** Analyze RLC circuits for transient response. **TLO 4.4** Determine time constant of circuits. **TLO 4.5** Distinguish between first and second order circuits	**4.1** Transient Response Concept **4.2** RL & RC Step Response **4.3** RLC Transient Analysis **4.4** Time Constant **4.5** First & Second Order Circuits	**10**	**8**
Unit-5 Network Topology	**TLO 5.1** Understand basic concepts of network topology. **TLO 5.2** Apply graph theory to electrical networks. **TLO 5.3** Formulate tie-set matrices. **TLO 5.4** Formulate cut-set matrices.	**5.1** Network Topology Basics **5.2** Graph Theory **5.3** Tie-set Matrix **5.4** Cut-set Matrix	**8**	**7**
Unit-6 Practical Applications and Simulation	**TLO 6.1** Understand the importance of circuit simulation tools. **TLO 6.2** Design electrical circuits using simulation software. **TLO 6.3** Analyze and verify circuit performance through simulation.	**6.1** Introduction to Simulation Tools **6.2** MATLAB / Multisim / PSPICE **6.3** Simulation-based Circuit Analysis	**8**	**6**

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL			
Sr. No.	**Practical/Laboratory Learning Outcome (LLO)**	**Practical Titles**	**Relevant COs**
1	**LLO 1.1**: To study and verify KVL in electrical circuit.	Realize the KVL	CO1
2	**LLO 2.1**: To study and verify KCL in electrical circuit.	Realize KCL	CO1
3	**LLO 3.1**: To study and verify series and parallel connection of resistance network.	Realize series and parallel connection of resistor	CO3
4	**LLO 4.1**: To study and verify Mesh analysis of the electrical network.	Prove Mesh analysis	CO5
5	**LLO 5.1:** To study and verify superposition theorem for a network analysis.	Prove superposition theorem for a network analysis	CO2

6	**LLO 6.1**: To study and verify Thevenin's theorem.	Prove Thevenin's theorem.	CO2
7	**LLO 7.1:** To study and verify Maximum Power Transfer theorem.	Prove Maximum Power Transfer theorem.	CO2
8	**LLO 8.1**: To study and verify Reciprocity theorem.	Prove Reciprocity theorem.	CO2
9	**LLO 9.1**: To study and verify Norton's theorem.	Prove Norton's theorem.	CO2
10	**LLO 10.1:** To observe the response of the first order R-C circuits.	Realize response of the first order R-C circuits.	CO4
11	**LLO 11.1**: To study about passive filters.	Realize passive filters.	CO4

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

A. Self-Learning Assignments / Activities

1. **Circuit Law Practice**
   - Solve real-life DC circuit problems using **Ohm's Law, KCL, and KVL**.
   - Skill Developed: Analytical thinking, problem solving.
2. **Network Elements Identification**
   - Identify and classify R, L, C elements and sources from real electronic devices or circuit diagrams.
   - Skill Developed: Practical understanding of components.
3. **Theorem-Based Circuit Simplification**
   - Analyze given circuits using **Superposition, Thevenin's, and Norton's theorems**.
   - Skill Developed: Logical reasoning and circuit simplification.
4. **AC Circuit Phasor Analysis**
   - Convert time-domain AC signals into **phasor form** and solve AC networks.
   - Skill Developed: Mathematical modeling and interpretation.
5. **Power Factor Improvement Study**
   - Study power factor correction techniques used in industries and prepare a short report.
   - Skill Developed: Industry awareness, energy efficiency concepts.
6. **Transient Response Analysis**
   - Plot and analyze **RL, RC, and RLC transient responses** for step input.
   - Skill Developed: Time-domain analysis skills.
7. **Network Topology Exercise**
   - Draw graph representation of a given circuit and identify **nodes, branches, loops**.
   - Skill Developed: Network modeling skills.
8. **Simulation-Based Learning**
   - Simulate basic DC and AC circuits using **MATLAB / Multisim / PSPICE** and compare with theoretical results.
   - Skill Developed: Software proficiency, validation skills.

B. Mini Projects (Skill Development Focused)

1. **Design and Analysis of DC Network**
   Design a multi-loop DC circuit and analyze it using mesh and nodal analysis.
   Skills: Circuit design, analytical skills.
2. **Thevenin–Norton Equivalent Finder**
   Develop a small tool or procedure to find Thevenin and Norton equivalents of given networks.
   Skills: Circuit reduction, application of theorems.
3. **AC Resonance Demonstration**
   Design and simulate a **series or parallel resonance circuit** and study resonance characteristics.
   Skills: AC analysis, simulation.
4. **Transient Response Visualizer**
   Simulate RL/RC/RLC circuits and observe transient responses for different time constants.
   Skills: Dynamic system analysis.

5. **Power Factor Improvement Model**
   Design a simple circuit showing power factor improvement using capacitors.
   Skills: Energy optimization, practical design.
6. **Network Topology Analysis Project**
   Analyze a complex network using **tie-set and cut-set matrices**.
   Skills: Advanced network analysis, matrix methods.
7. **Simulation-Based Circuit Design**
   Design and simulate a practical electrical network using industry-standard software.
   Skills: Industry readiness, simulation expertise.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD	
1	Network Analysis Trainer Board (R–L–C network with provision for DC and AC sources)
2	Regulated DC Power Supply (0–30 V or equivalent)
3	Single Phase AC Power Supply / Function Generator (Sine, Square, Triangular waveforms)
4	Digital Multimeter (DMM) (For voltage, current, resistance measurement)
5	Cathode Ray Oscilloscope (CRO) / Digital Storage Oscilloscope (DSO) (For transient and AC waveform observation)
6	Decade Resistance Box (For variable resistance in experiments)
7	Decade Capacitance Box (For AC and transient analysis experiments)
8	Decade Inductance Box (For resonance and transient studies)
9	Patch Cords / Connecting Wires (Banana plug type / flexible leads)
10	Breadboard / General Purpose Trainer Board (For circuit construction and testing)
11	Computer System with Simulation Software (MATLAB, Multisim, PSPICE)

IX. LIST OF REFERENCE BOOKS

Sr.No.	Title	Author	Publication
1	Network Theory	U.A. Bakshi & A.V. Bakshi	Technical Publication
2	Circuit Theory: Analysis and Synthesis	A. Chakrabarti	Shree Hari Publications
3	Network Analysis	Van Valkenburg & M.E. Van Valkenburg	Pearson Education
4	Network Analysis and Synthesis	K.M.Soni	S K Kataria and Sons

X. LINK OF LEARNING WEB RESOURCE	
1	https://nptel.ac.in/courses/108105159
2	https://onlinecourses.nptel.ac.in/noc20_ee46/preview
3	https://www.coursera.org/courses?query=circuit%20analysis&utm
4	https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Basics of Electrical Networks	CO1	8	5	4	3	**12**
2	Network Theorems	CO2	8	3	3	6	**12**
3	AC Circuit Analysis	CO2	8	3	3	4	**10**
4	Transient Analysis	CO4	8	3	4	3	**10**
5	Network Topology	CO3	7	3	3	2	**8**
6	Practical Applications and Simulation	CO5	6	2	3	3	**8**
Grant Total			**45**	**19**	**20**	**21**	**60**

XII. COs AND POs AND PSOs MAPPING

Course outcome (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	3	2	1	2	3
CO2	3	2	2	1	2	3	2	2	3	2
CO3	1	2	3	2	2	2	3	3	2	1
CO4	2	3	1	2	1	1	2	2	3	2
CO5	2	3	1	1	2	2	1	2	1	3

Legends: - *3- High 2-Moderate/Medium 1-Slight/Low 0-None*