25EEMJ204: Electrical Circuits & Networks

w. e. f. Academic Year:	**2026-27**
Semester:	**B.E. 3rd (Electrical Engineering)**
Category of the Course:	**PCC**
Prerequisite:	Fundamental concepts of Electrical Engineering, including voltage, current, power and energy
Rationale:	Subject provides a fundamental understanding of electrical circuits and network analysis techniques

Course Outcomes:

After Completion of the Course, Student will able to:

	Course Outcome (CO)	**RBT Level (Cognitive Domain)**
CO1	Understand mesh and nodal analysis techniques to solve DC and AC electrical circuits.	Remember, Understand
CO2	Analyze transient behavior of first- and second-order electrical circuits.	Analyze
CO3	Apply network theorems and topology methods to simplify electrical networks.	Analyze
CO4	Evaluate two-port network parameters and their interrelationships.	Evaluate, Create
CO5	Apply and analyze electrical circuit techniques and network concepts to interpret and solve real-life electrical system problems. Network considering sustainability and efficiency.	Apply, Analyze

Teaching and Evaluation Scheme:

Teaching Scheme					**Examination Scheme**				
L	**T**	**P**	**C**	**Hrs/Week**	**IE**	**EE**	**CIA**	**Practical**	**Total Marks**
2	0	2	3	4	40	60	30	20	150

IE: Internal Exam CIA: Continuous Internal Assessment
EE: External Exam (End Semester) Practical: Practical Exam (End Semester))

Detailed Syllabus:

Unit No.	**Topic**	**Hrs.**	**Marks % Weightage (Approx.)**
UNIT: 1	**Basic Concepts of Circuit:** Basics of circuits and KCL, KVL law, Active and passive elements, Concept of ideal and practical sources. Source transformation, Analysis of networks by Mesh and Node, Duality, Dot convention. Study of basic circuit	**8**	**30**

	systems contributing to sustainable mobility.		
UNIT: 2	**Initial Condition:** Initial Conditions in elements, Derivative interpretation, Initial condition evaluation Analysis aimed initial condition used in electrical circuit.	**4**	**10**
UNIT: 3	**Transients in First and Second order linear circuits-RL, RC and RLC:** First order differential equation and solution, Time constant, Second order homogeneous differential equation and solution, RL and RC sinusoidal transient. Transient circuit used enhance sustainable in Practice.	**6**	**20**
UNIT: 4	**Network Theorems & Network Topology:** Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, Incidence Matrix, Loop or Circuit Matrix, Cut Sets and Cut Set Matrix, Network theorem applied in Electrical, and improving lifecycle sustainability.	**6**	**20**
UNIT: 5	**Two Port Parameters:** Z-parameters, Y-Parameters, h- Parameters, g- Parameters, ABCD Parameters, Inverse T Parameters, Relations between various Parameters. Two port network considered enhance sustainable.	**6**	**20**
		30	**100**

List of Practical:

Sr No	Topic	Hrs
1	To Verify Kirchhoff's Voltage Law (KVL)	2
2	To Verify Kirchhoff's current Law (KCL).	2
3	Transient Response of a RL Circuit.	2
4	Transient Response of a RC Circuit.	2
5	To Verify Superposition theorem for Resistive Network.	2
6	To Verify Thevenin's Theorem for Resistive Network.	2
7	To Verify Norton's Theorem for Resistive Network.	2
8	To Verify Maximum Power Transfer Theorem for Resistive Network.	2
9	To Verify Receprocity Theorem for Resistive Network.	2
10	Determination of Z-Parameters of given Two Port Network.	2
11	Determination of Y-Parameters of given Two Port Network.	2
12	Determination of ABCD Parameters of given Two Port Network	2
13	Determination of h- Parameters of given Two Port Network	2
14	Determination of g Parameters of given Two Port Network	2
15	Determination of T Parameters of given Two Port Network	2
		30

Learning Resources:

1. Network Analysis and Synthesis by U.A.Patel11th Edition, Mahajan Publishing House.
2. Circuit Theory (Analysis and Synthesis) By A. Chakrabarti, 6th Edition Dhanpat Rai & Company
3. Network Analysis by M.E.Vanvalkenburg, PHI PublicationElectrical Power system by C.L.Wadhwa, 5th Edition
4. NPTEL Couse on subject

Teaching Learning Method

- Lecture-based teaching-learning
- Group-teaching and learning
- Individual learning/self-study
- Inquiry-based learning
- Technology-based Learning
- Peer Teaching
- Learning through problem-solving

Course Outcomes Mapping:

CO No.	Course Outcome (CO)	POs/ PSOs Mapped	Cognitive Level (RBT)	Knowledge Category	Class Sessions (Lecture)
CO1	Understand mesh and nodal analysis techniques to solve DC and AC electrical circuits.	PO1, PO2, PO9, PSO1	Remember, Understand	Procedural	8
CO2	Analyze transient behavior of first- and second-order electrical circuits.	PO1, PO2, PO4, PO6, PSO1	Analyze	Conceptual	4
CO3	Apply network theorems and topology methods to simplify electrical networks.	PO1, PO2, PO4, PO8, PO10, PSO2	Analyze	Analytical	6
CO4	Evaluate two-port network parameters and their interrelationships.	PO1, PO2, PO3, PO7, PSO2	Evaluate, Create	Conceptual	6
CO5	Apply and analyze electrical circuit techniques and network concepts to interpret and solve real-life electrical system problems. Network considering sustainability and efficiency.	PO1, PO2, PO3, PO5, PO11, PSO1, PSO2	Apply, Analyse	Application	6

Mapping of COs with POs & PSOs:

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3	3							2			3	
CO2	3	3		2		1						3	
CO3	3	3		2				1		1			3
CO4	3	3	2				1						3
CO5	3	3	2		1						1	3	3

3: High, 2: Medium, 1: Low,0 → No significant correlation

Sustainable Development Goals (SDG) Integration

This course integrates principles of sustainable engineering by emphasizing efficient Here's a structured SDG Mapping with Course Outcomes (COs) for Network Analysis / Electrical Circuits, with sustainability and efficiency clearly embedded in each outcome. SDG 7 SDG 9 SDG 12 SDG 13 (Sustainable Cities and Communities), and SDG 12 (Responsible Consumption and Production).

SDG Mapping with Course Outcomes

CO	Course Outcome	Relevant SDGs	Justification
CO1	Understand mesh and nodal analysis techniques to solve DC and AC electrical circuits.	SDG 7 SDG 9	Enables efficient circuit design and infrastructure reliability
CO2	Analyze transient behavior of first- and second-order electrical circuits.	SDG 7 SDG 13	Reduces energy loss and protects systems from transient inefficiencies
CO3	Apply network theorems and topology methods to simplify electrical networks.	SDG 9 SDG 12	Promotes simplified, resource-efficient circuit design
CO4	Evaluate two-port network parameters and their interrelationships.	SDG 9 SDG 12	Improves efficient power/signal transfer with minimal losses
CO5	Apply and analyze electrical circuit techniques and network concepts to interpret and solve real-life electrical system problems. Network considering sustainability and efficiency.	SDG 7, SDG 12 SDG 13	Supports sustainable, energy-efficient real-world solutions