



INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal, Hyderabad -500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE DESCRIPTOR

Course Title	ELECTRICAL CIRCUITS LABORATORY				
Course Code	AEEB07				
Programme	B.Tech				
Semester	II	EEE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	1	4	2	1
Chief Coordinator	Ms. S Swathi, Assistant Professor				
Course Faculty	Dr. D Shobha Rani, Professor Ms. S Swathi, Assistant Professor				

I. COURSE OVERVIEW:

This course introduces the concepts of basic electrical engineering parameters, quantities, analysis of DC circuits. The course teaches different fundamental laws Ohms laws, Kirchhoff laws, different electrical concepts, Measuring the choke coil parameters, small transformer characteristics, electrical energy using single phase energy meter and Measuring the impedance of series RL, RC and RLC circuits.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHSB02	I	Linear Algebra and Calculus	UG

III. MARKSDISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Electrical Circuits Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✗	Chalk & Talk	✗	Quiz	✗	Assignments	✗	MOOCs
✓	LCD / PPT	✗	Seminars	✗	Mini Project	✓	Videos
✓	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	Laboratory		Total Marks
	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	Performance	Calculations and Graph	Results and Error Analysis	Viva	Total
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Calculations of the observations
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	3	Exercise, Discussion and Seminars
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	Seminar
PO5	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	Term observations

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	Problem Solving Skills: Able to utilize the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based team work.	2	Exercise, Discussion and Seminars
PSO2	Professional Skills: To explore the scientific theories, ideas, methodologies and the new cutting edge technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems universally.	--	--
PSO3	Modern Tools in Electrical Engineering: To be able to utilize of technologies like PLC, PMC, process controllers, transducers and HMI and design, install, test, and maintain power systems and industrial applications.	--	--

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand the characteristics of basic electrical components
II	Perform the soldering of electrical and electronics components for smooth functioning.
III	Calculate and verify the electrical quantities in series RL, RC and RLC circuit.
IV	Measure the choke coil parameters and small transformer characteristics and electrical energy using single phase energy meter.
V	Estimate electrical earthing resistance and study its importance.

IX. COURSE OUTCOMES(COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the various nomenclature used to study the characteristics of DC networks and design of different wiring connections for various applications.	CLO 1	Understand the characteristics of basic electrical and electronics components.
		CLO 2	Design the different conductor systems used in residential and light commercial wiring in accordance with the codes and authorities for installation.
CO 2	Perform the soldering of electrical and electronics components, apply the network reduction techniques indirectly to calculate electrical quantities.	CLO 3	Perform the soldering of electrical and electronics components for smooth functioning.
		CLO 4	Determine the power consumed by fluorescent lamp.
		CLO 5	Apply Ohm's law and Kirchhoff's laws to determine equivalent resistance, current and voltage in any branch of a circuit.
CO 3	Determine parameters of choke coil, transformer and calculate impedance and current in electrical circuits.	CLO 6	Measure the choke coil parameters and small transformer characteristics.
		CLO 7	Calculate and verify the impedance in series RL, RC and RLC circuit.
		CLO 8	Develop an circuit to generate current value with low voltage.
CO 4	Evaluate Electrical Quantities Associated With Series RLC Circuit, Energy Meter And Observe Characteristics Of Alternating Quantities.	CLO 9	Calculate electrical quantities associated with series RLC circuit.
		CLO 10	Measure the electrical energy using single phase energy meter.
		CLO 11	Identify The Characteristics of Alternating Quantities With Its Instantaneous, Average And Root Mean Square Values.
CO 5	Observe The Resonance Phenomena In Series, Parallel Circuits And Calculate Electrical Earthing Resistance.	CLO 12	Determine the resonant frequency in series RLC circuits.
		CLO 13	Evaluate the resonant frequency In parallel RLC circuits.
		CLO 14	Estimate electrical earthing resistance and study its importance.

X. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)				Program Specific Outcomes (PSOs)
	PO1	PO2	PO3	PO5	PSO2
CO 1	2		3	3	2
CO 2	3	3	3	3	2
CO 3	2		3	3	2
CO 4	2	3	2	3	2
CO 5	2	2	3	3	2

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XI. COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB07.1	CLO 1	Understand the characteristics of basic electrical and electronics components.	PO1, PO5	2
AEEB07.2	CLO 2	Design the different conductor systems used in residential and light commercial wiring in accordance with the codes and authorities for installation.	PO1, PO3,PO5	3
AEEB07.3	CLO 3	Perform the soldering of electrical and electronics components for smooth functioning.	PO1, PO3, PO5	3
AEEB07.4	CLO 4	Determine the power consumed by fluorescent lamp.	PO1, PO5	3
AEEB07.5	CLO 5	Apply Ohm's law and Kirchhoff's laws to determine equivalent resistance, current and voltage in any branch of a circuit.	PO1, PO2	3
AEEB07.6	CLO 6	Measure the choke coil parameters and small transformer characteristics.	PO1,PO3, PO5	3
AEEB07.7	CLO 7	Calculate and verify the impedance in series RL , RC and RLC circuit.	PO1, PO5	3
AEEB07.8	CLO 8	Develop an circuit to generate current value with low voltage.	PO1, PO3,PO5	2
AEEB07.9	CLO 9	Calculate electrical quantities associated with series RLC circuit.	PO1,PO5	2
AEEB07.10	CLO 10	Measure the electrical energy using single phase energy meter.	PO1, PO5	2
AEEB07.11	CLO 11	Identify The Characteristics of Alternating Quantities With Its Instantaneous, Average And Root Mean Square Values.	PO1, PO2, PO5	2
AEEB07.12	CLO 12	Determine the resonant frequency in series RLC circuits.	PO1, PO2, PO3, PO5	2
AEEB07.13	CLO 13	Examine The Resonant Phenomenon In Parallel RLC Circuits.	PO1, PO2, PO3, PO5	2
AEEB07.14	CLO 14	Estimate electrical earthing resistance and study its importance.	PO1, PO5	2

XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	2				3								2		
CLO 2	2		3		3								2		
CLO 3	2		3		3								2		
CLO 4	3				3								2		

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 5	3	3											2		
CLO 6	2		3		3								2		
CLO 7	3				3								2		
CLO 8	1		3		3								2		
CLO 9	2				3								2		
CLO 10	2				3								2		
CLO 11	1	2											2		
CLO 12	2	2	3		3								2		
CLO 13	2	2	3		3								2		
CLO 14	1				3								2		
CLO15	3	3	2		3				2	2	2		2		

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XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2 PO 3, PO 5, PSO2	SEE Exams	PO 1, PO 2 PO 3, PO 5 PSO2	Assignments	PO 1	Seminars	PO 2
Laboratory Practices	PO 1, PO 2 PO 3, PO 5	Student Viva	PO 1, PO 2 PO 3, PO 5	Mini Project	PO 2	Certification	-

XIV. ASSESSMENT METHODOLOGIES - INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XV. SYLLABUS:

LIST OF EXERCISES	
Week. 1	STUDY OF ELECTRICAL AND ELECTRONIC COMPONENTS AND THEIR SPECIFICATIONS
To identify the electrical and electronic components and selection of these components based on their specifications.	
Week. 2	TYPES OF ELECTRICAL WIRING AND RESIDENTIAL HOUSE WIRING

Study the staircase wiring, fluorescent lamp wiring and corridor wiring; To implement residential house wiring using switches, fuse, indicator and lamp.	
Week. 3	SOLDERING PRACTICE
To practice soldering and de-soldering for the electronic circuit by assembling and disassembling the resistors and capacitor in the given Printed Circuit Board (PCB).	
Week. 4	MEASUREMENT OF POWER CONSUMED BY A FLUORESCENT LAMP
To obtain power consumed and power factor of a fluorescent lamp, operated at different voltages.	
Week. 5	OHM'S LAW, KCL AND KVL
Verification of Ohm's law, KCL and KVL.	
Week. 6	DESIGN OF CHOKE AND SMALL TRANSFORMER
Study the design concepts and assembly of prototype choke and small transformer.	
Week. 7	DETERMINATION OF CIRCUIT IMPEDANCE
Calculation and verification of impedance and current of RL, RC and RLC series circuits.	
Week. 8	STUDY OF CONSTANT CURRENT SOURCE
To develop a circuit which provides substantially constant current using a low voltage input source.	
Week. 9	MEASUREMENT OF ELECTRICAL PARAMETERS
To measure the electrical quantities like voltage, current, power and power factor in RLC series circuit.	
Week. 10	MEASUREMENT OF ELECTRICAL ENERGY
To measure the electrical energy using single phase and three phase energy meters	
Week. 11	CHARACTERISTICS OF PERIODIC WAVEFORMS
Calculation of average value, RMS value, form factor, peak factor of sinusoidal and square waveform.	
Week. 12	RESONANCE PHENOMENA IN SERIES CIRCUIT
Demonstrating resonance phenomena in series RLC circuits and measurements of resonance characteristics using hardware and digital simulation.	
Week. 13	RESONANCE PHENOMENA IN PARALLEL CIRCUIT
Demonstrating resonance phenomena in parallel RLC circuits and measurements of resonance characteristics using hardware and digital simulation.	
Week. 14	MEASUREMENT OF EARTH RESISTANCE AND EARTH POTENTIAL
Study of earthing and determination of earth resistance and earth potential.	

TEXT BOOKS:

1	A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6 th Edition, 2006.
2	William Hayt, Jack E Kemmerly S.M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7 th Edition, 2010.
3	K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1 st Edition, 2013.

REFERENCES:

1	John Bird, "Electrical Circuit Theory and technology", Newnes, 2 nd Edition, 2003.
2	C. L. Wadhwa, "Electrical Circuit Analysis including Passive Network Synthesis", New Age International, 2nd Edition, 2009.
3	David A. Bell, "Electric circuits", Oxford University Press, 7th Edition, 2009.

XVI. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Week No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Study Of Electrical And Electronic Components and Their Specifications.	CLO 1	T2:1.2 R1:1.4
2	Types Of Electrical Wiring And Residential House Wiring.	CLO 2	T1:1.5 R1:2.4
3	Soldering Practice.	CLO 3	T1:2.5 R1:2.5
4	Measurement Of Power Consumed By a Fluorescent Lamp.	CLO 4	T1:2.5 R1:2.6
5	Ohm's Law, KCL and KVL.	CLO 5	T2:1.5
6	Design Of Choke and Small Transformer.	CLO 6	T1:6.3 R1:5.3
7	Determination Of Circuit Impedance.	CLO 7	T2:4.2 R1:6.3
8	Study Of Constant Current Source.	CLO 8	T1:8.5 R1:6.8
9	Measurement Of Electrical Parameters.	CLO 9	T1:12.2 R1:13.1
10	Measurement Of Electrical Energy.	CLO 10	T2:9.3 R1:13.2
11	Characteristics Of Periodic Waveforms.	CLO 11	T2:9.5 R1:13.7
12	Resonance Phenomenon In Series Circuit	CLO 12	T1:11.2 R1:10.2
13	Resonance Phenomenon In Parallel Circuit	CLO 13	T3:10.13 R1:10.2
14	Measurement Of Earth Resistance And Earth Potential.	CLO 14	T3:10.14 R1:10.4

XVII. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	Description	Proposed Actions	Relevance With POS	Relevance With PSOS
1	Analysis of electrical circuits using MATLAB	Seminars and Laboratory Practice	PO2	---
2	Design of electrical circuit using graph theory in PC	Seminars and Laboratory Practice	PO3	PSO1

Prepared by:

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