

COURSE DESCRIPTION			
Program	Biomedical Engineering, Electronics and Communication, Electronics Engineering, Electronics Engineering (Embedded Systems), Electronics and Computer Engineering, Integrated Circuit Design & Fabrication, Instrumentation Engineering, Micro Electronics		
Course Title	Elements of Electrical & Electronics Engineering		
Course Code	2041	Semester	II
Type of Course	Theory	Contact Hours	60
Teaching Scheme (L: T:P:R)	4:0:0:0	Credits	4
CIE Marks	40	ESE Marks	60

Introduction

This course provides a foundational understanding of electrical and electronics engineering concepts. It covers the basic principles of electricity, circuit laws, and domestic electrical installations. The course also introduces the fundamentals of electronic devices, digital electronics, and recent trends in electronics. It aims to develop essential technical knowledge required for further studies and practical applications in electrical and electronics engineering.

Course Objectives

1	To impart fundamental knowledge of electrical engineering principles and circuit laws for solving basic numerical and practical engineering problems.
2	To enable learners to identify and apply concepts of domestic electrical supply systems for analyzing electrical installations and estimating energy utilization.
3	To develop an understanding of static electricity, electrostatic discharge (ESD), ESD protection techniques, and the necessity of voltage regulation in electronic circuits.
4	To introduce the fundamentals of digital electronics, including number systems, number conversions, binary arithmetic, and basic logic gates for basic digital circuit analysis.

Course Pre-requisite

Topic	Course code	Course Title	Semester
Basic knowledge in Physics	2002A	Engineering Physics for Applied Electrical Technology and Computing	I/II
Fundamental of Mathematics	1002	Fundamentals of Engineering Mathematics	I
Basic knowledge in Electronics	1041	Elementary Concepts of Electronics	I

Course Outcome

CO	Course Outcome	Blooms Taxonomy Level
CO1	Demonstrate fundamental concepts of electrical engineering and circuit laws to solve numerical and practical engineering problems.	Apply
CO2	Identify and apply knowledge of domestic electrical supply system components to analyze installations and calculate energy utilisation.	Apply
CO3	Explain static electricity, electrostatic discharge, ESD precautions, and the importance of voltage regulation in electronic circuits	Understand
CO4	Apply fundamentals of digital electronics including number systems, number conversions, binary arithmetic, and basic logic gates	Apply

CO-PO mapping

COURSE ARTICULATION MATRIX											
Course Outcomes	PROGRAM OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	-
CO2	3	2	2	-	2	-	-	-	-	-	-
CO3	2	2	-	-	2	2	-	-	-	-	1
CO4	3	2	-	-	2	1	-	-	-	-	1
Total	11	9	2	-	8	3	-	-	-	-	2
Correlation Level	2.67	2.25	2	-	2	1.5	-	-	-	-	1

Legends: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

Teaching and Assessment Scheme

Teaching Scheme/Week				Self-learning (SS)/Week	Total Hours/Semester	Credits C	Examination Scheme						
							Theory			Practical			Total
L	T	P	S				CIE	ESE	Total	CIE	ESE	Total	
4	0	0	0	6	60	4	40	60	100	0	0	0	100

L: Lecture (One unit is of one-hour duration with one credit), T: Tutorial (One unit is of one-hour duration with one credit), P: Practical (One unit is of one-hour duration with 0.5 credit), S: Project (One unit is of one-hour duration with 0.5 credit) SS: Self-Learning, CIE: Continuous Internal Evaluation, ESE: End Semester Examination

Syllabus - Major Topics

Module	Title	Major Topics	Instructional Hours	
			L	T
Module I	Fundamental Laws in Electrical Engineering	Introduction - Definition of Current , Voltage and Resistance - Concept of AC and DC - Ohm's Law - Law of resistance, Kirchhoff's Laws - Voltage Division and Current Division Rules - Faraday's laws of electromagnetic induction - Generation of AC Voltage - Representation of Sinusoidal waveform	15	0
Module II	Domestic electrical supply system and Energy Utilization	Basic terms in electrical circuits - Structure of a domestic electrical supply system - Protection Devices - Earthing - Electrical Safety and Electrical shock-Wiring in residential buildings - Power factor and types of powers - Electrical Energy	15	0
Module III	Static Electricity, ESD, and Voltage Regulation in Electronic Circuits	Static Electricity-Electrostatic Discharge (ESD)-ESD Precautions-Need for Voltage Regulation in Electronic Circuits-Voltage regulation	15	0
Module IV	Digital Electronics Fundamentals	Introduction to Digital Electronics- Number Systems- Conversion of Numbers- Binary Arithmetics -Logic gates	15	0

Detailed Syllabus

Subtopic	Student Learning Outcome	Mode of delivery (L/T)	Mapped CO	Taxonomy Level	Instructional Hours
Module I					
Introduction	Describe the key milestones in the discovery of electricity.	L	CO1	Remember	1
Definition of Current, Voltage and Resistance	Define electric current, voltage, and resistance using appropriate terminology, SI Units and Equations.	L	CO1	Remember	1
Concept of AC and DC	Explain the concept of alternating current and direct current, identify their waveform representations, and list common sources and applications.	L	CO1	Understand	1
Ohm's Law	Apply Ohm's Law to calculate voltage, current, or resistance in simple circuits.	L	CO1	Apply	1.5
Law of Resistance	State Law of resistance Describe how resistance varies with length, cross-sectional area, and material of a conductor.	L	CO1	Apply	0.5
Kirchhoff's Laws	State Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). Solve simple numerical problems using KCL and KVL to determine unknown currents and voltages in Resistive networks.	L	CO1	Apply	3
Voltage Division and Current Division Rules	State and apply the voltage division rule to calculate voltage drops across resistors in series circuits. State and apply the current division rule to calculate branch currents in parallel circuits.	L	CO1	Apply	3
Faraday's laws of electromagnetic induction	State the two laws of electromagnetic induction proposed by Faraday	L	CO1	Understand	1
Generation of ac voltage.	Explain the principle involved in the generation of AC voltage and significance of Fleming's Right-Hand Rule and Lenz's Law.	L	CO1	Understand	2

Representation of Sinusoidal Waveform	Represent a sinusoidal waveform in appropriate graphical and mathematical forms. Define Amplitude, Frequency, Time period, Angular velocity, Instantaneous value, Maximum value, RMS Value of a sinusoidal waveform.	L	CO1	Understand	1
Module II					
Basic terms in electrical circuits	Define and explain basic electrical terms such as Circuit, Load, Phase, Neutral and Earth using appropriate electrical terminology. Explain the basic concept of single-phase and three-phase power supply.	L	CO2	Understand	2
Structure of a domestic electrical supply system	Describe the structure and the main parts of a domestic electrical supply system such as Service Connection, Energy meter, Main switch.	L	CO2	Understand	2
Protection Devices	Identify and describe the functionality of Fuse (rewirable and cartridge), Miniature Circuit Breaker, Earth leakage circuit breaker and Neutral link.	L	CO2	Remember	3
Earthing	Explain the need for earthing. Describe the two types of earthing (plate, pipe). Describe the earthing materials: earth wire and earth electrode	L	CO2	Understand	1
Electrical Safety and Electrical shock	Explain the importance of electrical safety in workplaces and daily life. Explain the causes, effects and prevention of electrical shock.	L	CO2	Understand	1
Wiring in residential buildings	Describe different types of wiring systems such as Cleat wiring, Batten wiring, Casing and capping wiring, Conduit wiring and its types (open and concealed). List various wiring materials.	L	CO2	Remember	2
Power factor and Types of powers	Define power factor, Active Power, Reactive Power, Apparent power. solve simple numerical problems related to power factor.	L	CO2	Apply	2
Electrical Energy	Define Electrical Energy with its basic unit, and commercial unit. Calculate electrical energy consumption and estimate monthly electricity bills.	L	CO2	Apply	2
Module III					
Static Electricity	Understand the concept and basic causes of static electricity	L	CO3	Understand	2
Electrostatic Discharge (ESD)	Explain the concept of electrostatic discharge and its impact on electronic components	L	CO3	Understand	1
ESD Precautions	Explain ESD precautions to prevent damage to electronic components	L	CO3	Understand	2
Need for Voltage Regulation in Electronic Circuits	Explain why electronic circuits require regulated voltage and stable power.	L	CO3	Understand	2
Voltage regulation	Describe the concept of load and line regulation	L	CO3	Understand	
Voltage regulation	Explain the working principle of a Zener diode as a voltage regulator.	L	CO3	Understand	2
Voltage regulation	Types of voltage regulator ICs (Fixed and variable regulator ICs) Fixed voltage regulator ICs: Identify the 78XX and 79XX ICs and its output voltage from its name. Explain the basic connection circuit of 78XX and 79XX voltage regulators. Explain the basic connection circuit of LM317 variable voltage regulators.	L	CO3	Understand	5
Module IV					
Introduction to Digital Electronics	Describe the basic concept, advantages and applications of digital electronics, compare analog and digital system		CO4	Understand	2
Number Systems	Recognize various number systems-Decimal, Binary, and Hexadecimal.		CO4	Understand	2

Conversion of Numbers	Apply conversion methods to transform numbers from one system to another- binary to decimal, decimal to binary, Hex to decimal, decimal to Hex, binary to hex, Hex to binary		CO4	Understand	4
Binary Arithmetic	Perform Binary arithmetic- 1s compliment, 2s compliment, Binary addition and binary subtraction		CO4	Understand	3
Logic gates	Draw the symbol, write the Truth table and Logic Equation of different logic gates- NOT, AND, OR, NAND, NOR, ExOR, and ExNOR. List the applications of logic gates		CO4	Understand	4

Suggested Student Activities for Self-Learning

Week	Self-Learning description	Hours
Module I		
1	Prepare a list of electricity generation methods used in India. Create a chart of generating stations with generating power.	6
2	Study the difference between renewable and non-renewable energy sources.	6
3	Observe the household appliances used in your home. Prepare a list indicating whether each appliance operates on AC or DC, and also identify its power rating.	6
4	Prepare a document on major Stakeholders in Kerala's electricity sector	6
Module II		
5	Identify the type of wiring system used in your home and the classroom. Write two reasons why this wiring method may have been selected.	6
6	Walk around your home and list the electrical safety measures used. Write how each measure helps in preventing accidents.	6
7	Prepare a list of major electrical equipment used in your home. Identify their power ratings and estimate the monthly electricity bill based on their usage. Compare it with the actual electricity bill obtained from the electricity board.	6
Module III		
8	Prepare a comparison chart between ordinary (Transformer type) DC power supply with SMPS	6
9	Download the data sheets of 78XX series ICs . Prepare a chart showing its characteristics	6
10	Study the internal diagram of LM317 and list out the typical applications of this IC	6
11	Study the troubleshooting of ordinary power supply using a video tutorial. List the troubleshooting steps	6
Module IV		
12	Download the data sheets of some ICs used as two input basic logic gates. List the characteristics.	6
13	Explore the major laws in the field of digital electronics	6
14	Prepare a list of digital devices that are used in your day to day life.	6
15	Prepare a document on the historical milestones in the field of Digital electronics	6
Total Self-Learning hours		90

Learning Resources

TEXT BOOK			
Sl. No.	Title	Author	Publication
1	Textbook of Electrical Technology: Part 1 - Basic Electrical Engineering in S. I. Units.	B. L. Thereja and A. K. Thereja	S. Chand Publication
2	Electronic Devices and Circuits	J B Gupta	Katson Books

REFERENCE			
Sl. No.	Title	Author	Publication
1	Basic Electronics and Linear Circuits	N.N. Bhargava,D.C. Kulshreshtha S.C. Gupta	Tata McGraw Hill Education
2	Fundamentals of Digital Circuits.	A. Anand Kumar	Prentice Hall India Pvt. Ltd.

WEB RESOURCES

Sl. No.	URL	Modules Covered
1	NPTEL - Basic Electrical Technology https://nptel.ac.in/courses/108108076	I & II
2	NPTEL - Fundamentals of Electrical Engineering https://nptel.ac.in/courses/108105112	I & II
3	NPTEL-Basic Electronic Course: https://nptel.ac.in/courses/122106025	III
4	NPTEL-Digital Electronic Circuits https://nptel.ac.in/courses/108105132	IV

Assessment Methodology - Theory

Mode	Attendance	CA1	CA2	CA3	CA4	CA5	CA6	ESE
		Self-learning activities (Module 1)	Self-learning activities (Module 2)	Self-learning activities (Module 3)	Self-learning activities (Module 4)	Series Exam (2 modules)	Series Exam (2 modules)	Written Exam (theory)
Duration						2 hours	2 hours	2.5 hours
Exam mark		15	15	15	15	50	50	60
Converted to						20	20	
Marks	5	15				20		60
Total	40							60
Tentative schedule	End of semester	By 4th week	By 7th week	By 11th week	By 14th week	8th week	15th week	End of semester

Series Examination Pattern- Theory

Time	Module	Part A	Marks	Part B	Marks	Part C (With choice)	Marks	Total
2 hours	Any one module	2	1	3	3	2	7	25
	Any one module	2	1	3	3	2	7	25
	Number	4		6		4		50

End Semester Examination Pattern of Question Paper - Theory

Duration	Module	TYPE OF QUESTIONS						
		Part A (2 Questions from each module)		Part B 2 out of 3 questions from each module)		Part C (1 set questions with choice from each module)		Total Marks
		No. of Questions	Marks (1 mark each)	No. of Questions	Marks (3 marks each)	No. of Questions	Marks (7 marks each)	
2.5 hours	1	2	2	3	6	1 set	7	15
	2	2	2	3	6	1 set	7	15
	3	2	2	3	6	1 set	7	15
	4	2	2	3	6	1 set	7	15
		8	8	12	24	4 sets	28	60