

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Analog & Digital Electronics
Course Code:	1ET1090303
Pre-requisite Course:	Fundamental Knowledge of Semiconductor physics and Basic Electronics are required

Course Objectives:

1. The course has been designed to introduce fundamental principles of analog and digital electronics.
2. The students completing this course will understand basic analog and digital electronics, including semiconductor properties, operational amplifiers, combinational and sequential logic and analog-to-digital digital-to-analog conversion techniques.
3. students will gain experience in with the design of analog amplifiers, power supplies and logic devices.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	-	2	5	28	70	12	30	12	30	08	20	150

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Op-amp basics: Introduction, Block diagram representation of a typical op-amp, ICC circuits, types, designations, packages, pin configurations and power supplies. Concept of ideal op –amp including its ideal voltage transfer curve, equivalent circuit, open loop op - amp configurations of differential, inverting and non-inverting amplifiers, Op amp parameters – offset voltages and currents, bias current, PSRR, CMRR, Slew Rate.	08	16
2	Feedback Amplifiers: Concept of positive feedback and negative feedback in op-amp, Op-amp feedback amplifier analysis, differential amplifier with one and two amps.	06	12
3	Op-amp and Nonlinear ICs applications: Op-amp as Summing, scaling and averaging amplifiers, Instrumentation Amplifier: typical block diagram of an Instrumentation Amplifier, Instrumentation amplifier using transducer bridge, op-amp as an integrator, op-amp as a differentiator, Functional diagram of 555 Timer IC including its mono-stable (one shot) mode and astable (free running) mode, block diagram of PLL system and its applications, 78XX and 79XX	10	20

	series three terminal voltage regulator ICs, LM317 Adjustable Voltage Regulator IC.		
4	Number System and Codes: Decimal, Binary, octal, and hexa-decimal number systems and their arithmetic. Number based conversion, its Arithmetic and Complements, Binary code, excess -3 code, gray code, error detection and correction codes, Conversion and its Arithmetic.	08	15
5	Logic Families and Boolean Algebra: Positive logic and Negative Logic, AND, OR, NOT, NAND, NOR, X-OR GATE, electrical characteristics, introduction, Logic Operators, Postulates and theorems, properties, Converting Boolean expressions to Logic and Vice versa, NAND and NOR implementation, Product of Sums and Sum of Products, Karnaugh Map method – 2,3,4,5 variable K-maps, Don't-Care conditions.	08	15
6	Combinational Logic Circuits: Half and full Adder, Half and full Subtractor, Binary parallel adder, BCD Adder, Magnitude comparator (1 – bit, 2 – bit, 4 – bit only) – Encoders (Octal to Binary, Decimal to BCD) & Decoders (3 x 8, 4 x 16, BCD to Decimal), Multiplexers (2, 4, 16 input), De-multiplexer (1 x 4, 1 x 8), BCD to 7 Segment.	05	09
7	Flip-Flops & Sequential Circuits: Basic difference between Combinational logic and Sequential logic, Flip Flops like S-R, JK, D, Master Slave– Triggering of (Level and Edge triggered) flip-flops, Asynchronous and Synchronous Inputs –Excitation tables for flip flops; Counters, Registers, Shift Registers (SISO, SIPO, PISO, PIPO).	05	09
8	Digital to Analog and Analog to Digital Converters: Role of Memory in Computer Systems and their types, Analog to Digital (A/D) Converters, Digital to Analog (D/A) Converters, Converter applications.	02	04

Text Books:

1. Fundamentals of Digital Electronics by A. Anandkumar, PHI.
2. Digital Electronics Principal and Integrated Circuits by Anil K. Maini, WILEY-INDIA.
3. Digital Logic and Computer Design by M. Morris Mano, PHI.

Reference Books:

1. Digital Computer Electronics by Malvino & Brown, Tata McGraw Hil.
2. Ramakant A Gayakwad, Op- Amps and Linear Integrated Circuits, Prentice Hall of India.
3. U. A. Bakshi and A. P. Godse, Analog Electronics, Technical Publications.

List of Experiments:

1. Op-amp as an inverting amplifier.
2. Op-amp as non-inverting amplifier.
3. Op-amp circuit as an integrator.
4. Op-amp circuit as a differentiator.
5. 555 Timer IC – Astable mode operation.
6. 555 Timer IC – Monostable mode operation.
7. Verify the operation of IC 78XX and IC 79XX as a 12V voltage regulator.
8. Develop understanding of number systems and Boolean algebra.

9. Understand the functioning of logic gates, their implementation and verification of truth tables.
10. Develop the understanding of the working of different combinational logic circuits.
11. Understand and verify the working of various sequential logic circuits.
12. Understand simulation tools for digital logic circuits and simulation of digital logic circuits.
13. Understand logic analyzer for testing the logic circuits.
14. Understand and verify the working of Various Types of D/A and A/D converters.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Acquire the knowledge regarding concept of Boolean algebra and its different theorems, properties etc.	2 Understanding
CLO2	Understand different flip-flops and its applications.	2 Understanding
CLO3	Capable to understand sequential logic circuits and basic design of sequential circuits and counters.	3 Applying 1 Remembering
CLO4	Know working of D/A and A/D converters.	1 Remembering
CLO5	To test circuits with op-amps and other electronics components for different applications.	4 Analyze
CLO6	Acquire knowledge regarding various circuits using different ICs.	2 Understanding

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	M		M			L					M		L			
CLO2	H			L	H		M			L		L		L		H
CLO3				M	L				M					M		L
CLO4		L	H		M	M						M				L
CLO5	M				L					M					M	L
CLO6		H		H	L				M		M	M	L		H	L

H: High, M: Medium, L: Low