Subject Code: EE1L003	Subject Name: Analog and Digital Electronic Circuits	L-T-P-C: 3-1-0-4

Learning Outcome

- Explain the structure and principle of operation of diodes, BJTs, and MOSFETs. Analyze their characteristics and apply them in rectification, amplification, and switching applications.
- Integrate analog and digital electronics concepts to analyze and design mixed-signal circuits. Evaluate amplifier parameters such as voltage/current gain, input/output resistance, linearity, bandwidth, and power efficiency.
- Design and analyze RC and LC low-pass, high-pass, band-pass, and band-stop filters of single and higher order.
- Apply binary arithmetic, signed numbers, complements, and weighted codes in digital computations. Develop truth tables and realize switching functions using logic gates.
- Design combinational circuits such as encoders, decoders, multiplexers, comparators, adders, and ALUs. Construct state diagrams, transition tables, and excitation tables for sequential circuits.
- Demonstrate proficiency in using theoretical analysis and practical IC implementation for real-world circuit design.
- Apply ADE knowledge in higher-level courses such as VLSI, Communication Systems, Embedded Systems, and Power Electronics.

Syllabus

Semiconductor devices: Diode, BJT, MOSFET, their structures and principle of operations

Operational Amplifiers: Functionality, specifications (voltage gain, current gain, input resistance, output resistance, dynamic range, bandwidth, linearity, power efficiency etc.), effect of cascading, various applications and typical circuits;

Filters: Low pass, high pass, band pass and band stop filters, single and higher order passive filter topologies (RC and LC);

Feedback: Basic concept of negative and positive feedback, application of negative feedback in amplifiers, effect on gain, bandwidth, input resistance, output resistance and desensitivity to parameter variations;

Oscillators: Barkhausen criterion, sinusoidal and non-sinusoidal oscillators, applications and typical circuits;

Operational amplifier: Differential mode of operation, common mode rejection, typical op-amp specifications, inverting amplifier, non-inverting amplifier, integrator, differentiator, summing amplifier etc.

Number Systems: Decimal, binary, octal, hexadecimal number system and conversion , binary weighted codes, signed numbers, 1s and 2s complement codes, Binary arithmetic

Boolean Algebra: Binary logic functions , Boolean laws, truth tables, associative and distributive properties, DeMorgans theorems, realization of switching functions using logic gates

Combinational Logic: Switching equations, canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions, Quine-McCluskey minimization technique, mixed logic combinational circuits, multiple output functions.

Analysis & design of Combinational Logic: Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers as function generators, binary adder, substractor, BCD adder, Binary comparator, arithmetic logic unit

Sequential Logic: Sequential circuits, flip-flops, clocked and edge triggered flipflops, timing specifications, asynchronous and synchronous counters, counter design with state equations, Registers ,

serial in serial out shift registers, tristate registor, timing considerations.

Sequential Circuits: State diagrams and tables, transition table, excitation table and equations. Examples using flip-flops. Analysis of simple synchronous sequential circuits, construction of state diagram, counter design.

Practical analog and Digital ICs, LM741, LM555, LM311 etc., Data sheet ,

Text books:

1. "Integrated Electronics: Analog and Digital Circuits and Systems" – Jacob Millman & Christos Halkias

2. A. Malvino and D. J Bates "Electronic Principles," Tata McGrawHill Education, 2006

3. M. Morris Mano, "Digital Logic and Computer Design," 1st Ed., Prentice Hall, 1979, 15th Reprint 2013.

4. S. Lee, "Digital Circuits and Logic Design," 1st Ed., Prentice Hall India, 2008.

Reference Books

1. Malvino and Brown, "Digital Computer Electronics," Tata McGraw - Hill Education, 2001

2. Samuel C. Lee, "Digital Circuits and Logic Design," PHI Learning, 2009.