Digital Circuits and Systems

1.1 Course Number: ECE221

1.2 Contact Hours: 3-1-0 Credits: 11

1.3 Semester-offered: 3rd Year-Odd

1.4 Prerequisite: Solid State Electronic Devices; Fundamentals of Electronics Engineering

1.5 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Abhishek Kumar Singh, Dr. Sajal Agarwal, Dr. Vijay Kumar Singh, Dr. Ankur Pandey.

2. Objective: To understand number representation and conversion between different representation in digital electronic circuits. To analyze logic processes and implement logical operations using combinational logic circuits. To understand characteristics of memory and their classification. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introduction	Binary codes, error-detecting and error-correcting codes, Minimization of Boolean function: Min-terms and maxterms, sum-of-products and product-of-sum representations, Karnaugh map, don't-care conditions, prime implicants, Quine–McCluskey technique, NAND/NOR circuits, analysis of circuit.	8
2	Combinational Circuit	Arithmetic circuits: adder, subtractor, multiplier; code converters, amplitude comparator, multiplexer, encoder, de-multiplexer, decoder, complex combinational circuits, PLA, PAL, RAM – Static and Dynamic, ROM, PROM, EPROM, EEPROM.	10
3	Sequential Circuit	Latches and flip-flops, flip flop conversion, design of synchronous and asynchronous counters, shift register counter, shift register, synchronous and asynchronous sequential circuits, Mealy-type and Moore-type sequential circuits, ASM, finite state machine of synchronous sequential circuits, state reduction, Hazards.	11
4	Digital Logic families	Classification of logic families, Characteristics of Digital ICs: Speed of operations, power dissipation, figure of merit, Fan out, Fan in, Noise margin, Temperature, current and voltage parameter, limitations and applications, Digital logic families: TTL, ECL, and CMOS.	06

5	Data Converters	Sample and Hold, ADC and DAC circuits.	05
		Total	**40**

4. Readings

4.1 Textbook:

1. Digital Logic and Computer Design, M. Morris Mano, PHI
2. Pulse, Digital and switching Waveforms, Jacob Millman and Herbert Taub, TMH
3. Digital Design: Principles and Practices, J. F. Wakerly, Pearson
4. Digital Design by Roth

4.2 Reference Book:

1. Digital Circuits and Logic Design, S. C. Lee, PHI

5. **Outcome of the Course:** After successful completion of the course student will be able to develop a digital logic and apply it to solve real life problems. Analyze, design and implement combinational logic circuits. Classify different semiconductor memories. Analyze, design and implement sequential logic circuits.