|  |  |  |
| --- | --- | --- |
| **EC4501** | **Digital Electronics** | **L-T-P: 3-1-0; Total 42 Lectures** |

***Prerequisites****:* Elements of Electronics Engineering

***Objectives****:* This course is intended to provide the students with a good knowledge of all varieties of Digital Circuits (both combinational & sequential circuits) & timing circuits, IC Chips, their design & applications along with Analog to Digital & Digital to Analog conversion of Signals. The students are also exposed to different types of RAMs & ROMs with their in depth knowledge.

***Course Outcome****:* Upon successful completion of this course, students should be able to:

* Design & implement digital circuits using logic gates IC chips.
* Design & implement digital circuits using multiplexer & demultiplexer IC chips.
* Design & implement registers & counters using different flip-flop IC chips.
* Convert Analog to Digital & Digital to Analog Signals by different methods.

Topics Covered

**Unit 1: Minimization Technique and Logic Gates (5 Lectures)**

Number Systems, Boolean postulates and laws, De- Morgan’s Theorem, Principle of Duality Boolean expression, Minimization of Boolean expressions, Minterm, Maxterm, SOP, POS, Karnaugh map Minimization, Don’t care conditions,Quine Mc Cluskey method of min-imization. Binary Codes: Gray Code, BCD Code. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive OR and Exclusive NOR. Implementations of Logic Functions using gates, NAND–NOR implementations, Multi level gate implementations.

**Unit 2: Analysis and Synthesis of Combinatorial Logic Circuits (6 Lectures)**

Adders and Subtractors, Carry look-ahead adders; Multiplexers; De-multiplexers; Encoders; Priority Encoder; Decoders; Code Converters; Magnitude Comparators; Parity generators and Checkers

**Unit 3: Sequential Circuits (9 Lectures)**

Sequential Circuit Blocks-Latches, Flip Flops- Race around condition, Master-Slave and edge triggered, SR, JK, D & T Flip Flop; Shift Registers; Counters- Synchronous and synchronous, design of ripple counter. Johnson counter, ring counter, sequence generator, Finite state machine (Mealy and Moore Type)

**Unit 4: Memories (6 Lectures)**

Classification of memories, ROM: ROM organization, PROM, EPROM, EEPROM, EAPROM. RAM: RAM organization, Write operation, Read operation, Memory cycle Timing wave forms, Memory decoding, memory expansion. Static RAM Cell: MOSFET RAM cell, Dynamic RAM cell, Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of combinational logic circuits using ROM, PLA and PAL

**Unit 5: Synchronous and Asynchronous Sequential Circuit Analysis: (6 Lectures)**

Synchronous Sequential Circuits: General Model, Classification, Design, Use of Algorithmic State Machine, Analysis of Synchronous Sequential Circuits. Asynchronous Sequential Circuits: General Model, Races and Cycles

**Unit 6: Data Converters (6 Lectures)**

Use of basic building block in designing larger systems such as Digital to Analog Converters (DAC ) -Weighted resistor and R-2R,Analog to Digital (ADC)-Comparator, Counter and Succession

**Unit 7: Integrated Circuit Logic Families (4 Lectures)**

RTL, DTL, TTL, CMOS, IIL/ I2L (Integrated Injection Logic) & Emitter Coupled Logic

**Text Books**:

1. Digital Systems- Principles & Applications by Tocci, Widmar and Jain, Pearsons

2. Digital Fundamentals by Floyd and Jain, Pearson

**References Books**:

1. Fundamentals of VHDL Design by Stephen Brown and Zovenkeo Vrasesic, TMH

2. Introduction to Logic Design with CDROM by Alan B. Marcovity, TMH

3. Fundamentals of Digital Logic with Verilog Design by Stephen Brown, TMH

4. Modern Digital Electronics by R. P. Jain, TMH.

5. Problems and solution on Digital circuits (Vol-I & Vol-II) By D. Roychowdhary, Platinum

 Publishers

6. Digital Circuits (Vol-I & vol-II) By D. Roychowdhary, Platinum Publishers