2/4 B.Tech - FOURTH SEMESTER

EC4T3 **Switching Theory and Logic Design** **Credits: 4**

Lecture : 4 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives:

- To study the basic philosophy underlying the various number systems, negative number representation, binary arithmetic, binary codes and error detecting and correcting binary codes.
- To study the theory of Boolean algebra and to study representation of switching functions using Boolean expressions and their minimization techniques.
- To study the combinational logic design of various logic and switching devices and their realization.
- To study the sequential logic circuits design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations.
- To study some of the programmable logic devices and their use in realization of switching functions.

Learning Outcomes:

- Students will be aware of theory of Boolean Algebra & the underlying features of various number systems.
- Students will be able to use the concepts of Boolean Algebra for the analysis & design of various combinational & sequential logic circuits.
- Students will be able to design various logic gates starting from simple ordinary gates to complex programmable logic devices & arrays.

UNIT- I

Number Systems & Codes: Philosophy of number systems – complement representation of negative numbers-binary arithmetic-binary codes-error detecting & error correcting codes –hamming codes.

UNIT- II

Boolean Algebra and Switching Functions: Fundamental postulates of Boolean Algebra - Basic theorems and properties - switching functions–Canonical and Standard forms-Algebraic simplification digital logic gates, properties of logic gates –universal gates-Multilevel NAND/NOR realizations.

UNIT- III

Minimisation of switching functions: Minimisation of switching functions using K-Map up to 6-variables, Tabular Method, Prime –Implicant chart, simplification rules.

UNIT- IV

Combinational Logic Design

Design using conventional logic gates, Encoder, Decoder, Multiplexer, De-Multiplexer, Modular design using IC chips, MUX Realization of switching functions Parity bit generator, Code-converters.

UNIT- V

Programmable Logic Devices: PROM, PLA, PAL, realization of switching functions using PROM,PLA and PAL; comparison of PROM, PLA, and PAL, Programming tables of PROM,PLA and PAL.

UNIT- VI

Sequential Circuits - I: Classification of sequential circuits (synchronous and asynchronous): basic flip-flops, truth tables and excitation tables (nand RS latch, nor RS latch, RS flip-flop. JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals).Conversion of flip-flop to flip-flop. Design of ripple counters, design of synchronous counters, Johnson counters, ring counters. Design of registers, Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT- VII

Sequential Circuits - II: Finite state machine, capabilities and limitations, analysis of clocked sequential circuits, design procedures, reduction of state tables and state assignment. Realization of circuits using various flip-flops. Mealy to Moore conversion and vice-versa.

UNIT- VIII

Asynchronous sequential logic: Analysis and Design – Race conditions and Cycles – Hazards in combinational circuits – Hazard free realization.

Learning Resources

Text Books:

1. Digital Design, Morris Mano, PHI, 4th Edition, 2008.
2. Switching & Finite Automata theory, Zvi Kohavi, TMH, 3rd Edition, 2011.

References:

1. An Engineering Approach To Digital Design, Fletcher, PHI, 2009.
2. Digital Logic Application and Design, John M. Yarbrough, Thomson, 2006.
3. Fundamentals of Logic Design, Charles H. Roth, Thomson Publications, 5th Edition, 2009.