2 / 4 B.Tech. THIRD SEMESTER

EM3T6 SWITCHING THEORY AND LOGIC DESIGN Credits: 3

Lecture: 3 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 system.
- 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.

U nit 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,Michael D. Ciletti,Pearson, 4th Edition, 2008.
2.Switching & Finite Automata theory – ZviKohavi, Niraj K. Jha, Cambridge University Press, 3rd Edition, 2011.

REFERENCE BOOKS :

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