CourseNo:EE2001

CourseName: Digital Systems & Lab

Credit Distribution: C: L: T: P: E: O: TH:

Course Type:

Description: At the end of this course, the student should be able to:1. understand number systems2. implement and analyse digital systems based on combinational and sequential logic3. understand and design state machines4. design systems using RTL

CourseContent:1. Introduction to Digital Systems and Boolean AlgebraBinary, octal and hexadecimal number systems; Truth table; Basic logic operation and logic gates. Basic postulates and fundamental theorems of Boolean algebra; Canonical (SOP and POS) forms2. Logic Minimization and ImplementationMinterm and Maxterm expansions; - Karnaugh-maps, essential prime implicants, incompletely specified functions, NAND and NOR implementation, Quine-McCluskey method; Switch level representation and realization using transistors; Logic families â€“ TTL, CMOS3. Combinational Logic Multi level gate circuits, Decoders, encoders, multiplexers, demultiplexers and their applications; Parity circuits and comparators; Representation of signed numbers; Adders, Ripple carry. Introduction to HDL (VHDL /Verilog), HDL description of combinational circuits.4. Sequential LogicLatches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Setup and Hold parameters, timing analysis; Registers and counters; Shift register; Ripple counter, Synchronous counter design using D, T, and JK flip flops. HDL description of sequential circuits.5. State Machine Design State machine as a sequential controller; Moore and Mealy state machines; Derivation of state graph and tables; Sequence detector; state table reduction using Implication table; state assignment, logic realization; equivalent state machines, Designing state machine using ASM charts. state machine modeling based on HDL.6. Memory and Programmable Logic DevicesROM and RAM; Sequential PLDs and their applications; State- machine design with sequential PLDs; FPGAs7. Register transfer language: Notation, HDL features for RTL, Digital design at the RTL level, Simple design of a microcontroller using RTL.8. Advanced TopicsAsynchronous Sequential Machines, Static and Dynamic hazards; race free design; testing digital circuits.Syllabus: LaboratoryExperiments on design of combinational circuits including adders and magnitude comparators; realization using multiplexers and other approaches; identification of critical path Design of sequential circuits including flip-flops, counters and registers Digital to analog converter design and study of characteristicsExperiments on motor control using flip-flops and gates Introduction to hardware description languages and simulation of simple circuits

TextBooks:1. Morris. M. Mano, Michael D. Ciletti, Digital Design, Fourth Edition, Prentice-Hall India. 2008.2. Charles. H. Roth, Jr., Fundamentals of Logic Design, Fifth Edition, Thomson Brooks /Cole, 2005. 3. S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition, Pearson Education, 2004.

ReferenceBooks:1. S. Brown and Z. Vranesic, Fundamentals of digital logic with Verilog design, ThirdEdition, McGraw-Hill, 2013 2. Charles. H. Roth, Jr., Digital System Design using VHDL, Indian Edition, Thomson Brooks /Cole, 2006. 3. Mohammad A.Karim, Xinghao Chen, Digital Design, CRC press 2008.4. J.F. Wakerly, Digital Design: Principles and Practices, Fourth Edition, Prentice Hall, 2005

Prereqisites: