

213304
Digital Electronics & Logic Design

Credit Points		Teaching Hrs/Week	Practical Hrs/Week
5		4	2
Objective		<p>1. To learn and understand basic digital design techniques. 2. To learn and understand design and construction of combinational and sequential circuits.</p>	
Prerequisites		Basic Electronics Engineering	
Unit	Topic Name	Details	Hrs
1	Concepts of Boolean Algebra & Logic Gates	Introduction. Binary, Hexadecimal numbers, Octal numbers and number conversion. Signed Binary number representation. Signed Magnitude, 1's complement and 2's complement representation. Binary, Hexadecimal Arithmetic. 2's complement arithmetic. Arithmetic Operations: - Binary Addition, Subtraction, BCD Addition. Algebra for logic circuits : Logic variables; Logic function : NOT, AND, NOR, XOR, OR, XNOR, NAND. Codes : BCD, Excess-3, Gray code , Binary Code and their conversion Boolean algebra, DeMorgan's Rules, Basic theorems and properties of Boolean algebra	8L
2	Combinational Logic	Logic minimization Representation of truth-table, SOP form, POS form, Simplification of logical functions, Minimization of SOP and POS forms, Don't care conditions. Reduction techniques: K-Maps (only up to 4 variables) & Quine – McClusky technique Circuits: - Half- Adder, Full Adder, Half Subtract or, Full Sub tractor, BCD adder using and subtract using 7483, look ahead and carry, parity generator and checker using 74180, magnitude comparator using 7485. Multiplexers (MUX) : Working of MUX, Implementation of expression using MUX (IC74153, Demultiplexers 74151). Demultiplexers (DEMUX):- Implementation of expression using DEMUX, Encoder & Decoder. (IC 74138).	10L
3	Introduction to HDLs	Library, Entity, Architecture, Modeling styles, Data objects, Concurrent and sequential statements, Design examples, using VHDL for basic combinational and sequential circuits, Attributes (required for practical) (Test benches and FSM excluded).	6L
4	Sequential	Introduction: Sequential Circuits. Difference between	10L

	Circuits	combinational circuits and sequential circuits Flip-flop : SR, JK, D, T; Preset & Clear, Master and Slave Flip Flops their truth tables and excitation tables, Conversion from one type to another type of Flip Flop. Study of 7473,7474,7476 Application of Flip-flops. Registers : Buffer register; shift register;7495 Counters : Asynchronous counter. Synchronous counter, ring counters, BCD Counter, Johnson Counter, Modulus n counter(IC 7490, 74191), Pseudo Random Binary Sequence Generator,Sequence generator and detector.	
5	ASM & Programmable Logic Devices	Algorithmic State Machines, ASM charts, notations, design of simple controller, multiplexer controller method Examples. RTL Notation & Implementation. Programmable Logic Devices PLD: PLA- Input, Output Buffers, AND, OR, Invert/ Non-Invert Matrix. Design Example- Any 4 Variables SOP function using PLDs. Study of basic architecture of FPGA CPLD	6L
6	Logic Families	TTL: Standard TTL characteristics- Speed, power dissipation, fan-in, fan-out, current and voltage parameters, noise margin, operating temperature etc. Operation of TTL NAND gate. TTL Configurations- Active pull-up, Wired AND, totem pole, open collector. CMOS: CMOS Inverter, CMOS characteristics, CMOS configurations- Wired Logic, Open drain outputs. Interfacing: TTL to CMOS and CMOS to TTL	6L

Lab/ Term Work
<ol style="list-style-type: none"> 1. Simplification and implementation of a Boolean function using k-map technique 2. Code Conversion using logic gates 3. Design & implement 2 bit comparator 4. Design & implement BCD Adder using IC 7483 5. Design & implement combinational logic circuit using multiplexer & demultiplexer 6. Design & Implement of SR, JK Flip Flop using discrete gates & T,D Flip Flop using Master Slave JK Flip Flop.(IC 7476)

7. Design & Implement 4 bit bidirectional shift register using flip-flop
8. Design & implement pulse train generator using IC 7495
9. Design & implement 4 bit up-down ripple counter using flip-flop
10. Verification of mod-n counters using IC 7490 & IC 74191
11. Design & implement sequence generator / detector using MS JK flip-flop
12. Simulation of all Combinational & Sequential Circuits in VHDL.

Text Books	<ol style="list-style-type: none"> 1. M.M. Mano :” Digital design”, PHI. 2. R. P. Jain, “Modern Digital Electronics”, 3rd Edition, Tata McGraw-Hill. 3. Stephen Brown, Zvonko Vranesic “ Fundamentals of Digital Logic with VHDL Design” Mcgraw-Hill
Reference Books	<ol style="list-style-type: none"> 1. R J Tocci - Digital Systems - (PHI) 2. Gothman - Digital Electronics - (PHI) 3. Flyod “Digital Principles”, Pearson Education 4. Malvino, D.Leach “ Digital Principles and Applications”, 5th edition, Tata Mc-Graw Hill 5. J.Bhaskar “VHDL Primer” 3rd Edition, Pearson Edition
Related Websites	

Examination Scheme	Internal Assessment	40 marks
	Term Work	25 marks
	Final Theory Paper	60 marks