GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
Bachelor of Engineering
Subject Code: 3131704
Semester – III
Subject Name: Digital Electronics

Type of course: Professional Core Course

Prerequisite: NA

Rationale: Understanding of principle, operation and analysis of digital electronics

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	BINARY SYSTEM: Digital computer and digital systems, Binary Number, Number base conversion Octal and Hexadecimal Number, complements, Binary Codes, Binary Storage and register, Binary Logic, Integrated Circuit	3
2	BOOLEAN ALGEBRA AND LOGIC GATES: Basic Definition, Axiomatic Definition of Boolean Algebra, Basic Theorem and Properties of Boolean Algebra, Minterms And Maxterms, Logic Operations, Digital Logic Gates, IC digital Logic Families	5
3	SIMPLIFICATION OF BOOLEAN FUNCIONS: Different types, K Map method, Product of sum Simplification, NAND or NOR implementation, Don't Care condition, Tabulation method	5
4	COMBINATIONAL LOGIC: Introduction, Design Procedure, adder, subtractor, Code Conversion, Universal Gate	5
5	COMBINATIONAL LOGIC WITH MSI AND LSI: Introduction, Binary Parallel Adder, Decimal Adder, The look ahead carry Adder, Excess-3 Adder, Binary Multipliers, Parity bit Generators/checkers, Magnitude Comparator, Encoder, Decoder, Multiplexer, De-multiplexer, Hazards and hazards free realization .	9
6	SEQUENTIAL LOGIC: Introduction, Flip-Flops, Triggering of Flip-Flops, Analysis of	10

	Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables, Design Procedure, Design of Counters, Design with State Equations, The finite state model, Synthesis of synchronous sequential circuits, Serial Binary adder with Moore type FSM, The sequence Detector, Mealy type model, Moore type circuit.	
7	REGISTERS, COUNTERS AND THE MEMORY UNIT: Introduction, Registers, Shift Registers, Ripple Counters, Synchronous Counters, Timing Sequences, Memory Unit, RAM, ROM, EPROM, EEPROM, Flash Memory	**5**
8	REGISTERS TRANSFER LOGIC & MICRO OPERATION: Introduction, Inter-register Transfer, Arithmetic, logic and shift Micro- Operations, Conditional Control Statements, Fixed-Point Binary Data, overflow, Arithmetic Shifts, Decimal Data, Floating-Point Data, Instruction Codes, Design of Simple Computer.	**5**
9	LOGIC FAMILIES: Digital IC specification Terminology: Threshold voltage, Propagation Delay, Power dissipation, Fan-in, Fan-out, Voltage and current parameters, Noise margin, Operating Temperature, Speed power product. Transistor Transistor Logic: Two input TTL NAND gate, Totem pole output, Current sinking, Current sourcing, TTL loading and Fan-out. Open Collector gates: Wired AND operation, Tri state TTL, Buffer/Drivers.	**5**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
21	**21**	**14**	**7**	**7**	**7**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. M Morris Mano, "Digital Logic and Computer Design",Person, LPE, 4th ed., 2009

2. A. Anandkumar, "Fundamentals of Digital circuits", PHI, Second Edition.
3. Malvino& Leach, "Principle of Digital Electronics", MCGraw-Hill, 2nded, 1975
4. R.P.Jain, "Modern Digital Electronics", McGraw-Hill, 4th ed. 2010.
5. Boyce J. C., "Digital Logic: Operation and Analysis", Prentice Hall, 2nded., 1982

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Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.	30
CO-2	Identify, formulate and solve a problem based on combinational and sequential circuits	40
CO-3	Select the appropriate hardware and software tools for combinational and sequential circuit design.	30

List of Experiments:

1. Verification of logic gates using digital ICs and configuring NAND and NOR gates as universal logic gates.
2. Implementation of Boolean Logic Functions using logic gates and combinational circuits, measure digital logic gates specifications such as propagation delay, noise margin, Fan-in and Fan-out
3. Design and implementation of Binary Half adder, full adder, half subtractor, full subtractor, Parallel adder.
4. Design and implementation of code converters.
5. Design and implementation of Encoder and Decoder.
6. Design and implement of Magnitude comparator.
7. Design and implementation of multiplexer and de-multiplexer.
8. Design and Implement JK-flip-flop, RS-flip-flop, D – flip-flop and T-flip-flop using digital Ics.
9. Design and implement universal shift registers using digital IC.
10. Design and implement Asynchronous and synchronous Counters.

Major Equipment: Digital Storage Oscilloscope (DSO), CROs, Multi-meters, Function generator, Bread board trainer, Logic gate ICs

List of Open Source Software/learning website:

http://nptel.iitm.ac.in, http://vlab.co.in/