GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION AND CONTROL (17)

DIGITAL LOGIC CIRCUITS

SUBJECT CODE: 2131704

B.E. 3rd Semester

Type of Course: Program 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
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE End Semester Examination; PA- Progressive Assessment.

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	BINARY SYSTEM: Digital computer and digital systems, Binary Number, Number baseconversion Octal and Hexadecimal Number, complements, Binary Codes,Binary Storage and register, Binary Logic, Integrated Circuit	3	6
2.	BOOLEAN ALGEBRA AND LOGIC GATES: Basic Definition, Axiomatic Definition of Boolean Algebra, Basic Theorem and Properties of Boolean Algebra, Minterms And Maxterms, LogicOperations, Digital Logic Gates, IC digital Logic Families	5	10
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	10
4.	COMBINATIONAL LOGIC: Introduction, Design Procedure, adder, subtractor, Code Conversion, Universal Gate	5	10
5.	COMBINATIONAL LOGIC WITH MSI AND LSI: Introduction, Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Decoder, Multiplexer, ROM, Programmable Logic Array.	5	10
6.	SEQUENTIAL LOGIC: Introduction, Flip-Flops, Triggering of Flip-Flops, Analysis of ClockedSequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables, Design Procedure, Design of Counters, Design with State Equations	5	10
7.	REGISTERS TRANSFER LOGIC & MICRO OPERATION: Introduction, Inter-register Transfer, Arithmetic, logic and shift Micro- Operations, Conditional Control Statements, Fixed-Point	5	10

	Binary Data, overflow, Arithmetic Shifts, Decimal Data, Floating-Point Data, InstructionCodes, Design of Simple Computer, Gain-Bandwidth Product, Emitter Follower at High Frequencies.		
8.	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	12
9.	LOGIC FAMILIES:Diode Transistor Logic, High Threshold Logic, Transistor Transistor Logic, Resistor Transistor Logic, Direct Coupled Transistor Logic, Emitter Coupled Logic, Comparison of Logic families	5	10
10.	ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS: Digital to Analog Conversion, R-2R ladder type DAC, Weighted resistor type DAC, Switched current source type DAC, Switched capacitor type DAC, Analog to Digital Conversion, Counter type A/D Converter, , Flashtype A/D converter, Dual slope A/D converter, Successive approximation ADC.	5	12

Reference Books:

1. M Morris Mano, "Digital Logic and Computer Design",Person, LPE, 4th ed., 2009
2. Malvino& Leach, "Principle of Digital Electronics", MCGraw-Hill, 2nded, 1975
3. R.P.Jain, "Modern Digital Electronics", McGraw-Hill, 4th ed. 2010.
4. Boyce J. C., "Digital Logic: Operation and Analysis", Prentice Hall, 2nded., 1982
5. Ronald J. Toccii, "Digital Systems: Principles and Applications", Pearson LPE, 4th ed. 2009.

Course Outcomes:

After learning the course the students should be able to:

1. Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
2. Identify, formulate and solve a problem based on combinational and sequential circuits
3. Select the appropriate hardware and software tools for combinational and sequential circuit design.

List of Practical:

S. N.	**Name of Experiment**
1	Measurement IC's parameters like rise time, fall time, propagation delays, and current and voltage parameters.
2	To study the function and implementation of logic gates i.e. AND, OR, NOT, NOR, NAND, Ex-OR gates.
3	Design and implementation of arithmetic circuits.
4	Design and implementation of code converters.
5	Study and implementation of multiplexer and demultiplexer
6	Implement RS flip flop and JK flip flop by using logic gates and ICs.
7	To design 3 bit asynchronous ripple counter
8	To study 3 bit synchronous up- counter. Using J-K flip flop.
9	Study and implementation of encoders and decoders.
10	Study and implementation of shift registers.

Design based Problems (DP)/Open Ended Problem:

- Design interfacing circuit for ADC 0808 for given analog input voltage range.
- Convert given digital data to analog signal using DAC 0808
- Study, design and implementation and traffic light controller
- Study design and implementation of digital clock.

Major Equipments:
Digital Storage Oscilloscope (DSO), CROs, Multimeters, Function generator, Bread board trainer, Logic gate ICs

List of Open Source Software/learning website:http://nptel.iitm.ac.in, http://vlab.co.in/

Active learning Assignments (AL) : Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ part of chapters to groups of students so that the entire syllabus of Digital Logic Design is covered. The power-point slides should be put up on the web-site of the college/Institute, along with the name of the group, the name of faculty, Department and College on the first slide. The best three works should be sent to GTU.