Marwadi University

Syllabus for Bachelor of Technology

Information and Communication Technology

Subject Code: 01EC0102

Subject Name: Digital Electronics

B. Tech. Year – I (Semester II)

Objectives:

1. To understand the basic of Digital Electronic concepts required in analysis and design of digital electronic circuits and systems.
2. To understand the number system, logic gates, Boolean algebra, etc.
3. To understand Construction and operation of various digital circuits such as Adder, Subtractor, Multiplexer, Demultiplexer, Decoder, Encoder, Flip-flops, Counters, Registers and memory devices.
4. To devolve the capability to Simplify, Analyze and Design the Various Digital Electronic Circuits.

Credits Earned: 04 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Perform conversion between various number systems.
2. Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
3. Identify, formulate and solve a problem based on combinational and sequential circuits
4. Select the appropriate hardware and software tools for combinational and sequential circuit design.
5. Design various counters.
6. Verify the functions of various digital integrated circuits.
7. Evaluate the specifications of logic families.
8. Create a course project using digital integrated circuits.

Pre-requisite of course: Elementary knowledge of science and mathematics

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial / Practical Marks		Total Marks
				E	I		V	T	
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term Work	
3	0	2	4	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	**Number Systems and Codes** Analogue versus Digital, Various Number Systems and Conversion between them, Accuracy of Conversion, Floating-Point Numbers, Various Binary Codes.	6
2	**Digital Arithmetic** Basic Rules of Binary Addition and Subtraction, Binary Addition and Subtraction using Complements, BCD Addition and Subtraction, Binary Multiplication and Division, Floating-Point Arithmetic.	4
3	**Logic Gates and Related Devices** Positive and Negative Logic, Various Logics Gates with IEEE/ANSI symbols, Boolean equations, truth table and IC Details. Universal Gates, Gates with Open Collector/Drain output, Tristate Gates, AND-OR-INVERT Gates, Schmitt Gates, Special Output Gates, Fan-Out of Logic Gates, Buffers and Transceivers	4
4	**Logic Families** Significance of Families, Characteristic Parameters, Types of Logic Families: TTL, ECL, CMOS, Bi-CMOS, NMOS and PMOS, Comparison between various logic families. Interfacing between CMOS and TTL logic families	3
5	**Boolean Algebra and Simplification Techniques** Introduction, Postulates and Theorems, Various types of Boolean expressions, Simplification Techniques - Karnaugh Map Method and Tabulation Method	4
6	**Combinational Logic Circuits** Combinational Circuits and its implementations, Arithmetic Circuits - Adders and Subtractors, BCD Adder, Look-Ahead Carry Generator, ALU, Multiplier, Magnitude comparator. Multiplexer, Encoders, Demultiplexers and Decoders, Parity Generation and Checking.	8
7	**Sequential Logic Circuits** R-S and D Flip-flop, Level Triggered and Edge-Triggered Flip-flops, J-K and T Flip-flop, Synchronous and Asynchronous Input, Flip-flop Timing Parameters, Application of Flip-flop. Ripple Counter, Synchronous Counter, Modulus Counter, Binary Ripple Counter, Synchronous Counters, UP/Down Counters, Decade and BCD Counters, Presettable Counters, Decoding Counter, Cascading Counter, Designing Counter with Arbitrary Sequences, Shift Register, Shift Register, Counters, IEEE/ANSI Symbols for counters and Registers.	10
8	**Memory Devices** Anatomy of Computer, A computer Systems, Computer Memory, RAM and	3

	ROM, Expanding Memory Capacity	
	Total Hours	42

Suggested Text books / Reference books:

1. Anil K. Maini, "Digital Electronics: Principles, Devices and Applications" Wiley-India Pvt. Ltd, 1st Edition, 2008
2. David J. Comer "Digital Logic & State Machine Design", 3rd Indian Edition, Oxford University Press.
3. M Morris Mano, "Digital Logic and Computer Design", 4th Edition, 2009, Pearson, LPE, R.P.Jain, "Modern Digital Electronics", McGraw-Hill, 4th ed. 2010.
4. Malvino & Leach "Digital Principles and Applications", 7th Edition, McGraw-Hill Education

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
15%	20%	30%	20%	10%	5%

Suggested List of Experiments:

1. Study data sheet of various digital logic circuits and see how to test these circuits using Digital IC Tester.
2. Study of Digital IC Testers, Logic State Analyzer and Digital Pattern Generators.
3. Verify the truth tables of various Digital Logic Gates.
4. Verify the application of NAND and NOR logic gates as universal gates.
5. Implementation of Boolean Logic Functions using logic gate ICs.
6. Design and implement digital logic for given case study.
7. Measure digital logic gate specifications such as propagation delay, noise margin, fan in and fan out.
8. Implement various combinational logic circuits such as adder, subtractor, decoder, encoder, multiplexers, demultiplexer, etc.
9. Design any one code converter and implement using discrete ICs on the bread board.
10. Verify operation of various flip-flops, registers and counters using digital ICs.

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc. for effective teaching.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.
4. Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.

Open Ended Projects:

1. Design and Implementation of combinational lock circuit with varying number of bits (For example 4, 8)
2. Design and Implementation of visitor counter for Shopping Mall.
3. Design and Implementation of 4 bit Arithmetic and Logic Unit with minimum 4 functions using digital integrated circuits.
4. Design and Implementation of a scrolling display.
5. Design and Implement a digital dice which will generate any random number from 1 to 6.
6. Note: A student and faculty may choose any other such problem which includes the concept used in the course.

Supplementary Resources:

1. PSpices and NGSpice
2. Xcircuit
3. NPTEL website and IITs virtual laboratory