Syllabus for Diploma Engineering

Electrical Engineering

Semester – IV

Subject Name: Digital Electronics and Instruments

Subject Code: 09EE0404

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: Objective of this course is to familiarize the students with number representation and conversion between different representation in digital electronic circuits, to inculcate fundamental principles of digital logic, sequential circuits and digital instruments used in electrical systems. It provides exposure to classical hardware design for both combinational and sequential logic circuits.

Credits Earned: 4 Credits

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

1. Understand basic concept of numbers system, logic gates & families and Boolean algebra.
2. Understand basic architectures of data conversion.
3. Apply concept of combinational and sequential logic circuits.
4. Analyze and examine various digital logic circuits.
5. Compare and choose optimum circuits for different applications.
6. Understand concept of build small digital circuits like: device switching, gate entry counter etc.

Pre-requisite of course: DC Circuits, AC Circuits, Basic Electronics, Electric Measurements & Instrumentation Skill

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
0	0	4	4	00	30	20	25	25	100

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	**Introduction to Digital System and Number Systems:** • Introduction to digital systems **Different numbers systems**: • Decimal, binary, octal, hexadecimal • Conversion of numbers from one number system to other number system • Binary arithmetic • Complements of numbers and its arithmetic **Codes for digital system** • Classification of codes, BCD code, XS3 code, gray code, error detecting and correcting codes, ASCII code.	**4**	**7**
2	**Logic Gates and Boolean Algebra:** **Logic Gates:** • AND, OR and NOT, NOR, NAND, X-OR, and X-NOR, Universal gates. • Inhibit circuits • Study of gate ICs. (its symbol and truth table) **Boolean Algebra:** • De Morgan's theorem, • Various identities • Reduction of Boolean functions and implementation using gates (formation of truth tables • K map (up to 4 variables) and implementation using AOI logic • NAND- NAND logic • NOR – NOR logic	**16**	**28**
3	**Combinational Logic Circuits:** • Introduction to adder and subtractor • Design and implementation of half & full adder and subtractor • Multiplexer and Demultiplexer • Encoder and Decoder • BCD to seven segment decoder and types of display devices • Magnitude comparator (up to 2 bit) • comparator ICs	**4**	**7**

4	**Sequential Logic Circuits:** **Flip flops and Latches:** • RS flip-flop, JK flip-flop, D flip-flop, T flip-flop, Master slave flip flop. • Edge and Level triggering of flip flops • Latches – SR Latch, D-Latch- 74LS373 • Introduction to buffer. • Synchronous and asynchronous inputs **Registers:** • Shift register (shift right, shift left, serial in serial out, serial in parallel out, parallel in serial out, parallel in parallel out) • Bidirectional shift register • Universal shift register **Counters:** • Asynchronous and synchronous counters (Up, down, up-down, modulo, sequence generator) • Application of counters • Introduction to memory types and its terminology	**16**	**28**
5	**Logic Families:** • Introductions to logic families • Electrical parameters • TTL, CMOS, ECL etc.	**2**	**5**
6	**Analog To Digital And Digital To Analog Conversion:** • D to A conversion and its types • A to D converters and its type	**4**	**7**
7	**Digital Instruments for Electrical Applications** • Introduction to digital instruments • Comparison between analog and digital instruments • Construction and working of various electrical digital instruments: voltmeter, ammeter, watt meter, energy meter, frequency meter, clamp on meter, multimeter	**10**	**18**

Suggested List of Practical:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	To study different numbers systems	4
2	2	To Verify the truth table of Logic gates.	4
3	2	To Implement various Logic gates using only NAND and NOR gate.	4
4	2	To Implement of half adder, full adder and half and full subtractor.	4
5	2	To Verify of function of Binary to Grey code conversion and Grey to Binary code	4
6	2	To verify De morgen theorems	4
7	4	To Verify the function of 3 line to 8 line decoder and Verification of function of 8 line to 3 line encoder.	4
8	4	To Verify function of 4 to 1 multiplexer and Verification of function of 1 to 4 DE multiplexer. Display various alpha numeric characters.	6
9	4	Verification of shift left/ right register.	4
10	4	To Verify the counter circuits.	4
11	6	To implement the Digital to Analog converter vice versa	4
12	7	To demonstrate digital ammeter, voltmeter, Wattmeter and energy meter.	6
13	7	To demonstrate multi meter and clamp on meter.	4

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

e. Show video or animation of working of various types of logic gates and digital instruments.

References:

1. Anand Kumar A., *"Fundaments of Digital Circuits"*, PHI Learning Pvt. Ltd, 2016.
2. M. Morris Mano, *"Digital logic and Computer Design"*, Pearson Publication, India, 2016.
3. Donald P Leach, *"Digital Principles and Applications"*, Tata McGraw Hill education Pvt. Ltd, 2011.
4. Jan M. Rabaey, *"Digital Integrated Circuits"*, PHI Learning Pvt. Ltd, 2013.
5. David J. Comer, *"Digital Logic and State Machine Design"*, Oxford University press, 1995.

Supplementary Resources:

1. Learning resource by NPTEL https://nptel.ac.in/courses/117106086/**,** Digital Circuits and Systems, Prof. S. Srinivasan, IIT Madras.
2. Learning resource by Neso Academy https://www.youtube.com/playlist?list=PLBlnK6fEyqRjMH3mWf6kwqiTbT798eAOm.
3. http://www.electrodiction.com/videolist/play/74-ls-373-latch-chip.