

## Digital Electronics

**Subject Code -ECE201**

Course Content Delivery	Learning Method
<b>UNIT –I: NUMBER SYSTEMS AND CODES</b>	
1.1 Comparison between analog and digital signals with real-world examples. Number systems: Binary, Octal, Decimal and Hexadecimal. Relevance and examples.	Teaching, examples and exercises
1.2 Conversion between number systems with examples	Teaching, examples and exercises
1.3 Arithmetic operations-Addition, Subtraction, Multiplication and Division on binary numbers with examples.	Teaching, examples and exercises
1.4 Addition and subtraction of Hexadecimal numbers. 1's & 2's complement of binary numbers with examples.	Teaching, examples and exercises
1.5 Application of Complement numbers: Representation of signed binary numbers and Example for realizing subtraction using addition.	Teaching, examples and exercises
1.6 Codes: Relevance, types (BCD, Gray, Excess-3, ASCII and EBCDIC) with examples and applications.	Teaching, examples and exercises
1.7 BCD Addition, Conversion between BCD and Decimal, Binary and Gray Numbers, Decimal and Excess-3 with examples.	Teaching, examples and exercises
<b>UNIT –2: BASIC LOGIC CIRCUITS</b>	
2.1 Boolean algebra: Constants, variables, functions, Logic-gates (NOT, OR, AND, NOR, NAND, EX-OR and EX-NOR): Symbol, function, expression and truth-table.	Teaching, examples and exercises. Hands-on demonstration/practice for all logic gates

2.2. Boolean identities and laws with proof and examples.	Teaching, examples and exercises
2.3 De Morgan's and Duality Theorem with proof and examples.	Teaching, examples and exercises Hands-on demonstration/practice for De Morgan's theorem
2.4 Universal gates: Concept, examples, relevance and realization of all logic gates using NAND gate.	Teaching, examples and exercises
2.5 Realization of all logic gates using NOR gate.	Teaching, examples and exercises
2.6 Simplification of Boolean expressions using Boolean algebra and build the logic circuit.	Teaching, examples and exercises
2.7 SOP and POS forms, Conversion into standard SOP and POS forms.	Teaching, examples and exercises
2.8 Translate SOP and POS expressions into truth-table, Convert truth-table to SOP and POS expressions (maximum 4 variables).	Teaching, examples and exercises
2.9 SOP to POS & POS to SOP conversion	Teaching, examples and exercises
2.10 Karnaugh Map: Need, K-map for 2 variable, 3 variable and 4 variable Boolean expression.	Teaching, examples and exercises
2.11 Simplification of Boolean expression using K-map and realization of logic circuit for 2 and 3 variable.	Teaching, examples and exercises

2.12 Simplification of Boolean expression using K- map and realization of logic circuit for 4 variable	Teaching, examples and exercises
<b>UNIT -3: ARITHMETIC CIRCUITS</b>	
3.1 Features of combinational circuits and examples. Half adder (HA): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, example sand exercises
3.2 Full adder (FA): Concept, truth-table, logical expression, gate-level implementation and application. List of FA ICs.	Teaching, examples and exercises. Hands-on demonstration/practice FA using gates
3.3 Half Subtractor (HS): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises
3.4 Full Subtractor (FS): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises
3.5 Serial & Parallel adders: Concept, comparison & applications.	Teaching, examples and exercises.
3.6 Three-bit parallel adder circuit: Given the circuit, analyze it's working.	Teaching, examples and exercises.
3.7 Two-bit magnitude comparator: Concept, truth-table, logical expression, gate-level implementation and application. Identify ICs	Teaching, examples and exercises. Hands-on demonstration/practice of 2-bit Magnitude Comparator using IC or gate-level circuit.
<b>UNIT -4: MULTIPLEXERS AND DEMULTIPLXERS</b>	
4.1 Multiplexers (Mux): Concept, relevance and applications, 2:1 Mux: Symbol, truth-table, logical expression, gate-level implementation and application. Identify ICs	Teaching, examples and exercises

4.2 High-order Mux: Concept, examples (4:1, 8:1, and 16:1), Relation between number of inputs and control lines.	Teaching, examples and exercises. Hands-on demonstration/practice: 4:1 using 2:1 Mux or 8:1 using 4:1 Mux, using ICs.
4.3 Realization of high-order (4:1) Mux using low-order (2:1) Mux. List Mux ICs.	Teaching, examples and exercises
4.4 Realization of logic gates and simple logic equations using multiplexers. (Max. 3 variables)	Teaching, examples and exercises
4.5 Demultiplexer (Demux): Concept, relevance and applications. 1:2 Demux: Symbol, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises
4.6 High-order Demux: Concept and examples (1:4, 1:8, 1:16), relation between number of outputs and control lines. Analysis of Demux: Given 1:4 Demux, write logical expressions and truth table.	Teaching, examples and exercises Hands-on practice for 1:8 using 1:4 Demux, using ICs
<b>UNIT –5: ENCODERS AND DECODERS</b>	
5.1 Encoders and Decoders: Relevance and applications.	Teaching, examples and exercises
5.2 Decimal-to-BCD encoder: Logic diagram, working, truth-table and applications. List ICs	Teaching, examples and exercises. Hands-on demonstration/practice of an Decimal to BCD encoder
5.3 Priority Encoder: Relevance, Logic diagram, working and Truth Table. Identify IC	Teaching, examples and exercises
5.4 BCD-to-Decimal decoder: Logic diagram, working and truth-table	Teaching, examples and exercises

<p>5.5 Seven-segment display: Principle and types. Identify ICs for 7-segment display and Decoder.</p>	<p>Teaching, examples and exercises.</p>
<p>5.6 BCD-to-seven segment decoder: Logic diagram, working and truth table</p>	<p>Teaching, examples and exercises. Hands-on demonstration/ practice on BCD to Seven Segment decoder</p>
<p><b>UNIT –6: LOGIC FAMILIES</b></p>	
<p>6.1 ICs: Concept, advantages and disadvantages. IC classification: Based on scale of integration. Concept, need and types of logic families</p>	<p>Teaching, examples and exercises</p>
<p>6.2 Logic family specifications: Propagation delay, fan-out, fan-in, power dissipation, noise margin, speed and speed-power product. 6.3 IC data sheet: Identify the specifications in typical standard TTL IC</p>	<p>Teaching, examples and exercises. Demonstration of IC datasheet interpretation</p>
<p>6.4 Features of Standard TTL, CMOS &amp; ECL. Identify TTL/CMOS/ECL NAND gate ICs and compare their specifications.</p>	<p>Teaching, examples and exercises.</p>
<p>6.5 Interfacing between TTL and CMOS: Need, concept and precautions. Handling of ICs and ESD.</p>	<p>Teaching, examples and exercises. Demonstration of ICs' handling / placement / removal on IC base/sockets with anti-ESD gloves</p>

## **SUGGESTED LEARNING RESOURCES:**

### **Reference Books**

- i) Digital fundamentals Thomas L. Floyd, PEARSON EDUCATION publication, Eleventh edition Global Edition, ISBN 10: 1-292-07598-8, ISBN 13:978-1-292-07598-3.
- ii) Digital Electronics principles and integrated circuits. Anil K. Maini. Wiley publications, first edition. ISBN:978-81-265-1466-3.
- iii) Digital principles and applications. Donald P Leach, Albert Paul Malvino, Goutam Saha, McGraw Hill Publisher, 7th edition, ISBN:978-0-07-014170-4.
- iv) Digital Systems-principles and applications. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Prentice Hall Publications, 8th edition, ISBN:0-13-085634-7.
- v) Digital Computer Fundamentals, -Thomas C Bartee, McGraw-Hill Publisher, 4th edition. ISBN 0-07-003892-9.

### **Web-based/online Resources**

1. <https://www.electronics-tutorials.ws/>
2. <https://learn.sparkfun.com/>
3. <https://www.allaboutcircuits.com/textbook/digital/>
4. <http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm>
5. <https://www.gadgetronicx.com/electronic-circuits-library/>
6. <https://www.electronics-lab.com/>
7. <https://learn.adafruit.com/>
8. <https://www.instructables.com/circuits/>
9. <https://www.digitalelectronicsdeeds.com/>
10. <https://www.electrical4u.com/digital-electronics/>
11. [https://www.tutorialspoint.com/digital\\_circuits/index.htm](https://www.tutorialspoint.com/digital_circuits/index.htm)