MINOR COURSE- MN 2B	Digital Systems	(Theory Credit -03) (Total Marks=60+15)

Course Objective:

1. To provide students with a fundamental understanding of digital circuits, including binary number systems and basic logic gates.
2. To familiarize students with Boolean algebra and its applications in simplifying and designing logic circuits.
3. To enable students to understand and work with data processing circuits such as multiplexers, de-multiplexers, decoders, and encoders.
4. To equip students with the knowledge of arithmetic circuits, including binary addition, subtraction, and design of adders and subtractors.
5. To teach the operation of sequential circuits and flip-flops (SR, D, and JK), focusing on their triggering methods and operations.
6. To give students an understanding of timers, shift registers, and counters, along with their practical applications in digital systems.

Course Outcomes:

1. Students will be able to distinguish between analog and digital circuits and perform conversions between different number systems.
2. Students will develop the ability to simplify and design logic circuits using Boolean algebra and Karnaugh maps.
3. Students will understand the role and operation of data processing circuits and will be able to design simple multiplexing and encoding circuits.
4. Students will be capable of designing and analyzing arithmetic circuits, including adders and subtractors, for binary operations.
5. Students will be able to design sequential circuits using flip-flops and will understand their clocking mechanisms, including race-around conditions.
6. Students will be proficient in designing and using timers, shift registers, and counters in digital systems, including the use of ICs like the 555 timer.

Course Contents:

Digital Circuits (10 HRS): Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates. NAND and NOR Gates as Universal Gates. XOR and XNOR Gates

Boolean algebra (10 HRS): De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

Data processing circuits (04 HRS): Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders.

Arithmetic Circuits (04 HRS): Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders, 4-bit binary Adder.

Sequential Circuits (04 HRS): SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.

Timers and Shift registers (05 HRS): IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator.Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in Parallel-out Shift Registers (only up to 4 bits).

Counters (4 bits) (04 HRS): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

Conversion (04 HRS): Resistive networks (Weighted and R-2R Ladder). Accuracy and resolution in conversion. Principles of A/D conversion using successive approximation.

Reference Books:

1. Digital Computer Electronics, Malvino and Brown, 3/e, McGraw Hill Education
2. Digital Electronics G K Kharate ,2010, Oxford University Press
3. Digital Systems: Principles & Applications, R. J. Tocci, N. S. Widmer, 2001, PHI Learning
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill
7. Digital Systems and Applications, Nutan Lata, Pragati Prakashan, 1/e, 2019
8. Digital design, Moris Mano

MINOR COURSE- MN 2B	Digital Systems	(Practical Credit -01) (Total Marks=25)

1. To design a switch (NOT gate) using a transistor.
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To design a combinational logic system for a specified Truth Table.
4. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
5. To minimize a given logic circuit.
6. Half Adder, Full Adder and 4-bit binary Adder.
7. Half Adder and Full Adder Truth table verification using I.C.
8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
9. To design an Astable multivibrator of given specifications using 555 Timer.
10. To design a Monostable multivibrator of given specifications using 555 Timer.