Minor in Electronics

Course Code	Course Name
MI-BT061	Electronic Devices and Circuits

Course Objectives

1. Introduction to electronic devices: diodes, transistors, operational amplifiers.
2. Discuss applications of electronic devices.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Describe the functions of various electronic devices.
2. Utilize electronic devices for various applications

Course Content

Module No.	*Details*	*Hrs.*
1	Introduction to diodes PN junction diode, Zener diode: Working and Characteristics	**02**
2	Diode applications: Rectifiers, Clippers, Clampers, Voltage Regulator	**04**
3	Introduction to Bipolar Junction Transistor and Field Effect Transistor: Working and Characteristics	**04**
4	Transistor as switch, amplifiers, power amplifier, oscillator	**06**
5	Introduction to operational amplifier: Concept of differential amplifier, working principle, parameters	**02**
6	Op-amp applications: summing, scaling and averaging amplifiers, instrumentation amplifier, differentiator, integrator, comparator, clipper, clamper	**05**
7	Introduction to IC 555 timer using block diagram, Applications: Astable and Mono-Stable multivibrator..	**05**

Text Books

1. Robert Boylestad and Louis Nashelsky,"Electronic devices and circuits", Prentice HallofIndia, London
2. Donald A. Neamen, "ElectronicCircuitAnalysisandDesign",TataMcGraw-Hill publishing Company Limited.
3. Gayakwad Ramakant,"Op-Amps and Linear Integrated Circuits", PHI publication

Reference Books

1. David Bell, "Electronic Devices and Circuits", 5 th Edition, Oxford University Press, 2008
2. Allen Mottershead,"Electronic Devices and Circuits an introduction", Prentice Hall of India, 1979 Robotics 2nd edition, SIE, McGraw Hill Education (India) Pvt Ltd (2012)

Course Code	Course Name
MI-BT062	Digital Electronics

Course pre-requisites	

Course Objectives
The objectives of this course are 1. Understand the number systems and coding. 2. Discuss the features of combinational circuits. 3. Understand flip flops and their applications.
Course Outcomes
Upon successful completion of the course, students should be able to 1. Differentiate between number systems and classify different binary codes. 2. Analyze and design combinational circuits and Sequential circuits. 3. Solve problems using Finite state machines.

Course Content

Module No.	*Details*	*Hrs.*
1	Number System and Codes: Binary, Octal, Hexadecimal number systems, Conversion from one system to another,Binary Arithmetic. BCD, GRAY, Alphanumeric codes, Error detecting codes-odd and even parity, error detecting and correcting codes-HammingCodes	**06**
2	Combinational circuits: Derive Gates, Max terms, Min terms, SOP and POS implementation, K-Maps and their use in simplifying Boolean expressions, Implementing a logic function using universal Gates.	**06**
3	Combination Logic Circuit Design: (i) Adders, Subtractors (Half and Full), carry look ahead adder, serial adder, magnitude comparators (ii) Arithmetic logic units, multiplexers, demultiplexers, parity encoder, code converter.	**08**
4	Sequential Logic Circuits: Comparison of combinational and sequential circuits, Flip-flops: SR, T, D, JK, converting one flip flop to another. .	**06**
5	Counter: Ripple counter, up-down counter, Synchronous counter, and designing of counters, state transition diagram, unused states and locked conditions	**05**
6	Registers: SISO, SIPO, PISO, PIPO registers, ring counter, twisted ring counter, pseudorandom sequence generator.	**05**
7	Introduction to finite state machine: State table, state diagram, next stateanalysis, Mealy and Moore state machines. State machine reduction.	**06**

Text Books
1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009. 2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016
1. A. Kuma; Fundamentals of Digital Circuits", Prentice Hall India, 2016. 2. William I. Fletcher, „An Engineering Approach to Digital Design“, PHI.

Course Code	Course Name
MI-BT063	Microcontroller

Course pre-requisites	Digital Electronics

Course Objectives
This course aims to teach the detailed functioning of 8051 Microcontroller with peripheral interfacing

Course Outcomes
Upon successful completion of the course, students should be able to 1. Describe 8051 microcontroller. 2. Code for 8051 based applications in assembly language. 3. Interface various peripherals

Course Content

Module No.	*Details*	*Hrs.*
1	Fundamentals of Microcontrollers: Microcontroller architecture, Comparison of 8-bit, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051family..	**06**
2	The 8051 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles	**06**
3	Instruction Set and Programming I: Addressing modes: Introduction, Instruction syntax, Data addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set,	**06**
4	Instruction Set and Programming II: Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs.	**06**
5	Memory and I/O Interfacing: Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices	**08**
6	External Communication Interface Synchronous and Asynchronous Communication. RS232, SPI, I2C.	**05**
7	Applications: LED, LCD and keyboard interfacing. Stepper motor interfacing.	**05**

Text Books

1. Ramesh Gaonkar, “Microprocessor Architecture, Programming, and applications with 8085”, Penram International Publication 6 th edition, 2013.
2. Muhammad Ali Mazidi, “The 8051 Microcontrollers and Embedded Systems using Assembly and C”, Pearson 2 nd edition, .2007

3. Kenneth J .Ayala,“ The 8051 Microcontroller Architecture, Programming, and applications ”, Penram Publishers, 1991

Reference Books

1. Mano M., “Computer System and Architecture”, Pearson, 3 rd edition, 2017.
2. William Stallings, “ Computer Organization and Architecture”, Pearson, 11 th edition, 2022
3. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 3 rd h edition, 2017

Course Code	Course Name
MI-BT064	VLSI Circuits

Course pre-requisites	Electronic Devices and Circuits/ Digital Electronics

Course Objectives

.1. To introduce the fundamental principles of VLSI circuit design and layout techniques.
2. To highlight the circuit design issues in the context of VLSI technology.
3. To examine the basic building blocks of large-scale digital integrated circuits

Course Outcomes

Upon successful completion of the course, students should be able to
1. Demonstrate a clear understanding of choice of technology and technology scaling.
2. Design MOS based circuits and draw layout.
3. Realize logic circuits with different design styles.
4. Demonstrate a clear understanding of system level design issues such as timing and power dissipation

Course Content

Module No	*Details*	*Hrs*
1	**Introduction and overview:** History, basic transistor technology, NMOS and CMOS technology. **Fabrication process and layout:** NMOS, LOCOS, CMOS, CMOS Design rules, MOSFET Scaling: Types of scaling, MOSFET capacitances.	**06**
2	**MOSFET Inverters**: **Circuit Analysis**: Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load and CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters, CMOS Latch- up. **Logic Circuit Design**: Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter.	**06**
3	**MOS Circuit Design Styles:** **Design Styles**: Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS. **Circuit Realization**: SR Latch, JK FF, D FF.	**06**
4	**Semiconductor Memories:** ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation 3T, 1T, operation modes, leakage currents, refresh operation, Input-Output circuits).	**08**
5	**Low Power CMOS Circuits**: Various components of power dissipation. CMOS, Limits on low power design, low power design through voltage Scaling.	**04**
6	**Hardware Description Languages for VLSI Design:** Managing concurrency and time in Hardware Description Languages, Introduction to VHDL, Basic Components	**08**

	inVHDL, Structural Description in VHDL, Behavioral Description in VHDL and Introduction to Verilog.	
7	**VLSI Clocking**: CMOS clocking styles, Clock generation, stabilization and distribution.	**04**

Text Books
1. Sung-Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits Analysis and Design", Tata McGraw Hill. 2. Neil H. E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education
Reference Books
1. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education. 2. Etienne Sicard and Sonia Delmas Bendhia, "Basics of CMOS Cell Design", Tata McGraw Hill. 3. Debaprasad Das, "VLSI Design", Oxford. 4. Kaushik Roy and Sharat C. Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley, Student Edition.