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| Program : Diploma in Electronics/ Electronics and Communication Engineering/ Biomedical Engineering | |
| Course Code : 4041 | Course Title: Microcontroller and Applications |
| Semester : 4 | Credits: 4 |
| Course Category: Program Core | |
| Periods per week: 4(L:3, T:1, P:0) | Periods per semester: 60 |

Course Objectives:

- To equip students on architecture, interfacing and Assembly Language Programming (ALP) of 8051 microcontrollers.
- To enable students to develop simple interfacing applications for daily use
- To prepare students for troubleshooting of microcontroller-based equipment.

Course Prerequisites:

| Topic/Description | Course code | Course Title | Semester |
|--|-------------|---------------------|----------|
| Basic Engineering mathematics principles and theorems | | Mathematics I & II | 1 & 2 |
| Different number systems, codes, combinational and sequential circuits, memory | | Digital Electronics | 3 |

Course Outcomes

On completion of the course, the student will be able to:

| CO _n | Description | Duration (Hours) | Cognitive level |
|-----------------|---|------------------|-----------------|
| CO1 | Explain the features and block diagram of 8051 Microcontroller. | 12 | Understanding |
| CO2 | Develop simple Assembly Language Programs (ALP) for 8051. | 17 | Applying |
| CO3 | Explain interrupts, timer and serial communication in 8051 | 14 | Understanding |
| CO4 | Illustrate the interfacing of various I/O devices with 8051 | 15 | Understanding |
| | Series Test | 2 | |

CO-PO Mapping:

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 2 | | | | | | |
| CO2 | 3 | | | | | | |
| CO3 | 2 | | | | | | |
| CO4 | 2 | | | | | | |

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

| Module Outcomes | Description | Duration (Hours) | Cognitive Level |
|--|--|------------------|-----------------|
| CO1 | Explain the features and block diagram of 8051 Microcontroller. | | |
| M1.01 | Compare Microprocessor and Microcontroller | 2 | Understanding |
| M1.02 | List the features of 8051 microcontroller. | 1 | Remembering |
| M1.03 | Explain the block diagram of 8051 microcontroller. | 2 | Understanding |
| M1.04 | Explain the memory of 8051. | 7 | Understanding |
| Contents: Features and Block diagram of 8051 Introduction to microprocessors and microcontrollers, features of 8051, simple block diagram of 8051, Data memory organization, program memory organization, PSW register. | | | |
| CO2 | Develop simple Assembly Language Programs(ALP) for 8051. | | |
| M2.01 | Explain the structure of Assembly Language Programming. | 3 | Understanding |
| M2.02 | Explain various addressing modes and types of instructions. | 4 | Understanding |
| M2.03 | Describe Jump, Loop, Call and single bit level instructions. | 4 | Understanding |
| M2.04 | Develop Assembly language programs for 8051. | 6 | Applying |
| | Series Test – I | 1 | |
| Contents: Introduction to Assembly Language programming of 8051 – Structure, addressing modes, Types of instructions: -Data transfer, arithmetic, logical, Compare, Rotate and swap instructions. Describe jump instruction- conditional and unconditional, call instructions, calling subroutines. machine cycle, Delay generation. Single-Bit level instructions, Data serialization. Simple programs: - 8-bit Addition, 8-bit subtraction, | | | |

multiplication, division, ASCII to packed BCD, packed BCD to ASCII, BCD to hex and hex to BCD, port reading and writing.

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| CO3 | Explain interrupts, timer and serial communication in 8051. | | |
| M3.01 | Explain concept, types, priority, Registers for Interrupts and handling of interrupts. | 4 | Understanding |
| M3.02 | Explain TMOD register and timer operating modes. | 4 | Understanding |
| M3.03 | Illustrate TCON register and time delay calculation for Timer. | 3 | Understanding |
| M3.04 | Illustrate special function registers for serial communication. | 3 | Understanding |

Contents:

Interrupts, Timers, Serial communication.

8051 Interrupts: Concept, Types, Interrupt service routine (ISR), IE register, Steps in executing an interrupt, Interrupt priority, IP register.

Timer: TMOD register, Timer operating modes, TCON register, Time Delay calculation.

Basics of serial communication, Baud rate, 8051 connections to RS232 connector, SBUF register, SCON register and Different serial data transmission modes in 8051. PCON register.

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| CO4 | Illustrate the interfacing of various I/O devices with 8051 | | |
| M4.01 | Explain the interfacing of stepper motor with 8051. | 4 | Understanding |
| M4.02 | Explain the interfacing of DC motor for speed control. | 3 | Understanding |
| M4.03 | Illustrate the interfacing of 4x4 keyboard and 16x2 LCD system with 8051. | 4 | Understanding |
| M4.04 | Illustrate ADC, DAC and LM35 temperature sensor interfacing with 8051. | 4 | Understanding |
| | Series Test – II | 1 | |

Contents:

Stepper motor – operation, explain the interfacing with 8051

DC motor – operation, explain the interfacing with 8051

4x4 -Matrix keyboard – Structure, identifying key press, explain the interfacing with 8051.

16x2 LCD - Pin description, advantages of LCD, explain the interfacing with 8051.

Explain the interfacing of 8051 - with ADC, with DAC, with temperature control system using LM35 temperature sensor.

Text / Reference:

| T/R | Book Title/Author |
|------------|---|
| T1 | Muhammad Ali Mazidi and Janice Gillispie Mazidi - The 8051 Microcontroller and Embedded Systems Using Assembly and C - Pearson Education- Second Edition. |
| T2 | Subratha Ghoshal – 8051 microcontroller internals, instructions, programming and interfacing- Pearson |
| T3 | Kenneth J Ayala - The 8051 Microcontroller - Thomson - Third Edition. |

Online resources:

| Sl.No | Website Link |
|--------------|---|
| 1 | https://www.electronicshub.org |
| 2 | https://www.elprocus.com |
| 3 | https://www.tutorialspoint.com |