PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Microcontroller and Applications (MCA) **COURSE CODE :** 21432

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme						Examination Scheme							
Hrs / week				Credits	TH Paper Hrs.	Marks							
TH	TU	PR	HRS				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	04	03	Max.	80	20	100	--	25	25	150
						Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

An electronics/electrical engineer working in an industry are required to make use of micro controller programming for various applications. The objective of this course is to enable the student to use micro controller for variety of industrial application. The technology of microprocessor has led to a single chip Microcontroller technology. MCS- 51 family architecture, details of 8051 Microcontroller and its assembly and C programming is covered in this course. This will help to Student in developing innovative solutions to particular industrial problems or to emerge as an entrepreneur.

2.0 COURSE OBJECTIVES:

The student will be able to,
1. Compare Microprocessor and Microcontroller.
2. Describe architecture and operation of microcontroller 8051.
3. Develop assembly language programs using instruction set of 8051.
4. Understand the use of C-language to develop programs for 8051microcontroller.
5. Interface peripheral and write programs with microcontroller 8051.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:
1. Select appropriate version of microcontroller for different application.
2. Use internal architecture for program development.
3. Write and execute assembly language program for data manipulations.
4. Develop C-Program using proper simulator tool for microcontroller 8051.
5. Develop assembly language program for interfacing of peripherals.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basics of Microcontroller**	1a. Compare microprocessor and microcontroller. 1b. Differentiate between microcontroller architectures. 1c. Explain generalized block diagram of microcontroller.	1.1 Introduction to microcontroller. 1.2 Comparison of Microprocessor & Microcontroller. 1.3 Evolution of Microcontroller. 1.4 Terminology: RISC, CISC, Harvard and Von-Neumann Architectures and their comparisons. 1.5 Generalized functional block diagram of microcontroller.	06
Unit-II **8051**	2a. State features of 8051 microcontroller. 2b. Draw pin diagram and	2.1 Features and Pin diagram with function of all pins of 8051. 2.2 Architecture of 8051.	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Microcontroller Architecture	architecture of 8051. 2c. Explain pin functions and architecture of 8051. 2d. Explain Concept of Stack and Stack Pointer. 2e. Draw and explain register format of TMOD, TCON, SCON and PCON registers. 2f. State and explain the function of various 8051 Interrupts.	2.3 Function of program counter and data pointer, A and B registers, Program status word (PSW) register, concept of Stack and stack pointer register. 2.4 Internal Memory: Concept and Structure of 128 byte internal RAM 2.5 Timers and Counters: Study of Timer SFR's TMOD and TCON. Square waveform generation using timer. 2.6 Interrupts: Details of IE and IP SFR, Interrupt Priorities. 2.7 Study of SCON and PCON SFRs	
Unit-III **Addressing Modes and Instruction Set**	3a. State, use and explain 8051 assembler directives, Data types. 3b. Identify addressing Modes of instructions. 3c. Explain functions of all assembly instructions of 8051. 3d. Develop assembly language program for different operations.	3.1 Instruction syntax and data types: Opcode, Operand, label, comment and assembler directives such as DB, ORG, EQU, END, Data types and data range. 3.2 8051 Addressing modes- Definition and types. 3.3 8051 Instruction Set: Data transfer, Arithmetic, Logical, Branch-jump & Call Instructions, Bit manipulation instructions. 3.4 Simple Programming: 8-bit addition, subtraction, multiplication, division, largest number, smallest number, ascending order, block transfer(only external to internal memory)	14
Unit-IV **8051 Programming Using C**	4a. Use different software simulators. 4b. State and explain various C data types. 4c. Develop C program for desired application using 8051.	4.1 Software Simulators of 8051(MIDE-51, Keil's Tool) 4.2 C data types: unsigned/signed char, unsigned/signed int, sbit, sfr. 4.3 C Programming: LED Blinking, Display 0 to 9 BCD number on Seven Segment Display.	04
Unit-V **Peripheral Interfacing and Programming**	5a. Draw Interfacing diagram of peripheral with 8051 such as ADC, DAC, LCD, DC and Stepper Motor. 5b. Develop assembly language program to use peripheral with 8051 such as ADC, DAC, LCD, DC & Stepper Motor.	5.1 ADC 0808/0809 interfacing & assembly programming 5.2 DAC 0808 Interfacing - Generation of Square wave, Triangular wave using assembly program 5.3 LCD interfacing- Initialization, assembly programming. 5.4 DC & Stepper motor interfacing with assembly Programs. 5.5 Temperature sensor LM35	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		interfacing with 8051 using ADC (only interfacing diagram)	
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Basics of Microcontroller	04	04	00	08
II	8051 Microcontroller Architecture	08	08	04	20
III	Addressing Modes and Instruction Set	04	08	12	24
IV	8051 Programming Using C	02	02	04	08
V	Peripheral Interfacing and Programming	02	06	12	20
	TOTAL	**20**	**32**	**28**	**80**

Legends: R = Remembrance (Knowledge); U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/TUTORIALS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.

Sr. No.	Unit No.	Practical Exercises (Any 10) (Outcomes in Psychomotor Domain)	Hours
01	II	Study of Pin diagram and architecture of 8051.	02
02	III	Develop and execute assembly language program using simulator for 8-bit addition and 8-bit subtraction.(using internal memory)	04
03	III	Develop and execute assembly language program using simulator for 8-bit Multiplication and Division.(using internal memory)	04
04	III	Develop and execute assembly program using simulator for Addition of 10 nos. stored in internal memory of 8051/52 and store the result in next two locations.	02
05	III	Develop and execute assembly program to find largest/smallest number from group of 10 numbers using simulator.	04
06	III	Develop and execute assembly program to arrange 5 numbers in ascending order using simulator.	02
07	III	Develop and execute assembly program to transfer 10 numbers from external memory to internal memory using simulator.	02
08	II	Develop and execute assembly program to generate square waveform using timer.	04
09	IV	Develop, execute and download on kit C-program/assembly program (8051) to interface and blink LEDs on I/O ports.	04
10	IV	Develop, execute and download on kit 'C' /assembly program to interface 7-	04

Sr. No.	Unit No.	Practical Exercises (Any 10) (Outcomes in Psychomotor Domain)	Hours
		segment and display BCD-counter on it.	
11	V	Develop, execute and download on kit assembly program to interface (16x2) LCD and display message on it.	04
12	V	Develop, execute and download on kit assembly program to interface stepper motor or DC motor and to rotate it in clockwise and anticlockwise direction.	04
		TOTAL	**32/40**

7.0 SUGGESTED STUDENT ACTIVITIES:

Other than the Classroom and laboratory learning, following are the suggested Student-related co-curricular activities. This can be undertaken to accelerate the attainment of the various outcomes in the course,

1. Prepare a chart of architecture of 8051.
2. Prepare a chart showing all instructions of 8051.
3. Prepare chart to represent the interfacing diagram of microcontroller with different Peripherals.
4. Prepare/Download a dynamic animation to illustrate the following Data transfer operation
   a. LCD Interfacing
   b. Stepper / DC Motor Interfacing

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course,

1. Show video/animation film to demonstrate the working of microcontroller.
2. Arrange expert lecture of a person in the area of Microcontroller.
3. Arrange visit to relevant industry.

9.0 LEARNING RESOURCES:

A) Books:

Sr.No.	Title of Book	Author	Publication
01	The 8051 Microcontroller Architecture, Programming and Application	Kennneth J. Ayala	Thomson & Delmar Learning. (PRI), Second Edition.
02	The 8051 Microcontroller and Embedded systems	Mazidi, Mazidi & Mckinlay	Pearson Publication, Second Edition.
03	Microcontrollers	Ajay Deshmukh	Tata-McGraw Hill Publication, first Edition.
04	Programming and customizing the 8051 microcontroller	Myke Predko	Tata-McGraw Hill Publication 1999.
05	Exploring C for microcontrollers- A hands on approach	J. S. Parab, V.G. Shelake	Springer
06	Programming and customizing the 8051 microcontroller	Myke Predko	Tata-McGraw Hill Publication 1999.

B) Software/Learning Websites:

1. http://www.8052mcu.com/
2. https://www.tutorialspoint.com
3. https://www.circuitstoday.com/8051-microcontroller
4. https://embetronicx.com/8051-tutorials/