A. Course Objective

The educational objectives of this course are

- To understand the basics and evolution of microcontroller.
- To study about the functional components of *8051* in detail.
- To study about the Assembly & C language programming.
- To study the various types of instructions provided by 8051 and addressing Modes.
- To study about timer, Counter, Serial and interrupt Programming.
- To study concepts of Interfacing of LCD, ADC, DAC, Sensor, Keypad, External Memory, RTC, Relay, PWM, DC and Stepper Programming in C & Assembly.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EC-502	**Microcontroller & Interfacing**	4	0	2	6	5	3	70	30	20	30	150

C. Detailed Syllabus

1 **8051 Microcontrollers:**
Microcontrollers and embedded processors, Overview of the 8051 family.

2 **8051 Assembly Language Programming:**
Architecture of 8051, Introduction to 8051 assembly programming, Assembling and running an 8051 program, The program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and the PSW register, 8051 register banks and stack.

3 **Jump, Loop, And Call Instructions:**
Loop and jump instructions, Call instructions time delay for various 8051 chips.

4 **I/O Port Programming:** 8051 I/O programming, I/O bit manipulation programming.

5 **8051 Addressing Modes:**
Immediate and register addressing modes, Accessing memory using various addressing modes, Bit addresses for I/O and RAM, Extra 128-byte on-chip RAM in 8052.

6 **Arithmetic and Logic Instructions and Programs:**
Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction and data serialization, BCD, ASCII, and other application programs.

7 **8051 Programming in C:** Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C.

8 **8051 Hardware Connection and Intel Hex File:**
Pin description of the 8051, Design and test of 8051 Minimum Module, Explaining the Intel hex file.

9 **8051 Timer Programming in Assembly and C:**
Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.

10 **8051 Serial Port Programming in Assembly and C:**
Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in Assembly, Programming the second serial port, Serial port programming in C.

11 **Interrupts Programming in Assembly and C:**
8051 interrupts programming, Timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt programming in C.

12 **Interfacing of External Devices & Programming:**
LCD interfacing, Keyboard interfacing, Parallel and serial ADC, DAC interfacing, Sensor interfacing and signal conditioning, Semiconductor memory, Memory address decoding, 8031/51 interfacing with external ROM, Flash RAM, 8051 data memory space, Accessing external data memory in 8051 C, RTC interfacing, RTC programming in C, Alarm, SQW, and IRQ features of the DS12887 chip, Relays and Optoisolators, Stepper motor interfacing, DC motor interfacing and PWM

D. Lesson Planning

Sr. No.	Lectures (Hours)	Weightage in % in Exam	Topics
1.	02	04	**8051 Microcontrollers:** Microcontrollers and embedded processors, Overview of the 8051 family.
2.	04	12	**8051 Assembly Language Programming:** Architecture of 8051, Introduction to 8051 assembly programming, Assembling and running an 8051 program, The program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and the PSW register, 8051 register banks and stack.
3.	03	05	**Jump, Loop, And Call Instructions:** Loop and jump instructions, Call instructions time delay for various 8051 chips.
4.	03	05	**I/O Port Programming:** 8051 I/O programming, I/O bit manipulation programming.
5.	02	04	**8051 Addressing Modes:** Immediate and register addressing modes, Accessing memory using various addressing modes, Bit addresses for I/O and RAM, Extra 128-byte on-chip RAM in 8052.
6.	05	08	**Arithmetic and Logic Instructions and Programs:** Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction and data serialization, BCD, ASCII, and other application programs.
7.	05	08	**8051 Programming in C:** Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C.
8.	04	04	**8051 Hardware Connection and Intel Hex File:** Pin description of the 8051, Design and test of 8051 Minimum Module,

			Explaining the Intel hex file.
9.	04	08	**8051 Timer Programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.
10.	04	06	**8051 Serial Port Programming in Assembly and C:** Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in Assembly, Programming the second serial port, Serial port programming in C.
11.	04	06	**Interrupts Programming in Assembly and C:** 8051 interrupts programming, Timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt programming in C.
12.	20	30	**Interfacing of External Devices & Programming:** LCD interfacing, Keyboard interfacing, Parallel and serial ADC, DAC interfacing, Sensor interfacing and signal conditioning, Semiconductor memory, Memory address decoding, 8031/51 interfacing with external ROM, Flash RAM, 8051 data memory space, Accessing external data memory in 8051 C, RTC interfacing, RTC programming in C, Alarm, SQW, and IRQ features of the DS12887 chip, Relays and Optoisolators, Stepper motor interfacing, DC motor interfacing and PWM
Total	60	100	

E. <u>Instructional Method And Pedagogy</u> (ANNEXURE-I)

F. <u>Suggested List Of Experiments:</u>

1. To study about 8051 micro controller trainer kit.

2. To study timer/counter control logic.

3. To study about programming of 8051 and instruction syntax.

4. Program 4(a)**:** write a program to add two 8-bit numbers stored in registers or internal/external memory locations.
Program 4(b): write a program to division two 8-bit numbers stored in registers or internal/external memory locations.
Program 4(c): write a program to multiply two 16-bit numbers.

5. Program 5(a)**:** write a program to add block of data stored in internal/external memory locations.
Program 5(b)**:** write a program to transfer block of data from internal memory locations to external memory locations.
Program 5(c)**:** write a program to sort block of data in ascending or descending order.

6. Program 6(a)**:** write a program to perform the following.
1. Keep monitoring p1.2 until it becomes high
2. When p1.2 becomes high write value 45h on p0.
3. Sent a high to low pulse to p2.3.

Program 6(b): a switch is connected to p1.7. Write a program to check the status of switch and perform the following.

1 If switch = 0, send letter "n" to p2.
2. If switch = 1, send letter "y" to p2.

7. Write a program to generate 1 kHz and 5 kHz pulse waveform for different duty cycle on pin 1.0.

8. Write a program to transfer data, message and letter serially using 8051 microcontroller.

9. Assume that XTAL = 11.0592 MHz. What value do we need to load the timer's register if we want to have a time delay of 5 ms (milliseconds)? Show the program for timer 0 to create a pulse width of 5 ms on P2.3.

10. Program 10(a): Write a C program to toggle bits of P1 ports continuously with 250 ms.

Program 10 (b): Write an 8051 C program to get a byte of data form P0. If it is less than 100, send it to P1; otherwise, send it to P2.

11. To Write a C program to interface matrix keyboard using 8051 microcontroller.

12. To Write a C program to interface LED and LCD using 8051 microcontroller.

13. To write a C program to interface stepper motor using 8051 microcontroller.

14. To write a C program interface dc motor using pwm.

G. Students Learning Outcomes

On successful completion of the course:
The student can learn about detailed aspects about 8051 Microcontrollers & its programming, I/O Port Programming, 8051 Programming in C and interfacing of external devices. A Serial and Parallel Port communication.

H. Recommended Study Materials:

TEXT BOOKS:

* The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2/e by

  Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay

  (Second Edition, Pearson Education).

REFERENCE BOOKS:

KADI SARVA VISHWAVIDYALAYA

- 1. The 8051 Microcontroller & Embedded Systems using Assembly and C By K. J. Ayala, D. V. Gadre (Cengage Learning, India Edition).

- 8051 Microcontrollers: MCS51 family and its variants by Satish Shah, Oxford University Press.

- 8051 Microcontroller: Internals, Instructions, Programming and Interfacing by Subrata Ghoshal, Pearson Education.

  Web materials: http://www.microcontroller.com

  http://www.wikipedia.com

  http://www.atmel.com