SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech. II: Semester –IV

Subject Name: Micro-controller & Interfacing **Subject Code: BTIC13403**

Type of course: PCC

Prerequisite (if any): C programming, Digital Electronics

List of Courses where this course will be prerequisite: Embedded System Design,

This course will provide the students (i) platform for learning 32 bit controller (ii) to fulfill the project purpose as every project is hardware and software combination where students can program the controller aspects. (iii) idea of interfacing various hardware like motor, matrix keyboards, LCD etc. with Microcontroller for their applications.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
4	0	2	5	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Content	Total Hrs	Module Weight

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory noncredit course

			age
1	**Introduction & architecture of 8051 Micro controller** Definition of Micro controller, Difference between Microprocessor and Microcontroller, Harvard and Princeton Architecture, Block diagram of 8051 Microcontroller, over view of 8051 family **8051 Microcontroller Architecture** Architecture of 8051 Microcontroller, The program counter and ROM space in the 8051, 8051 flag bits and the PSW register, 8051 register banks, stack and RAM Space.	**5**	**8%**
2	**8051 Assembly Language Programming:** Introduction to 8051 assembly programming, Structure of Assembly language, Assembling and running an 8051 program, 8051 data types and directives **Jump, Loop, And Call Instructions:** Loop and jump instructions, Call instructions time delay for various 8051 chips **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.	**8**	**13%**
3	**I/O Programming:** Pin Description of 8051. Minimum connection for 8051 based system. Internal configuration and structure of all Ports, I/O port Programming. Interfacing of SPST switch and Seven Segment LED with ports of Microcontroller and programming.Design of components while interfacing LED, and Switches.	**6**	**10%**
4	**8051 Programming in embedded C Programming:** 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.	**5**	**7%**
5	**8051 Timer Programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 in assembly and C.	**6**	**10%**
6	**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. **Interrupts Programming in Assembly and C:**	**6**	**10%**

	8051 interrupts programming, Timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt		
7	**LCD and Keyboard Interfacing:** LCD interfacing in Assembly and C. Keyboard interfacing in Assembly and C.	**6**	**10%**
8	**ADC and DAC interfacing** Types of ADC and DAC. Parallel ADC 0804 and 0808 interfacing with 8051 Parallel DAC 0808 interfacing with 8051, converting I_{out} to voltage in DAC0808, Generation of sine wave using DAC0808.	**5**	**8%**
9	**ARM 32-BIT MICROCONTROLLER and STM32F0 Arm (Cortex M0) I/O Programming** ARM Cortex M0/M4/STM32xx Micro controller Architecture in detail. GPIO Programming and Interfacing, GPIO Register Address. LED switch interfacing , Seven Segment LED Interfacing and programming, Analog input interfacing.	**13**	**22%**

Suggested Specification table with Marks (Theory): (For B Tech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**30%**	**20%**	**10%**	**10%**	**10%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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.

Reference Books:

Sr no	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**	**Year of publication**	**Publication Edition**

1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazidi	Pearson ISBN:978-81-317-1026-5	2013	2nd
2	The 8051 Microcontroller & Embedded Systems using Assembly and c	By K. J.Ayala, D. V. Gadre	Cengage Learning, India Edition	2007	3rd
3	The 8051 Microcontrollers: Architecture, Programming and Applications	by K Uma Rao, Andhe Pallavi	Pearson Education.		
4	STM32F0 Arm Cortex M0 Programming for Embedded Systems: Using C Language with STM32F0 Nucleo Board	Muhammad Ali Mazidi, Shujen Chen, Nasim Yazdani	ISBN: 13:978:1-970054-22-4		1st
5	The Definitive Guide to the ARM Cortex-M0/M0+ processors,	Joseph Yiu	Newnes,Elsevier	2015	2nd

Course Outcomes:

After studying the subject, Student will be able to

Sr. No.	CO statement	Marks % weightage

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory noncredit course

CO-1	Describe microcontroller family, 8051 controller pin diagram, ports structure, addressing modes, basics of serial communication, timer-counter configuration and interrupt handling.	30%
CO-2	write, debug and analyze the code in assembly as well as Embedded C language.	10%
CO-3	Calculate instruction execution time, delay, baud rate, and write assembly and C Code, for different timer mode, serial communication mode and interrupt priorities	15%
CO-4	Apply digital logic design and programming principles to interface and access external memories and Input-Output devices like keyboard, Seven segment LED and LCD displays, ADC, DAC , motors etc. with micro controller.	25%
CO-5	Role play as an individual and as a team-member to design, formulate and implement automation project using micro-controller with Fire-Bird Robot or other development board for developing different application.	5%
CO-6	Analyze merits of ARM controllers along with architectural features and instructions of ARM Cortex-M microcontroller.	15%

How strongly Pos are addressed by each CO of a subject is indicated by level 1: Slight (Low)2: Moderate (Medium)3: Substantial (High)

Mapping CO-POs

	PO 1	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3		2								2	3		
CO2					3							2	3	3	1
CO3	3	3	3		3							3	3	3	2

CO4	2		3									3	3		2
CO5			3						3	3	3	3	3	3	3
CO6				3	3							3	3		3

List of Open learning website:

NPTEL lectures on Embedded System Design

https://onlinecourses.nptel.ac.in/noc20_ee98/preview

List of Open Source Software:

Keil Simulator, Flash Programmer

FOR LAB SESSIONS:

List of Experiments:

1) A) Write a program to add and subtract two 8-bit numbers stored in registers or internal/External Memory locations.
   B) Write a program to multiply and divide two 8-bit numbers stored in registers or memory Locations.
   C) Write a program to perform 16-bit addition and multiplication.
2) A) Write a program to add block of data stored in internal/external memory locations.
   B) Write a program to transfer block of data from internal memory locations to external memory Locations.
3) 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
   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.

4) Interfacing of seven segment display with 8051 and programming to display from 0 to 9 at every second using loop.

5) Write a program to interface 8 SPST switch and one seven segment display with 8051 and display the number of switch whichever is presses at a time on seven segment display

6) A) Write a program to generate 5 KHz pulse waveform of 50% duty cycle on pin 1.0 using timer 1 in mode 2.
B) Write a program to generate 1 KHz pulse waveform of 70% duty cycle on pin 1.0 using timer.

7) A) Write a program for the 8051 to transfer letter "A" serially, continuously.
B) Write a program to transfer the message "YES" serially. Do this continuously.
C) Program the 8051 to receive bytes of data serially, and put them in P1.

8) Using Firebird Robot , program it for buzzer control, and for line follower application.

9) Interface MC ADC with temperature IC LM35 and display temperature on LCD.

10) Introduce Keil ARM – MDK development flow and Write a program to flash simple LEDs (D0, D1... D7) connected to Ports in various Patterns

11) Display digital output for given analog input using internal ADC

Major Equipment Needed: Microcontroller kits, IC programmer, IC tester, Bread board trainer, Power Supply, Function generator, DSO, Special purpose ICs.