CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Electrical Engineering)**

Semester: **VIII**

Course Code: **202050805**

Course Title: **Advanced Microcontroller and Embedded System**

Course Group: **Professional Elective Course-VI**

Course Objectives: Use of advanced fast microcontrollers are essential in various areas of Electrical Engineering. This subject focuses on the study of advanced microcontrollers along with the use of microcontrollers. It also briefs the students about interfacing of memory and various I/O devices like A to D converter, D to A converter LED, LCD to advanced microcontrollers. The students learn the Programming language (Embedded C) used for microcontrollers. They will be able to use the advanced fast microcontroller in electrical engineering related fields like Power system protection, instrumentation, power electronics, Electrical Drives and control of Electrical Equipment's.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25/9	25 / 09	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Advanced concepts in the Microcontroller 8051 :** Review of the 8051 architecture, concepts of synchronous serial communication, SPI and I2C communication protocols, study of SAR ADC/DAC MCP3304/MCP 33, interfacing concepts of SPI based ADC/DAC, study of watchdog timer, study of PCA timer in different modes like capture mode, PWM generation mode, High speed output toggle mode Embedded 'C' programming for the above peripherals	15

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2	**Introduction to ARM CORTEX M:** CORTEX M0 and M4 cores, Harvard and Von Neumann architectures, CPU Registers, CPU Operating Modes, Thumb-2 Instruction Set, Memory Map, Bus Interface, bit bending , interrupt handling ,NVIC(Nested Vectored Interrupt Controller), system tick timer, Debug system	**05**
3	**Introduction to STM32F4xx architecture:** Features of STM32F4XXDSC, Memory and bus architecture, Multilevel AHB bus matrix, Memory organization, Memory map, NVIC Operation Exception Entry And Exit , Reset and Clock Circuit	**05**
4	**Advanced concepts in Embedded 'C' programming:** Pointers, structures, unions, pointers to structures, pointers to functions, addressing mechanism for memory mapped registers, enumerators, Interrupt Handlers Embedded software architecture: Round robin architecture, Round robin with interrupt architecture	**07**
5	**STM32F4 PERIPHERALS & PROGRAMING:** GPIO, General Purpose Timers, GPIO :Introduction, Main Features , Function Description, Registers, Basic timers (TIM6&TIM7): introduction, main features, functional description, registers, Embedded C Programming for GPIO and Timers	**10**

List of Practicals / Tutorials:

1	Introduction to Integrated Development Environment KEIL Micro Vision IV
2	Programming for serial communication
3	Programming of PCA Timer for 8-bit PWM Generation
4	Programming of PCA timer for Variable frequency square wave generation
5	Programming of PCA Timer for Frequency measurement and display on LCD using Capture mode.
6	Programming of SPI port for Interfacing with ADC MCP3304
7	Programming of SPI port for interfacing with DAC MCP4822
8	Programming of Watchdog Timer
9	Introduction to KEIL Microvision IV MDK-ARM IDE
10	Programming of GPIO port with LED toggling and key interface
11	Programming of Base timer for accurate delays
12	Introduction to auto code generation for STM32F4 target using MATLAB Toolbox and Simulink

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Reference Books:

1	Muhammad Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson Education, 2006.
2	David E. Simon. "An Embedded Software Primer" Addision Wesley Pearson Education, 1999.
3	Joseph Yiu, "The Definitive Guide to ARM® CORTEX®-M3 and CORTEX®-M4 Processors", Newnes, Elsevier, 2014.
4	Trevor Martin, " The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach", Newnes, Elsevier, 2016.

Supplementary learning Material:	
1	Datasheet of 89V51RD2 (www.nxp.com, www.atmel.com)
2	Datasheet MCP3304/MCP4822 (www.microchip.com)
3	Datasheet, programming and user reference manual of STM32F4xx (www.st.com)
4	www.hitex.com
5	www.nptel.ac.in

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation: The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
25%	30%	20%	15%	10%	0%	

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.

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Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand how microcontroller and its peripherals function.	**30**
CO-2	Interface to external peripherals	**20**
CO-3	Program an embedded system in assembly and C	**15**
CO-4	Design, implement and test a single-processor embedded systems for real-time applications	**20**
CO-5	Optimizing embedded software for speed and size for industrial applications.	**15**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025

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