



GUJARAT TECHNOLOGICAL UNIVERSITY
Syllabus for Integrated MSc, 9th Semester
Branch: Computer Science
Subject Name: Embedded System
Subject Code: 1390303

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Content:

Sr. No.	Content	Teaching Hours	Module Weightage (%)
1	FUNDAMENTALS OF EMBEDDED SYSTEMS: Introduction to Embedded Systems, Embedded System Design Methodologies, Microcontrollers and Microprocessors, Embedded System Hardware Components (Memory, I/O), Embedded System Software Components (Operating Systems, Device drivers).	6	10
2	EMBEDDED SYSTEM DESIGN: Embedded System Design Life cycle, Requirements Analysis and Specification, System Design and Architecture, Hardware-Software Co-Design, Design Verification and Validation.	5	20
3	MICROCONTROLLERS AND PROGRAMMING: Microcontroller Architecture and Programming, Embedded C Programming, Assembly Language Programming, Microcontroller Interfacing (GPIO, UART, SPI, I ² C), Microcontroller-Based System Design	7	20
4	REAL-TIME OPERATING SYSTEMS (RTOS): Introduction to RTOS, RTOS Architecture and Components, Task Management and Scheduling, Interrupt handling and Management, RTOS-Based System Design	6	15
5	EMBEDDED SYSTEM NETWORKING AND COMMUNICATION: Introduction to Embedded System Networking, Network Protocols and Standards (TCP/IP, HTTP, FTP), Wireless Communication Protocols (Wi-Fi, Bluetooth, Zigbee), Networked Embedded System Design, IoT and M2M Communication.	10	20
6	EMBEDDED SYSTEM SECURITY: Introduction to Embedded System Security, Threats and vulnerabilities in Embedded Systems, Secure Coding Practices for Embedded Systems, Cryptography and Encryption Techniques, Secure Boot and Firmware Updates.	6	15

Reference Books:



1. "Embedded System Design" by Peter Marwedel
2. "Embedded Systems: Real-Time Operating System for ARM Cortex-M Microcontrollers" by Jonathan W. Valvano
3. "Embedded Systems: A Contemporary Approach Using C and C++" by Frank Vahid and Tony Givargis
4. "The 8051 Microcontroller and Embedded Systems Using Assembly and C" by Muhammad Ali Mazidi
5. "Fundamentals of Microcontrollers and Applications In Embedded Systems" by amesh Gaonkar

Course Outcome:

1. Design and Develop embedded systems using microcontrollers and system-on-chip devices.
2. Analyze and optimize the performance of embedded systems, including power consumption, timing and memory usage.
3. Implement and integrate various peripherals and interfaces, such as GPIO, UART, SPI, I2C and USB.
4. Develop and debug embedded software using programming like C, C++, and assembly language.
5. Use industry-standard tools and software, such as Keil, IAR, and ARM Development studio.
6. Design and implement embedded systems with focus on low power consumption, reliability, and security.

List of Experiments:

- 1) LED Blinking: Blink an LED using a microcontroller (e.g. Arduino, ARM).
- 2) Button-Activated LED: Control an LED using a button and a microcontroller.
- 3) PWM-Controlled LED: Use Pulse Width Modulation to control an LED's brightness.
- 4) Temperature Monitoring: Measure temperature using a temperature sensor and display it on an LCD.
- 5) Traffic Light Controller: Design and implement a traffic light controller using a microcontroller.
- 6) Home Automation System: Develop a basic home automation system using a microcontroller and sensors.
- 7) Weather Station: Design and implement a weather station using sensors and microcontroller.

List of open Source software/learning Websites:

- Arduino IDE: A popular open-source IDE for Arduino boards.
- Eclipse : A popular, open-source IDE for various programming languages, including C/C++ for embedded systems.
- GCC: The GNU compiler collection, a free and open-source compiler for various programming languages.
- Sparkfun: A popular website for learning about embedded systems, featuring tutorials, projects, and resources.