GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Internet of Things

Course / Subject Code : ME01062021

Course / Subject Name: Embedded System & Architecture

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PCC

Prerequisite:	• Fundamental Knowledge of the Microprocessor & Microcontroller, Basic knowledge of assembly language, C programming and Fundamentals of Digital Logic Design are required.
Rationale:	• This course will introduce the students to embedded systems, their hardware and software, embedded bus protocols and the concept of embedded C programming. Students will also understand various embedded systems architectures and applications. This course is designed with two complementary goals: • To understand the scientific principles and concepts behind embedded systems. • To obtain hands-on experience in programming embedded systems.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
03	00	02	4	70	30	30	20	150

Course Content:

Sr No	Course Content	No of Hours	% of Weightage
1	**UNIT I: Embedded System Introduction** Embedded systems Vs general computing systems, introduction to real-time embedded system and general-purpose computers, classification of an embedded system,	8	20

	examples of an embedded system, major application areas, real-time system's requirements, real-time issues, interrupt latency, introduction to unified modelling language (UML), the core of the embedded system, memory, sensors and actuators, communication interface, embedded firmware, power-supply, PCB and passive components.		
2	**UNIT II : Embedded System Architectures:** CISC and RISC architecture, embedded processor : 8051, AVR architecture and pin functions, DSP processors, ARM processor family, application of ARM processor, the architectural inheritance, the ARM programmer's model, ARM development tools.	9	20
3	**UNIT III: Embedded Design Life Cycle** Embedded design life cycle – product specification – Hardware / Software partitioning – detailed hardware and software design – Integration – product testing – selection processes – microprocessor Vs microcontroller – performance tools – benchmarking – RTOS microcontroller - RTOS availability – toolchain availability	8	20
4	**UNIT IV: Embedded System Communication protocols:** UART and SPI communication protocol, I2C communication protocol: I2C Protocol, programming for I2C Protocol, a real-time application using RTC, advantages & disadvantages of I2C protocols. , USB communication protocol, PCI-bus communication protocol, CAN protocol	8	20
5	**UNIT V: Embedded System Software :** Embedded C programming: Integer and mixing data types, Useful typedef and defines, manipulating bits in memory and I/O ports, accessing memory-mapped I/O devices, structures, union and pointer, software architectures: requirements of embedded software, interrupts- basics, shared data problem, latency, Recent trends in Embedded systems.	9	20

Reference Book:

1. Introduction to Embedded Systems -Shibu K.V, McGraw Hill.
2. Embedded Systems -Raj Kamal, TMHGurusamy, PHI, EEE, 2001.
3. Embedded System Design -Frank Vahid, Tony Givargis, John Wiley

4. Fundamentals of Embedded Software: where c and assembly meet Daniel W lewis (Prentice hall)
5. Arnold S. Berger – Embedded System Design CMP books, USA 2002..

Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
01	Understand the concept of embedded systems, components and embedded system design.	UN
02	Implement various embedded system architectures	AP
03	Implement embedded design life cycle for embedded systems design	AP
04	Analyze the embedded architectures and communication protocols for embedded systems	AN
05	Evaluate embedded systems software for embedded systems design	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

- The practical work will be carried out based on the content covered during the academic sessions.

List of Laboratory/Learning Resources Required:

List of Hardware :

- ARM-Based LPC2148 Processor Kit along with Peripheral Board
- Arduino UNO Board

List of Open Source Tools/Simulator:

- Keil uVersion (Open Source Available)
- Arduino IDE (Open Source Available)
- Proteus (Open Source Available))

List of Useful websites/MOOCs:

- Course-related online MOOCs on NPTEL/SWAYAM platform
- Recently Published papers/articles in reputed journals

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