GUJARAT TECHNOLOGICAL UNIVERSITY

Minor Degree – Robotics
Subject Code: N115AO02
Semester: V (w.e.f. AY 2025-26)

Subject Name: Microprocessor and Embedded System

Type of course: Minor Degree (Module 3)

Prerequisite: Minor Degree (Module 1& Module 2)

Rationale:

This course aims to teach the detailed functioning of microprocessors and the role of embedded systems in a robotic system.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	0	30	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Embedded Systems and microcomputers:** Introduction to Embedded Systems, Embedded System Applications, Block diagram of embedded systems, Trends in Embedded Industry, Basic Embedded System Models, Embedded System development cycle, Challenges for Embedded System Design, Evolution of computing systems and applications. Basic Computer architecture: Von-Neumann and Harvard Architecture. Basics on Computer organizations. Computing performance, Throughput and Latency, Basic high performance CPU architectures, Microcomputer applications to Embedded systems and Mechatronics.	**10**
2	**Microprocessor:** 8086 Microprocessor and its Internal Architecture, Pin Configuration and their functions, Mode of Operation, Introduction to I/O and Memory, Timing Diagrams, Introduction to Interrupts. Introduction to C language, Instruction format, C language programming format, Addressing mode, Instruction Sets, Programming 8086 microprocessor.	**08**
3	**Microprocessor Interfacing:** Introduction to interfacing, Memory Interfacing, Programmable Peripheral Interfacing, Programmable I/O, Programmable Interrupt Controller, Programmable Timers, Programmable DMA Controller, Programmable Key Board Controller, Data acquisition Interfacing: ADC, DAC, Serial and parallel data Communication	**08**

	interfacing. Microcontroller: Introduction to Microcontroller and its families, Criteria for Choosing Microcontroller. Microcontroller Architecture, Programming model, addressing modes, Instruction sets, Assembly and C programming for Microcontroller, I/O programming using assembly and C language, Interrupt Controller, I/O interfacing, Timers, Real Time Clock, Serial and parallel Communication protocols, SPI Controllers. LCD Controller.	
4	**Microcontroller Interfacing:** Introduction to Microcontroller Interfacing and applications: case studies: Display Devices, controllers and Drivers for DC, Servo and Stepper Motor.	**05**
5	**Introduction to Advanced Embedded Processor and Software:** ARM Processor, Unified Model Language (UML), Embedded OS, Real Time Operating System (RTOS), Embedded C.	**05**
6	**Microprocessor and Embedded System Laboratories:** Basic C language programming implementation on Microprocessor and Microcontroller. Interfacing Displays, Key boards and sensors with Microprocessors and Microcontrollers, Data Acquisition using Microprocessor and Microcontroller, Implementation of Controlling schemes for DC, Servo, Stepper motor using C programming in microprocessors and Microcontrollers.	**05**

Reference Books:

1. K. V. Shibu, Introduction to Embedded Systems, McGRAW Hill Publications (2009).
2. Raj Kamal, Embedded Systems, TATA McGRAW Hill Publications (2003).
3. M. Morris Mano, Computer System Architecture, 3ed, Pearson Publication, (2007).
4. D. V. Hall, 8086 Microprocessors and Interfacings, TATA McGRAW Hill, (2005).
5. B. B. Brey, The Intel Microprocessors, Prentice Hall Publications, 8th ed, (2018).
6. M. A. Mazidi, R.D. Mckinlay and D. Casey, PIC Microcontrollers and Embedded Systems, Pearson Publications, (2008).
7. M. Predko, Programming and Customizing the PIC Microcontroller, McGRAW Hill Publications. 3ed, (2017).
8. R. Barnett, L. O'Cull and S. Cox, Embedded C Programming and Microchip PIC, Cengage Learning, (2003).

Distribution of marks weightage for cognitive level

Bloom's Taxonomy for Cognitive Domain	Marks % weightage
Recall	10
Comprehension	10
Application	30
Analysis	40
Evaluate	5

Create	5

Course Outcome:

After learning the course the students will able to:

Sr. No.	CO statement	Marks % weightage
CO-1	To prepare block diagrams for any robotic control-hardware design,	20
CO-2	To choose appropriate flow of embedded systems for a specific application.	30
CO-3	To Write code for micro controller devices.	30
CO-4	To use advanced embedded processor and software.	20

Major Equipment:

1. Computational facility.
2. Robotics laboratory
3. Microprocessor and Microcontroller lab

List of Experiments:

1. Introduction to 8086 microprocessor trainer kit.
2. Assembly language programming for data transfer operations in the 8086 microprocessor. Assembly language programming for arithmetic operations in the 8086 microprocessor.
3. Assembly language programming for logical operations in the 8086 microprocessor.
4. Interfacing of input/output devices with 8086 microprocessor.
5. Interfacing of ADC and DAC with 8086 microprocessor.
6. Interfacing of Keypad with 8086 microprocessor.
7. Introduction to Program Development Tools (IDE) for Microcontrollers.
8. Assembly language programming for arithmetic operations in the 8051 microcontroller.
9. Input/output port programming for 8051 microcontroller using PROTEUS.
10. Assembly language programming for logical operations and code conversion in the 8051.
11. Generating delay in 8051 microcontroller.
12. Interfacing of LCD with 8051 microcontroller.
13. Interfacing of 4x4 Matrix Keypad with 8051 microcontroller.

Alternative SWAYAM/NPTEL Course:

GUJARAT TECHNOLOGICAL UNIVERSITY

Minor Degree – Robotics
Subject Code: 115AO01

NPTEL Course Name	Instructor	Host Institute
Embedded Systems	Prof. Santanu Chaudhary	IIT Delhi