Module Code	ET2223	Module Title	Microprocessors Microcontrollers & Embedded Systems			
Credits	3	Hours/ Week	Lectures	42	Prerequisites	-
GPA/ NGPA	GPA		Continuous Assessments/ Tutorials	06		
Module Objectives		To provide the students with the knowledge of structure, operation and design of microprocessor based systems, microcontrollers and embedded systems.				
Learning Outcomes		After the completion of this module, the student will be able to **LO1 : Explain** numbering systems, microprocessor hardware constructions, interfacing circuits and adopt interfacing protocols. **LO2 : Develop** simple programmes using assembly language. **LO3 : Explain** principles of embedded systems design, microcontrollers and PLC and program a microcontroller and a PLC. **LO4 : Develop** a program for microcontrollers and specify communication protocols for interface design.				
Contents		**Digital number systems** Representing signed numbers, 1s and 2s, complement system, adders and subtractors			**LO1**	
		Microprocessor systems and VLSI devices Microprocessors, Basic microcomputers, structure and operation, hardware design, common microprocessors.			**LO1**	
		Interfacing techniques and circuits Standard interfaces, interface chips, interfacing protocols, memory design, interfacing between microprocessor and memory chip.			**LO1**	
		Assembly language programming Illustration of assembly language, programing fundamentals and techniques using an example microprocessor			**LO2**	
		Embedded system introduction Introduction to Embedded System, History, Design challenges, optimizing design metrics, time to market, applications of embedded systems and recent trends in embedded systems, embedded design concepts and definitions, memory management, hardware and software design and testing, communication protocols like SPI, I2C, CAN, ARM, PIC microcontrollers and AMBA, USB, PCI etc., families for buses.			**LO3**	
		System architecture Microprocessors and microcontrollers, Z80 and the 8051, a microcontroller survey, development systems for microcontrollers. Introduction to ARM core architecture, ARM extension family, instruction set, thumb Instruction set, Pipeline, memory management, Bus architecture, study of on-chip peripherals like I / O ports, timers, interrupts, on-chip ADC, DAC, RTC modules, WDT, PLL, PWM, USB, I2C, SPI, CAN etc. Use 2148 /2368/2378 as reference micro-controllers. And basic of PLC, ladder logic programming.			**LO3**	
		Interfacing and programming Basic embedded C programs for on-chip peripherals studied in system architecture. Need of interfacing, interfacing techniques, interfacing of different displays including Graphic LCD, interfacing of input devices including touch screen etc., embedded communication using SPI, I2C, GSM modem for AT command study etc.			**LO4**	

Laboratory/ Practical Sessions	In Class • Simulation of simple program for 8051 using Keil and Proteus simulator • C programming example for LCD interfacing using Arduino IDE and Proteus simulator	**LO3** **LO4**
Method of Assessment	Continuous assessment : 20% End Semester Examination :80%	
References	1. Ramesh S. Gaonkar, (2002). Architecture, Programming, and Applications with the 8085 (5th Edition), Prentice Hall. 2. Tammy Noergaar, (2021). Embedded systems architecture, Newnes. 3. Mohit Arora, (2016). Embedded System Design: Introduction to Soc System Architecture, Learning Bytes Publishing. 4. Eman Kamel and Khaled Kamel ,(2013)Programmable Logic Controllers: Industrial Control,McGraw-Hill Education.	

		Programme Outcomes											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Linkage between Learning Outcomes (LOs) and Programme Outcomes (POs)	**LO1 (0.29)**	M	H		H								
	LO2 (0.17)	M	H	H	H	H							L
	LO3 (0.32)	H	H	L	H	H				L			M
	LO4 (0.22)	M	H	H	H	H				L			M
	Module	**H**	**H**	**H**	**H**	**H**				**L**			**M**
	H – High, M – Medium, L - Low												
Lecturers													