

Branch Name:	Signal Processing and Communication
Program Code:	ET214
Course Name:	Embedded System Design
Course Code:	2ET2140201T
Pre-requisite Course:	Basic Knowledge of Analog Electronics, Digital Electronics, Microprocessors 8085 and 8086, Microcontroller 8051, Basic Knowledge of Computer Programming and C language

Course Objectives:

1. This course aimed to develop skills in the students related to Embedded System Design which introduces concepts of modern Microcontrollers and Microprocessors along with art of hardware and software designing for Electronics Systems.
2. This course also covers concepts of RTOS and DSP Processors which is the base for any Modern Electronics Systems.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	4	-	-	4	24	60	16	40		-	-	-	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction to Embedded Systems: - Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices In a System, Embedded Software in a system, Examples of Embedded Systems, Embedded System-on-chip(SOC) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design Process in Embedded System, Formulation of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills Required for an Embedded System Designer.	4	10

2	Platforms for Embedded System Design: - ARM7 Architecture: The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance, The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, Core extensions, Architecture revisions. PIC Architecture (PIC18Fxx Series): Architecture, Memory Organization, Addressing Modes, Instruction Set, Timers, Interrupts, I/O Ports, Interfacing I/O Devices, ADC, Serial Communication, MPLAB.	12	30
3	Programming the Embedded Systems: - Introduction to Assembly and Embedded C Language, Basics of Embedded C --Data types, Looping, Functions, Array, String, Pointers, I/O Programming in C, Arithmetic & Logical Operations in C, Data Serialization in C, Data Conversion in C etc. Introduction to KEIL IDE, MPLABX IDE.	3	7
4	Embedded System Design–Case Study:- Interfacing LCD Display, Keypad Interfacing, ADC, DAC and Sensor Interfacing, DCMotor Control with PWM Generation, UART Interfacing, RTC interfacing, I2C Bus Interfacing, CCP-modules, SPI, EEPROM.	7	18
5	Real Time Operating System: Operating system service, Process management, Timer function, Event function, Memory management, Device, File and I/O subsystem management, Interrupt routine in RTOS environment and handling of interrupt Sources calls, Real Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues, Introduction to Embedded Operating Systems uC/OS-II and FreeRTOS.	8	20
6	Digital Signal Processor and Applications: Over View of Texas instrument DSP processor Families TMS320C2000, TMS320C5000 and TMS320C6000 and its various fields of applications. TMS320C6713: Features, CPU block diagram, Memory Map, Peripheral modules: GPIO, Timers, I2C, McBSP, HPI, EMIF (Brief descriptions only).	6	15
	Total	40	100

List of Text Book:

1. “Embedded System: Architecture, Programming and Design”, Rajkamal , 2nd edition, 2010, Tata McGraw Hill

List of Reference Books:

1. “ARM System-on-chip Architecture”, Steve Furber, 2nd Edition” Pearson publication.
2. “PIC Microcontroller and Embedded Systems”, Muhammad Ali Mazidi, Rolin McKinlay, Danny Causey 2008, Pearson Education.
3. “Interfacing PIC Microcontrollers Embedded Design by Interactive Simulation”, Martin P. Bates 2006, Elsevier Publications.
4. “PIC Microcontrollers –Know it all”, Lucio Di Jasio, Tim Wilmshurst, Dogan Ibrahim, John Morton, Martin P. Bates, Jack Smith, David W Smith, Chuck Hellebuyck 2007, Elsevier Publications.
5. “Programming Embedded Systems in C and C++”, Michael Barr, O'Reilly Publications
6. “Embedded C”, Michael J. Pont.
7. “DSP Applications Using C and the TMS320C6x DSK”, Rulph Chassaing.
8. “Digital Signal Processing and Applications with the C6713 and C6416 DSK”, Rulph Chassaing.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand Embedded Systems and its need in today's electronics world.	1 Remembering 2 Understanding
CLO2	Understand the detailed concepts of PIC and ARM7 series of high end Microcontrollers which is mostly used in electronics applications.	2 Understanding 5. Evaluate
CLO3	Do the programming of microcontrollers with various dedicated IDEs with 'C' and C++ Language.	4 Analyze
CLO4	Design their own Embedded Systems for various applications.	3 Applying
CLO5	Learn the concepts of RTOS in its applications in embedded Systems.	3 Applying 4 Analyze
CLO6	Learn the DSP processors and its applications in high end Embedded Systems.	2 Understanding

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1					L	M						H	H	M	L	
CLO2		H	M	M	L					L		H		M	L	
CLO3		M	H		L									H		L
CLO4		M	H		L			L					L		M	H
CLO5	H	M	H		L				L			H	L		M	H
CLO6	H	M	H		L							M	L		M	H

H: High, M: Medium, L: Low