

Branch Name:	Information and Communication Technology
Program Code:	ET107
Semester/Year:	Semester VII / Fourth Year
Course Name:	Professional Elective –IV: Embedded System
Course Code:	2ET1070705T
Pre-requisite Course:	Knowledge of microprocessor/microcontroller hardware, programming concept in assembly and C.

Course Objectives:

1. Analysis, optimization, and implementation of embedded systems, enabling the students to adapt to a changing environment with the widespread use of embedded 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.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.	9	20
2	Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the Type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.	10	20
3	Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.	10	25
4	RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.	8	15

5	MSP430 (Case Study): Motivation for MSP 430 Microcontrollers, MSP430 RISC CPU architecture, Compiler-friendly features, On-chip peripherals and programming for - Watchdog Timer, Basic Timer, Real Time Clock (RTC), ADC, Universal Serial Communication Interface (USCI), Low-power features of MSP430	8	20
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List of Reference Books:

1. Embedded System: Architecture, Programming and Design by Raj Kamal, 2nd Edition, TMH Publication 2008.
2. Embedded Software Premier David Simon (Pearson) 2006
3. Computers as Components Principles of Embedded Computing System Design by Wayne Wolf, Morgan Kaufman 2000.
4. Real Times Systems Theory and Practice by Rajib Mall (Pearson Education) 2007.
5. Embedded Real-time Systems Programming Sri Ram Iyer and Pankaj Gupta (TMH) 2006.
6. The Linux Programming Interface , Michael Kerrisk 2010 Publisher(s): No Starch Press
7. MSP430 Microcontroller Basics by John H. Davies, 1st Edition, Elsevier Joseph Yiu, “The Definitive Guide to the ARM Cortex M3”, Second Edition, Elsevier Inc., 2010.
8. Jean J. Labrosse, “Micro /OS-II, The real time kernel”, Second Edition, CMP books 1998.
9. Arnold S. Berger, “Embedded System Design”, CMP Books, USA 2002
10. Michael Barr, “Programming Embedded Systems with C and GNU”, O Reilly, 2003

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.	1 Remembering 2 Understanding
CLO2	Recognize basics of various embedded hardware and protocol standards	2 Understanding
CLO3	Learn and analyze basics of operating system fundamentals and real-time operating systems concepts.	3 Applying 4 Analyze
CLO4	Analyze Inter-Process Communication methods	4 Analyze
CLO5	Demonstrate the use of RTOS principles and develop small-scale embedded systems using MSP430 LaunchPad.	3 Applying 4 Analyze 2 Evaluate

Faculty of Engineering and Technology
Bachelor of Technology (Semester VII / Fourth Year)
In Effect from Academic Year: 2023-24

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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CLO1	H	M	M	L	L	M							H	L		
CLO2		L		H	L	L					L	L	M	L		
CLO3	L	M		L	M			M		L			M	L		
CLO4	M	M		L	M	H		M	L				M	L		
CLO5	M	L	L	L	M	H		M		L			H	L		

H: High, M: Medium, L: Low