BCSE305L	Embedded Systems	L	T	P	C
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Pre-requisite	**NIL**	**Syllabus version**			
		1.0			

Course Objectives

1. To expose students to various challenges and constraints of special purpose computing systems in terms of resources and functional requirements.
2. To introduce students to various components of typical embedded systems viz., sensors and actuators, data converters, UART etc., their interfacing, programming environment for developing any smart systems and various serial communication protocols for optimal components interfacing and communication.
3. To make students understand the importance of program modeling, optimization techniques and debugging tools for product development and explore various solutions for real time scheduling issues in terms of resources and deadline.

Course Outcomes

On completion of this course, students should be able to:

1. Identify the challenges in designing an embedded system using various microcontrollers and interfaces.
2. To summaries the functionality of any special purpose computing system, and to propose smart solutions to engineering challenges at the prototype level.
3. To examine the working principle and interface of typical embedded system components, create programme models, apply various optimization approaches including simulation environment and demonstration using debugging tools.
4. To evaluate the working principle of serial communication protocols and their proper use, as well as to analyze the benefits and drawbacks of real-time scheduling algorithms and to recommend acceptable solutions for specific challenges.

Module:1	**Introduction**	**5 hours**

Overview of Embedded Systems, Design challenges, Embedded processor technology, Hardware Design, Micro-controller architecture -8051, PIC, and ARM.

Module:2	**I/O Interfacing Techniques**	**8 hours**

Memory interfacing, A/D, D/A, Timers, Watch-dog timer, Counters, Encoder & Decoder, UART, Sensors and actuators interfacing.

Module:3	**Architecture of Special Purpose Computing System**	**6 hours**

ATM, Handheld devices, Data Compressor, Image Capturing Devices–Architecture and Requirements, Challenges & Constraints of special purpose computing system.

Module:4	**Programming Tools**	**7 hours**

Evolution of embedded programming tools, Modelling programs, Code optimization, Logic analyzers, Programming environment.

Module:5	**Real Time Operating System**	**8 hours**

Classification of Real time system, Issues & challenges in RTS, Real time scheduling schemes- EDF-RMS & Hybrid techniques, eCOS, POSIX, Protothreads.

Module:6	**Embedded Networking Protocols**	**5 hours**

Inter Integrated Circuits (I2C), Controller Area Network, Embedded Ethernet Controller, RS232, Bluetooth, Zigbee, Wifi.

Module:7	**Applications of Embedded Systems**	**4 hours**

Introduction to embedded system applications using case studies – Role in Agriculture sector, Automotive electronics, Consumer Electronics, Industrial controls, Medical Electronics.

Module:8	**Contemporary Issues**	**2 hours**

	Total Lecture hours:	**45 hours**
Text Book		
1.	Marilyn Wolf, Computers as Components – Principles of Embedded Computing System Design, Fourth Edition, Morgan Kaufman Publishers, 2016.	
Reference Books		
1.	Embedded Systems Architecture, Programming and Design, by Raj Kamal, McGraw Hill Education, 3e, 2015.	
2.	Embedded System Design A Unified Hardware/Sofware Introduction, by Vahid G Frank and Givargis Tony, John Wiley & Sons, 2009.	
Mode of Evaluation: CAT, written assignment, Quiz, FAT.		
Recommended by Board of Studies	04-03-2022	
Approved by Academic Council	No. 65	Date 17-03-2022