| Programe:B. .Tech. (CSE) | Year: 3rd | Semester: 6th |
| Course: Program Elective | Credits: 3 | Hours: 40 |

Course Context and Overview (100 words):
An embedded system is an elective course for undergraduate and graduate students in the Electronics and Communication Engineering program. The purpose of this course is to teach students, the application and development of a system which interacts with the physical world. This course not only helps students in understanding the basics of embedded system, but also highlights the modern trends in the same.

Pre-requisite Courses:
Computer Organization, I/O Interface and basic knowledge of communication Systems and digital electronics concepts, C and VHDL

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1 Student should be able to understand the design concepts and design process.
CO2 Student should be able to understand the working of co-processors, hardware accelerators and I/O device configuration and communication.
CO3 Student should be able work with FPGA and software development kits.
CO4 Student should be able to program microcontroller boards (e.g. Arduino, AVR dragon, etc.).
CO5 Student should be able to demonstrate programming proficiency using various development tools including DS5, eclipse, MPLAB, AVR studio etc.
CO6 Student should be able to understand the file systems and functionality of various operating systems, i.e. RTOS, Linux, BSD, desktop environment (i.e. X11, GNOME, KDE). The student should be able to demonstrate programming proficiency using various development tools including DS5 eclipse, MPLAB, AVR studio etc.

Course Topics:

Topics	Lecture Hours	
UNIT - I 1. **Topic** Introduction to Embedded Systems		
1.1 Introduction to Embedded Systems	1	2

1.2 Overview and Design Process.	1	
UNIT - II 2. **Topic** Embedded Systems Architectures		
2.1 Instruction Set Architecture	2	7
2.2 Basic Embedded Processor/Microcontroller Architecture	2	
2.3 Memory System Architecture	1	
2.4 I/O Sub System, Co-processors and Accelerators	2	
UNIT - III 3. **Topic** Designing Embedded Computing Platform		
3.1 Using CPU Bus	2	
3.2 Memory devices and their characteristics	2	11
3.3 , I/O Devices, Component Interfacing	2	
3.4 Design with Processors	2	
3.5 Implementation, Design Examples.	3	
UNIT - IV 4. **Topic** Programming Embedded Systems		
4.1 Program Design and Programming Languages	3	
4.2 Desired language characteristics and Use of High level languages	3	9
4.3 Programming and run time Environment	3	
UNIT-V 5. **Topic** Operating System		
5.1 Basic features of an operating System	2	8
5.2 Kernel Features, Process and Threads, Context Switching, Scheduling	3	
5.3 Inter-process communication, I/O, Example Real-time OS	3	
UNIT-VI		

6. Topic Network Based Embedded Applications		
6.1 Network fundamentals, Layers and Protocols, Distributed Embedded Architectures	1	
6.2 Element of protocols, design, High level protocol design languages, Network based design	1	3
6.3 Internet-Enable systems, wireless applications	1	

Textbook references (IEEE format):

Text Book:

1. Computers as Components - Principles of Embedded Computing System Design, Wayne Wolf.

2. Microprocessors and Microcomputers, Hardware and software, 6-th edition, Ronald J. Tocci, Frank J. Ambrosio, Prentice Hall.

Reference books:

1. Computers as Components - Principles of Embedded Computing System Design, Wayne Wolf.
2. Embedded Systems. A Contemporary Design Tool, James K. Peckol, John Wiley & Sons, Inc.

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

Evaluation Methods:

Item	Weightage
Quiz1	
Quiz2	20
Quiz3	
Quiz4	
Assignment, Attendance and performance	10
Midterm	20
Final Examination	50

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