Course code	Course name	L-T-P-Credits	Year of Introduction
AE366	EMBEDDED SYSTEM DESIGN	3-0-0-3	2016

Prerequisite : Nil

Course objectives

- To impart the basic functions and structure of embedded systems Outcomes.

Syllabus

Embedded Systems Vs General Computing Systems - Purpose of Embedded Systems - Core of the Embedded System – Memory - Embedded Firmware - RTOS Based Embedded System Design - Task Communication - Task Synchronization - Programming concepts of Embedded programming in C Program - Concepts of embedded programming in C++ – Real time operating systems Definitions of process.

Expected outcome

- At the end of the semester students will be able to understand the basic concepts & applications of embedded systems.

Text Books

1. Shibu K.V, *Introduction to Embedded Systems*, Mc Graw Hill
2. Wayne Wolf, *Computers as Components: Principles of Embedded Computing System Design* – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001

Reference Books

1. David E. Simon *An Embedded Software Primer*, Pearson Education.
2. Frank Vahid and Tony Givargis, *Embedded System Design* – A unified Hardware / Software Introduction, John Wiley, 2002.
3. Lyla B Das, *Embedded Systems An Integrated Approach*, Pearson, 2013
4. Rajkamal, *Embedded Systems Architecture, Programming and Design*, TATA McGraw-Hill, First reprint Oct. 2003

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	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.	6	15%
II	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: On board and External Communication Interfaces.	7	15%
	FIRST INTERNAL EXAMINATION		
III	Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.	7	15%

IV	RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.	7	15%
SECOND INTERNAL EXAMINATION			
V	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.	7	20%
VI	Programming concepts of Embedded programming in C Program Elements, Macros and functions - Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of embedded programming in C++ – Cross compiler – Optimization of memory codes. Real time operating systems Definitions of process, tasks and threads.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)