INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**EMBEDDED SYSTEMS DESIGN**			
Course Code	**A70440 (R15)**			
Branch	**IV B. Tech I Sem (ECE branch)**			
Academic Year	**2018– 2019**			
Course Structure	**Lectures**	**Tutorials**	**Practical's**	**Credits**
	4	**1**	**-**	**4**
Course Coordinator	**Mr. N Paparao, Assistant Professor, ECE Dept.**			
Team Instructors	**Mr. S Lakshmanachari, Assistant Professor, ECE Dept.** **Mr. MD.Khadir, Assistant Professor, ECE Dept**			

I. COURSE OVERVIEW:

Embedded systems course is continuous of the Microprocessor and Microcontrollers, is intended to Designing, Implementation and Test of embedded applications. The topics covered are definition of embedded systems, history, classification, characteristics and major applications, Quality attributes of embedded systems, types of processors, ASICs, PLDs, COTS, Memory Interface, communication interface, embedded firmware design and development,RTC,RTOS,Task,taskscheduling,threads,multitasking,Taskcommunication,Task synchronization, techniques, device drivers. Understand need of microprocessors, microcontrollers in development of various projects and to know complete Operating Systems, RTOS.

II. PREREQUISITES:

Level	Credits	Periods / Week	Prer
UG	4	4	Microprocessors and Microcontrollers
UG	4	4	Operating system

III. MARKS DISRTRIBUTION:

Sessional Marks	University End Exam Marks	Total Marks
There shall be 2 midterm examinations. Each midterm examination consists of subjective test and objective test. The subjective test is for 10 marks, with duration of 1 hour. Subjective test of each subject shall contain 4 questions; the student has to answer any 2 questions, each carrying 5 marks. The objective test is for 10 marks, with duration of 20 min. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are marked for assignments. There shall be two assignments in every theory course. First assignment marks will be allotted to 1st mid for first two and half units and second assignment marks will be allotted to 2nd mid for the remaining portion. So each mid exam is conducted for 25 marks.	**75**	**100**

IV. EVALUATION SCHEME:

S.No	Component	Duration(Hrs)	Marks
1	I Mid Examination	1 hr 20 min	20
2	I Assignment	--	05
3	II Mid Examination	1 hr 20 min	20
4	Ii Assignment	--	05
5	End Semester Examination	3 hrs	75

V. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I. Remember about the basic functions, structure, concepts and applications of embedded systems.

II. Develop familiarity with 8051 Microcontrollers and their applications in an Real Time embedded Environment with programming concepts.

III. Understand the method of designing and program an Embedded Systems for real time applications with applications.

IV. Understand operating system concepts, types and choosing Real Time Operating System with examples.

V. Understand about the development of embedded software using RTOS and Implement small programs to solve well-defined problems on an embedded platform.

VI. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Understand basic concepts and applications of embedded systems.

2. Understand and analyze the applications in various processors and domains of embedded system.

3. Develop embedded hardware and software development cycles and tools.

4. Understand and remember what a microcomputer, core of the embedded system.

5. Remember the definitions of ASICs, PLDs, memory, memory interface.

6. Understand different concepts of a CTOS, sensors, memory interface, communication interface.

7. Remember the definitions of circuits and blocks of embedded firmware design.

8. Analyze to understand embedded firmware design approaches and development languages.

9. Analyze to understand real time operating systems with examples and Ability to learn debugging techniques for an embedded system.

10. Remember how to design RTOS in embedded systems and to document their designs and explain them to others.

11. Understand Task communication and synchronization, choosing of RTOS.

12. Remember about Shared Memory, Message Passing, Remote Procedure Call and Sockets.

13. Understand Task Synchronization, Task Communication Synchronization Issues, Task Synchronization Techniques.

14. Understand Device Drivers, How to Choose a Drivers. And explain basic concepts and applications.

15. Analyze to understand real time operating systems with examples of Task Communication Synchronization.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		LEVEL	PROFICIENCY ASSESSED BY
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	S	Lectures and problem solving
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Design Exercises and assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Lectures, Assignments, Exams
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid	N	--
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	H	Lectures and Design Exercises
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary Settings.	S	Group discussions
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Document Preparation and Presentation
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Discussions, Seminars
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	H	Development of Mini Projects

N = None **S = Supportive** **H = Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES AREASSESSED:

PROGRAM SPECIFIC OUTCOMES		LEV EL	PROFICIENCY ASSESSED BY
PSO 1	**Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.	H	Lectures and Assignments
PSO 2	**Problem-solving skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.	S	Tutorials
PSO 3	**Successful career and Entrepreneurship:** An understanding of social awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.	S	Seminars and Projects

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IX. SYLLABUS:

Unit-I
Introduction to Embedded Systems:
Definition of Embedded System, Embedded Systems Vs 5General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-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: Onboard and External Communication Interfaces.

UNIT-III
Embedded Firmware:
Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT-IV
RTOS Based Embedded System Design:
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT- 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 Drivers.

TEXT BOOKS:
1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

REFERENCE BOOKS:
Embedded Systems - Raj Kamal, TMH.
Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
Embedded Systems – Lyla, Pearson, 2013
An Embedded Software Primer - David E. Simon, Pearson Education.

X. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes (CLO):

Lecture Number	CLO	Unit	Course Learning Objective	Topics to be covered	Reference Number
1-2	1	I	Demonstrate to understand the definition and comparison of embedded system with other systems	**UNIT-I** **Introduction to Embedded Systems:** Definition of Embedded System, Embedded Systems Vs General Computing Systems	T1-Chapter 1
3	2	I	Explain to understand the history embedded system	History of Embedded Systems	T1-Chapter 1
4-5	3		Classify the embedded systems	Classification of Embedded Systems	T1-Chapter 1
6-8	4		List out the application areas of embedded systems	Major Application Areas	T1-Chapter 1
9-10	5		Understand the different purpose of the embedded systems	Purpose of Embedded Systems,	T1-Chapter 1
11-12	6		List out to understand the concepts of the characteristics and quality attributes	Characteristics and Quality Attributes of Embedded Systems.	T1-Chapter 3
13-14	7	II	Classify the processors and compare them	**UNIT-II** **Typical Embedded System:** Core of the Embedded System: General Purpose and Domain Specific Processors	T1-Chapter 2
15-16	8		Remembering the definitions of ASICs,PLDs	ASICs, PLDs,	T1-Chapter 2
17-19	9		Explain the concept of COTS	Commercial Off-The-Shelf Components (COTS),	T1-Chapter 2
20-22	10		Remembering the Memory and explain the memory interface	Memory: ROM, RAM, Memory according to the type of Interface	T1-Chapter 2
22-25			Explain the memory shadowing, memory selection	Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators	T1-Chapter 2
26-28	11		Explain the communication interface	Communication Interface: Onboard and External Communication Interfaces.	T1-Chapter 2
29-30	12	III	Applying the blocks and circuits	**UNIT-III** **Embedded Firmware**: Reset Circuit, Brown-out Protection	T1-Chapter 2
31-32				Oscillator Unit, Real Time Clock, Watchdog Timer,	T1-Chapter 2
33-34	13		Applying the embedded firmware design	Embedded Firmware Design Approaches and Development Languages	T1-Chapter9
35- 36	14	IV	Remembering the basics of operating system	**UNIT-IV** **RTOS Based Embedded System Design:** Operating System Basics, Types of	T1-Chapter10
37- 38	15		Understanding the definitions of task, threads	Tasks, Process and Threads,	T1-Chapter10
39-41	16		Analyze the multiprocessing, multi tasking, task scheduling	Multiprocessing and Multitasking, Task Scheduling.	T1-Chapter10

42-45	17	V	Understanding Task Communication	**UNIT- V** **Task Communication:** Shared Memory, Message Passing, Remote Procedure Call and Sockets	T1-Chapter10
46-48	18		Analyze the Task Synchronization	Task Synchronization: Task Communication Synchronization Issues	T1-Chapter10
49-51				Task Synchronization Techniques	T1-Chapter10
52-53				Device Drivers	T1-Chapter10
54-55	19		Analyze RTOS environment	How to Choose an RTOS.	T1-Chapter10

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	S	H	H		S				S	S			H		S
II	H		S						H			S	S	H	
III	S	H	S		H					S	S			S	
IV	S	H	S		H				S		S		H		
V	H		S						H			S	S		S

S= Supportive **H = Highly Rela**

XII. MAPPING COURSE OUTCOMES LEADING TO ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	S				S					S	S			S	S
2					H							S	S		
3		S	H								S				
4	S		S									S	H	S	S
5		H							S	H			S		
6									S			H			
7	S				S								S		S
8			H		S				H	S		S			
9	S										S		H	H	
10		S			H				H	H				S	
11	S				S							S	S		S
12		S	H								S				
13	S		S									S	H		S
14		H							S	H			S	H	
15									S			H			

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