



INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTION FORM

Course Title	EMBEDDED REAL TIME OPERATING SYSTEMS SYSTEMS			
Course Code	BES214			
Regulation	R16			
Course Structure	Lectures	Tutorials	Practicals	Credits
	3	-	-	3
Course Coordinator	Ms N Anusha Assistant Professor, ECE			
Team of Instructors	Ms N Anusha Assistant Professor, ECE			

I. COURSE OVERVIEW:

- III. This course starts by introducing some basic ideas of real time systems design paradigms. Subsequently the course covers important concepts like scheduling in real time and challenges, both with respect to software and hardware. In later units analysis of a system and programming tools and languages , to understand how the real time system design and fault tolerance techniques.

PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
PG	3	3	Real Time systems

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam Marks	Total Marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper and assignment. The essay paper is for 25 marks of 120 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. 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	70	100

Sessional Marks	University End Exam Marks	Total Marks
every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking. Marks shall be awarded considering the average of two midterm tests in each course.		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	120 minutes	25
2.	I Assignment	-	5
3.	II Mid Examination	120 minutes	25
4.	II Assignment	-	5
5.	External Examination	3 hours	70

V. COURSE OBJECTIVES:

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

- I. Understand the process of real-time system design.
- II. Use different scheduling algorithms for design of real time systems
- III. Identify the tools and programming language for development of real time systems.

VI. COURSE OUTCOMES:

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

1. Understanding the basic concepts of real time system.
2. Analysis of processor scheduling real time.
3. Understanding the programming language tools.
4. Application of software in real time system.
5. Understanding the real time techniques with examples.

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	H	Assignments, Tutorials
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	S	Assignments
PO3	Design/Development of Solutions Design solutions for complex engineering problems and design system components or processes that	H	Mini Projects

Program Outcomes		Level	Proficiency assessed by
	meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations		
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 conclusions	H	Projects
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	S	Projects
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	S	Assignments
PO8	Ethics Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	S	Oral Discussions
PO9	Individual and Team Work Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	N	--
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	Presentations
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	Seminars, Discussions
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 Prototype, Projects

N - None

S - Supportive

H - Highly Related

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	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, Assignments
PSO2	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
PSO3	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	S	Seminars and Projects

Program Specific Outcomes		Level	Proficiency assessed by
	applications using optimal resources as an Entrepreneur.		

N - None

S - Supportive

H - Highly Related

IX. SYLLABUS:

UNIT -I: INTRODUCTION

Introduction to UNIX/LINUX, overview of commands, file I/O (open, create, close, lseek, read, write), process control (fork, vfork, exit, wait, waitpid, exec).

UNIT-II: REAL TIME OPERATING SYSTEM

Brief history of OS, defining RTOS, Scheduler, objects, services, characteristics of RTOS, defining a task, task states and scheduling, task operations, structure, synchronization, communication and concurrency, defining semaphores, operations and use, defining message queue, states, content, storage, operations and use.

UNIT-III: OBJECTS,SERVICES AND INPUT OUTPUTS

Pipes, event registers, signals, other building blocks, component configuration.
Basic I/O concepts, I/O subsystem.

UNIT-IV: EXCEPTIONS , INTERRUPTS AND TIMERS

Exceptions, interrupts, applications, processing of exceptions and spurious interrupts, real time clocks, programmable timers, timer interrupt service routines, soft timers, operations.

UNIT-V: CASE STUDIES OF RTOS

RT linux, Micro C/OS-II, Vx works, embedded linux, tiny OS and basic concepts of android OS.

TEXT BOOKS:

1.Quing Li, “Real Time Concepts for Embedded Systems”,Elsevier,1st Edition,2011

REFERENCE BOOKS:

1. Rajkamal,”Embedded systems, Architecture, programming and Design” ‘Tata Mc Graw Hill,2nd Edition 2003.
2. Richard steven,”Advanced UNIX Programming”, Addison – Wesley professional,3rd Edition 2013.
- 3.Dr.Craig Hollabaugh ,”Embedded Linux :Hardware,software and Interfacing”,Addison Wesley,1st Edition,2002

X. COURSE PLAN:

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

Lecture No.	CLO	Unit	Learning Objective	Topics to be covered	Reference
		Course Content Delivery --- Lecture Wise Break-up of Topics			
			I SPELL		
1-3	1.	I	Understand the basic concept of real time system and the various standards used	Introduction to real time system, issues task class performances	Text book 1
4-5	2.		Analyzing the basics concepts of scheduling	Real time application	Textbook 1
6	3.		Identify the concept of on line algorithms	Basics in algorithms	Textbook1
7-10	4.		Application of various real timetask scheduling	Application specific scheduling of independent task	Text book 1
11	5.	II	Define the design of processor	Internal processor design	Text book 1
12-15	6.		Familiarize with scheduling techniques	Applications of each tasks	Text book 1
16-17	7.		Understanding the various multipurpose scheduling	Introduction to mulity	Text book 1
18	8.		Analyzing scheduling algorithms	Process of understanding the uni process scheduling	Text book 1
19-20	9.	III	Describe the programming language	Structure facilitating	Text book 1
21-22	10.		Define error handling and over loading	In run time exception errors	Text book 1
23	11.		Understanding low level programming	Programming concepts	Text book 1

24	12.		Analyze real time software architecture	Programming environments	Text book 1
25-26	13.		Understanding the concept of programming	Real time application	Text book 1
Lecture No.	CLO	Unit	Learning Objective	Topics to be covered	Reference
30-32	15.		Application real time system design	General introduction	Text book 1
33	16.		Describe the specification document	Design method for single program approach	
34	7.	IV	Understanding MASCOT	Basic features of MASCOT	Text book 1
35-36	18.		Analyzing the concepts of MASCOT	Design approach	Text book 1
37-40	19.		Describe the various design analysis	Real time software development	Text book 1
Course Content Delivery --- Lecture Wise Break-up of Topics					
			II SPELL		
41	20.		Understanding various issues of fault tolerance	Engineering issues of softwares	Text book 1
42-45	21.		Formulate & Analyze redundancy techniques	Error detection method	Text book 1
46-47	22.		Extend the concept for case studies	Real time application cases	Text book 1
48	23.	V	Formulating microcomputer application	Real time application	Text book 1
49-55	24.		Evaluate various real time applications and errors	Analyzing and evaluating the debugging testing, and maintaining.	Text book 1

**XI. COURSE OUTCOMES LEADING TO THE ACHEIVEMENT 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	H							S				H		S	S
II		S					S			S			H	S	
III				H				S			S		H	S	
IV			H		S							H	H	S	
V	H			H			S							S	

S – Supportive

H - Highly Related

**XII. MAPPING COURSE OUTCOMES LEADING TO THE 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	PSO 1	PSO 2	PSO 3
1			H					S			S	H		S	S
2					S		S				S		H	S	
3		S			S			S				H	H	S	
4				H			S	S		S	S			S	
5		S	H		S								H	S	
6			H	H			S			S			H	S	
7				H				S		S	S			S	
8		S	H		S		S						H	S	

S – Supportive

H - Highly Related

Prepared by : Ms. N Anusha, Assistant Professor, ECE

Date : 4th March, 2017

**HOD,
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