EMBEDDED REAL TIME OPERATING SYSTEMS

III Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB22	**Elective**	3	-	-	3	30	70	100

Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes: 45**

I. COURSE OVERVIEW:

This course is to introduce students with the basic concepts and approaches in the design and analysis of real-time operating systems. It covers design considerations of real time operating systems, task scheduling, threads, multitasking, task communication and synchronization. Applications of the course include real time operating systems in image processing, fault tolerant applications and control systems.

II. COURSE OBJECTIVES:

The students will try to learn:
  I.   How to analyze theory and implementation of tasks.
  II. The synchronization problems and to use semaphore operations.
  III. The interrupt service routines for interrupts and timers.

III. COURSEOUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Outline** the components of real time operating systems for the design of reliable embedded system.	Understand
CO2	**Interpret** real time operating system to provide resource management and synchronization for communication systems.	Apply
CO3	**Identify** Real-Time Clocks and System Clocks to keep tracks of current time and clock speeds.	Apply
CO4	**Construct** memory management system for fragmentation and compaction.	Apply
CO5	**Examine** hierarchical Timing Wheels to reduce timer overflow in single timing wheel and multiple timing wheels.	Analyze
CO6	**Analyze** finite state machine for the task scheduling and execution in kernel models.	Analyze

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09

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 SYSTEMS	Classes: 10

Brief history of OS, defining RTOS, Scheduler, objects, services, characteristics of RTOS, defining a task, asks 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 I/O	Classes: 08

Pipes, event registers, signals, other building blocks, component configuration.

Basic I/O concepts, I/O subsystem.

UNIT-IV	EXCEPTIONS, INTERRUPTS AND TIMERS	Classes: 10

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	Classes: 09

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

Text Books:

1. Qing 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 Stevens, "Advanced UNIX Programming", Addison-Wesley Professional, 3rd Edition, 2013
3. Dr. Craig Hollabaugh, "Embedded Linux: Hardware, Software and Interfacing", Addison Wesley, 1st Edition, 2002.

Web References:

1. http://nptel.ac.in/courses/106105036/
2. https://www.youtube.com/watch?v=rpdygqOI9mM
3. https://www.youtube.com/watch?v=hELr9-7aAG8

E-Text Books:

1. www.nptel.ac.in/courses/108105057/Pdf/Lesson-31.pdf
2. nptel.ac.in/courses/106108101/pdf/Lecture_Notes/Mod%208_LN.pdf