NIRMA UNIVERSITY
School of Technology, Institute of Technology
B.Tech. Electronics & Communication Engineering
Semester - VII
Department Elective V

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Course Code	2ECDE66
Course Title	Embedded Operating Systems

Course Outcomes (COs):

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

1. comprehend fundamental concepts of real-time systems.
2. recognize processes, threads, tasks, task scheduling, inter-process communication, and input-output operations related to real-time systems.
3. decide an embedded operating system for a given embedded system application.
4. evaluate the performance of µCOS and RTx51 Tiny for a given embedded system application for time and memory complexity.

Syllabus **Teaching Hours: 45**

UNIT I: Introduction **02**

Operating System functions, Computing System architecture, Operating-System Structure, Operating-System Operations, System Calls, Types of System Calls, System Programs, Types of Operating System

UNIT II: Operating System Services **04**

Process Management, Memory Management, Input-Output Management, Storage Management, Protection, and Security, Kernel Data Structures

UNIT III: Processes, Threads, and Tasks **04**

Process Concept, Operations on Processes, Threads, Operations on Threads, Tasks, Multithreading Models, Threading Issues, Comparison between Processes and Threads

UNIT IV: Real-Time Systems **06**

Real-Time Systems characteristics, types of real-time systems, Timing constraints, Multi-rate Systems, Context Switching, Multitasking, Cooperative Multi-tasking, Pre-emptive Operating Systems structure, Timing requirements on processes, Features of an Embedded Operating System, Comparison of Embedded Operating Systems and General Purpose Operating Systems, POSIX

UNIT V: Real-Time Task Scheduling **06**

Process state and scheduling, Clock driven and Event-driven scheduling, Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Fault-Tolerant Scheduling

UNIT VI: Inter-process Communication **06**

Signals, Shared Memory Communication, Message-Based Communication

UNIT VII: I/O Operations **06**

Synchronous and Asynchronous I/O, Interrupt Handling, Device Drivers

UNIT VIII: Handling Resource Sharing and Dependencies Among Real-Time Tasks **06**

Resource sharing Protocols: Priority Inheritance Protocol, Highest locker protocol, priority ceiling protocol, Priority Inversion, Issues in resource sharing protocols

UNIT IX: Case Study **05**

Process management, memory management, I/O management, and file management in µCOS, and RTx51 Tiny

Self-Study:
The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:
Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Reading:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc.
2. Rajib Mall, Real Times Systems Theory and Practice, Pearson Education
3. Computers as Components Principles of Embedded Computing System Design by Wayne Wolf, Morgan Kaufman
4. Real-Time Systems, Krisha & Shin, McGraw Hill

L = Lecture, T = Tutorial, P = Practical, C = Credit