NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
M. Tech. in Electronics and Communication Engineering (Embedded System)
M.Tech. Semester - II

L	T	Practical component				C
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Course Code	6EC251CC22
Course Title	Embedded Operating System

Course Learning Outcomes (CLOs):

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

1. Comprehend concepts of processes, threads, tasks, multitasking, multithreading in context of real time systems.
2. Decide for a given an embedded system whether an operating system will be required for its design.
3. Evaluate the performance of Rate-Monotonic Scheduling and Earliest-Deadline First Scheduling policies for a given real time system for task scheduling, turnaround time, waiting time, average waiting time of the processes.
4. Analyze the performance of RTx51Tiny and Micro-C Operating System in a given real time system for effects of scheduling, response-time, interrupt latency, memory management, process scalability, inter process communication and resource sharing.

Syllabus: **Teaching Hours:45**

UNIT I: Introduction **10**

Overview of OS, Multithread systems, Processes and Threads, Context switching, Multitasking, Cooperative Multitasking, Structure of Pre-emptive operating systems, Operating system function, Timing requirements on processes, Features of an Operating System

UNIT II: Real Time Task Scheduling **05**

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

UNIT III: Inter-Process Communication **03**

Signals, Shared Memory Communication, Message-based Communication

UNIT IV: Real-time Memory Management **04**

Process stack management, Dynamic allocation, I/O operations, Synchronous and Asynchronous I/O, Interrupt handling, Device drivers

UNIT V: Handling Resource Sharing and Dependencies among Real Time Tasks **10**

Resource sharing protocols, Priority inheritance protocol, Highest locker protocol, priority ceiling protocol, Priority inversion, Issues in resource sharing protocols

UNIT VI: Features of RTOS, POSIX, Case Studies **08**

µCOS, RTx51, Android OS for embedded systems, Building RTOS/EoS image for target hardware, Benchmarking of RTOS

UNIT VII: Evaluating and Optimizing Operating System Performance **05**

Effects of scheduling, Response-time calculation, Interrupt latency, Time-loading, Memory loading, Power optimization Strategies for processes, Advanced configuration and power interface

Self-Study:

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

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings:

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