

MCPE2019 REAL-TIME SYSTEMS (3-0-0)

Module I: Fundamentals of Real-Time Systems

Definition and characteristics of Real-Time Systems, Hard vs Soft Real-Time Systems, Real-Time workloads and task types, Task parameters: WCET, deadlines, release time, period, jitter, Real-Time system design issues, Performance metrics, Modeling Real-Time systems, Real-Time taxonomy

Module II

Preemptive and Non-Preemptive scheduling, Clock-driven scheduling, Table-driven scheduling, Priority-driven scheduling: Rate Monotonic Scheduling (RMS), Deadline Monotonic Scheduling, EDF Scheduling, Schedulability analysis, Multiprocessor scheduling basics, Priority inversion & priority inheritance protocol.

Module III

Inter-task communication models: Message-based communication, Shared memory communication, Mutual exclusion in real-time systems, Priority ceiling protocol (PCP), Deadlock, starvation, and bounded blocking, Clock synchronization — physical and logical clocks, Communication delays and timing constraints

Module IV

Real-Time Memory, OS Support & Case Studies: Real-Time Operating Systems basics, Real-Time Kernel requirements, Task control blocks, Interrupt handling, Timing services, Real-Time I/O handling, DMA control, Real-Time Memory Management: Contiguous allocation, Paging issues, Fragmentation, Real-Time OS case study examples: VxWorks, POSIX real-time extensions

Course Outcomes:

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

1. Understand the characteristics, constraints, and modeling of real-time systems.
2. Ability to analyze and determine schedulability using classical algorithms.
3. Understand real-time resource sharing, synchronization, and communication models.
4. Learn OS-level support, memory issues, interrupt management, and system-level integration.

Text Books

1. Real-Time Systems: Theory and Practice, *Rajib Mall, Pearson Education.*

Reference Books

1. Real-Time Systems, Jane W. Liu, Pearson
2. Real-Time Systems, Krishna & Shin, McGraw-Hill
3. Real-Time Concepts for Embedded Systems, Qing Li & Caroline Yao, Elsevier/Morgan Kaufmann