## **ICT 2258: OPERATING SYSTEMS [3 1 0 4]**

**Objectives:**

* To familiarize with the basic functionality and the evolution of different types of operating systems.
* To Learn and understand various algorithms related to CPU scheduling, deadlocks, memory management, and storage management.
* To learn basic aspects of real time operating systems

**Abstract:**

Introduction to Operating systems - Operating System Services, Operating system Structure, System calls, Process management - Process concept, Threads, Inter-process communication, CPU Scheduling, Process synchronization, Handling deadlocks – Deadlock Characterization, Deadlock Detection, Prevention, Avoidance and Recovery, Memory management - Main memory, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual memory – Demand Paging, Page Replacement, Thrashing, Allocating Kernel Memory, Storage Management- File management, Disk scheduling, Case study on Unix based Operating system – Design Principles, Kernel Modules, Basic concepts of Real time operating systems – Classification of Real Time Systems, Microkernels, Scheduling.

**Syllabus:**

**Introduction:**

Operating system structure, Operating system operations, Distributed systems, Special purpose systems, Computing environments, Open source operating systems. **[3 hours]**

**CPU Scheduling:**

Process concepts: Process states, Process control block, Scheduling queues, Schedulers, Context switch, Multi-threaded programming: Overview, Multithreading models, Threading issues, Process scheduling: Basic concepts, Scheduling criteria, scheduling algorithms. [**7 hours]**

**Process Synchronization:**

Synchronization: The Critical section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, monitors.  **[6 hours]**

**Deadlocks**:

Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock. **[8 hours]**

**Memory management:**

Memory management strategies, Swapping, Contiguous memory allocation, Paging, Structure of the page table, Segmentation. **[6 hours]**

**Virtual Memory:**

Demand paging, copy on write, page replacement, allocation of frames, thrashing.

**[7 hours]**

**Storage Management:**

File concept, Access methods, directory structure, file system structure, directory implementation, allocation methods, free space management, disk structure, and disk-scheduling **[5 hours]**

**Case study on UNIX based Operating system:**

Design principles, Kernel modules, Process management, Memory management. **[2 hours]**

**Real time systems:** Characteristics of Real time operating systems, classification of real time systems, Micro kernels and RTOS, scheduling in RTOS, Rate monotonic scheduling, EDF, Priority inversion **[4 hours]**

**Outcomes:**

At the end of the course, the students are able to,

* Express the knowledge of Operating System fundamentals
* Describe the operating system functionalities in detail.
* Apply the knowledge to solve issues in process and memory management.
* Describe the fundamental concepts of real time operating systems.

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References:

1. Silberschatz A., Galvin P.B. & Gagne G*., Operating System Concepts (9e),* Wiley, 2012*.*
2. Stallings W., *Operating Systems: Internals and Design Principles (9e),* Pearson, 2017*.*
3. Laplante P.A. & Ovaska S.J., *Real time systems design and analysis (4e),* Wiley, 2013*.*
4. Mall R., *Real time systems: Theory and Practice (2e),* Pearson, 2009.