SUBJECT: COMPUTER SCIENCE							
DSE	**BCS-E501**	**Operating Systems**	**L**	**T**	**P**	**C**	**Time for ESE**
			4	**-**	**-**	**4**	**3 Hrs.**

Pre- requisite: Basics of computers

Course Objectives:

- To learn the mechanisms of OS to handle processes and threads and their communication.
- To learn the mechanisms involved in memory management in contemporary OS.
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
- To know the components and management aspects of concurrency management.

Course Outcomes:

CO1	An appreciation of the role of an operating system.
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time
CO4	Design and implement file management system.
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Course Contents

UNIT	Contents	Lectures Required
1.	**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	4
2.	**Process:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, Priority, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF .	8

3.	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson‟s Solution, Lamport‟s Bakery Algorithm, The Producer/ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader‟s & Writer Problem, Dinning Philosopher Problem etc.	8
4.	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	6
5.	**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.	7
6.	**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	7
7.	**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms. **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, CSCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	8
	Total Lectures	48

Suggested Text Book(s):

1.	Silberschatz, Peter Galvin, Greg Gagne,
2.	William Stallings, Operating Systems: Internals and Design Principles, Pearson.

Suggested Reference Book(s):

1.	Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing.
2.	Gary J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley.

Other Useful Resource(s)

1.	https://nptel.ac.in/courses/106108101//
2.	https://nptel.ac.in/courses/106106144/

3.	https://www.class-central.com/course/udacity-introduction-to-operating-systems-3419

Course Outcomes Contributed to Programme Outcomes

PO→ CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	AVERAGE
CO1	1	1	1	1	1	3	-	1	**1.1**
CO2	1	2	1	2	1	3	-	1	**1.4**
CO3	1	1	2	2	1	3	2	2	**1.8**
CO4	2	2	1	2	2	3	2	2	**2.0**
CO5	2	2	1	3	2	3	3	3	**2.4**
AVG.	**1.4**	**1.6**	**1.2**	**2.0**	**1.4**	**3.0**	**1.4**	**1.8**	**1.7**

Course Outcomes Contributed to Programme Specific Outcomes

PSO→ CO↓	PSO1	PSO2	PSO3	AVERAGE
CO1	3	-	3	**2.0**
CO2	3	2	3	**2.7**
CO3	2	2	3	**2.3**
CO4	2	2	3	**2.3**
CO5	3	2	3	**2.7**
AVG.	**2.6**	**1.6**	**3.0**	**2.3**