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| **Semester: 4** | |
| **Programme : B.Sc. Computer Science (Hons)** | |
| **Course : Operating System** | |
| **Paper code: B2CS230412T / B2CS230412P** | **Credits: 4** |
| **Hours/week: Theory: 3 / Practical: 2** | |
| **Category: Core/MDC/SEC/VAC/Minor: Minor** | |
| **Theory / Practical / Composite : Composite** | |
| **No of Modules: 1** | |

**Course Overview:** This course introduces the fundamental concepts of **Operating Systems (OS)** and their role in managing computer hardware and software resources. It covers the basic functions and types of operating systems, including concepts such as **multiprogramming, multitasking, batch processing, and time sharing**. The course also explains the **organization of operating systems**, including kernels, processor modes, and system calls. Students will learn about **process management, threads, and scheduling algorithms**, as well as **memory management techniques** such as physical and virtual address spaces. The course concludes with an introduction to **concurrent processes and deadlocks**, providing a foundation for understanding how modern operating systems ensure efficient and reliable system performance.

**Course Outcome:**

1. **Explain** the basic concepts, functions, and different types of operating systems.
2. **Describe** the organization and structure of an operating system, including kernels, processor modes, and system calls.
3. **Analyse** the concepts of process management, including process states, threads, and system resources.
4. **Evaluate** different process scheduling algorithms used for efficient CPU utilization.
5. **Explain** memory management concepts such as physical and virtual address spaces and basic memory allocation strategies.
6. **Identify** issues related to concurrent processes and deadlocks and understand their impact on system performance.

**Prerequisites:** Students should have a basic understanding of **computer fundamentals**, including basic knowledge of **computer hardware, programming concepts, and data structures**. Familiarity with how computers execute programs and basic problem-solving skills will help in understanding operating system concepts.

**SYLLABUS**

| UNIT/Module | CONTENT | HOURS or NUMBER OF CLASSES | CO Mapping | COGNITIVE LEVEL |
|---|---|---|---|---|
| **I.** | Introduction to operating systems: OS functions, types of operating systems, concurrent processing, multiprogramming, multitasking, batch | **6** | **CO1** | **K1–K2 (Remember/Understand))** |

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| | processing, time sharing. | | | |
| **II.** | Introduction to Organization of OS - Processor and user modes, kernels, system calls and introduction to system programs | **6** | **CO2** | **K1–K2 (Remember/Understand)** |
| **III.** | Process Management – State of the process, types of resources, process state, threads, Process Scheduling algorithms. | **10** | **CO3,CO4** | **K2,K3,K4 (Understand/Apply/Analyse**) |
| **IV.** | Memory Management - Physical and virtual address space, Introduction to memory allocation strategies. | **9** | **CO5** | **K2–K3 (Understand/Apply)** |
| **V.** | Introduction to Concurrent Processes and deadlock. | **8** | **CO6** | **K3,K4,K5,K6 (Apply/Analyse/Evaluate/Create)** |

**Text Books**

1. Operating System Concepts – **Abraham Silberschatz, Peter B. Galvin, Greg Gagne**, Wiley.
2. Modern Operating Systems – **Andrew S. Tanenbaum and Herbert Bos**, Pearson.
3. Operating Systems: Internals and Design Principles – **William Stallings**, Pearson.

**Suggested readings**

1. Operating Systems – Harvey M. Deitel and Paul J. Deitel, Pearson.
2. Schaum's Outline of Operating Systems – **J. Archer Harris**, McGraw-Hill.

**Web Resources**

1. **NPTEL – Introduction to Operating Systems (IIT Madras)**
   https://onlinecourses.nptel.ac.in/noc24_cs80/preview
   Provides structured lectures, assignments, and course materials on OS concepts such as processes, scheduling, memory management, and deadlocks
2. **MIT OpenCourseWare – Operating System Engineering**
   https://ocw.mit.edu/courses/6-828-operating-system-engineering/

| **Evaluation :** | Theory<br>CIA: 12 Attendance: 3<br>Semester Exam: 45 | Practical<br>CA: 38 Attendance: 2 |
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**Paper Structure for Theory Semester Exam Module :** Answer 3 out of 5 of 15 marks each

**Course outcomes (COs) and Cognitive Level Mapping**

| COs | CO Description | Cognitive levels |
|---|---|---|
| **CO1** | Explain the basic concepts, functions, and types of operating systems. | K1–K2 (Remember/Understand) |
| **CO2** | Describe the organization of operating systems including processor modes, kernels, system calls, and system programs. | K1–K2 (Remember/Understand) |
| **CO3** | Analyze the concepts of process management including process states, resources, and threads | K2,K3,K4 (Understand/Apply/Analyse) |
| **CO4** | Evaluate different process scheduling algorithms for effective CPU utilization. | K3,K4,K5 (Apply/Analyse/Evaluate) |
| **CO5** | Explain memory management concepts such as physical and virtual address spaces and memory allocation strategies. | K2–K3 (Understand/Apply) |
| **CO6** | Analyze and evaluate issues related to concurrent processes and deadlocks in operating systems. | K3,K4,K5 (Apply/Analyse/Evaluate) |