# National University

**of Computer & Emerging Sciences**

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| **Department** | Department of Computer Science | **Dept. Code** | CS |
| **Course Title** | Operating System | **Course Code** | CS220 |
| **Pre-requisite(s)** | Data Structures and Algorithms | **Credit Hrs.** | 3+1 |

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| **Course Objective:** | |

| PLO | Program Learning Outcome (PLO) Statement |
|---|---|
| 02 | **Problem Analysis:** Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences. |
| 03 | **Design/Develop Solutions:** Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. |
| 05 | **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems. |

| CLO | Course Learning Outcome (CLO) | Domain | Taxonomy Level | PLO | Tools |
|---|---|---|---|---|---|
| 01 | Understand the characteristics of different structures of the Operating Systems and identify the core functions of the Operating Systems. | Cognitive | 3 | 2 | **A, M1,F** |
| 02 | Analyze and evaluate the algorithms of the core functions of the Operating Systems and explain the major performance issues with regard to the core functions. | Cognitive | 4 | 3 | **A,M2,F** |
| 03 | Demonstrate the knowledge in applying system software and tools available in modern operating systems. | Cognitive | 5 | 5 | **A,P,F** |
| *Tool: A = Assignment, Class Activities = CA, P=Project, M = Midterm, F=Final,* | | | | | |

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| **Text Book(s)** | **Title** | Operating system Concepts 10th Edition |
| | **Author** | Abraham Silberschatz |
| **Ref. Book(s)** | **Title** | Modern Operating Systems |
| | **Author** | Andrew S. Tanenbaum |
| | **Title** | Operating System Internal Designs & Principles |
| | **Author** | William Stallings |

| Week | Course Contents/Topics | Chapter | CLO |
|---|---|---|---|
| 01 | **Introduction to Operating system:** basic OS definition, computer organization, I/O, DMA, mass storage, protection, UMA and NUMA architecture, symmetric & asymmetric clustering, security, computing platforms. | 1 | 1 |
| 02 | **Operating system structure:** basic concept CLI, GUI, scripts, API, system programming & goals, OS design principles. | 2 | 1,5 |
| 03 | **Operating system structure: (Continue)** | 2 | 1,5 |
| 04 | **Process Concept:** basic concept, scheduler types, Queues, process creation, interprocess communication methods. | 3 | 1,2,3 |
| 05 | **Process scheduling Algorithm:** pre-emptive & non – preemptive, FCFS, SJF, SRTF, Priority, RR, multiprocessor, real –time scheduling. | 5 | 1,2,3 |
| 06 | Mid-I Term Exam | | |
| 07 | **Multi-threaded Programming:** basic control blocks, thread models, thread concepts, process vs. threads, data and task parallelism, Amdahl's law, pthread APIs, OpenMP introduction. | 4 | 2,3,5 |
| 08 | **Process Synchronization:** concurrency,race condition, critical section, Peterson solution, test and set instruction, mutex, semaphore. Classical problems such as bounder buffer, reader writer, dinning philosopher. | 6,7.1 | 2,3, |
| 09 | **Process Synchronization: (Continue)** | 6,7.1 | 2,3, |
| 10 | **Memory Management:** basic memory definition, dynamic allocation, problems of dyamic allocation,swapping, fragmentation, segmentation, paging, structure of page tables, System architecture. | 9 | 1,2 |
| 11 | Mid-II Term Exam | | |
| 12 | **Virtual Memory:** basic VM concept, demand paging, COW,page replacement algos, FIFO, optimal,LRU,second chance,frame allocation,thrashing,kernel memory, buddy, slab allocation. | 10 | 1,2 |
| 13 | **Virtual Memory: (Continue)** | 10 | 1,2 |
| 14 | **Deadlock:** basic concept**,** detection, prevention, avoidance**,** banker's algorithm, resource allocation algo, safety algo. | 8 | 1,2 |
| 15 | **Disk Scheduling:** (FCFS, SSTF,SCAN,CSCAN) | 11 till 11.2.3 | 1,2 |

**Assessment Plan:**

| Assessment | Weightage |
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| Class Activities | 5% |
| Assignment | 5% |
| Projects | 10% |
| Midterm Exams | 30% |
| Final | 50% |