**COEN 4820 Operating Systems and Networking**

 **Credits and contact hours:** 3 credit course, meeting for 3 50-minute periods each week.

**Course coordinator:** George Corliss

**Text:**

* Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, *Operating Systems Concepts,* 8th Edition, John Wiley & Sons, 2008.
* Brian W. Kernighan and Dennis M. Richie, *The C Programming Language,* 2nd Edition, Prentice Hall, 1988.

**Catalog description:** Introduces the fundamental concepts of operating systems together with the basics of networking and communications including: memory management, scheduling, concurrent processing, device management, file systems, networking, security, and system performance. Examples are drawn from legacy and modern operating systems.

**Prerequisites:** COSC 2100 Data Structures or COSC 2010 Data Structures for Engineers

**Selected Elective** in ELEN Computer Hardware & Software area.

**Required** in the Computer Engineering program and for the Biocomputing major in the Biomedical Engineering program.

**Professional component:** Engineering Science - 100 %

**Course Goals:**To provide students with an understanding of the standard problems and their solutions in the area of operating systems (including process management, storage management, I/O systems design, distributed systems, protection and security) and with practical experience with one or more modern operating systems (usually some versions of Unix and Windows).

**Specific outcomes of instruction***By the end of this course, students should be able to perform the following tasks:*

1. Describe the concept of a process and how processes deal with scheduling, cooperation, and communication with other processes.
2. Write a program spawning multiple processes and communicate between them using shared memory and using messages.
3. Explain the classical problems in process synchronization and know several different ways to solve such problems, including semaphores, critical regions, and monitors.
4. Write a program using synchronization to protect critical regions in multiple processes.
5. Explain how to characterize and cope with processor deadlock, including prevention, avoidance, detection, and recovery.
6. Describe several different schemes for managing main memory, including swapping, virtual memory, paging, and segmentation.
7. Describe the characteristics of an I/O system and explain how the user, the operating system, and the hardware interact with I/O.
8. Describe how disks are structured and how their space is managed by the operating system.
9. Describe several different network topologies and network types and the processes involved in designing a network.
10. Describe the challenges of designing a distributed operating system and a distributed file system and give several design alternatives.

**Student outcomes addressed by the course:**Partial fulfillment of Criterion 3 objectives A, C, E, F, G, H, I, J, and K

**Brief list of topics to be covered**

* Overview of operating systems: Role and purpose of the operating system; history of operating system development; functionality of a typical operating system.
* Operating system principles: Structuring methods; abstractions, processes, and resources; concepts of application program interfaces; device organization; interrupts; concepts of user/system state and protection.
* Concurrency: Synchronization principles; the "mutual exclusion" problem and some solutions; deadlock avoidance; producer-consumer problems and synchronization.
* Scheduling and dispatch: Preemptive and non-preemptive scheduling; schedulers and policies; processes and threads; deadlines and real-time issues.
* Memory management: Review of physical memory and memory management hardware; overlays, swapping, and partitions; paging and segmentation; placement and replacement policies; working sets and thrashing; caching.
* Distributed algorithms: Consensus and election; fault tolerance.
* Net-centric computing: Background and history of networking and the Internet; network architectures; the range of specializations within net-centric computing.
* Networking and communications: Network architectures; issues associated with distributed computing; simple network protocols; APIs for network operations.
* Web technologies; characteristics of web servers; nature of the client-server relationship; web protocols; support tools for web site creation and web management.
* Network security: Fundamentals of cryptography; secret-key algorithms; public-key algorithms; authentication protocols; digital signatures; examples.

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