## COURSE DESCRIPTION

| Dept., Number | CS4375 | **Course Title** | Operating Systems Concepts |
|---|---|---|---|
| **Approval Date** | 12/2024 | **Course Coordinator** | Nigel Ward |

## CATALOG DESCRIPTION

Process and thread management, processor scheduling and concurrency, inter-process communication, memory management, input/output management, file systems, and networking basics.

## TEXTBOOK

Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, "Three Easy Pieces," http://pages.cs.wisc.edu/~remzi/OSTEP/

## COURSE OUTCOMES

**Level 1: Knowledge and Comprehension:**
Level 1 outcomes are those in which the student has been exposed to the terms and concepts at a basic level and can supply basic definitions. Upon successful completion of this course, students will be able to:
1. Choose a scheduling approach suitable for a given simple problem.
2. Explain segmentation and its security implications.
3. Explain some ways in which virtualization creates vulnerabilities.
4. Explain the components of process and virtual machine context.
5. Explain the need for paging and the basics of demand loading.
6. Describe the motivation for and gross characteristics of a trusted computing base.
7. Explain how domain names, IP addresses, file names, and memory segments are handled.
8. Given an application, identify the factors relevant to choosing a synchronous or asynchronous solution.
9. Choose when to use datagram versus virtual-circuit communication.
10. Differentiate transmission and propagation latencies and some factors affecting them.
11. Explain how data is serialized (byte order, representation, buffsering).
12. Interpret the output of a packet capture tool.
13. Explain the role of cryptographic hashes and symmetric and asymmetric keys insecurity.
14. Explain the basic concepts of the Domain Name System (DNS) and the Internet Protocol (IP)
15. Explain the functionality handled at different network layers.
16. Explain the memory hierarchy and the basic concepts of distributed storage.
17. Explain generic device APIs, including the bidirectional handling of interrupts and requests.

**Level 2: Application and Analysis:**

Level 2 outcomes are those in which the student can apply the material in familiar situations, e.g., can work a problem of familiar structure with minor changes in the details.

Upon successful completion of this course, students will be able to:

18. Use the concepts of process state and state transition to characterize system and process behavior.
19. Relate the distinction between supervisor and user permissions to the design and implementation of system calls.
20. Write programs that use interprocess communication, specifically pipes and/or sockets.
21. Use simple system calls for common needs.
22. Implement producer-consumer coordination.
23. Build a server-side program that uses multi-threading to handle multiple simultaneous clients.
24. Identify situations where deadlock may occur and suggest ways to prevent it.
25. Perform simple arithmetic computations related to major families (for example determine page number or whether an address is within a power-of-2 segment).
26. Correctly use semaphores or condition variables for simple problems.


**Level 3: Synthesis and Evaluation**

Level 3 outcomes are those in which the student can apply the material in new situations. This is the highest level of mastery. Upon successful completion of this course, students will be able to:

27. When a process or a computer is running too slowly, infer some probable causes.
28. Choose among virtual machines, processes, containers and sandboxes as ways to support common programmer needs.
29. Distinguish when blocking versus nonblocking calls are appropriate.

## ABET STUDENT OUTCOMES MAPPING

| Course outcomes | Student Outcome |
| --- | --- |
| 10, 11, 18, 22, 23, 25 | 1 |
| 8, 27-29 | 2 (ABET 1) |
| None | 3 (ABET 2) |
| None | 4 (ABET 5) |
| None | 5 (ABET 4) |
| None | 6 (ABET 3) |
| None | 7 |
| None | 8 |
| 12, 20 | 9 |
| 23 | 10 (ABET 6) |

## PREREQUISITES BY TOPIC

CS 3432 with a grade of C or better