**CSE 302: SYSTEMS PROGRAMMING**

Credit Hours: 3

Contact Hours: 3  
Grading:  As per UET Rules

1. **COURSE OUTLINE:**

This course introduces the kernel concepts in Unix. It describes in detail the various system calls used for interrupt handling, inter-process communication, device handling, network handling, and device drivers. It discusses programs, processes, threads, policies, process/task scheduling, and dispatching. It also provides details of threads/process synchronization. File systems and their handling using kernel calls are studied in detail.

1. **WEEKLY COURSE OUTLINE:**

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| **Week** | **Contents** |
| Week 1 | Introduction to Systems Programming |
| Week 2 | OS Kernel Data Structures and Memory Footprints |
| Week 3 | Program, Processes, and Threads |
| Week 4 | Processes in UNIX (fork and wait) |
| Week 5 | Processes in UNIX (exec) |
| Week 6 | Background processes and task/data division |
| Week 7 | UNIX I/O (read and write) |
|  | **Mid Term Examination** |
| Week 8 | File Monitoring |
| Week 9,10 | Files and Directories (inodes; hard and symbolic links) |
| Week 11 | UNIX Special Files (pipes) |

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| Week 12 | UNIX Special Files (Fifos) |
| Week 13 | Inter-Process Communication |
| Week 14 | Signals and Interrupts (Signal Generation and Blocking) |
| Week 15 | Signals and Interrupts (Signal Handlers) |
| Week 16 | Project Discussion/Presentations |
|  | **Final Term Examination** |

1. **MAPPING OF CLOS WITH PLOS:**

After completing this course, students will be able to:

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| **CLO #** | **Course Learning Outcomes (CLOs)** | **Level of Learning (Bloom's Taxonomy)** | **Program Learning Outcomes (PLOs)** |
| 1 | Apply standard approaches for file handling, error handling, and signals handling in UNIX programs for writing reliable systems programs | Cog-3 (Application) | PLO1 (Engineering Knowledge) |
| 2 | Modify sequential algorithms to be executed on multi-core machines using UNIX POSIX standard multi-threading and multi-processing APIs | Cog-4 (Analysis) | PLO2 (Problem Analysis) |
| 3 | Design algorithms for real-world problems of Inter-Process Communication (IPC) using UNIX special files such as FIFOs, Pipes, and Sockets | Cog-5 (Synthesis) | PLO3 (Design/Development of Solutions) |

1. **MAPPING OF CLOs WITH COURSE ASSESSMENT TOOLS:**

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| **Course Assessment Tools** | **CLOs** | | |
| **CLO 1** | **CLO 2** | **CLO 3** |
| Assignments | ✓ | ✓ | ✓ |
| Quizzes | ✓ | ✓ | ✓ |
| Mid term examination | ✓ | ✓ |  |
| Final term examination | ✓ | ✓ | ✓ |

1. **RESOURCES:**

TEXTBOOKS

UNIX Systems Programming: Communication, Concurrency, and Threads by K. A. Robbins and S. Robbins. Prentice Hall, 2003. ISBN: 0-13-042411-0.

REFERENCE BOOKS

Unix for Programmers and Users, Graham Glass and King Ables, 3rd Edition

SOFTWARE TOOLS

Unix/Linux/Mac system

Bash

GCC compiler