M.Sc. Computer Science First Year 2018-23

Advanced Operating System

Semester II	Subject Code: MS21802	Lectures: 60

Objectives:

The syllabus aims in equipping students with,

- To learn Advanced Operating Systems Concepts using Unix/Linux and Windows as representative examples.
- Most Units start with the theory and then switches focus on how the concepts are implemented in a C program.
- This course describes the programming interface to the Unix/Linux system - the system call interface.
- It concludes with an overview of Windows Threads Management, an understanding of the functions of Operating Systems. It also provides provide an insight into functional modules of Operating Systems.
- The concepts underlying in the design and implementation of Operating Systems.

Unit 1: Concept of UNIX/Linux Kernel and File & Directory I/O	16
Ch 1: Introduction to UNIX/Linux Kernel • Introduction to Kernel /Shell Programming, Unix Commands • System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System • Concepts of Linux Programming- Files and the File system, Processes, Users and Groups, Permissions, Signals, Interprocess Communication	3

BOS Members:

Prof. Seema Chowhan (Subject Expert)

Prof. M.B. Lonare (Subject Expert)

Ms. Shilpa Khadilkar (Subject Expert)

Ms Anuradha Bhamre (Industry Expert)

Ms Aishwarya Kaliyiluvila (Alumni)

Prof. Ashwini Kulkarni (Chairman)

Prof. Swati Pulate (Internal Faculty)

Prof. Shubhangi Jagtap (Internal Faculty)

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Ch 2: File and Directory I/O • Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek, close, pipes, dup • open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatasync, fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files • Scatter/Gather I/O, Mapping Files into Memory, Advice for Normal File I/O, I/O Schedulers and I/O Performance, Directories, Copying and Moving files, Device Nodes, Out-of-Band Communication • Activity based on chapter-2	13
Unit 2: Process Environment, Process Control and Process Relationships	14
Ch 3: Process Environment, Process Control and Process Relationships • System boot and INIT process, Process states and transitions, layout of system memory, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, changing the size of the process, The Shell, Process Scheduling	

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• Process termination, environment list, memory layout of a C program, shared libraries, environment variables, setjmp and longjmp, getrlimit and setrlimit, process identifiers, fork, vfork, exit, wait and waitpid, waitid, wait3 and wait4, race conditions, exec, changing user IDs and group IDs,system function, user identification, process times • The Process ID, Running a New Process, Terminating a Process, Waiting for Terminated Child Processes, Users and Groups, Daemons, Process Scheduling, Yielding the Processor, Process Priorities, Processor Affinity • Activity based on chapter-3	
Unit 3: Memory Management and Signal handling	**12**
Ch 4: Memory Management • The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, Choosing a Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation • Swapping, Demand Paging	**6**
Ch 5: Signal Handling • Signal concepts, signal function, unreliable signals, interrupted system calls, reentrant functions, SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause, signal sets, sigprocmask, sigpending, sigsetjmp and siglongjmp, sigsuspend, abort, system function revisited, sleep • Signal Concepts, Basic Signal Management, Sending a Signal, Reentrancy, Signal Sets, Blocking Signals, Advanced Signal Management, Sending a Signal with a Payload • Activity based on chapter-5	**6**

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Unit 4: Windows Thread Management	**6**

Ch 6: Windows Thread Management
• Thread Internals
  • Data Structures, Kernel Variables, Performance Counters, Relevant Functions, Birth of a Thread Examining Thread Activity : Limitations on Protected Process Threads, Worker Factories (Thread Pools)
• Thread Scheduling
  • Overview of Windows Scheduling, Priority Levels, Windows Scheduling APIs, Relevant Tools, Real-Time Priorities, Thread States, Dispatcher Database, Quantum, Scheduling Scenarios, Context Switching, Idle Thread, Priority Boosts
	6

***Contact hours – 12 hours**

Reference Books:

1. Robert Love , *Linux System Programming*, O'Reilly.
2. Mark E. Russinovich and David A. Soloman ,*Windows Internals*, Microsoft Press.
3. Maurice J. Bach , *The Design of the UNIX Operating System*, PHI.
4. Richard Stevens , *Advanced Programming in the UNIX Environment*, Addison-Wesley.
5. A Robbins, *Linux Programming by Example: The Fundamentals"*, 2nd Edition, 2008, ISBN 9788131704196, Pearson Education.

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