

## ***Suggested Teaching Guidelines for Operating System Concepts-PG-DAC August 2019***

**Duration:** 30 class room hours + 30 Lab hours (60hrs)

**Objective:** To introduce Advanced Operating System Concepts with Linux environment.

**Prerequisites:** Knowledge of Computer Fundamentals

**Evaluation method:** Theory exam– 40% weightage

Lab exam – 40% weightage

Internal exam– 20% weightage

### **List of Books / Other training material**

#### **Text Books:**

1. Operating Systems Principles by Silberschatz, Galvin / Wiley
2. Unix Concepts and Applications Sumitabha Das /Tata Mcgraw Hill

#### **Reference Books:**

1. Modern operating Systems, Tanenbaum.
2. Principles of Operating Systems by Naresh Chauhan / Oxford University Press
3. Beginning Linux Programming 4th Edition, Neil Matthew, Richard Stones, wiley
4. Operating System : A Design-Oriented Approach 1st Edition, Charles Crowley /TMH

#### **Session 1**

##### **Lecture:**

- Overview of OS
- Introduction to Linux
- The Linux File System
  - Working with Files and Directories
- Getting Started to Linux
- Revision of basic Commands

##### **Assignment –Lab:**

Getting Acquainted with the Linux Environment

Use various commands in Linux system.

(ls, cp, mv, lpr, sort, grep, cat, tac, more, head, tail, man, whatis, whereis, locate, find, diff, file, rm, mkdir, rmdir, cd, pwd, ln and ln -s, gzip and gunzip, zip and unzip, tar and its variants, zcat, cal, bc and bc -l, banner date, time, wc, touch, echo, who, finger, w, whoami, who am i, alias, unalias, touch, push, pop, jobs, ps, etc.)

#### **Session 2**

##### **Lecture:**

##### **Gaining confidence with Linux**

- Access control list and chmod command
- chown and commands
- Network Commands like telnet, ftp, ssh, and sftp, finger

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- Use of secondary storage devices (Like: - Hard disk, Floppy, CDROM) in Linux environment and formatting of these devices.

**Assignment –Lab:**

Review Exercises

**Session 3**

**Lecture: Linux shell**

- What is shell?
- Different types of Linux shells
- Bourne Again Shell (BASH)
- Shell variables (environment and user defined)
- Shell files (.bashrc, .profile, .bash\_profile, .bash\_logout)
- Wild cards (\* and ?)
- I/O redirection and tee command
- Shell meta characters
- Command line expansion

**Assignment –Lab:**

Review Exercises

**Session 4**

**Lecture:**

**Linux shell programming**

- Command line arguments
- Arithmetic in shell scripts
- Read and echo commands in shell scripts
- Taking decisions:
  - if-then-fi
  - if-then-else-fi
  - The test command (file tests, string tests)
  - Nested if-elses
  - The case control structure

**Assignment –Lab:**

Review Exercises

**Session 5**

**Lecture:**

**Linux shell programming (Contd.)**

- The loop control structure
  - The while, until and for loop structures
  - The break and continue statements
- Directory stacks manipulation

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- Job control, history and processes
- Built-in functions

**Session 6: (Operating System Architecture)****Lecture:**

- Introduction to Operating Systems and Terminology
- Kernel Components and Non-kernel Components
- User-space vs Kernel-space and User-mode vs Kernel-mode
- Types of Kernel
- Interrupt Management and System calls

**Session 7: (Process management, Scheduling Policies)****Lecture:**

- Process Management
- Process Scheduling / CPU Scheduling: Preemptive vs Non-preemptive
- Different types of Scheduling Policies/Algorithms – FCFS, RR, PRIO, FAIR-SHARE, EDF.
- Preemptive Kernel vs Non-preemptive Kernel
- Introduction to Threads - User-level vs Kernel-level(many-to-one vs one-to-one)
- Advantages of Multi-threading and some Real-world examples.

**Session 8: (Inter-Process Communication)****Lecture:**

- Introduction to Inter-process Communication Mechanisms ( IPCs ) - for Processes and Threads
- IPCs - Synchronization vs Data-exchange
- IPCs - Semaphores and Mutex
- Message-queues and Shared-memory (Related to VM)
- Producer Consumer problem
- Dead-lock vs Starvation

**Session 9: (Memory Management)****Lecture:**

- Memory Management
- Hardware Techniques available for Memory-management (Segmentation/Paging)

**Session 10: (Virtual Memory Techniques)****Lecture:**

- Software Techniques built on top of H/W Techniques (Virtual-memory Techniques)
- Page Replacement Algorithms

**Session 11: (File System Management)****Lecture:**

- File System Organization - Physical File System Organization Techniques
- (Use Linux File System - ext2/ext3 for Illustration)
- Virtual File System Manager

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- File System Management - File System Manager in the Kernel
- Disk structure and Disk Scheduling Algorithms

**Session 12: (Process and signals)**

**Lecture**

- Process Creation
- fork, waitpid and exec System call
- Basic Concepts of the signals
- Generating and Handling Signals

**Assignment – Lab:**

- Assignment based on Process creation
- Assignments Based on the Signals

**Session 13: (Inter–Process Communication, Semaphores)**

**Lecture**

- Synchronization with Semaphore
- Shared Memory Concept and Implementation
- Message queues

**Assignment –Lab:**

- Assignment based on implementation Semaphore
- Assignment based on the implementation of the shared memory

**Session 14: (File handling)**

**Lecture**

- Working with Files and Directories
- Hard and soft links
- Pipes and FIFOs implementation

**Assignment –Lab:**

- Assignment based on the implementation of the pipes, fifos

**Session 15: (POSIX Threads and Mutex)**

**Lecture**

- Thread Management
- Thread Safety
- Thread Synchronization with Mutex

**Assignment –Lab:**

- Assignment based on the Implementation of the threads and Mutex