

Savitribai Phule Pune University, Pune		
Third Year Information Technology (2019 Course)		
314446 : Operating Systems Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credits	PR: 25 Marks TW: 25 Marks
Prerequisites: <ol style="list-style-type: none"> 1. C Programming 2. Fundamentals of Data Structure 		
Course Objectives: <ol style="list-style-type: none"> 1. To introduce and learn Linux commands required for administration. 2. To learn shell programming concepts and applications. 3. To demonstrate the functioning of OS basic building blocks like processes, threads under the LINUX. 4. To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion), CPU Scheduling, Memory Management and Disk Scheduling in LINUX. 5. To demonstrate the functioning of Inter Process Communication under LINUX. 6. To study the functioning of OS concepts in kernel space like embedding the system call in any LINUX kernel. 		
Course Outcomes: On completion of the course, students will be able to– CO1: Apply the basics of Linux commands. CO2: Build shell scripts for various applications. CO3: Implement basic building blocks like processes, threads under the Linux. CO4: Develop various system programs for the functioning of OS concepts in user space like concurrency control, CPU Scheduling, Memory Management and Disk Scheduling in Linux. CO5: Develop system programs for Inter Process Communication in Linux.		
Guidelines for Instructor's Manual		
1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.		
Guidelines for Student's Lab Journal		
1. Student should submit term work in the form of handwritten journal based on specified list of assignments. 2. Practical Examination will be based on the term work. 3. Candidate is expected to know the theory involved in the experiment. 4. The practical examination should be conducted if and only if the journal of the candidate is complete in all aspects.		

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to the theory & implementation of the experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

Guidelines for Laboratory Conduction

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student's programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

List of Laboratory Assignments

Group A

Assignment No. 1 :

A. Study of Basic Linux Commands: echo, ls, read, cat, touch, test, loops, arithmetic comparison, conditional loops, grep, sed etc.

B. Write a program to implement an address book with options given below: a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit

Assignment No. 2:

Process control system calls: The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states.

A. Implement the C program in which main program accepts the integers to be sorted. Main program uses the FORK system call to create a new process called a child process. Parent process sorts the integers using sorting algorithm and waits for child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.

B. Implement the C program in which main program accepts an array. Main program uses the FORK system call to create a new process called a child process. Parent process sorts an array and passes the sorted array to child process through the command line arguments of EXECVE system call. The child process uses EXECVE system call to load new program which display array in reverse order.

Assignment No. 3:

Implement the C program for CPU Scheduling Algorithms: Shortest Job First (Preemptive) and Round Robin with different arrival time.

Assignment No. 4:

A. Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.

B. Thread synchronization and mutual exclusion using mutex. Application to demonstrate: Reader-Writer problem with reader priority.

Assignment No. 5:

Implement the C program for Deadlock Avoidance Algorithm: Bankers Algorithm.

Assignment No. 6:

Implement the C program for Page Replacement Algorithms: FCFS, LRU, and Optimal for frame size as minimum three.

Assignment No. 7:

Inter process communication in Linux using following.

A. FIFOs: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process and displays on standard output.

B. Inter-process Communication using Shared Memory using System V. Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and writes the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.

Assignment No. 8: Implement the C program for Disk Scheduling Algorithms: SSTF, SCAN, C-Look considering the initial head position moving away from the spindle.

Study Assignment: Implement a new system call in the kernel space, add this new system call in the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.

Reference Books:
<ol style="list-style-type: none">1. Das, Sumitabha, UNIX Concepts and Applications, TMH, ISBN-10: 0070635463, ISBN-13: 978-0070635463, 4th Edition.2. Kay Robbins and Steve Robbins, UNIX Systems Programming, Prentice Hall, ISBN-13: 978-0134424071, ISBN-10: 0134424077, 2nd Edition.3. Mendel Cooper, Advanced Shell Scripting Guide, Linux Documentation Project, Public domain.4. Yashwant Kanetkar, UNIX Shell Programming, BPB Publication.