M.Sc. (CA) (2nd Semester)

040020202 : UNIX Internals and Shell Programming

Teaching Schedule

Objective: To acquaint the students with the basic internal structure & operations of UNIX operating system, able to develop system programs using system calls and to introduce utilities & Shell Programming.

Course Outcomes: Upon completion of the course, students shall be able to

CO1: Understand UNIX architecture and get familiar with UNIX environment.
CO2: Work with UNIX utilities and to develop shell scripts.
CO3: Understand data structure, algorithms and system calls that provide the user interface to the file system.
CO4: Understand the context of a process with system calls that manipulates and control process context.
CO5: Understand memory management, including swapping and paging system in UNIX operating system.
CO6: Study various Interprocess communication methods.

Unit	Sub Unit	No. of Lecture(s)	Topics	Reference Chapter/Additional Reading	Teaching Methodology to be used	Evaluation Parameters
Unit 1: Introduction to UNIX operating system						
	1.1	02	History, characteristics of UNIX operating system System structure – user perspective, Operating system services, kernel architecture	MB #1-Page no 1-14 LK #3-Page no 12-45 RS #1-Page no 1-4	PPT	Unit Test – 1
	1.2	03	UNIX Shell, types of shell, utilities in UNIX Notation of UNIX command, general purpose commands, commands for file system, process management and administrations UNIX directory hierarchy	SD#2- Page no 22-41 SD#3 – Page no 44-64 SD#4 – Page no 64-82 SD#5 –Page no 82 – 104 SD#6- Page no 106-117 SD#9- Page no 173 – 192	PPT with Hands on Training	
Unit 2: UNIX Shell Programming						
	2.1	02	Shell types and Shell features: standard streams, redirection, pipes Command execution process Shell variables: predefined variables and user defined variable, environmental variables	SD#8 – Page no 145-171 SD#10 – Page no 194-199	Chalk & Talk, PPT with Hands on Training	Quiz – 1

	2.2	03	Writing scripts: basic concept, expression, decision and repetition, Special parameters, variables and argument processing	SD#14 – Page no 270-303	Chalk & Talk, PPT with Hands on Training	
	2.3	02	Filter utilities: head, tail, cut, paste, tr, sort, uniq, wc, comm, diff	SD#12 – Page no 227-243	Chalk & Talk, PPT with Hands on Training	
	2.4	04	grep and awk utilities	SD#13 – Page no 245-255 SD#18 – Page no 381-400	Chalk & Talk, PPT with Hands on Training	
Unit 3: The UNIX File System						
	3.1	02	The file system structure, type of files Internal representation of files: inodes, structure of a regular file	MB #4–Page no 60-67 LK #6-Page no 132-152	PPT with chalk & talk	Unit Test - 1
	3.2	03	Directories, conversion of path name to an inode inode assignment to new file, allocation of disk blocks	MB #4–Page no 67-87 LK #6-Page no156-161	PPT with chalk & talk	
	3.3	03	System calls for the file system: **open,** read, write, adjusting position of the file I/O, close, file creation, creation of special files, change directory, change root, change owner and change mode, stat and fstat etc.	MB #5–Page no 91-137 RS #3-Page no 59-85 RS #4-Page no 87-130	Chalk & talk, Hands on Training	
Unit 4: The UNIX Process Management						
	4.1	02	The structure of processes, attributes of process, process states and transition	MB #6–Page no 146-151 RS #7-Page no 179-194	Chalk & talk	Unit Test - 2
	4.2	02	Layout of system memory, the context of process, manipulation of process address spaces	MB #6–Page no 151-181	PPT with chalk & talk	
	4.3	03	Process control: process creation, process termination, Awaiting process termination, Invoking other programs, User ID of a Process	MB #7–Page no 191-199, 212-228 RS #7-Page no 209-259	PPT with chalk & talk	
	4.4	02	System boot and init process Login process and the shell process	MB #7–Page no 232-238	PPT with chalk & talk	
Unit 5: Memory Management and I/O Subsystem						
	5.1	02	Memory management techniques Swapping Demand paging	MB #9-Page no 271-307	PPT	Unit Test – 2
	5.2		A hybrid system with swapping and demand paging		PPT	
	5.3	02	Buffer cache: Buffer header, structure of the buffer pool, buffer retrieval scenario	MB #3-Page no 38-57	PPT	

	5.4	01	Introduction to I/O subsystem	MB #10-Page no 312-343	PPT	
Unit 6: Interprocess Communication						
	6.1	01	Introduction to inter-process communication	MB #11-Page no 355	PPT with chalk & talk	Internal Theory
	6.2	02	Signals: reliable & unreliable signal, signal generation, signal handling, signal implementation, sending signals from processes	MB #7-Page no 200-211 RS #10-Page no 289-353	PPT with chalk & talk	
	6.3	03	Pipes	MB #5-Page no 111-116 RS #15-Page no 495-517	PPT with chalk & talk	
	6.4	03	System V IPC: common elements, message queue, shared memory, semaphore	MB #11-Page no359-388 LK #5-Page no 108-128 RS #15-Page no 518-543 RS #16-Page no 545-583	PPT with chalk & talk	
	6.5	01	Network communications, sockets		PPT with chalk & talk	

References :

1. Bach M. J., The Design of UNIX Operating System, PHI [MB]
2. Stevens W. R., Rago S. A., Advanced Programming in the UNIX Environment, PEARSON [RS]
3. Das S., UNIX Concepts and Applications, McGraw Hill [SD]
4. Vahalia U., UNIX Internals The New Frontiers, PEARSON [UV]
5. Beck M., et. Al., Linux Kernel Programming, PEARSON [LK]

Course objectives and Course outcomes mapping:

- To study basic internal structure & operations of UNIX operating system : CO1,CO3,CO4,CO5
- Able to develop system programs using system calls : CO3,CO4,CO6
- To introduce utilities & Shell Programming : CO2

Course units and Course outcomes mapping:

Unit No.	Unit	Course Outcome					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Introduction to UNIX operating system	✓					
2	UNIX Shell Programming	✓	✓				
3	The UNIX file system			✓			
4	The UNIX Process Management				✓		
5	Memory Management and I/O subsystem					✓	
6	Interprocess Communication						✓

Computing Environment:

A student must have the following computing environment in laboratory and or on his/her laptop.

- UNIX/LINUX operating system or having account on UNIX/LINUX system and remote login utility.
- gcc Compiler.

Modes of Transaction (Delivery):

- **Lecture method** is generally used but along with it, as and when required, hands on during lecture would be fruitful. It shall be supplemented with various appropriate audio-visual aids.
- **Activity assignment** may be given to the students. Assignment method would help them to learn by doing practical work with using system call.
- **Seminar** may be used to teach in-depth view shell utilities, system call description, and various algorithms of subject.
- **Self Study** of following part of the syllabus shall be done by the students:

1.1 – History, characteristics, System structure, services of UNIX operating system

2.3 – Filter utilities

4.4 – Booting Process

Activities/Practicum:

The following activities shall be carried out by the students.

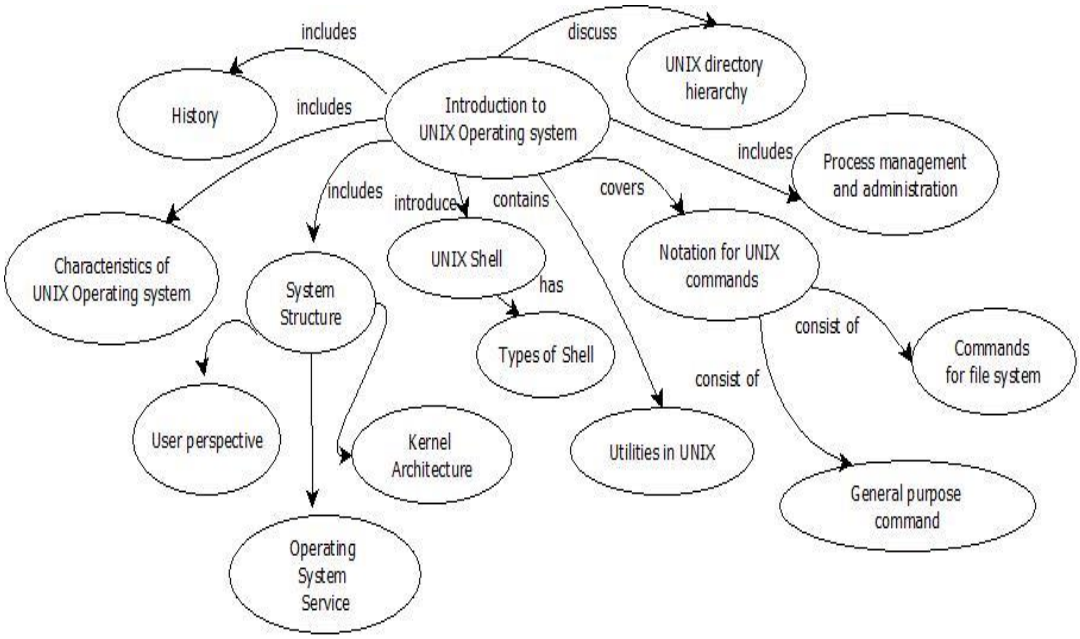
- Utilize most of basic UNIX utilities and to develop shell script for routine system navigation and use.
- To study administrative command of UNIX operating system.
- To explore the UNIX internal structure and use system calls to develop utilities.

The following activities shall be carried out by the teacher.

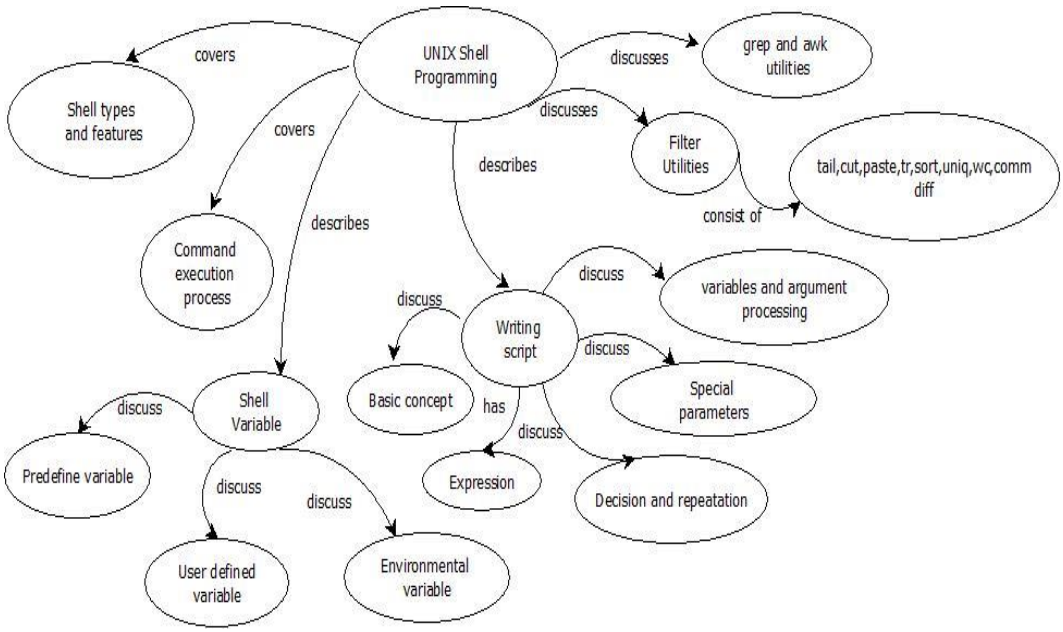
- To demonstrate source code of open source LINUX operating system like Debian.
- To aware students about Open source software.
- To demonstrate administrative shell utilities.
- To discuss UNIX history and different versions of it.

Concept map:

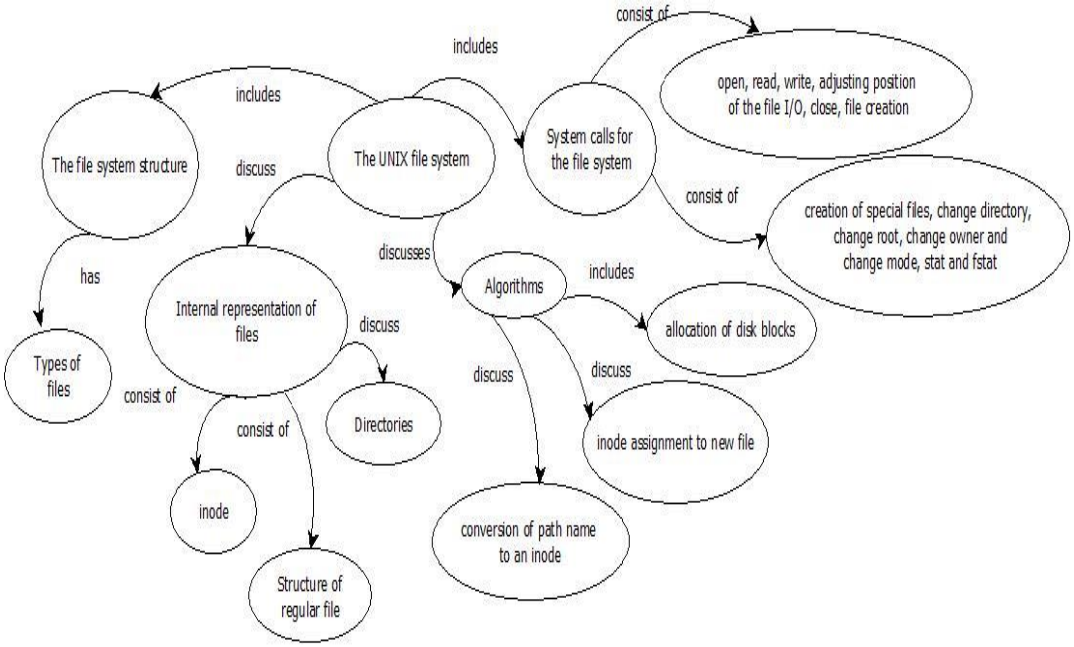
Unit-1: Introduction to UNIX operating system



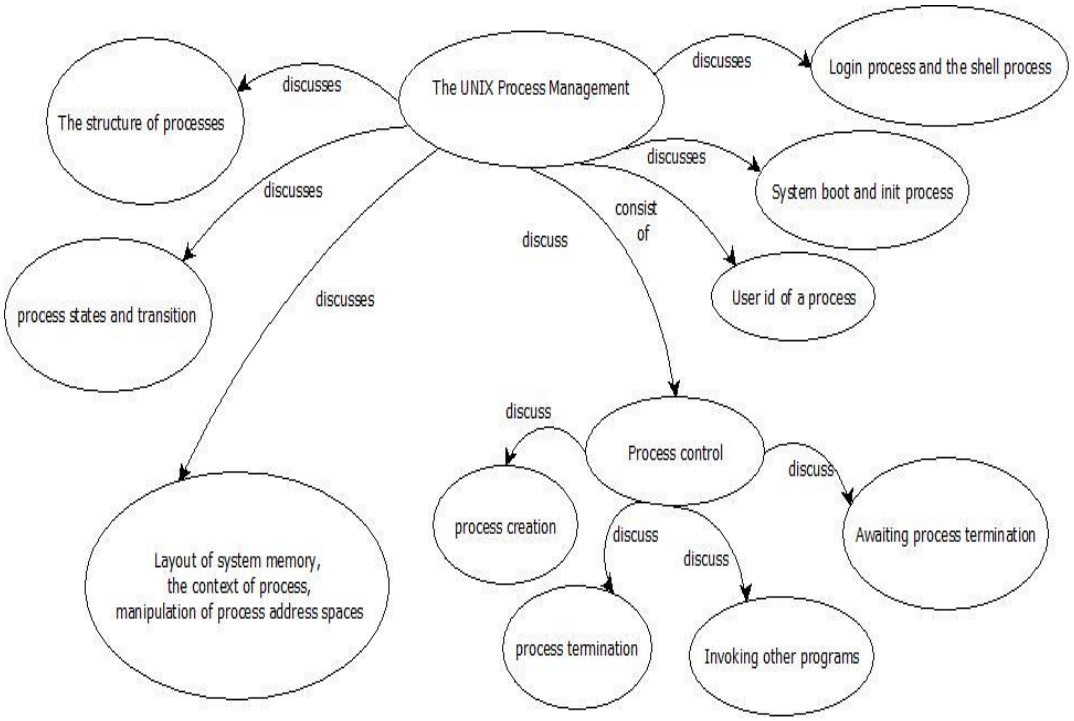
Unit-2: UNIX Shell Programming



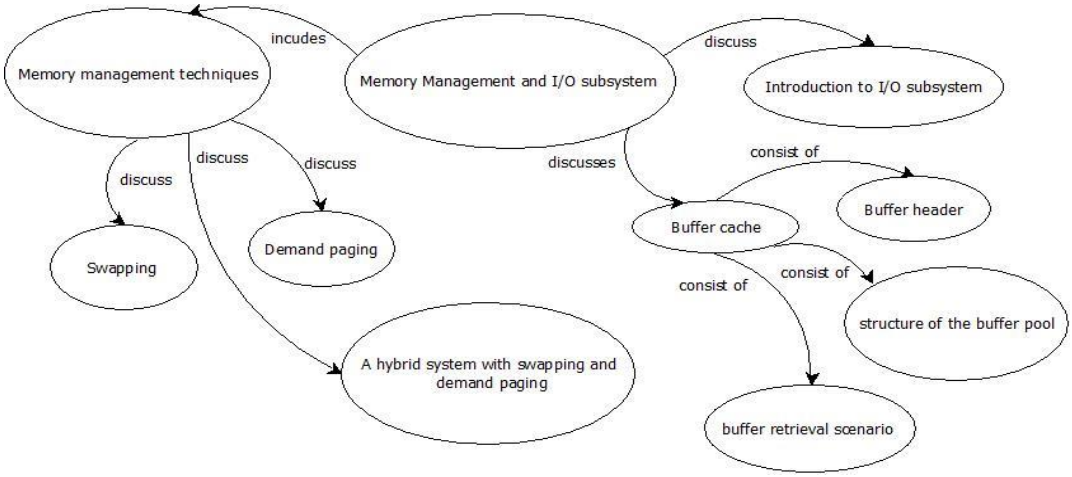
Unit-3: The UNIX File System



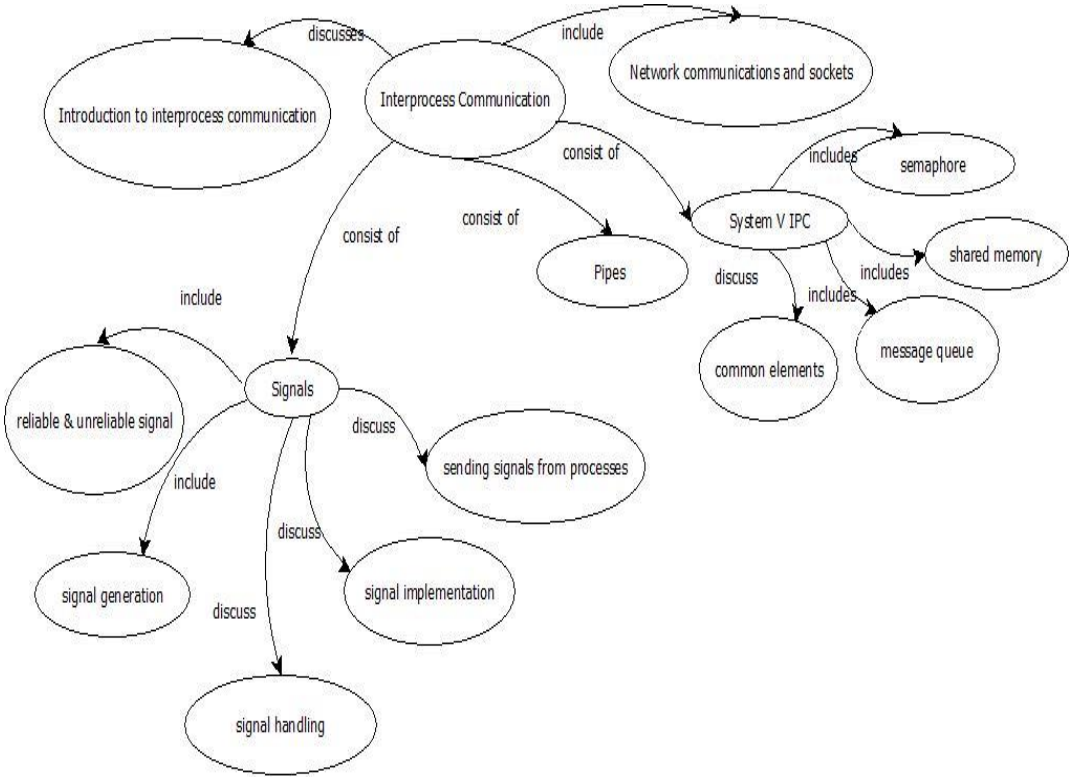
Unit-4: The UNIX Process Management



Unit-5: Memory Management and I/O subsystem



Unit-6: Interprocess Communication



UFM:

- If two or more submitted answer sheets are too similar for coincidence, a penalty shall be imposed that shall usually be the same for the student who did the original as for the one copying from it.
- Any ascertained fact of breaking institute policy shall be associated with one or all of the following: (i) zero marks for the work; (ii) report to the Course coordinator; (iii) report to the Director.