



K L Deemed to be University
Department of CSE – KLVZA
Course Handout
2020-2021, Odd Sem

Course Title	: OPERATING SYSTEMS DESIGN - S
Course Code	: 19CS2106S
L-T-P-S Structure	: 3-0-2-2
Pre-requisite	:
Credits	: 4.5
Course Coordinator	: VISHNUVARDHAN MANNAVA
Team of Instructors	:
Teaching Associates	:

Syllabus : Architecture of the UNIX operating system, OS Design Approaches, Operating system interfaces, Operating system organization, An Overview of the File Subsystem, buffer cache allocation algorithms: getblk, brelse, bread, bwrite. Log design, Lower Level File System Algorithms: namei, iget, iput, alloc, free, bmap, ialloc, ifree. File System Calls: open, read, write, close, creat, mknod, chdir, stat, pipe, dup, link, unlink. Processes, Context of a process, Process States and Transitions, kernel data structures, Under the Hood: The System Call, Paging hardware, Process address space, Physical memory allocation, Systems calls, exceptions, and interrupts, Assembly trap handlers, saving the context of a process, Disk driver, console, manipulation of the process address space: allocreg, loadreg, freereg, dupreg, sleep, wakeup. Process System Calls: fork, kill, exit, wait, brk, exec, xalloc. Shell Process scheduling: Scheduling Parameters, Multiplexing, Controlling Process Priorities, Fair Share Scheduler, Real-Time Processing. System calls for time, clock, Memory management policies: swapping, Demand Paging, Page faults, TLB, Segmentation, Hybrid approach: paging and segments. Locking, Models of inter-process communication: shared memory and message passing. Thread API, mutex, Deadlock, concurrent Linked Lists, Binary Semaphores (Locks), Counting Semaphores, The Producer/Consumer (Bounded Buffer) Problem, Reader-Writer Locks, The Dining Philosophers. The boot loader: Assembly bootstrap, C bootstrap, Introduction to Assembly language programming for X86.

Text Books : 1. Maurice J. Bach, The Design of The Unix Operating System, 2013 PHI Publishing. 2. Russ Cox, Frans Kaashoek, Robert Morris, xv6: a simple, Unix-like teaching operating system", Revision <https://pdos.csail.mit.edu/6.828/2018/xv6/book-rev11.pdf> 3. Frans Kaashoek, Robert Morris, and Russ Cox, The xv6 source code booklet (draft) (revision 11). <https://pdos.csail.mit.edu/6.828/2018/xv6/xv6-rev11.pdf>

Reference Books : 1. Operating Systems: Three Easy Pieces, Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, ArpaciDusseau Books, Createspace Independent Publishing Platform (2018). <http://pages.cs.wisc.edu/~remzi/OSTEP/> 2. Stallings, W. and Manna, M.M., 2015. Operating systems: internals and design principles. 2018 9th Edition Pearson. 3. Advanced programming in the UNIX Environment, 2013 Third Edition, W. Richard Stevens, Stephen A. Rago, The addison-wesley professional computing series. 4. Vahalia, U, UNIX internals: the new frontiers. 2008 Pearson Education India. 5. Tanenbaum, A.S., Modern operating system. 2009 4th Edition Pearson Education, Inc. 6. Silberschatz, A., Galvin, P.B. and Gagne, G., Operating system concepts essentials. 2018 10th Edition John 7. Marshall Kirk McKusick, George V. Neville-Neil, Robert N.M. Watson, The Design and Implementation of the FreeBSD Operating System, 2015, Pearson 8. Andrew S. Tanenbaum, Albert S. Woodhull, Operating Systems: Design and Implementation, 2006, Pearson 9. Richard Blum, Professional Assembly Language, wrox press, 2006. 10. Sumitabha Das - Your UNIX/Linux The Ultimate Guide, Third Edition-McGraw-Hill Education, 2012.

Web Links : 1. <https://www.cse.iitb.ac.in/~mythili/os/> 2. http://www.cse.iitm.ac.in/~chester/courses/15o_os/slides/ 3. <https://github.com/nbicocchi/operatingsystemsmisc> 4. <https://www.cs.columbia.edu/~junfeng/11sp-w4118/lectures/> 5. <http://pages.cs.wisc.edu/~remzi/Courses/537/Spring2018/Discussion/videos.html> 6. <https://www.ics.uci.edu/~aburtsev/238P/2018fall/index.html> 7. <https://pdos.csail.mit.edu/6.828/2011/schedule.html> 8. <https://www.cs.columbia.edu/~junfeng/13fa-w4118/syllabus.html> 9. <https://courses.cs.washington.edu/courses/csep551/17wi/>

MOOCS : 1. <https://cs385.class.uic.edu/lectures/2/>

Course Rationale : Examines some general conceptual issues relating to OS implementation strategies and looks at some low-level techniques that are often helpful for operating system developers, application programmers, and system administrators. Programmers on UNIX systems can gain a deeper understanding of how their programs interact with the system and thereby code more efficient programs.

Course Objectives : This course provides an in-depth view of the operating system's major kernel subsystems design & implementation. These include virtual memory system, process lifetime cycles and scheduling and the UNIX file system. The course will describe the differences between the different flavours of UNIX, such as BSD and SYSTEM V. Understanding design trade-offs, explaining parts of xv6 from a system design perspective. Students assess, customize and manipulate xv6.

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the internals of UNIX kernel architectures and explore design of File Subsystem, buffer cache, and File System Calls.	PSO1,PO3,PO4	3
CO2	Understand the internals of system call and explore design of structure of processes, process control, process system calls and scheduling in UNIX systems	PSO1,PO3,PO4	3
CO3	Understand Traps, interrupts, and drivers. Explore design tradeoffs and Implement parts of memory management policies, first address space, page tables and virtual memory in UNIX systems	PSO1,PO3,PO4	3
CO4	Analyse theory and implementation of inter-process communication, synchronization, concurrency, and Boot loader in UNIX variants.	PO4,PSO1,PO3	4
CO5	Implement parts of xv6 and develop Programs/commands using UNIX System Programming. Perform system administration.	PSO1,PO3,PO4,PO5	5

COURSE OUTCOME INDICATORS (COIs):

Outcome No.	Highest BTL	COI-1	COI-2	COI-3	COI-4
CO1	3	Btl-2 Characterize the internals of UNIX kernel architectures. Visualize File Subsystem Data Structures and algorithms	Btl-3 Construct buffer cache and File System Calls in UNIX systems. Explore the design of Lower Level File System Algorithms.		

CO2	3	Btl-2 Understand the internals of system call. Visualize saving the context of a process, system calls for time, clock, console, and init process.	Btl-3 Explore design of structure of processes and process control. Implement process system calls in UNIX systems Develop shell in UNIX systems. Customize scheduling in UNIX systems		
CO3	3	Btl-3 Understand Traps, interrupts, and drivers.	Btl-3 Implement the first process and address space. Perform physical memory allocation and multiplex address spaces using page tables in xv6. Manipulate process address space in UNIX systems Explore design trade-offs and Implement parts of memory management policies: swapping, segmentation, paging, TLB, Page faults and Advanced Page Tables		
CO4	4	Btl-2 Understand various Locking mechanisms, pthreads, and boot loader	Btl-3 Apply Mutex, Semaphores, and Condition variables to Perform concurrent programming Solve classic synchronization problems using pthreads.	Btl-4 Analyse Models of inter-process communication and Deadlocks for UNIX systems	
CO5	5			Btl-4 Implement parts of xv6 and develop Programs/commands using UNIX System Programming. Perform system administration	Btl-5 Porting xv6

PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES (POs/PSOs)

Po No.	Program Outcome
PO1	Engineering Knowledge :An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems in engineering
PO2	Problem Analysis :An ability to identify, formulate, research literature, analyze complex engineering problems in mechanical engineering using first principles of mathematics, natural sciences and engineering sciences
PO3	Design/ development of solutions :An ability to design solutions for complex engineering problems and system component or processes that meet the specified needs considering public health & safety and cultural, societal & environment
PO4	Conduct investigations of complex problems :An ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to obtain solutions to engineering problems
PO5	Modern tool usage :Ability to create, select and apply appropriate techniques, resources and modern engineering activities, with an understanding of the limitations
PO6	The engineer and society :Ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and sustainability Ability to demonstrate the knowledge of engineering solutions, contemporary issues understanding their impacts on societal and environmental contexts, leading towards sustainable development
PO8	Ethics : An ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice
PO9	Individual and team work :An ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
PO10	Communication :Ability to communicate effectively oral, written reports and graphical forms on complex engineering activities
PO11	Project management and finance :Ability to demonstrate knowledge and understanding of the engineering and management principles and apply those one's own work, as a member and leader in team, to manage projects and in multi-disciplinary environments
PO12	Lifelong learning An ability to recognize the need for and having the preparation and ability to engage independent and life-long learning in broadest context of technological change
PSO1	An ability to design and develop software projects as well as Analyze and test user requirements.
PSO2	An Ability to gain working Knowledge on emerging software tools and technologies.

Lecture Course DELIVERY Plan:

Sess.No.	CO	COI	Topic	Book No[CH No][Page No]	Teaching-Learning Methods	EvaluationComponents
1	CO1	COI-1	Architecture of the UNIX operating system	T1 CH 2.1 Page No [19 - 22]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
2	CO1	COI-1	OS Design Approaches	T6 CH 2.8 Page No [81-91], T2, CH 2.8,2.9,2.10 Page No [108-118]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
3	CO1	COI-1	Operating system Interfaces, Operating system organization: Abstracting physical resources, User mode, kernel mode, and system calls, Kernel organization	T2 CH 0 Page No [7 -16], T2 CH 1 Page No [17-20]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
4	CO1	COI-1	An Overview of the File Subsystem, Buffer Cache allocation algorithms: getblk, brelse	T1 CH 2.2.1 Page No [22 – 24, 44, 46] T3 Sheet No [44]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1

Sess.No.	CO	COI	Topic	Book No[CH No][Page No]	Teaching-Learning Methods	EvaluationComponents
5	CO1	COI-2	Buffer Cache allocation algorithms: bread, breada, bwrite Log design, Logging	T1 CH 3, [3.3, 3.4] Page No [54,55,56], T2 CH 6 Page No [79,80], T3 Sheet No [44,45], [47]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
6	CO1	COI-2	Lower Level File System Algorithms: iget, iput, bmap, namei	T1 CH 4 Page No [64,66,70,75], T2 CH 6, T3 Sheet No [50,52,53,54,57]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
7	CO1	COI-2	Lower Level File System Algorithms: ialloc, ifree, alloc, free	T1 CH [4], Page No [78,80,86,102], T2 CH 6, T3 Sheet No [50,52,53,54,57]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
8	CO1	COI-2	File System Calls: open, read, write, close	T1 CH 5 Page No [93,97,101,103]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
9	CO1	COI-2	File System Calls: creat, mknod, chdir, stat	T1 CH 5 Page No [106,108, 109,110] T2 CH 6 Page No[75-89] T3 Sheet No [36,64,61,63,65]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
10	CO1	COI-2	File System Calls: pipe, dup, link, unlink	T1 CH 5 Page No [112,119,129,133] T2 CH 0, 6 T2 CH 6 Page No13, 70, 75-89 T3 Sheet No 36,67,64,61	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
11	CO2	COI-1	Operating system organization: Process overview, Processes, Context of a process, Process States and Transitions, kernel data structures, sleep and wakeup	T2 CH 1 Page No [20-22], T1 CH 2.2.2, 2.3 Page No [24 - 34]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
12	CO2	COI-1	Under the Hood: The System Call	R1 http://pages.cs.wisc.edu/~remzi/OSFEP/intro-syscall.pdf	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
13	CO2	COI-1	Saving the context of a process	R1 CH 6.3, Page No [55], T1 CH 6 Page No [162,163,165,170,171], T2 CH [3,5], T3 Sheet No[16,34,33,37]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
14	CO2	COI-2	Sleep and wakeup	T1 CH 6 Page No [185-186], T2 CH 5 [68 – 70], T3 Sheet No [28,29,38]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
15	CO2	COI-2	Process System Calls: fork, kill, exit	T1 CH 7 Page No [193,210,212,215], T2 CH 1,2,5 T3Sheet No[20,24,25,28,29,37,87]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
16	CO2	COI-2	exec, shell, init process	T1 CH 7,7.5,7.8 Page No [218,232,235, 233,236,237], T2 CH [2,0], T3 Sheet No[18,66,65,85]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
17	CO2	COI-2	Process scheduling: Multiplexing, mycpu and myproc,	T2 CH 5[61 – 65], T3 Sheet No[24,30,28,27]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
18	CO2	COI-2	Process scheduling: Scheduling Parameters, Controlling Process Priorities.	T1 CH 8.1 Page No [247- 255] T3 Sheet No [24,30,28,27]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
19	CO2	COI-2	Process scheduling: Fair Share Scheduler, Real-Time Processing, problems	T1 CH 8.1 Page No [255 - 258]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
20	CO2	COI-2	System calls for time, clock, console	T1 CH [8.2,8.3] Page No [258-262], T2 CH [3,1] T3 Sheet No[75,38,4,79]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM1
21	CO3	COI-2	Operating system organization: creating and running the first process, Page tables: Paging, hardware, Process address space	T1 CH [6.2] Page No [151], T2 CH [2] Page No [29-32], T3 Sheet No[7,18,17]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
22	CO3	COI-2	Page tables: Physical memory allocation	T2 CH [2] Page No [32-34], T3 Sheet No [31]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
23	CO3	COI-1	Systems calls, exceptions and interrupts, Assembly trap handlers,	T2 CH [3] Page No [39-49], T3Sheet No[84,33,18,34,37,32]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
24	CO3	COI-1	Disk driver and Disk scheduling	R1 CH[36.7, 36.8, 37.5] Page No [426,427, 442], T2 CH [3] Page No [47 - 48], T3 Sheet No[42,43]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
25	CO3	COI-2	Manipulation of the process address space	T1 CH [6,7] Page No [173,178,180,182], T2 CH [2], T3 Sheet No[19,20]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
26	CO3	COI-2	Page tables: User part of an address space, sbrk, exec	T1 CH [7] Page No [213,218], T2 CH [2] Page No [34-37], T3 Sheet No[38,25,18,66,65]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2

Sess.No.	CO	COI	Topic	Book No[CH No][Page No]	Teaching-Learning Methods	EvaluationComponents
27	CO3	COI-2	Memory management policies: swapping, demand paging	R1 CH [14.2, 20.5, 28.13] Page No [132,227,328], T1 CH [9] Page No 271,273,281, T3 Sheet No 18,28	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
28	CO3	COI-2	Memory management policies: Page faults and replacement algorithms.	R1 CH [22] Page No [243 - 256], T1 CH [9] Page No [299,304]. T3 Sheet No [18,28,21]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
29	CO3	COI-2	TLB, Segmentation	R1 CH [16.1,19.1] Page No [155,199],	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
30	CO3	COI-2	Hybrid approach: paging and Segmentation, Multi-level paging	R1 CH [20.2, 20.3] Page No [216, 219],	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
31	CO4	COI-2	Locking: spin locks, Compare-And-Swap, Load-Linked and Store-Conditional, beache.lock,cons.lock,ftable.lock,icache.lock idelock,kmem.lock,log.lock,ptable.lock ticks lock,inode'sip->lock.	R1 CH [28.7-28.14] Page No [320 -332], T1 CH [5.4] Page No [103],T2 CH[4] Page No [51-59]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
32	CO4	COI-2	Locking: Fetch-And-Add, Lock With Queues, Test-and-set, Yield, Wakeup sleeplock, spinlock, getcallerpcs, acquire, release, kvmalloc, xchg,acquiresleep,getcallerpcs,holding,initlock	R1 CH [28.7-28.14] Page No [320 -332], T1 CH [5.4] Page No [103], T2 CH[4] Page No [51-59]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
33	CO4	COI-3	models of inter-process communication: message passing – msgsnd, msgrcv	T1 CH [11.2.1] Page No [359 - 367].	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
34	CO4	COI-3	Models of inter-process communication: shared memory - shmat	T1 CH [112.2] Page No[367-370]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
35	CO4	COI-2	Thread API, condition variable	R1 CH [27] Page No [303 - 313]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
36	CO4	COI-2	Mutex, Concurrent Linked Lists	R1 CH [28.2,29.2] Page No [316,342]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
37	CO4	COI-1	Binary Semaphores (Locks), Counting Semaphores, algorithm semop	R1 CH [31.1-31.4] Page No [367] T1 CH [11.2.3] Page No [376]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
38	CO4	COI-2	The Producer/Consumer (Bounded Buffer) Problem, Reader-Writer Locks, The Dining Philosophers	R1 CH [31.4-31.6] Page No [372], T1 CH [11.2.3] Page No [376]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
39	CO4	COI-3	Deadlocks, banker's algorithm	R1 CH [32.3] Page No [389] R6 CH[8] Page No [330 - 343]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2
40	CO4	COI-2	The boot loader: Assembly bootstrap, C bootstrap, Introduction to Assembly language	T2 Appendix A, B Page No [95 - 103] R9 CH[4,5] Page No [104, 125]	Chalk,LTC,PPT,Talk	End Semester Exam,SEM-EXAM2

Lecture Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Understand the functionalities of Operating system

Session Outcome: 2 Explore the Architecture of UNIX Operating systems.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Introduction to the course	2	Talk	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break/poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
10	Introduction to Architecture of the UNIX operating system	2	PPT	--- NOT APPLICABLE ---
10	Role, functionalities, and objectives of operating system	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Understand Operating Systems Design Approaches

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods

5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Traditional UNIX systems	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Modern UNIX systems	2	PPT	--- NOT APPLICABLE ---
10	LINUX Kernel	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 3

Session Outcome: 1 Understand Operating system Interfaces and organization.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Operating system interfaces	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Operating system organization: Abstracting physical resources	2	PPT	--- NOT APPLICABLE ---
10	User mode, kernel mode, and system calls, Kernel organization	2	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 1 Understand and Explore the Design of File Subsystem and Buffer Cache Algorithms.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	An Overview of the File Subsystem, File System Layout	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Buffer Cache allocation algorithms: getblk, brelse.	3	PPT	--- NOT APPLICABLE ---
10	Xv6 functions: bget, brelse. Design and Implementation of bio.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 1 Understand and explore the Design of Buffer Cache allocation algorithms.

Session Outcome: 2 Apply Log design and Logging.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Buffer Cache allocation algorithms: bread, breada, bwrite	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Log design, Logging	3	PPT	--- NOT APPLICABLE ---
10	Xv6 functions: bread, bwrite. Design and Implementation of log.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 1 Understand and Explore the Design of Lower Level File System Algorithms: iget, iput, bmap, namei

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Lower Level File System Algorithms: iget, iput, bmap, namei	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	2	Talk	--- NOT APPLICABLE ---
10	Xv6 functions: iget, iput, bmap, namei, dirlookup xv6 functions: create, sys_mknod, sys_mkdir, sys_chdir, sys_fstat, filestat, stat.h	3	PPT	Case Study
10	Design and Implementation of creat, mknod, chdir, stat, file.c, sysfile.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 7**Session Outcome: 1** Understand and Explore the Design of Lower Level File System Algorithms

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Lower Level File System Algorithms : ialloc, ifree, alloc	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6 functions: ialloc, itrunc, balloc, bfree	3	PPT	Case Study
10	Design and Implementation of algorithms in fs.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 8**Session Outcome: 1** Understand and Explore the Design of File System Calls: Open, read, write, close

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for File System Calls: open, read, write, close	3	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6 functions: sys_open, filealloc, sys_read, fileread, sys_write, filewrite, sys_close, fileclose	3	PPT	Case Study
10	Design and Implementation of open, read, write, close, file.c, sysfile.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 9**Session Outcome: 1** Understand and Explore the Design of File System Calls: creat, mknod, chdir, stat

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for File System Calls: creat, mknod, chdir, stat	3	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	xv6 functions: create, sys_mknod, sys_mkdir, sys_chdir, sys_fstat, filestat, stat.h	3	PPT	Case Study
10	Design and Implementation of creat, mknod, chdir, stat, file.c, sysfile.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 10**Session Outcome: 1** Understand and Explore the Design of File System Calls: Pipe, dup, link, unlink

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for File System Calls : Pipe, dup, link, unlink	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: sys_pipe, pipealloc, piperead, pipewrite, sys_dup, filedup, sys_link, dirlink, sys_unlink	3	PPT	Case Study
10	Design and Implementation of Pipe, dup, link, unlink, sysfile.c, pipe.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 11**Session Outcome: 1** Understand Operating system organization: Process overview

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Processes, Context of a process	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	States and Transitions	2	PPT	--- NOT APPLICABLE ---
10	kernel data structures, sleep and wakeup	2	PPT	--- NOT

SESSION NUMBER : 12**Session Outcome: 1** Understand Under the Hood: The System Call

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Under the Hood system call	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: usys.s, read(), tvinit, mpmain(), alltraps, traps, syscall()	2	PPT	Case Study
10	understand usys.s, main.c, trap.c, mmu.h, vectors.s, trapasm.s, trap.ctraps.h, syscall().c	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 13**Session Outcome: 1** Understand saving the context of a process

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for inthand, syscall, Context Switch, Copying Data between System and User Address space	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	xv6: pushcli, trap, alltraps, popcli, tvinit, syscall, swtch, copyout	2	PPT	Case Study
10	understand spinlock.c, trap.c, tapasm.s, spinlock.c, trapasm.s, syscal.c, swtch.s, vm.c	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 14**Session Outcome: 1** Understand and Explore the Design of sleep and wakeup algorithms

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Sleep, wakeup algorithms	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: sleep, sys_sleep, wakeup, wakeup1	3	PPT	Case Study
10	Design and Implementation of Sleep, wakeup algorithms in proc.c, sysproc.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 15**Session Outcome: 1** Understand and Explore the Design of Process system calls: fork, kill, exit

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for fork, kill, exit	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	2	Talk	--- NOT APPLICABLE ---
10	Xv6: allocproc, copyvm, fork, fork1, forkret, sys_fork, kill, sys_kill, exit, sys_exit	2	PPT	Case Study
10	Design and Implementation of fork, kill, exit in proc.c, syscall.c	2	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 16**Session Outcome: 1** Understand init process and Explore the Design of Exec and shell,

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for exec, shell, init process	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6 functions: Exec, shell, start, init setupkvm, exec, sys_exec, sh.c, init.c	2	PPT	Case Study

10	Design and Implementation of vm.c,exec.c, sysfile.c, sh.c, init.c	3	LTC	--- NOT APPLICABLE ---
10	Conclusion & Summary	3	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 17

Session Outcome: 1 Understand and Explore the Design of process scheduling: Multiplexing, mycpu and myproc.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Process scheduling: Multiplexing, mycpu and myproc.	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	xv6 functions: mycpu, myproc,	3	PPT	Case Study
10	Design and Implementation of proc.c, swtch.s	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 18

Session Outcome: 1 Understand and Explore the Design of process scheduling: schedule_process, Scheduling Parameters, Controlling Process Priorities.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Process scheduling: schedule_process algorithm, Scheduling Parameters, Controlling Process Priorities	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	xv6 functions: mycpu, myproc, swtch, yield, scheduler, sched	3	PPT	Case Study
10	Working of cswtch.s, proc.c, problems	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 19

Session Outcome: 1 Understand and explore the design of process scheduling: Fair Share Scheduler, Real-Time Processing

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Fair Share Scheduler, Real-Time Processing	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: mycpu, myproc, swtch, yield, scheduler, sched	3	PPT	Case Study
10	Working of proc.c, swtch.s, problems	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 20

Session Outcome: 1 Understand system calls for time, clock, and console

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Understand console. Algorithms for stime, time, times, and alarm, clock	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: cmostime, sys_uptime, timerinit, cprintf	2	PPT	Case Study
10	explanation of lapic.c, sysproc.c, defs.h,timer.c, console.c	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 21

Session Outcome: 1 Understand and Explore the Design of Operating system organization and page tables

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Operating system organization: creating and running the first process, Page tables: Paging hardware, Process address space	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT

				APPLICABLE ---
10	Xv6: mmu.h, kvmalloc, setupkvm, kmap, mappages, walkpgdir	3	PPT	Case Study
10	Implementation of mmu.h, vm.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 22**Session Outcome: 1** Understand and Explore the Design of Page tables: Physical memory allocation

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Page tables: Physical memory allocation	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: kinit1, kinit2, kfree	3	PPT	Case Study
10	Implementation of kalloc.c, kalloc.c, kalloc.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 23**Session Outcome: 1** Understand Systems calls, exceptions, and interrupts, Assembly trap handlers,

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Systems calls, exceptions, and interrupts, Assembly trap handlers	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: initcode.s, tvinit, switchvm, alltraps trap, trapret, syscall, switchvm vectors.pl	2	PPT	Case Study
10	explanation of initcode.s, trapasm.s, vm.c, trapasm.s, trap.c, trapasm.s, syscal.c, vm.c, vectors.pl	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 24**Session Outcome: 1** Understand and Explore the Design of Disk driver and scheduling

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Disk driver and Disk scheduling.	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: ideinit, idewait, iderw, idestart, ideintr, ioapicenable	2	PPT	Case Study
10	Explanation of ide.c, problems on Disk space	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 25**Session Outcome: 1** Understand and Explore the Design of the process address space manipulation

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for manipulation of the process address space: allocreg, loadreg, freereg, dupreg, xalloc	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: allocvm, loadvm, deallocvm, copyvm	3	PPT	Case Study
10	Implementation of vm.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 26**Session Outcome: 1** Understand and Explore the Design of Page tables: User part of an address space, sbrk, exec

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Page tables: User part of an address space, Algorithms for sbrk, exec	2	PPT	--- NOT APPLICABLE ---

5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6: brk, exec sys_sbrk, growproc, setupkvm, exec, sys_exec	3	PPT	Case Study
10	Implementation of sysproc.c, proc.c, vm.c, exec.c, sysfile.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 27**Session Outcome: 1** Understand and Explore the Design of memory management policies: swapping and Demand Paging

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Memory management policies: swapping, Demand Paging	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Algorithms for malloc, swapper. Xv6: kvmalloc, malloc, yield, copyout	3	PPT	Case Study
10	Implementation of vm.c, proc.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 28**Session Outcome: 1** Understand and Explore the Design of Page faults and replacement algorithms

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Page faults and replacement algorithms	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Algorithms for vfault, pfault, Xv6: kvmalloc, malloc, yield, copyout	3	PPT	Case Study
10	Implementation of vm.c, proc.c	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 29**Session Outcome: 1** Understand and Explore the Design of TLB and Segmentation

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Algorithms for TLB	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Algorithms for Segmentation	2	PPT	--- NOT APPLICABLE ---
10	Design of TLB, problems	3	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 30**Session Outcome: 1** Understand and Explore the Design of Hybrid approach and Multi-level paging.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Hybrid approach: paging and segments Segmentation algorithm	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Algorithms for Multi-level paging	2	PPT	--- NOT APPLICABLE ---
10	X86 Multi-level paging, problems, Paging and Address translation in X86	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 31**Session Outcome: 1** Understand xv6 Locking: spin locks, Compare-And-Swap, Load-Linked and Store-Conditional, bcache.lock, cons.lock, ftable.lock, icache.lock, idelock, kmem.lock, log.lock

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT

				APPLICABLE ---
20	Locking algorithms: atomic exchange (xchg), spin locks, Compare-And-Swap, Load-Linked and Store-Conditional	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6 Locking: bcache.lock, cons.lock, ftable.lock, icache.lock Idelock, kmem.lock, log.lock, ptable	2	PPT	Case Study
10	Explanation of lockticks lock, inode'sip->lock.	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 32

Session Outcome: 1 Understand xv6 Locking: Fetch-And-Add, Lock With Queues, Test-and-set, Yield, Wakeup, sleeplock, spinlock, getcallerpcs, acquire, release, kvmalloc, xchg, acquiresleep, getcallerpcs, holding, initlock

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Questions	1	Talk	--- NOT APPLICABLE ---
20	Locking algorithms: Fetch-And-Add, Lock with Queues, Test-and-set, Yield, Wakeup	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Xv6 Locking: sleeplock, spinlock, getcallerpcs, acquire, release, kvmalloc	2	PPT	Case Study
10	Explanation of xchg, acquiresleep, getcallerpcs, holding, initlock	2	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 33

Session Outcome: 1 Understand and Explore the Design Models of inter-process communication: message passing – Message Queues.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop Question	1	Talk	--- NOT APPLICABLE ---
20	Models of INTERPROCESS COMMUNICATION: shared memory and message passing	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Message queues: Algorithm msgsnd	4	PPT	--- NOT APPLICABLE ---
10	System V Message queues: Implementation of msgrcv	4	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 34

Session Outcome: 1 Understand and Explore the Design of inter-process communication: shared memory

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
20	Models of INTERPROCESS COMMUNICATION: shared memory and message passing	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Algorithm shmat	3	PPT	--- NOT APPLICABLE ---
10	Shared Memory: Implementation of shmat	4	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 35

Session Outcome: 1 Understand and Explore the Design Thread API

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
20	Thread API, critical section	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	pthread_self, pthread join and exit	3	PPT	--- NOT APPLICABLE ---
10	Condition variable	4	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 36

Session Outcome: 1 Understand and Explore the Design mutex, concurrent Linked Lists

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
20	mutex	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	concurrent Linked Lists	4	PPT	--- NOT APPLICABLE ---
10	Solve increment problem.	4	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 37

Session Outcome: 1 Understand and Explore the Design Binary Semaphores (Locks), Counting Semaphores

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
20	Binary Semaphores (Locks)	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Counting Semaphores, semop algorithm	4	PPT	--- NOT APPLICABLE ---
10	Parent waiting for a child	4	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 38

Session Outcome: 1 Understand and Explore the Design The Producer/Consumer (Bounded Buffer) Problem, Reader-Writer Locks, The Dining Philosophers

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
20	The Producer/Consumer (Bounded Buffer)	4	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	The Dining Philosophers	3	PPT	--- NOT APPLICABLE ---
10	Problem, Reader-Writer Locks , semop	3	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 39

Session Outcome: 1 Understand and Explore the Design Deadlocks, banker's algorithm

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
20	Deadlocks	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Banker's algorithm	4	PPT	--- NOT APPLICABLE ---
10	Deadlocks in The Producer/Consumer	4	PPT	--- NOT APPLICABLE ---

SESSION NUMBER : 40

Session Outcome: 1 Understand The boot loader: Assembly bootstrap, C bootstrap and Assembly language.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
20	The boot loader: Assembly bootstrap, C bootstrap,	2	PPT	--- NOT APPLICABLE ---
5	Ask for any doubts through Public chat/ Break	1	Talk	--- NOT APPLICABLE ---
10	Introduction to Assembly language, bootasm.S, bootmain.c	2	PPT	--- NOT APPLICABLE ---

10	kernel.ld	2	PPT	--- NOT APPLICABLE ---
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Tutorial Course DELIVERY Plan: NO Delivery Plan Exists

Tutorial Session wise Teaching – Learning Plan

No Session Plans Exists

Practical Course DELIVERY Plan:

Tutorial Session no	Topics	CO-Mapping
1	Pre Lab: 1. cat.c: which forms the essence of cat) copies data from its standard input to its standard output. If an error occurs, it writes a message to the standard error. 2. fork.c: A Simple Child Creation Program Post Lab: 1.C library functions for file handling. Standard I/O library that will copy data from one file to another file. 2.io.c: A Program That Does I/O	CO5
2	Pre lab: 1. ccp.c: Copying a File. Show a pictorial arrangement of File Descriptor, File and Inode tables for a single process that has two different files open. 2. Write a system program which will opens files in the parent and uses dup2 in the child to reassign the descriptors	CO5
3	Pre Lab: 1. execl and execv, Gathering the exit Status using wait with standard input and output redirection. 2. Show a pictorial arrangement - Sharing of open files between parent and child after fork. Post Lab: 1.orphan.c, zombie.c: create orphan and processes 2.Program that creates a new Process to Copy Files	CO5
4	Pre Lab: 1.pipe.c: Runs two programs in a pipeline Child runs cat, parent runs tr 2. A half-baked directory using mknod. Post Lab: 1.mylink.c -- create the filename "another.txt" and link it to the other file. Later delete it using unlink. 2.Unlinking an opened file	CO5
5	In lab: 1.attributes.c -- Uses lstat call and struct stat to display file attributes. 2. lsdir.c -- Lists only directories - Uses S_IFMT and S_ISDIR macros Post Lab: mychown.c -- change the group of the file. mychmod.c -- changed the permission flags of the file.	CO5
6	In Lab: 1.signal.c -- Waits for 5 seconds for user input and then . 2.Generates SIGALRM that has a handler specified killproc ss.c -- Uses fork and exec to run a user-defined program and kills it if it doesn't complete in 5 seconds Post Lab: 1. mynice.c: A child process inherits its priority value from its parent, and change it by using nice () 2. program to demonstrate time and times System Call	CO5
7	In Lab: 1. Write a program to display the address space of various segments (stack, heap, data...etc) and show that memory address a programmer see is virtual not real. 2. Develop a program to illustrate the effect of free() on the program break. This program allocates multiple blocks of memory and then frees some or all of them, depending on its (optional) command-line arguments. Post Lab: 1. Write a simple memory allocator: memalloc is a simple memory allocator. Which uses your own malloc(), calloc(), realloc() and free() implemented using system calls.	CO5
8	In Lab: 1. Write a program to demonstrate Accessing Memory with Paging - linear translates. 2. Write a program that translates logical to physical addresses for a virtual address space of size $2^{16} = 65,536$ bytes. Your program will read from a file containing logical addresses and, using a TLB as well as a page table Post Lab: 1. Write a program to demonstrate Accessing Memory with segmentation - linear translates	CO5
9	In Lab: 1. Write a program for the simulation of following paging algorithms FIFO LRU and MRU NFU Post Lab: 1. Program to demonstrate Multi-level Page Table Control Flow	CO5
10	In Lab: 1. System V shared memory 2. Write a program to create 5 pthreads and display Hello world. Main thread should wait until all new threads are terminated. Use Simpler Argument Passing to a Thread. Post Lab: System V message queues	CO5
11	In Lab: 1. Illustrate how mutex is used for thread synchronization, print the counter variable upon each increment which is in the critical section. (Two threads update a global shared variable with and without synchronization) 2. Write a UNIX system program to implement concurrent Linked List Post Lab: 1. Write a Unix System program to make A Parent Waiting for Its Child using semaphores	CO5
12	In Lab: Solve producer consumer problem using mutex, binary and counting semaphores, and condition variables Post Lab: 1. Solve readers writer's problem using mutex and semaphores	CO5

Practical Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 implement : 1. cat.c 2. fork.c

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	attendance/poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation: 1. cat.c: which forms the essence of cat) copies data from its standard input to its standard output. If an error occurs, it writes a message to the standard error. 2. fork.c: A Simple Child Creation Program	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT

				APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	3	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	3	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 implement: 1. ccp.c 2. Write a system program which will opens files in the parent and uses dup2 in the child to reassign the descriptors

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. ccp.c: Copying a File. Show a pictorial arrangement of File Descriptor, File and Inode tables for a single process that has two different files open. 2. Write a system program which will opens files in the parent and uses dup2 in the child to reassign the descriptors.	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	3	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	3	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 3

Session Outcome: 1 Implement : 1. execl and execv 2. Show a pictorial arrangement - Sharing of open files between parent and child after fork.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. execl and execv, Gathering the exit Status using wait with standard input and output redirection. 2. Show a pictorial arrangement - Sharing of open files between parent and child after fork.	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 1 Implement : 1. pipe.c 2. A half-baked directory using mknod.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. pipe.c: Runs two programs in a pipeline Child runs cat, parent runs tr 2. A half-baked directory using mknod.	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 1 Implement : 1. attributes.c -- Uses lstat call and struct stat to display file attributes. 2. lsdir.c -- Lists only directories - Uses S_IFMT and S_ISDIR macros

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. attributes.c -- Uses lstat call and struct stat to display file attributes. 2. lsdir.c -- Lists only directories - Uses S_IFMT and S_ISDIR macros	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT

				APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation/ Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 1 Implement : 1. signal.c 2. Generates SIGALRM that has a handler specified kill proce ss.c -- Uses fork and exec to run a user-defined program and kills it if it doesn't complete in 5 seconds

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1.signal.c -- Waits for 5 seconds for user input and then . 2.Generates SIGALRM that has a handler specifiedkillproce ss.c -- Uses fork and exec to run a user-defined programand kills it if it doesn't complete in 5 seconds	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	1	Talk	--- NOT APPLICABLE ---
20	Documenting Results Summary and Result Explanation	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 7

Session Outcome: 1 Implement : 1. display the address space of various segments (stack, heap, data...etc) and show that memory address a programmer see is virtual, not real.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. Write a program to display the address space of various segments (stack, heap, data...etc) and show that memory address a programmer see is virtual not real. 2. Develop a program to illustrate the effect of free() on the program break. This program allocates multiple blocks of memory and then frees some or all of them, depending on its (optional) command-line arguments.	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 8

Session Outcome: 1 Implement : a program to demonstrate Accessing Memory with Paging - linear translates.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. Write a program to demonstrate Accessing Memory with Paging - linear translates. 2. Write a program that translates logical to physical addresses for a virtual address space of size $2^{16} = 65,536$ bytes. Your program will read from a file containing logical addresses and, using a TLB as well as a page table	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	1	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 9

Session Outcome: 1 Implement : 1. program for the simulation of following paging algorithms FIFO LRU and MRU NFU

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT

				APPLICABLE ---
10	Experiment explanation : 1. Write a program for the simulation of following paging algorithms FIFO LRU and MRU NFU	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	1	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 10

Session Outcome: 1 Implement : a program to create 5 pthreads and display Hello world. Main thread should wait until all new threads are terminated. Use Simpler Argument Passing to a Thread.

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. System V shared memory 2. Write a program to create 5 pthreads and display Hello world. Main thread should wait until all new threads are terminated. Use Simpler Argument Passing to a Thread.	2	Talk	--- NOT APPLICABLE ---
5	Split sections	2	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 11

Session Outcome: 1 Implement : a UNIX system program to implement concurrent Linked List

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. Illustrate how mutex is used for thread synchronization, print the counter variable upon each increment which is in the critical section. (Two threads update a global shared variable with and without synchronization) 2. Write a UNIX system program to implement concurrent Linked List	1	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	1	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 12

Session Outcome: 1 Implement producer-consumer problem using a mutex, binary and counting semaphores, and condition variables

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance /poll	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : Solve producer-consumer problem using mutex, binary and counting semaphores, and condition variables	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

Skilling Course DELIVERY Plan:

Skilling session no	Topics/Experiments	CO-Mapping
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Skilling session no	Topics/Experiments	CO-Mapping
1	Bridge COurse:Linux Command Line: What Is the Shell, Navigation, Exploring the System, Compiling Programs Xv6 design & implementation: cat.c syscall.c syscall.h sysproc.c user.h usys.S xv6 Customisation: 1. XV6 Installation 2. adda-new- system-call-in- xv6	CO1
2	Linux Command Line: Manipulating Files and Directories. Xv6 design & implementation: echo.c xv6 customization: cp, wc.c	CO1
3	Linux Command Line: Searching for Files, Archiving and Backup Xv6 design & implementation: ls.c xv6 customization: ls, date, head	CO1
4	Bridge course: Linux Command Line: Seeing the World as The Shell Sees It, Advanced Keyboard Tricks, Permissions Xv6 design & implementation: kill.c, grep.c xv6 customization: 1. Triply-Indirect- Block filesystem in xv6. 2. xv6 filesystem visualizer	CO2
5	Linux Command Line: Working with Commands, Redirection Xv6 design & implementation: exec.c xv6 customization: pwd, cd, mv	CO2
6	Linux Command Line: Seeing the World as The Shell Sees It, Advanced Keyboard Tricks, Permissions Xv6 design & implementation: ln.c rm.c, mkdir.c xv6 customization: rm, getpinfo	CO2
7	Bridge Course: Linux Command Line: Formatting Output, Printing Xv6 design & implementation: vm.c xv6 customization: shell	CO3
8	Linux Command Line: Text Processing, awk Xv6 design & implementation: vm.c, umalloc.c xv6 customization: Priority scheduler in xv6, chpr	CO3
9	Linux Command Line: Processes Xv6 design & implementation: vm.c xv6 customization: ps, back trace	CO3
10	Linux Command Line: The Environment, A Gentle Introduction To vi, Customizing the Prompt Xv6 design & implementation: vm.c xv6 shared memory	CO4
11	Bridge Course: Linux Command Line: Package Management, Storage Media, Networking xv6: A Sample Assembly Language Program xv6 customization: xv6 Assembly code	CO4
12	Linux Command Line: Writing Shell Scripts Assembly programming: 1. Using Inline Assembly 2. Using Li Porting xv6 with POSIX compliance + VFS + ulibc + ACPI	CO4

Skilling Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Exploring the System, Compiling Programs and Execution of Programs

Session Outcome: 2 Understand Xv6 design & implementation: cat.c syscall.c syscall.h sysproc.c user.h usys.S 1. XV6 Installation 2. add a-new- system-call-in- xv6

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. Xv6 design & implementation: cat.c syscall.c syscall.h sysproc.c user.h usys.S 2. XV6 Installation 3. add-a-new- system-call-in- xv6	1	Talk	--- NOT APPLICABLE ---
5	Split sections/Poll/Pop	1	Talk	--- NOT APPLICABLE ---
40	Experimentation using tool/remote lab/hardware setup	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	3	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and result Explanation, Submitting as Assignment in LMS	3	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Understand Xv6 design & implementation: echo.c

Session Outcome: 2 xv6 customization: cp, wc.c

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. Xv6 design & implementation: echo.c 2. xv6 customization: cp, wc.c	2	Talk	--- NOT APPLICABLE ---
5	split sections/poll	1	Talk	--- NOT APPLICABLE ---

40	experiment using tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results,submitting in LMS as assignment	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 3**Session Outcome: 1** Understand Xv6 design & implementation: exec.c**Session Outcome: 2** xv6 customization: pwd, cd, mv

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment Explanation: 1.Xv6 design & implementation: exec.c 2. xv6 customization: pwd, cd, mv	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	experiment using tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results, submitting in LMS as assignment	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 4**Session Outcome: 1** Understand Xv6 design & implementation: ln.c rm.c, mkdir.c**Session Outcome: 2** xv6 customization: rm, getpinfno

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1. Xv6 design & implementation: ln.c rm.c, mkdir.c 2. xv6 customization: rm, getpinfno	2	Talk	--- NOT APPLICABLE ---
5	Split sections/poll	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	1	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation,Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 5**Session Outcome: 1** Understand the Xv6 design & implementation: ls.c**Session Outcome: 2** xv6 customization: ls, date, head

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment Explanation: 1.Xv6 design & implementation: ls.c 2. xv6 customization: ls, date, head	2	Talk	--- NOT APPLICABLE ---
5	Split sections/poll	1	Talk	--- NOT APPLICABLE ---
40	experiment using tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results, submitting in LMS as assignment	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 6**Session Outcome: 1** Understand Xv6 design & implementation: kill.c, grep.c**Session Outcome: 2** Triply-Indirect- Block filesystem in xv6, xv6 filesystem visualizer

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1.Xv6 design & implementation: kill.c, grep.c 2. Triply-Indirect-	2	Talk	--- NOT

	Block filesystem in xv6. 3. xv6 filesystem visualizer.			APPLICABLE ---
5	Split sections/poll	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	1	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 7**Session Outcome: 1** Understand Xv6 design & implementation: vm.c, umalloc.c**Session Outcome: 2** xv6 customization: Priority scheduler in xv6, chpr

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1.Xv6 design & implementation: vm.c, umalloc.c 2.xv6 customization: Priority scheduler in xv6, chpr	2	Talk	--- NOT APPLICABLE ---
5	Split sections/poll	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 8**Session Outcome: 1** Understand Xv6 design & implementation: vm.c**Session Outcome: 2** xv6 customization: shell

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment Explanation : 1. Xv6 design & implementation: vm.c 2. xv6 customization: shell	2	Talk	--- NOT APPLICABLE ---
5	Split sections/poll	1	Talk	--- NOT APPLICABLE ---
40	experiment using tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results, submitting in LMS as assignment	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 9**Session Outcome: 1** Understand Xv6 design & implementation: vm.c**Session Outcome: 2** xv6 customization: ps, back trace

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation	2	Talk	--- NOT APPLICABLE ---
5	split sections/poll	1	Talk	--- NOT APPLICABLE ---
40	Experiment using tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting results, Submitting as assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 10**Session Outcome: 1** Understand Xv6 design & implementation: vm.c**Session Outcome: 2** customization of xv6 shared memory

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
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5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment Explanation: 1. Xv6 design & implementation: vm.c 2.xv6 shared memory	2	Talk	--- NOT APPLICABLE ---
5	Split sections/poll	2	Talk	--- NOT APPLICABLE ---
40	experiment using tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results, submitting in LMS as assignment	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 11**Session Outcome: 1** Understand A Sample Assembly Language Program**Session Outcome: 2** xv6 Assembly code

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment explanation : 1.A Sample Assembly Language Program 2.xv6 Assembly code	2	Talk	--- NOT APPLICABLE ---
5	Split sections/poll	1	Talk	--- NOT APPLICABLE ---
40	Experiment Using Tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results Summary and Result Explanation, Submitting as Assignment in LMS	2	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 12**Session Outcome: 1** Understand Assembly programming**Session Outcome: 2** Porting xv6 with POSIX compliance + VFS + ulibc + ACPI

Time(min)	Topic	BTL	Teaching- Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
10	Experiment Explanation	2	Talk	--- NOT APPLICABLE ---
5	Split sections	1	Talk	--- NOT APPLICABLE ---
40	experiment using tool	3	LTC	--- NOT APPLICABLE ---
10	Assessment and Interaction	2	Talk	--- NOT APPLICABLE ---
30	Documenting Results, submitting in LMS as assignment	2	Talk	--- NOT APPLICABLE ---

WEEKLY HOMEWORK ASSIGNMENTS/ PROBLEM SETS/OPEN ENDED PROBLEM-SOLVING EXERCISES etc:

Week	Assignment Type	Assignment No	Topic	Details	co
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COURSE TIME TABLE:

	Hour	1	2	3	4	5	6	7	8	9
Day	Component									
Mon	Theory	-	-		--	V-S13,V-S14,V-S15,V-S16,V-S17,V-S18,V-S19,V-S20,V-S21,V-S22,V-S23,V-S24,V-S25	V-S13,V-S14,V-S15,V-S16,V-S17,V-S18,V-S19,V-S20,V-S21,V-S22,V-S23,V-S24,V-S25	-	-	---
	Tutorial	-	-		--	--	--	-	-	---
	Lab	-	-	V-S13,V-S13,V-S14,V-S14,V-S15,V-S15,V-S16,V-S16,V-S17,V-S17,V-S18,V-S18,V-S19,V-S19,V-S20,V-S20,V-S21,V-S21,V-S22,V-S22,V-S23,V-S23,V-S24,V-S24,V-S25	V-S13,V-S13,V-S14,V-S14,V-S15,V-S15,V-S16,V-S16,V-S17,V-S17,V-S18,V-S18,V-S19,V-S19,V-S20,V-S20,V-S21,V-S21,V-S22,V-S22,V-S23,V-S23,V-S24,V-S24,V-S25	--	--	-	-	---

			S22,V-S23,V-S23,V-S24,V-S24,V-S25,V-S25	S22,V-S23,V-S23,V-S24,V-S24,V-S25,V-S25				
	Skilling	- - - -	--	--	--	--	- - - -	---
Tue	Theory	- - - - - -	V-S1,V-S2,V-S3,V-S4,V-S5,V-S6,V-S7,V-S8,V-S9,V-S10,V-S11,V-S12	V-S1,V-S2,V-S3,V-S4,V-S5,V-S6,V-S7,V-S8,V-S9,V-S10,V-S11,V-S12	--	--	- - - - - -	---
	Tutorial	- - - -	--	--	--	--	- - - -	---
	Lab	- - - - - -	--	--	V-S1,V-S1,V-S2,V-S2,V-S3,V-S3,V-S4,V-S4,V-S5,V-S5,V-S6,V-S6,V-S7,V-S7,V-S8,V-S8,V-S9,V-S9,V-S10,V-S10,V-S11,V-S11,V-S12,V-S12	V-S1,V-S1,V-S2,V-S2,V-S3,V-S3,V-S4,V-S4,V-S5,V-S5,V-S6,V-S6,V-S7,V-S7,V-S8,V-S8,V-S9,V-S9,V-S10,V-S10,V-S11,V-S11,V-S12,V-S12	- - - - - -	---
	Skilling	- - - - - -	--	--	--	--	- - - - - -	---
Wed	Theory	- - - - - -	---	---	---	---	- - - - - -	V-S13,V-S14,V-S15,V-S16,V-S17,V-S18,V-S19,V-S20,V-S21,V-S22,V-S23,V-S24,V-S25
	Tutorial	- - - - - -	---	---	---	---	- - - - - -	--
	Lab	- - - - - -	---	---	---	---	- - - - - -	--
	Skilling	- - - - - -	---	---	---	---	- - - - - -	--
Thu	Theory	- - - - - -	---	---	---	---	- - - - - -	---
	Tutorial	- - - - - -	---	---	---	---	- - - - - -	---
	Lab	- - - - - -	---	---	---	---	- - - - - -	---
	Skilling	- - - - - -	---	---	---	---	- - - - - -	---
Fri	Theory	- - - - - -	---	---	---	---	- - - - - -	--
	Tutorial	- - - - - -	---	---	---	---	- - - - - -	--
	Lab	- - - - - -	---	---	---	---	- - - - - -	--
	Skilling	- - - - - -	---	---	---	---	- - - - - -	V-S13,V-S13,V-S14,V-S14,V-S15,V-S15,V-S16,V-S16,V-S17,V-S17,V-S18,V-S18,V-S19,V-S19,V-S20,V-S20,V-S21,V-S21,V-S22,V-S22,V-S23,V-S23,V-S24,V-S24,V-S25,V-S25
Sat	Theory	- - - -	--	--	--	--	- - - -	--
	Tutorial	- - - -	--	--	--	--	- - - -	--
	Lab	- - - -	--	--	--	--	- - - -	--
	Skilling	- - - -	--	--	--	--	- - - -	--
Sun	Theory	- - - -	--	--	--	--	- - - -	--
	Tutorial	- - - -	--	--	--	--	- - - -	--
	Lab	- - - -	--	--	--	--	- - - -	--
	Skilling	- - - -	--	--	--	--	- - - -	--

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REMEDIAL CLASSES:

Supplement course handout, which may perhaps include special lectures and discussions that would be planned, and schedule notified according

SELF-LEARNING:

Assignments to promote self-learning, survey of contents from multiple sources.

S.no	Topics	CO	ALM	References/MOOCs
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DELIVERY DETAILS OF CONTENT BEYOND SYLLABUS:

Content beyond syllabus covered (if any) should be delivered to all students that would be planned, and schedule notified accordingly.

S.no	Advanced Topics, Additional Reading, Research papers and any	CO	ALM	References/MOOCs
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EVALUATION PLAN:

Evaluation Type	Evaluation Component	Weightage/Marks	Assessment Dates	Duration (Hours)	CO1	CO2	CO3	CO4	CO5
End Semester Summative Evaluation Total= 40 %	Lab End Semester Exam	Weightage	9	120					9
		Max Marks	50						50
	Exam – Exercise	Weightage	4.5	120	1.125	1.125	1.125	1.125	
		Max Marks	50		12.5	12.5	12.5	12.5	
	End Semester Exam	Weightage	26.5	180	6.625	6.625	6.625	6.625	
		Max Marks	100		25	25	25	25	
In Semester Formative Evaluation Total= 25 %	Questions & Answers	Weightage	2	100	0.5	0.5	0.5	0.5	
		Max Marks	100		25	25	25	25	
	Continuous Evaluation - Lab Exercise	Weightage	8	100					8
		Max Marks	100						100
	ALM	Weightage	6	50	1.5	1.5	1.5	1.5	
		Max Marks	100		25	25	25	25	
	Attendance	Weightage	5	50	1	1	1	1	1
		Max Marks	5		1	1	1	1	1
	Home Assignment and Textbook	Weightage	4	60	1	1	1	1	
		Max Marks	40		10	10	10	10	
In Semester Summative Evaluation Total= 35 %	Semester in Exam-I	Weightage	11.65	120	5.825	5.825			
		Max Marks	50		25	25			
	Semester in Exam-II	Weightage	11.65	120			5.825	5.825	
		Max Marks	50				25	25	
	Lab In Semester Exam	Weightage	7.7	100					7.7
		Max Marks	50						50
	Exercise	Weightage	4	100	1	1	1	1	
		Max Marks	50		12.5	12.5	12.5	12.5	

ATTENDANCE POLICY:

Every student is expected to be responsible for regularity of his/her attendance in class rooms and laboratories, to appear in scheduled tests and examinations and fulfill all other tasks assigned to him/her in every course

In every course, student has to maintain a minimum of 85% attendance to be eligible for appearing in Semester end examination of the course, for cases of medical issues and other unavoidable circumstances the students will be condoned if their attendance is between 75% to 85% in every course, subjected to submission of medical certificates, medical case file and other needful documental proof to the concerned departments

DETENTION POLICY :

In any course, a student has to maintain a minimum of 85% attendance and In-Semester Examinations to be eligible for appearing to the Semester End Examination, failing to fulfill these conditions will deem such student to have been detained in that course.

PLAGIARISM POLICY :

Supplement course handout, which may perhaps include special lectures and discussions

COURSE TEAM MEMBERS, CHAMBER CONSULTATION HOURS AND CHAMBER VENUE DETAILS:

Supplement course handout, which may perhaps include special lectures and discussions

Name of Faculty	Delivery Component of Faculty	Sections of Faculty	Chamber Consultation Day (s)	Chamber Consultation Timings for each day	Chamber Consultation Room No:	Signature of Course faculty:
SHAHANA BANO	L	7-MA,22-MA	-	-	-	-
SHAHANA BANO	P	7-A,22-A	-	-	-	-
SHAHANA BANO	S	7-A,22-A	-	-	-	-

VISHNUVARDHAN MANNAVA	L	1-MA,16-MA	-	-	-	-
VISHNUVARDHAN MANNAVA	P	1-A,16-A	-	-	-	-
VISHNUVARDHAN MANNAVA	S	1-A,16-A	-	-	-	-
VIJAYA BABU BURRA	L	2-MA,17-MA	-	-	-	-
VIJAYA BABU BURRA	P	2-A,17-A	-	-	-	-
VIJAYA BABU BURRA	S	2-A,17-A	-	-	-	-
SAI KIRAN PASUPULETI	L	3-MA,18-MA	-	-	-	-
SAI KIRAN PASUPULETI	P	3-A,18-A	-	-	-	-
SAI KIRAN PASUPULETI	S	3-A,18-A	-	-	-	-
THIRUPATHI RAO KOMATI	L	4-MA,19-MA	-	-	-	-
THIRUPATHI RAO KOMATI	P	4-A,19-A	-	-	-	-
THIRUPATHI RAO KOMATI	S	4-A,19-A	-	-	-	-
TIRAPATHI REDDY BURRAMUKKU	L	5-MA,20-MA	-	-	-	-
TIRAPATHI REDDY BURRAMUKKU	P	5-A,20-A	-	-	-	-
Pradeepini Gera	L	6-MA,21-MA	-	-	-	-
Pradeepini Gera	P	6-A,21-A	-	-	-	-
Pradeepini Gera	S	6-A,21-A	-	-	-	-
swetha Kolachana	L	8-MA,23-MA	-	-	-	-
swetha Kolachana	P	8-A,23-A	-	-	-	-
swetha Kolachana	S	8-A,23-A	-	-	-	-
Naresh Vurukonda	P	3-B,18-B	-	-	-	-
Naresh Vurukonda	S	8-B,19-B	-	-	-	-
Talluri Lakshmi Siva Rama Krishna	P	25-B	-	-	-	-
Talluri Lakshmi Siva Rama Krishna	S	3-B,15-B	-	-	-	-
VENKATA MANDHALA	P	4-B	-	-	-	-
VENKATA MANDHALA	S	9-B,20-B	-	-	-	-
LAKSHMANA MAGULURI	L	9-MA	-	-	-	-
LAKSHMANA MAGULURI	P	9-A,14-B	-	-	-	-
LAKSHMANA MAGULURI	S	9-A,21-B	-	-	-	-
CHANDOL MOHAN KUMAR	L	10-MA	-	-	-	-
CHANDOL MOHAN KUMAR	P	10-A,19-B	-	-	-	-
CHANDOL MOHAN KUMAR	S	10-A,23-B	-	-	-	-
SAI PRASANTHI MAGANTY	L	11-MA,24-MA	-	-	-	-
SAI PRASANTHI MAGANTY	P	11-A,24-A	-	-	-	-
SAI PRASANTHI MAGANTY	S	11-A,24-A	-	-	-	-
Yellamma Pachipala	P	1-B,16-B	-	-	-	-
Yellamma Pachipala	S	4-B,16-B	-	-	-	-
sadhana BURLA	L	14-MA	-	-	-	-
sadhana BURLA	P	11-B,14-A	-	-	-	-
sadhana BURLA	S	5-A,14-A	-	-	-	-
GUNASEKHAR T	P	24-B	-	-	-	-
GUNASEKHAR T	S	5-B,17-B	-	-	-	-
ASDAQUE HUSSAIN MOHAMMED	L	13-MA	-	-	-	-
ASDAQUE HUSSAIN MOHAMMED	P	13-A	-	-	-	-
ASDAQUE HUSSAIN	S	6-B,13-A	-	-	-	-

MOHAMMED						
BHAVANI VASANTHA	P	6-B,21-B	-	-	-	-
BHAVANI VASANTHA	S	11-B,24-B	-	-	-	-
MOUNIKA VALASAPALLI	P	10-B,13-B	-	-	-	-
MOUNIKA VALASAPALLI	S	10-B,22-B	-	-	-	-
JHANSI RANI PARITALA	L	12-MA,25-MA	-	-	-	-
JHANSI RANI PARITALA	P	12-A,25-A	-	-	-	-
JHANSI RANI PARITALA	S	12-A,25-A	-	-	-	-
ARPITA ROY	P	7-B,22-B	-	-	-	-
ARPITA ROY	S	25-B	-	-	-	-
RAVI TEJA KANAKALA	L	15-MA	-	-	-	-
RAVI TEJA KANAKALA	P	9-B,15-A	-	-	-	-
RAVI TEJA KANAKALA	S	15-A	-	-	-	-
M Mekala	P	8-B,23-B	-	-	-	-
M Mekala	S	20-A	-	-	-	-
Gottumukkala varma	S	1-B,13-B	-	-	-	-
HITESHWAR AZAD	P	2-B,17-B	-	-	-	-
HITESHWAR AZAD	S	7-B,18-B	-	-	-	-
Debnath Bhattacharyya	P	5-B,20-B	-	-	-	-
Debnath Bhattacharyya	S	2-B,14-B	-	-	-	-
Sindhura Surapaneni	P	12-B,15-B	-	-	-	-
Sindhura Surapaneni	S	12-B	-	-	-	-

GENERAL INSTRUCTIONS

Students should come prepared for classes and carry the text book(s) or material(s) as prescribed by the Course Faculty to the class.

NOTICES

Most of the notices are available on the LMS platform.

All notices will be communicated through the institution email.

All notices concerning the course will be displayed on the respective Notice Boards.

Signature of COURSE COORDINATOR

(VISHNUVARDHAN MANNAVA)

Signature of Department Prof. Incharge Academics & Vetting Team Member

Department Of CSE

HEAD OF DEPARTMENT:**Approval from: DEAN-ACADEMICS**

(Sign with Office Seal) [object HTMLDivElement]