PART A: Introduction				
Program: **Degree**		Class: **B.Sc.**	Year: **III Year**	Session: 2023-24
Subject: **Computer Science**				
1.	Course Code || S3-COSC1D		
2.	Course Title || **Operating System (Group A – Paper I) (Theory)**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational || **Discipline Specific Elective**		
4.	Pre-Requisite (if any) || This course can be opted as an elective by the students of Computer Science.		
5.	Course Learning Outcomes (CLO) || **After the completion of this course, a student shall be able to do the following**: • Describe the importance of computer system resources and the role of operating system in their management policies and algorithms. • Specify objectives of modern operating systems and describe how operating systems have evolved over time. • Understand various process management concepts and can compare various scheduling techniques, synchronization, and deadlocks. • Describe the concepts of multithreading and memory management techniques. • Identify the best suited memory management technique for any process. • Describe various file operations, file allocation methods and disk space management. • To understand and identify potential threats to operating systems and the security features design to guard against them. • Learn to operate the Linux system, along with its administration and Shell programming • Getting to know the Android OS and its application framework.		
6.	Credit Value || **Theory - 4 Credits**		
7.	Total Marks		Max. Marks : **30+70**		Min. Passing Marks: **35**
PART B: Content of the Course				
No. of Lectures (in hours per week): **2 Lectures per week**				
Total No. of Lectures: **60 Hrs.**				
Module	**Topics**			**No. of Lectures**
I	**Introduction to Operating System**: What is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems– Multiprogramming Systems, Batch Systems, Time Sharing Systems; Operating Systems for Personal Computers, Workstations and Hand-held Devices, Process Control & Real time Systems.			4

Abhilasha Kumar

Chairman, Central Board of Studies, Computer Science

	Keywords: *Functions of OS, resource abstractions, multiprogramming, time sharing, workstation.*	
II	**Process Management**: Process Concepts, Process states & Process Control Block. **Process Scheduling**: Scheduling Criteria, Scheduling Algorithms (Preemptive & Non- Preemptive) – FCFS, SJF, SRTN, RR, Priority, Multiple-Processor, Real-Time, Multilevel Queue and Multilevel Feedback Queue Scheduling. **Deadlock -** Definition, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock. **Deadlock Handling Approaches**: Prevention, Avoidance, Detection and Recovery. **Keywords:** *process states, preemptive and non-preemptive scheduling, FCFS, SJF, RR, deadlock.*	10
III	**Memory Management**: Introduction, Address Binding, Logical versus Physical Address Space, Swapping, Contiguous & Non-Contiguous Allocation, Fragmentation (Internal & External), Compaction, Paging, Segmentation, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms. **File Management**: Concept of File System (File Attributes, Operations, Types), Functions of File System, Types of File System, Access Methods (Sequential, Direct & other methods), Directory Structure (Single-Level, Two-Level, Tree-Structured, Acyclic-Graph, General Graph), Allocation Methods (Contiguous, Linked, Indexed). **Keywords:** *swapping, fragmentation, paging, virtual memory, file management, directory structure.*	10
IV	**Disk Management**: Structure, Disk Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK), Swap Space Management, Disk Reliability, Recovery. **Security**: Security Threats, Security policy mechanism, Protection, Trusted Systems, Authentication and Internal Access Authorization, Windows Security. **LINUX**: Introduction, History and features of Linux, advantages, hardware requirements for installation, Linux architecture, file system of Linux - boot block, super block, inode table, data blocks. Linux standard directories, Linux kernel, Partitioning the hard drive for Linux, installing the Linux system, system - startup and shut-down process, init and run levels. Process, Swap, Partition, fdisk, checking disk free spaces. Difference between CLI OS & GUI OS, Windows v/s Linux, Importance of Linux Kernel, Files and Directories. Concept of Open Source Software. **Keywords:** *disk scheduling, recovery, authorization, boot block, kernel, partitioning, open source.*	10
V	**Linux Administration**: **Types of user**-Root and normal user, Multiple logins at same time (Ctrl + Alt + F1, F2..F6), who command. **Help**: whatis, --help, man command. **Basic Commands:** For displaying current directory, files and directories of current/absolute/relative location(s), creating, removing, renaming, copying and moving files or directories. For comparing, and editing file content, displaying file content(s) with tr, head, tail, last, grep, sort, piping.	14

Abhilasha Kumar

Chairman, Central Board of Studies, Computer Science

		Searching file content or searching file within different directories based on particular search criteria.	
		For implementing general purpose utilities – calendar, date, calculator, basic arithmetic expressions, compression and extraction of file/directory.	
		Text editors: vi, joe, vim, gedit, atom, nano etc. Command mode & Insert mode, cut, yank, undo.	
		Managing multiple processes: connecting processes with pipes, tee, redirecting input output, changing process priority with nice, cron commands, kill, ps.	
		Managing user accounts- Sudo, users: useradd, usermod, userdel, passwd.	
		Group: Primary & Secondary Group, chgrp, chown, groupadd, groupdel.	
		Permissions: adding and removing permissions.	
		Package installation through GUI/ apt-get/yum/dnf.	
		Keywords: *head, tail, grep, sort, piping, yank, kill, chgrp, chown, groupadd.*	
VI		**Shell Programming**: Types of Shells, Shell Meta Characters - $#, $*,$?, Shell Variables, Shell Scripts, Debugging scripts, echo, read, operators, keywords, Integer Arithmetic and String Manipulation, Functions, I/O Redirection and Piping. **Decision Making**: if-else-elif-fi, case-esac. **Loop Control**: while, for, until, break & continue. **Automation and Exception Handling**: Creating shell programs for automating tasks, file handling, trapping signals etc. **Android Operating System:** Introduction, Development Framework, Application Architecture, Process Management and File System, Small Application Development using Android Development Framework. **Indian contribution to the field** – the BOSS operating system, open source softwares, growth of LINUX, Aryabhatt Linux, contributions of innovators – Rajen Sheth, Sunder Pichai etc. **Keywords:** *shell programming, exception handling, Android development framework. BOSS OS, Linux, Arya Bhatt, Rajen Sheth, Sunder Pichai.*	12

PART C: Learning Resources
Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:
- A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, John Wiley Publications.
- A.S. Tanenbaum, Modern Operating Systems, Pearson Education.
- J.L.Peterson, Operating System Concepts.
- Sumitabh Das, Linux, TMH.

Reference Books:
- G. Nutt, Operating Systems: A Modern Perspective, Pearson Education.
- W. Stallings, Operating Systems, Internals & Design Principles, Pearson Education.
- M. Milenkovic, Operating Systems- Concepts and Design, Tata McGraw Hill.

Suggestive digital platform web links
https://web.iitd.ac.in/~minati/MTL458.html
https://www.cse.iitb.ac.in/~mythili/os/
https://www.youtube.com/watch?v=aCJ3YgoolHQ

Suggested equivalent online courses
https://nptel.ac.in/courses/106/102/106102132/

Abhilasha Kumar
Chairman, Central Board of Studies, Computer Science

PART D: Assessment and Evaluation		
Suggested Evaluation Methods: **Maximum Marks: 100** **Continuous Comprehensive Evaluation (CCE): 30 Marks** **University Exam (UE): 70 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Tests/ Presentation / Assignment	30 **Marks**
External Assessment: University Exam (UE): Time : **03.00 Hours**	Section (A) : Very Short Questions Section (B) : Short Questions Section (C) : Long Questions	70 **Marks**
Any remarks/suggestions:		

Abhilasha Kumar

Chairman, Central Board of Studies, Computer Science

PART A: Introduction				
Program: **Degree**		Class: **B.Sc.**	Year: **III Year**	Session: **2023-24**
Subject: **Computer Science**				
1.	Course Code		**S3-COSC1Q**	
2.	Course Title		**Operating System Lab (Group A – Paper I) (Practical)**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational		**Discipline Specific Elective**	
4.	Pre-Requisite (if any)		This course can be opted as an elective by the students of Computer Science.	
5.	Course Learning Outcomes (CLO)		**After the completion of this course, a student shall be able to do the following**: • Operate the Linux system, along with its administration and Shell programming. • Understand and be familiar with the Linux environment. • Learn and run the various Linux commands. • Use vi editor for programming. • Learn and run the shell scripting programs.	
6.	Credit Value		**Practical – 2 Credits**	
7.	Total Marks		Max. Marks : **100**	Min. Passing Marks: **35**
PART B: Content of the Course				
No. of Lab. Practicals (in hours per week): 1 **Lab. per week**				
Total No. of Lab.: **30 Hrs.**				
Suggestive List of Practicals				No. of Labs.
I. Linux: **a) Linux Directory Commands:** pwd, mkdir, rm -rf, ls, cd, cd / , cd ~ **b) Linux File Commands:** touch, cat, cat >, cat >>, rm , cp, mv, rename **c) Linux Permission Commands:** su, id, useradd, passwd, groupadd, chmod, groupdel, chown, chgrp **d) Linux File Content & Filter Commands:** head, tail, tac, more, less, grep, cat, cut, grep, comm, sed, tee, tr, uniq, wc, od, sort, diff. **e) Linux Utility Commands:** find, bc, locate, date, cal, sleep, time, df, mount, exit, clear, gzip, gunzip. **f) Linux Networking Commands:** ip, ssh, mail, ping, host **g) Edit Crontab file:** to wall message on system on particular time automatically. **h) Vi editor:** Create file, edit, save and quit. Highlighting the searched term within a file, cut, yank, undo. **II. Shell Scripting:** a) Write a shell script to print a message.				30

Abhilasha Kumar

Chairman, Central Board of Studies, Computer Science

b) Write a shell script to access arguments passed on command line.

c) Write a shell script to create files with the names passed on command line.

d) Write a shell script to input number from user and display its factorial.

e) Write a shell script to input file name and create multiple directories individually for the name in the file given.

f) Write a shell script to input number from user and display whether it is prime number or not.

g) Write a shell script to list all the files in any directory given by the user

h) Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory.

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

- Richard Peterson, Linux: The Complete Reference, TMH
- Sumitabh Das , Linux , McGraw Hill
- Jason Cannon, Linux for Beginners, Createspace Independent Publishing Platform
- William E. Shotts Jr., The Linux Command Line: A Complete Introduction, O'Reilly Media, Inc.

Suggestive digital platform web links

https://web.iitd.ac.in/~minati/MTL458.html
https://www.cse.iitb.ac.in/~mythili/os/
https://www.youtube.com/watch?v=aCJ3YgoolHQ

Suggested equivalent online courses

https://nptel.ac.in/courses/106/102/106102132/
https://www.youtube.com/watch?v=OHCMfsNpqCc

PART D: Assessment and Evaluation

Internal Assessment :		External Assessment :	
Class Interaction/Quiz		Viva voce practical	
Attendance		Practical record file	
Assignments (Charts/ Model)/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	30	Table work / Experiments	70
Total Marks: 100			
Any remarks/ suggestions:			

Abhilasha Kumar
Chairman, Central Board of Studies, Computer Science