Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-4(B.Tech.)

Subject: Operating System-BETCE14305

Type of course: Major (Core)

Prerequisite: Linear and non-linear data structures and knowledge of any structured programming language.

Rationale:

The study of operating systems (OS) is essential because it provides the foundation for understanding how computers manage hardware and software resources. An OS serves as the intermediary between the user and the computer hardware, ensuring efficient task execution, memory management, and device control. It allows for multitasking, process scheduling, and file management, enabling programs to run smoothly. Knowledge of operating systems equips students with the skills to optimize system performance, troubleshoot issues, and develop software that interfaces effectively with hardware. Understanding OS concepts is vital for careers in software development, system administration, and IT infrastructure management.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T-Tutorial; P -Practical; C –Credit; ESE -End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA -Continuous Assessment; ALA- Active Learning Activities.

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Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Introduction:** Computer system overview, Architecture, Goals & Structures of O.S Basic functions, Interaction of O.S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real-time O.S.	10	15%
2	**Process and Threads Management:** Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR, Priority, Thread Scheduling, Real Time Scheduling. System calls like ps, fork, join, exec family, wait. **Memory Management:** Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Swapping, Paging and Fragmentation. Demand Paging. **Virtual Memory:** Concepts, VM management, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing, Virtualization. **I/O Management & Disk scheduling:** I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache.	25	40%
3	**Concurrency:** Principles of Concurrency, Mutual Exclusion: S/W approaches H/W Support, Semaphores, Pipes, Message Passing, Signals, and Monitors. **Inter Process Communication:** Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc., Scheduling, Scheduling Algorithms. **Deadlock**: Principles of Deadlock, Starvation, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, System Calls.	15	35%

4	**Security & Protection:** Security Environment, Design Principles Of Security, User Authentication, Protection Mechanism: Protection Domain, Access Control List. **Unix/Linux Operating System:** Development Of Unix/Linux, Role & Function Of Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure, System Administration.	10	10%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Process Scheduling Simulator:** Students will use simulators (CSS, PSS, EdSim51, Queuing Theory, and GNS3) to implement and observe CPU scheduling algorithms (FCFS, SJF, Priority, RR). They will input process attributes (arrival time, burst time, priority) and analyze each algorithm's performance, comparing waiting time, turnaround time, and CPU utilization. The final report, including observations, screenshots, charts, and a summary of findings, will be uploaded individually to the GMIU web portal.	10
2	**Deadlock Detection and Resolution Exercise :** Students are given a multi-threaded application where a deadlock situation might occur. They analyze the code, identify potential deadlock risks, and modify the code to implement deadlock prevention or resolution strategies (such as resource allocation graphs, Banker's Algorithm, or ordering of resource acquisition) The final document of before and after findings, will be uploaded individually to the GMIU web portal.	10
3	**Creation of threads:** Creation of threads using Java or python, students have to submit individually to the GMIU web portal.	10
	Total	30

Suggested Specification table with Marks (Theory):100

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage %	35%	45%	20%	-	-	-

Course Outcome:

After learning the course the students should be able to:	
CO1	Analyze the structure of OS and basic architectural components involved in OS design.
CO2	Compare and contrast various CPU scheduling algorithms. Also Analyze various algorithms for memory management, I/O management and security aspects of operating systems.
CO3	Apply various concepts related to Concurrency, IPC and Deadlock.
CO4	Implement shell scripts in Unix/Linux O.S.

List of Practical

Sr. No	Description	Unit No	Hrs.
1	Install and configure Linux (or alike) operating system.	1	2
2	Write a script to check entered string or a number is palindrome or not. Write a shell script which will generate first n Fibonacci numbers like: 1, 1, 2, 3, 5, 13, …	1	4
3	Write a script to find the smallest of three numbers as well as largest among three numbers. Write a script to display the digits which are in odd position in a given a 6-digit number in Linux.	1	4
4	Shell Script to make a menu driven calculator using case in UNIX / Linux / Ubuntu.	2	2
5	Write script that prints names of all sub directories present in the current directory.	2	2
6	Write a script to count the number of files, directories, and symbolic links in a specified directory.	2	2
7	Write a script to reverse the contents of a file. Write a menu driven shell script for Copy a file, remove a file, Move a file in Linux.	2	4
8	Write a script to monitor disk usage and alert if any partition exceeds 80% usage.	3	2
9	Write a script to translate the string from capital letters to small and small letters to capital using awk command.	3	2
10	Write a program for process creation using C. (Use of gcc compiler).	4	2

11	Study of Commands: File and Directory Management(ls,pwd,cd,mkdir,rmdir,mv,touch), File Viewing and Manipulation(Cat, cut, sort , wc) Process Management (ps, kill).	4	2
12	Study of Commands: User and Permissions Management (who, whoami, chmod, chown), Networking (ping, ipconfig), System Monitoring (uptime, free, uname), General Utilities (echo, date, history, man, clear, alias).	4	2
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

Practical examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Reference Books:

[1] Operating System Concepts- Abraham Silberschatz, Peter B. Galvin, Greg Gagne.

[2] Understanding Operating Systems - Ann McIver McHoes, Ida M. Flynn.

[3] Modern Operating Systems,Andrew S Tanenbaum 3rd edition, PHI.

[4] Operating Systems- Internals and Design Principles.William Stallings,6th Edition.Pearson education.

[5] Principles of Operating Systems, B.L.Stuart. Cengage learning, India Edition.