Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI412	**Semester** Odd **(specify Odd/Even)**	**Semester** V **Session** 2022-23 **Month from** July to Dec 2022
Course Name	Operating Systems and Systems Programming		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Sec 62: Ashish Mishra , Sec 128: Dr. Anubhuti Mohindra
	Teacher(s) (Alphabetically)	Sec 128: Dr. Anubhuti, Prof. Charu, Dr. Neeraj Jain, Dr. Gaurav Nigam

COURSE OUTCOMES		**COGNITIVE LEVELS**
C311.1	Describe and explain the fundamental components of operating systems and system programming.	Understand Level (C2)
C311.2	Apply and compare various policies of scheduling in processes and threads in OS.	Apply Level (C3)
C311.3	Describe and discuss various resource management techniques of operating systems and compare their performances.	Compare Level (C3)
C311.4	Understand the concept of IPC and describe various process synchronization techniques in OS.	Describe Level (C2)
C311.5	Discuss the working of IO management and apply various disk scheduling techniques.	Apply Level (C3)
C311.6	Analyze and report appropriate OS design choices when building real-world systems.	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction and Historical context of Operating Systems	What are Operating Systems? All components Description, The Evolution of OS: Batch Systems, multi programming systems, Time sharing systems, Parallel systems, Real Time systems, Distributed systems.	2
2.	Operating Structure and Architecture	Operating system structure: Micro kernel, Monolithic systems, Layered systems, Virtualization, Client-server model, Mobile Operating System. X86 architecture overview, Booting sequences, Boot loaders and their stages, BIOS and its routines, Interrupts.	2
3.	Process Concepts, Threads & Concurrency, Scheduling Concurrency & Synchronization issues,	Process concepts, Threads: Overview, Benefits, User and Kernel threads, Multithreading models. Scheduling, Operations on processes, Cooperative processes, IPC, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Process synchronization: Critical section problems, Semaphores, Synchronization hardware and monitors.	10
		T1	
4.	Deadlock	System model, Characterization, Methods for handling deadlocks. Deadlock prevention, Avoidance and detection, Recovery from deadlock	5

5.	Memory Management.	Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory	8
		T2	
6.	File System management and Input output management	File concept, Access models, Directory structure, Protection, File-system Structure, Allocation methods, Free space management. Overview, I/O hardware, Application I/O interface.	2
7.	Secondary Storage Management	Disk structure, Disk scheduling, Disk management., Swap-space management	2
8.	Fault and Security Issues	Overview of system security, Security methods and devices, Protection, access, and authentication, Models of protection, Memory protection.	2
9.	Distributed O.S	Int. to distributed operating systems, synchronization and deadlock in distributed systems	1
10.	Case studies of OS	Windows, Linux ,IBM	2
11.	System Programming	Introduction, Components of a Programming System: Assemblers, Loaders, Macros, Compliers, Formal System.	2
12.	Interrupts and Exceptions	Synchronous and asynchronous interrupts, Calling a System Call from User Space, INT, Trap Handling, System call dispatch, arguments and return value, Device Interrupts.	2
13.	Kernel Synchronization, System Calls and System Signals	Disabling Interrupts, Lock Implementation, Linux Synchronization Primitives	2
		T3	
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (5), Quiz/Assignment/Mini Project/Case Study (15))
Total	**100**

The students in the group of 3-4 submitted a case study of the Real-World Operating System like Windows, Linux, Macintosh etc. which was best suited for their mini project developed in their 5th semester. In the case study, they explained all the major components and services provided by the Operating system used for their mini project. This gives the students an exposure of the various components and services of real-world operating systems and helps them to map these services with the concepts taught in the subject and which further motivates them in the futuristic designing of a new Operating System.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc)	
Text Books	
1	Tanenbaum, Andrew S. Operating system design and implementation. PHI, 2009.
2	Tanenbaum, Andrew S., and Herbert Bos. Modern operating systems. Pearson, 2015
3	Love, Robert. Linux Kernel Development: Linux Kernel Development _p3. Pearson Education, 2010.
4	Silberschatz, Abraham, Peter B. Galvin, and Greg Gagne. Operating system concepts. John Wiley & Sons, 2006.
Reference Books	
1	Nutt, Gary J. Operating systems: a modern perspective. Addison-Wesley Longman Publishing Co., Inc., 1999.
2	Crowley, Charles. Operating systems: a design-oriented approach. McGraw-Hill Professional, 1996.
3	Solomon, David A., and Mark Russinovich. Inside Microsoft Windows 2000. Microsoft Press, 2000.
4	Dhamdhere, Dhananjay M. Systems Programming and Operating Systems. Tata McGraw-Hill Publishing Company Limited, 1999.