Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021

COURSE HANDOUT (PART II)

Date: 17/08/2020

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In addition to part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

Course No. **: CS F372**
Course Title **: Operating Systems**
Instructor-In-Charge**: Prof. G. Geethakumari**
Instructors **: Dr. Paresh Saxena**
: Dr. Dipanjan Chakraborty

Scope of the Course:

An operating system (OS) is a set of softwares that manages the computer hardware resources and provides common services for all computer programs that are executed on it. Alternatively stated, an OS acts as a manager of resources. OS provides an established, convenient, and efficient interface between the user programs and the hardware of the computer on which it runs. It provides relatively uniform interfaces to access the extremely wide variety of devices that a computer interacts with, ranging from input/output devices such as printers and digital cameras, to multiple processors that are available on a single board. OS is responsible for sharing the computing resources (e.g., disks, memory, processors etc.,), by providing the common services needed by different programs (e.g., access to the printer), and protecting the individual programs from interfering with each other. Operating Systems are being designed for wide range of computing systems. This includes embedded devices like on-board computers for space shuttles, auto mobiles, cellphones, PCs, workstations, mainframes and supercomputers. The intent of this course is to provide a thorough discussion of the fundamentals of operating system concepts and to relate these to the contemporary design issues and current directions in the development of operating systems.

Objectives of the Course:

- To learn about how the process management is carried by the OS. This will include process creation, thread creation, CPU scheduling, process synchronization and deadlocks.
- To learn about memory management carried out by OS. This will include concepts like paging, segmentation, swapping, and virtual memory.
- To learn how the permanent storage like files and disks are managed by OS. This will include topics related to access methods, mounting, disk scheduling, and disk management.
- To gain hands-on experience on the above mentioned topics in the tutorial sessions through the Linux operating system.

Text Book:

T1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, 10th edition, John Wiley & Sons, 2018.

Reference Books:

R1. W. Stallings, “Operating Systems: Internals and Design Principles”, 6th edition, Pearson, 2009.
R2. Tanenbaum, Woodhull, “Operating Systems Design & Implementation”, 3rd edition, Pearson, 2006.
R3. Dhamdhere, “Operating Systems: A Concept based Approach”, 2nd edition, McGrawHill, 2009.
R4. Robert Love, “Linux Kernel Development”, 3rd edition, Pearson, 2010.
R5. W. Richard Stevens and Stevens A. Rago, “Advanced Programming In The Unix Environment”, 3rd Edition, Addison-Wesley Professional Computing Series, 2013.

Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Chapter
1-3	To understand the various components of a computer and the role OS plays to control them.	**Introduction:** What OS does? Computer System Organization & Architecture, OS Operations, Computing environments.	T1: Ch. 1
4-6	To learn how a system boots and what functions and services an OS provides	**OS Structures:** OS Services, Interfaces, System calls, OS structure, OS Debugging, System boot.	T1: Ch. 2
7-10	To learn how processes are created and handled by the OS and how they communicate with each other.	**Processes:** Process Control Block (PCB), Process states, Operations on processes, Inter Process Communication (IPC), Scheduling queues, Types of schedulers, Context switch.	T1: Ch. 3
11-13	To understand how threads are created and managed by OS and how they are different from processes	**Threads:** Motivation, Benefits, Multicore programming, Multithreading models, Thread library, Threading issues.	T1: Ch. 4
14-17	To learn how multiple processes are executed by OS	**CPU Scheduling:** Scheduling Criteria, Scheduling Algorithms, Thread scheduling, Algorithm evaluation.	T1: Ch. 5
18-21	To understand how OS manages the concurrent resource access requests	**Process Synchronization:** Critical section problem, Peterson’s solution, Hardware solutions, Semaphores, Classical synchronization problems, Monitors, Synchronization examples.	T1: Ch. 6
22-25	To identify how two or more processes can wait indefinitely for accessing resources and how to resolve the situation	**Deadlocks:** Resource Allocation Graphs, Cycle and Knot, Solutions to deadlock: Prevention, Avoidance, Detection, and Recovery from deadlocks.	T1: Ch. 8
26-29	To learn how main memory is divided into different parts and allocated to the processes so that degree of multiprogramming can be increased.	**Main Memory Management:** Address binding, Logical vs physical address space, Dynamic loading, Swapping, Contiguous memory allocation, Paging: Hardware support, Structure of Page table, Segmentation.	T1: Ch. 9
30-33	To understand how to combine RAM and Hard disk to get a Virtual memory so that larger programs can be run.	**Virtual Memory:** Demand paging, Page replacement algorithms, Allocation of frames, Thrashing, Memory mapped files, Allocating Kernel memory.	T1: Ch. 10

34-35	To learn how secondary storage structures are implemented and managed	**Mass Storage:** Disk structure, disk scheduling, disk management, and RAID.	T1: Ch. 11
36-37	To understand how OS manages various I/O devices	**I/O Systems:** I/O hardware, I/O Interface, Kernel I/O subsystem.	T1: Ch. 12
38-39	To identify what abstraction OS provides to access contents from a hard disk	**File System Interface:** File system, Access methods, Mounting, sharing, and disk structures.	T1: Ch. 13
40-41	To understand how file system implementation helps to improve the efficiency of storage space	**File System Implementation:** Structure and Implementation, Allocation methods and Free space management.	T1: Ch. 14
42	To develop an understanding of how OS provides security through access control schemes	**Security and Protection:** Goals of protection, Access Matrix, Capability-based systems.	T1: Ch. 16

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Test 1	30 min	15%	September 10 – September 20 (during scheduled class Hour)	Open Book
Test 2	30 min	15%	October 9-October 20(during scheduled class hour)	Open Book
Test 3	30 min	15%	November 10-November 20 during scheduled class hour)	Open Book
Programming Assignments (3Nos - online mode)	-	30%		Open Book
Comprehensive Examination	120 min	25%		Open Book

- Tutorial classes will involve coding/implementation aspects on the theory covered in the classes and may as well include some problem solving.

Consultation Hour:

To be announced later.

Notices:

All notices pertaining to this course will be displayed on the CMS course page.

Make-up Policy:

- ***No makeup for Programming assignments.***

Academic Honesty and Integrity Policy:

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
CS F372