Course Code: CSE 323 **Credits**: 1.0+3.0
Course Title: Operating Systems **CIE Marks**: 60
SEE Marks: 40

Course Description (from syllabus)/Rational:
Operating systems are central to computing activities. An operating system is a program that acts as an intermediary between a user of a computer and the computer hardware. Two primary aims of an operating system are to manage resources (e.g. CPU time, memory) and to control users and software. Operating system design goals are often contradictory and vary depending of user, software, and hardware criteria. This course describes the fundamental concepts behind operating systems, and examines the ways that design goals can be achieved.

Course Learning Outcome: (at the end of the course, student will be able to do :)

CLO1	Able to explain and analyze the functions, facilities, structure, environment and security of operating systems.
CLO2	Able to investigate operating system administrative functions and can build shell program for process and file system management with system calls.
CLO3	Able to analyze the performance and can apply different algorithms used in major components of operating systems, such as scheduler, memory manager, concurrency control manager and mass-storage manager, I/O manager.
CLO4	Able to select, implement and justify recommending an operating system for a specified application and system configuration.

Mapping of Course Learning Outcomes to Program Learning Outcomes [attainment level used for Cos from 1(weak)-3(strong) correlation]

PLO's **CLO's**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CO1	**3**	**3**	2									
CO2		**2**	3	2								
CO3			**3**	2								
CO4			2	**3**					1		1	

Teaching and Learning Activities (TLA)

TLA1	Interactive discussion using Online/multimedia or whiteboard.
TLA2	Group presentation regarding related problems and assign task.
TLA3	Evaluation of class performances to reach each student in a class for every topic

Course Delivery Plan (include Lab if any)

Week/Lessen (hour)	**Discussion Topic & Book Reference**	**Student Activities during Online and Onsite and TLA**	**Assessment and Mapping with CLO**
Wk. 1 Lessen 1 (1.5) Lab Session 1 (3.0)	Introduction to operating System, operating system Structures, functions, computing environment.**(Ref. Text, Ch. 1)** Introduction to Linux, Linux Installation, Introduction to Shell, Creating user account.	**Week-1:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1** **Lab 01:** Work using Ubuntu / online platform (Webminal)	**CLO1,CLO2**
Wk. 2 Lessen 2 (1.5) Lab Session 2 (3.0)	Operating System services, user interface, System calls, Operating System structure, design and Implementation .**(Ref. Text, Ch. 2)** Course Project discussion and group formation – list of projects, team formation, project plan and deliverables with presentation	**Week-2:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt., PPT, Video, H5P. **TLA1** **Lab 02** Review exercise, Student form team for the project and fill the team info using Google form.	**CLO1,CLO2**

Week/Lessen (hour)	**Discussion Topic & Book Reference**	**Student Activities during Online and Onsite and TLA**	**Assessment and Mapping with CLO**
Wk. 3 Lessen 3 (1.5) Lab Session 3 (3.0)	Process concept, scheduling, Operations on processes , IPC.**(Ref. Text, Ch. 3)** Introduction to Linux tools- Linux files, Directories, Root, File Permissions, Working with files and directories, Disk related commands	**Week-3:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1** **Lab 03:** Practice different shell commands in Ubuntu terminal / online platform (Webminal)	**CLO1,CLO2**
Wk. 4 Lessen 4 (1.5 each) Lab Session 4 (3.0)	Review on Previous Topics Scheduling Criteria, Scheduling algorithms .**(Ref. Text, Ch. 6)** Introduction to Shell Scripts- Shell programming, Shell Variables, Shell Keywords, Write simple Shell program	**Week-4:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1** **Lab 04: P**ractice different problems of shell script in Ubuntu / online platform (Webminal)	**CLO1, CLO2,CLO3**
Wk. 5 Lessen 5 (1.5 each)	Scheduling algorithms.**(Ref. Text, Ch. 6)**	**Week-5:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1**	**CLO2, CLO3** **Class Test# 1** (Either online or onsite based on Wk1-Wk4 discussion) based on CLO1, CLO3

Week/Lessen (hour)	**Discussion Topic & Book Reference**	**Student Activities during Online and Onsite and TLA**	**Assessment and Mapping with CLO**
Lab Session 5 (3.0)	Decision making and Loop control structure	**Lab 05: P**ractice different problems of shell script in Ubuntu / online platform (Webminal)	
Wk. 6 Lessen 11 & 12 (1.5 each)Scheduling algorithms.**(Ref. Text, Ch. 6)** Lab Session 6 (3.0)	Scheduling algorithms.**(Ref. Text, Ch. 6)** Review on previous topics(conditional statement, loop) and Functions	**Week-6:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1** **Lab 06: P**ractice different problems of shell script in Ubuntu / online platform (Webminal)	**CLO2, CLO3 Assignment 1 (will be due by Wk8) (BLC)**
Wk.7	**Midterm Exam Week Topics: Wk 1 – Wk 6**		
Wk. 8 Lessen 8 (1.5)	Deadlock characterization, Methods for handling deadlocks Deadlock prevention, Deadlock avoidance, Deadlock detection. .**(Ref. Text, Ch. 7)**	**Week-8:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1** **Student Submit Assigment-1 in LMS or BLC (online)**	**CLO1, CLO2, CLO4**

Week/Lessen (hour)	**Discussion Topic & Book Reference**	**Student Activities during Online and Onsite and TLA**	**Assessment and Mapping with CLO**
Lab Session 7 (3.0)	Shell Administration Adding and removing users, Daily administrative works, Configure/installing different software/ language Ubuntu	**Lab 07: P**ractice different problems in Ubuntu / online platform (Webminal)	
Wk. 9 Lessen 9 (1.5) Lab Session 8 (3.0)	Deadlock avoidance algorithm. **(Ref. Text, Ch. 7)** Processes in Linux, Process Scheduler	**Week-9:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1,TLA3** **Lab 08:** Observe status of different process in Ubuntu terminal and Practice different scheduling algorithm using c or any other language on Ubuntu/any other OS / online platform	**CLO2, CLO3**
Wk. 10 Lessen 10	Group Presentation		**CLO2, CLO3**
Lab Session 9 (3.0)	Deadlock avoidance , Disk management, Monitoring system and Ensuring system	**Lab 09:** Practice different algorithm using c or any other language on Ubuntu/any other OS / online platform	
Wk. 11 Lessen 11 (1.5)	Memory management strategy	**Week-9:** Online/Onsite discussion; Review feedback online;	**COL2,COL3,CLO4**

Week/Lessen (hour)	**Discussion Topic & Book Reference**	**Student Activities during Online and Onsite and TLA**	**Assessment and Mapping with CLO**
Lab Session 10 (3.0)	Swapping, paging, segmentation. **(Ref. Text, Ch. 8)** **Lab 11**: Group Project Presentation Sharing by Team	Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1, TLA2** Lab 11: Course project presentation by team members	
Wk. 12 Lessen 12 (1.5 each) Lab Session 11 (3.0)	Review on previous topic, Virtual memory management, Demand Paging, Page replacement. **(Ref. Text, Ch. 9)** **Lab 12**: Lab Performance Test by Lab Final	**Week-10:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1,TLA2,TLA3** Lab 12: Solve problems using shell script and other language	**CLO2,CLO3,CLO4**
Wk. 13	Review class on Wk. 8, Wk. 9, Wk. 10 and Wk. 11	**Week-11:** Online/Onsite discussion; Review feedback online; Using Interactive Content e.g. Voice over ppt, PPT, Video, H5P. **TLA1, TLA3**	**COL1, COL2, COL4**
Wk 14	**Final Exam Week** Topics: Wk. 8 to Wk.12		

Text Books

1. **Operating System Concepts, 9th edition by Silberschatz, Galvin, Gagne**

Reference Books:

1. Modern Operating Systems (Latest Edition): Andrew S. Tanenbaum

2. Unix Shell Programming- Yashavant P. Kanetkar

CIE – Breakup (Theory) [60 marks]

Bloom's Criteria	**Attendance (07)**	**Class Test (15)**	**Assignment (05)**	**Presentation (08)**	**Mid Exam (25)**
Remember		05			
Understand		05	02	02	05
Apply		05		03	05
Analyze			03		05
Evaluate					05
Create				03	05

CIE – Breakup (Lab) [100 marks]

Bloom's Criteria	**Attendance (10)**	**Lab Performance (25)**	**Lab Report (25)**	**Lab Final (40)**
Remember				
Understand		05	05	10
Apply		05	05	05
Analyze		05	05	10
Evaluate			10	05

Create		10		10

SEE – Semester End Examination [40 marks] {Theory}

Bloom Criteria	**Score for the Test**
Remember	05
Understand	05
Apply	15
Analyze	05
Evaluate	05
Create	05

Appendix-1: Program outcomes

POs	**Category**	**Program Outcomes**
PO1	**Engineering Knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis**	Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.
PO3	**Design/Development of Solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
PO4	**Investigations**	Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
PO5	**Modern tool usage**	Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to

		complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.
PO9	**Individual work and teamwork**	Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.
PO10	**Communication**	Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
PO11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.
PO12	**Life Long Learning**	Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.