Bangladesh University of Business and Technology (BUBT)
Department of Computer Science and Engineering (CSE)

Course Information

Program : B.Sc. Engineering in CSE

Course Code : CSE 309

Course Title : Operating Systems

Course Credit : 3.00

Contact Hours : 3_{hrs}

Semester : Fall 2020-21

Intake : 39^{th} [Shift: Day]

Section : 01

Prerequisites : **None**

Course Objectives

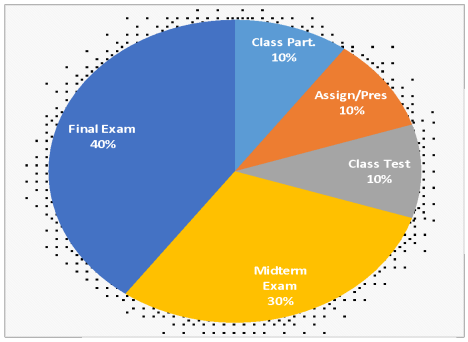
The course provides the students with an understanding of the basic components of a computer operating system, and the interactions among the various components. They will able to know the concept of process, thread and how interacts among them and communicate with each other. They will know how the system performs optimally and how the system can be made faster. They will able to know critical situations of software and hardware and solve the critical situation by learning CPU scheduling and utilization, deadlocks, starvation, memory management, physical memory, early paging and segmentation technique, modern virtual memory concepts and techniques, synchronization, system calls, and file systems. They will able to explore better solution in case of different kinds of operating system related issues. They will able to introduce with various tools. Students will also able to implement a significant portion of an operating system.

Course Synopsis

Principles of operating systems, Operating-System Structure, Operating-System Operations, Process Concept, Operations on Processes, Inter-process Communication, Threads, Multi-core Programming, Multi-threading Models, Thread Libraries, Threading Issues, Process Synchronization, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, CPU Scheduling, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Deadlocks, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance , Deadlock Detection, Recovery from Deadlock, Main Memory, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Page Replacement, Allocation of Frames, Mass-Storage Structure, File-System Interface, File-System Implementation.

Assessment

Class Participation	:	10%
Assignment/Presentation	:	10%
Class Test	:	10%
Midterm Examination	:	30%
Final Examination	:	40%



Course Outcomes (COs)

After completion of this course students will be able to:

CO1:	**Understand** the basic concept and design of the major components of modern Operating System.
CO2:	**Explain** different terms and techniques such as process, thread, CPU scheduling, deadlock and memory management.
CO3:	**Apply** algorithms for CPU scheduling, process synchronization, deadlocks handling etc for utilization of computer resources.
CO4:	**Analyze** several solutions for deadlock detection and handling, memory management techniques and disk scheduling algorithm for better performance.

Mapping of Course Outcomes (COs) to Program Outcomes (POs)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3			√									
CO4		√										

Sl. No.	COs	Corresponding POs	Bloom's taxonomy domain/level	Delivery methods and activities	Assessment tools
CO1	**Understand** the basic concept and design of the major components of modern Operating System.	PO1	Understand	Class Lecture	Midterm
CO2	**Explain** different terms and techniques such as process, thread, CPU scheduling, deadlock and memory management	PO1	Understand	Class Lecture	Midterm, Final
CO3	**Apply** algorithms for CPU scheduling, process synchronization, deadlocks handling etc for utilization of computer resources.	PO3	Apply	Class Lecture	Midterm, Final
CO4	**Analyze** several solutions for deadlock detection and handling, memory management techniques and disk scheduling algorithm for better performance.	PO2	Analyze	Class Lecture	Final

Descriptions of Program Outcomes (POs)

PO1	**Engineering Knowledge (Cognitive):** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis (Cognitive):** 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 (Cognitive, Affective):** 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	**Investigation (Cognitive, Psychomotor):** 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 (Psychomotor, Cognitive):** 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 (Affective):** 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 (Affective, Cognitive):** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics (Affective):** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.
PO9	**Individual Work and Teamwork (Psychomotor, Affective):** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.
PO10	**Communication (Psychomotor, Affective):** 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 (Cognitive, Psychomotor):** 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 (Affective, Psychomotor):** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

Weekly Schedule

Week	Lecture	Course Topics	Remarks	CO	Assessment
1	1	Introduction, Computer system organization Operating system structure, Operating system operations	(Silberschatz) Ch-1	CO1	Mid- Term Exam (30)
	2	Dual Mode operation, Computer system architecture, Multi-programming, Multitasking	Ch -2	CO1	
2	3	Process management, storage management, memory management, protection security, Distributed systems,	Ch-3	CO1	
	4	Communication in client-server system, direction of data flow, Process concept, Process Scheduling, Operations on Process	"	CO1	
3	5	Short-term Scheduler, Medium term scheduler, long term scheduler and degree of multi-programming, Process mixing	"	CO2	
	6	Interposes communication, Multi-threaded Programming, basic concepts, multi-core programming	Ch-4	CO2	
4	7	Multi-threaded models, thread libraries, threading issues	[CT-1]	CO2	
	8	Process Scheduling, basic concepts, scheduling criteria	Ch-5	CO2	
5	9	Preemptive scheduling, Non-Preemptive scheduling, Scheduling algorithms: FCFS, SJF, Priority, RR	"	CO3	
	10	Preemptive scheduling, Non-Preemptive scheduling, Scheduling algorithms(Continued)	"	CO3	
6	11	Thread Scheduling, Multiple-processor scheduling, algorithm evaluation	"	CO3	
	12	Review class for Semester Mid Term			

7	**Mid Term Examination**				
8	13	Process synchronization, Critical section problem, Two process synchronization problems and solutions	Ch-6	CO3	Final Exam (40)
	14	Semaphore , Classical problems of synchronization, monitor	"	CO3	
9	15	Deadlocks, deadlock characterization ,resource allocation graph	Ch-7	CO2	
	16	Methods for handling deadlock, deadlock prevention	"	CO3	
10	17	Deadlock avoidance, safe state, Banker's algorithm	[CT-2]	CO4	
	18	Memory management strategies, swapping	Ch-8 "	CO2	
11	19	Contiguous memory allocation, paging	"	CO4	
	20	Segmentation	"	CO4	
12	21	Virtual memory, demand paging	Ch-9	CO2	
	22	Copy-on-write, Page replacement algorithm, Thrashing, memory mapped files	"	CO4	
13	23	Disc Management ,Disc Scheduling	Ch-10	CO4	
	24	File concept, access methods	[CT-3]	CO2	
14	25	File system mounting, file sharing, protection	"	CO2	
	26	***Review class for Semester Final Examination***			
15	**Final Examination**				

Descriptions of Cognitive Domain (Anderson and Krathwohl's Taxonomy 2001):

Level	Category	Meaning	Keywords
C1	Remembering	Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information.	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write
C2	Understanding	Constructing meaning from different types of	Classify, compare,

		functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining.	exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report
C3	Applying	Using a procedure through executing, or implementing. Applying relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations.	Apply, change, choose, compute, dramatize, implement, interview, select, show, transfer, use
C4	Analyzing	Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are differentiating, organizing, and attributing, as well as being able to distinguish between the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.	Analyze, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure
C5	Evaluating	Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation.	Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, prove, rank, rate, select, monitor
C6	Creating	Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product. This process is the most difficult mental function.	Construct, design, develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce

Teaching Materials/Equipment

Required Text Book:

1. Operating System Concepts, 9th Edition by Silberschatz, Galvin and Gagne.

Recommended References:

1. Modern operating systems, 4th Edition by Andrew S. Tanenbaum.
2. Operating Systems: Internals and Design Principles, 7th Edition by William Stallings.

Overall CO Assessment Scheme

Assessment Area	CO				Assessment Area Mark
	CO1	CO2	CO3	CO4	
Class Test					
Assignment					
Attendance					
Midterm Exam	10	10	10		30
Final Exam		10	20	10	40
Total Mark	10	20	30	10	70

COs (Bloom's Level)	Excellent (80%-100%)	Good (70%-79%)	Satisfactory (60%-69%)	Poor (40%-59%)	Unsatisfactory (0-39%)	Marks (70)
CO1 (Understand)	Answer is complete and sufficient detail provided to support issues related to the question.	Answer is brief with sufficient detail provided to support issues were introduced.	Answer is brief with insufficient detail provided to support issues were introduced.	Answer is incomplete and excessive discussion of unrelated issues.	None of the relevant details were included or didn't answer.	10
CO2 (Explain)	Answer is complete and sufficient detail	Answer is brief with sufficient detail	Answer is brief with insufficient detail	Answer is incomplete and excessive discussion of	None of the relevant details were included or didn't answer.	20

	provided to support issues related to the question. And also deals fully with the entire question.	provided to support issues were introduced. And most of the basic details are included but some are missing.	provided to support issues were introduced.	unrelated issues. And serious gaps in the basic details.		
CO3 (Apply)	The question is answered appropriately by applying the suggested method in the question.	The question is answered briefly by applying the suggested method in the question.	The question is answered correctly by applying the suggested method in the question but some steps are missing.	The question is answered incompletely by applying the suggested method in the question but some steps are correct.	No attempt to implement the suggested method.	30
CO4 (Analyze)	A clear, complete, and properly ordered chain of analyzing steps (i.e. proper explanation of the procedure) is followed to answer the question.	The chain of analyzing steps is complete and correctly ordered but lack of expected explanation.	One or more intermediate analyzing steps are missing or unclear, but the correctness of the analysis is not compromised.	One or more intermediate analyzing steps are missing or unclear to answer the question.	The stated chain of analysis does not lead to the stated question.	10

Grading System

Numerical Grade	Letter Grade		Grade Pont
80% and above	A+	(A Plus)	4.00
75% to less than 80%	A	(A Regular)	3.75
70% to less than 75%	A-	(A Minus)	3.50
65% to less than 70%	B+	(B Plus)	3.25
60% to less than 65%	B	(B Regular)	3.00
55% to less than 60%	B-	(B Minus)	2.75
50% to less than 55%	C+	(C Plus)	2.50
45% to less than 50%	C	(C Regular)	2.25
40% to less than 45%	D		2.00
Less than 40%	F		0.00

Instructor Information

Instructor : **Suman Saha**
Assistant Professor,
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Class Schedule

Day	Time	Room No
Wednesday	01:20 PM – 02:40 PM	313
Thursday	10:00 AM – 11:20 AM	318

Office Hour

Day	08:30 - 09:50	10:00 –11:20	11:30 –12:50	01:20 – 02:40	02:50 –04:10	04:20-05.40	06:00 – 09:00
Sun							
Mon			C.H.	C.H.		.	
Tue		C.H.	C.H.				
Wed			C.H.		C.H.		
Thu				C.H.	C.H.		
Fri							

Special Instructions

- Students are expected to attend all classes and examinations. A student MUST have at least 70% class attendance to sit for the final exam.
- Students will not be allowed to enter into the classroom after 20 minutes of the starting time.
- For plagiarism, the grade will automatically become zero for that exam/assignment.
- All mobile phones MUST be turned to silent mode during class and exam period.
- There is zero tolerance for cheating in exam. The only penalty for cheating is expulsion for several semesters as decided by the Disciplinary Committee of the university.

Prepared by: **Checked by:** **Approved by:**

Suman Saha
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Dept. of CSE, BUBT