Course Code	USA20302J	Course Name	OPERATING SYSTEMS	Course Category	C	Professional Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Applications	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Utilize operating systems based on its features and utility	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Utilize the Process Management functions of an Operating system			
CLR-3 :	Utilize the features of Memory Management concepts of an Operating system			
CLR-4 :	Analyze how Device Management part of an Operating system functions			
CLR-5 :	Utilize the File Management functions of an Operating system			
CLR-6 :	Analyze the practical operating systems and evaluate their utility			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	Identify functions of an operating system, analyze the process management functions	2	80	70	H	H	H	H	H	M	L	M	H	M	-	H	H	H	M
CLO-2 :	Analyze CPU scheduling and synchronization process of an operating system	3	85	75	H	H	H	H	H	M	L	M	H	M	-	H	H	H	M
CLO-3 :	Analyze the need of Memory management functions of an operating system	3	75	70	H	H	H	H	H	M	L	M	H	M	-	H	H	H	M
CLO-4 :	Identify the significance of device management and file management's role of an operating system	3	85	80	H	H	H	H	H	M	L	M	H	M	-	H	H	H	M
CLO-5 :	Identify the essentials of inter process communication in an operating system, evaluate hypervisors	3	85	75	H	H	H	H	H	M	L	M	H	M	-	H	H	H	M
CLO-6 :	Analyze how operating systems are constructed, analyze the features and aspects of different operating environments	3	80	70	H	H	H	H	H	M	L	M	H	M	-	H	H	H	M

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Introduction Operating Systems (OS):	Process concept : Introduction	Process Synchronization - Background	Deadlocks - System model	Memory management: introduction
	SLO-2	Operating System overview ,Operating system as a resource management	Process states : Process creation and process termination	The Critical section problem		
S-2	SLO-1	Operations, Assembler, Compiler, loader, linker	Process state transition diagram	Two process Solutions	Deadlock characterization - Necessary conditions	Logical Vs physical address space
	SLO-2	Evolution of Operating Systems ,serial processing and batch processing	Operation on process	Multi process Solutions		
S-3	SLO-1	Batch: Simple, Multiprogramming	Symmetric multiprocessing	Synchronization hardware solution	Resource Allocation Graph	Swapping
	SLO-2	Multiprocessor, Time Sharing, parallel systems			Methods for handling deadlocks	Organization : physical and logical organization
S-4	SLO-1	Distributed (client-server, peer-to-	Concurrent process	Semaphores – Usage	Deadlock Prevention - Mutual	Memory allocation method

		peer), Real-Time (hard, soft			exclusion, Hold and Wait	
	SLO-2	Clustering (symmetric, asymmetric, parallel)) , Network,)			No Preemption, Circular Wait	Single partition allocation
S 5-8	SLO-1	Lab 1: Comparison between various Operating Systems	Lab 4: Simulation of FCFS CPU scheduling algorithm	Lab 7: Write a procedure for timer interrupt handler	Lab 10: Program to implement Bankers Algorithm	Lab 13: multiple partition (dynamic)
	SLO-2					
S-9	SLO-1	Microkernel: Architecture, Kernel mode, user mode, Monolithic, differences	CPU Scheduling: Process Scheduler (long, short, medium term)	Semaphores –Implementation	Deadlock Avoidance - Safe state	Multiple partition memory management : contiguous (fixed, dynamic)
	SLO-2	System Call Types	Scheduling criteria	Binary semaphores	Resource Allocation Graph Algorithm	
S-10	SLO-1	((a) process control: fork(), exit(), wait()b)file manipulation: open(), read(), write(), close() (c)device mgt: ioctl(), read(), write()	CPU utilization, throughput, time: (a) turnaround (b) waiting (c) response Scheduling Types: FCFS, SJF	Classic Problems of Synchronization - The Bounded Buffer problem	Banker's Algorithm - Safety Algorithm	Contiguous Types: memory protection, allocation, fragmentation (c) partitioned
	SLO-2	b)file manipulation: open(), close()	Scheduling Types: FCFS, SJF	The Readers - Writers Problem		Compaction
S-11	SLO-1	read(), write()	Priority Scheduling: Preemptive, non-preemptive	The Dinning philosophers problem	Resource request algorithm	Paged memory management, Paging technique
	SLO-2					
S-12	SLO-1	Operating System services	Other Scheduling Types: Round Robin,	Critical Regions: Race condition and process synchronization	Examples	Segmentation
	SLO-2					Segmentation with paging
S 13-16	SLO-1	Lab 2: Booting process in GNU/Linux OS	Lab 5: Priority CPU scheduling algorithm	Lab 8: classical inter process communication problem (Producer consumer)	Lab 11: Program to implement memory allocation with pages	Lab 14 : Simulation of FIFO page replacement algorithm
	SLO-2					
S-17	SLO-1	System Programs: file management, status info	multilevel queue	Implementation of Critical region	Deadlock Detection - Single instance of each resource type	Demand paging
	SLO-2		multilevel feedback queue	Mutual Exclusion Algorithm: Peterson , Monitors	Several instances of a Resource type	
S-18	SLO-1	File modification, language support Loading and execution, communications,	multiple processor Scheduling	Producer consumer problem	Recovery from deadlock	Page replacement algorithms
	SLO-2	Communications Threads: Single thread, Multi-thread			Process termination	Page Replacement - FIFO Page replacement
S-19	SLO-1	Operating System structure	Real time scheduling	IPC : Inter process communication	Resource preemption	Optimal
	SLO-2	Layered approach				
		Micro kernels				
S-20	SLO-1	Multithreading	Performance comparison	Message passing	Concurrency mechanism	LRU page replacement
	SLO-2	Symmetric multiprocessing		Bounded Buffer Problem	Comparison between deadlock and starvation	Thrashing
S 21-24	SLO-1	Lab 3: Multi-thread Programming	Lab 6: Simulation of Round Robin CPU scheduling algorithm	Lab 9: Write a procedure to make message passing in inter process communication	Lab 12: Simulation of FIFO page replacement algorithm	Lab 15: Simulation of optimal page replacement algorithm
	SLO-2					

Learning Resources	1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne,(2013), "Operating Systems", 9th Ed., John Wiley & Sons 2. William Stallings, (2012), "Operating Systems-Internals and Design Principles", 7th Ed., Prentice Hall	3. Andrew S. Tanenbaum, Herbert Bos,(2015), "Modern Operating Systems", 4th Ed., Pearson 4. Bryant O'Hallaxn, (2015), "Computer systems- A Programmer's Perspective", Pearson

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
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