INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING(AI & ML)

QUESTION BANK

Department	**COMPUTER SCIENCE AND ENGINEERING(AI & ML)**				
Course Title	**OPERATING SYSTEMS**				
Course Code	ACSC12				
Program	B.Tech				
Semester	III				
Course Type	Core				
Regulation	UG-20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. K. Anjali, Assistant Professor				

COURSE OBJECTIVES:

The students will try to learn:

I	Principles of operating systems, services and functionalities with its evolution.
II	Discover the structures, functions and components of modern operating systems
III	Connect conventional hardware at different OS abstraction levels.
IV	Develop essential skills to examine issues and methods employed in design of operating systems with identification of various functionalities.

COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** different architectures used in design of modern operating systems.	Understand
CO 2	**Solve** problems related to process scheduling, synchronization and deadlock handling in uni and multi-processing systems.	Apply
CO 3	**Choose** memory allocation algorithms for effective utilization of resources.	Apply
CO 4	**Select** various page replacement algorithms applied for allocation of frames.	Apply

CO 5	**Make use of** different file allocation and disk scheduling algorithms applied for efficient utilization of storage.	Apply
CO 6	**Outline** mechanisms used in protection of resources in real time environment	Understand

QUESTION BANK:

MODULE I				
DESIGN AND ANALYSIS OF ALGORITHMS				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
1	Contrast the scheduling policies you might use when trying to optimize a time-sharing system with those you would use to optimize a multiprogrammed batch system.	Understand	This would require the learner to remember, understand the evolution of OS	CO 1
2	What are the challenges in designing a distributed system?	Understand	This would require the learner to recall the concept of distributed systenm	CO 1
3	Consider a computer system that has cache memory, main memory (RAM) and disk, and an operating system that uses virtual memory. It takes 1 nsec to access a word from the cache, 10 nsec to access a word from the RAM, and 10 ms to access a word from the disk. If the cache hit rate is 95 percent and main memory hit rate (after a cache miss) is 99 percent, what is the average time to access a word?	Apply	This would require the learner to recall the differnt kinds of memory	CO 1

4	What is a distributed operating system? What are the advantages of a distributed operating system?	Remember	This would require the learner to recall the evolution systems.	CO 1
5	What is the purpose of system calls, and how do system calls relate to the OS and to the concept of dual-mode (kernel-mode and user-mode) operation?	Understand	This would require the learner to recall the dual mode.	CO 1
6	Explain the difference between interrupt and exception.	Understand	This would require the learner to recall the interrupt and exception.	CO 1
7	It is sometimes difficult to achieve a layered approach if two components of the operating system are dependent on each other. Identify a scenario in which it is unclear how to layer two system components that require tight coupling of their functionalities.	Understand	This would require the learner to recall the layered approach.	CO 1
8	Explain Is OS a resource manager. If so justify your answer	Understand	This would require the learner to recall the OS is a resource manager.	CO 1
9	How could a system be designed to allow a choice of operating systems from which to boot?What would the bootstrap program need to do?	understand	This would require the learner to recall the concept of operating system design and implementation	CO 1
10	When a user program makes a system call to read or write a disk file, it provides an indication of which file it wants, a pointer to the data buffer, and the count. Control is then transferred to the operating ... What about the case of writing to the disk? Need the caller be blocked awaiting completion of the disk transfer?	Understand	This would require the learner to recall the concept of system calls	CO 1

PART B-LONG ANSWER QUESTIONS				
1	Define an operating system. State and explain the basic functions or services of an operating system	Remember	This would require the learner to recall the OS	CO 1
2	Explain the differences between multiprogramming and time- sharing systems	Understand	This would require the learner to recall the multiprogramming and time- sharing systems	CO1
3	Explain how operating system services are provided by system calls.	Understand	This would require the learner to recall the system calls.	CO 1
4	Explore the term operating system structures.	Understand	This would require the learner to recall the OS structures.	CO 1
5	Illustrate the puropose of using kernel. Distinguish between user mode and kernel mode operations of the operating System	Understand	This would require the learner to recall the operations of the Operating Systems	CO 1
6	Define the essential properties of the operating systems.	Remember	This would require the learner to recall the OS	CO 1
7	Explain the architecture of an operating system.	Understand	This would require the learner to recall the architecture of an OS	CO 1
8	Give details about computer evolution.	Understand	This would requirethe learner to recall the evolution of operating system	CO 1
9	Describe briefly about virtual machine.	Understand	This would require the learner to recall the concept of virtual machine	CO 1
10	Define essential properties of the following types of Operating system: i) Batch operating system ii) Interactive operating system iii) Time sharing operating system iv) Real time operating system v) Distributed operating system.	Understand	This would require the learner to recall the types of operating system	CO 1

11	Draw and explain the architecture of windows 2000 and traditional UNIX	Understand	This would require the learner to recall the OS architectures	CO 1
12	State the differences between system call and system program.	Understand	This would require the learner to recall the System program.	CO 1
13	Distinguish between the client-server and peer-to-peer models of distributed systems.	Understand	This would require the learner to recall the Peer to peer models	CO 1
14	Explain different types of System calls.	Understand	This would require the learner to recall the System calls	CO 1
15	Describe the kernel structure of the operating system.	Understand	This would require the learner to recall the Kernel structure of OS	CO 1
16	Discuss about evolution of operating system	Understand	This would require the learner to recall the Evolution of OS	CO 1
17	Explain about system call between user mode and kernel mode.	Understand	This would require the learner to recall the Use mode and kernel mode.	CO 1
18	Why do you need system calls in Operating System?How System Calls Work	Understand	This would require the learner to recall the concept of working of system call	CO 1
19	Illustrate the term system programs with its types.	Understand	This would require the learner to recall the types of system program	CO 1
20	Compare A.User mode and Kernel mode. B. Multithreading and multitasking	Understand	This would require the learner to recall the User mode, Kernel mode, multithreading and multitasking concepts	CO 1
21	Write short notes on. A.Command interpreter B.Graphical user interface C.Touch screen interface	Understand	This would require the learner to recall the types of system program	CO 1
21	Give the differences between A. Interrupt and Exception B. Hard real time system and Soft real time system	Understand	This would require the learner to recall the real time sytem	CO 1
PART-C - SHORT ANSWER QUESTIONS				

1	Define Operating Systems.	Remember	Recall the definition of Operating systems	CO 1
2	Define Distributed Systems.	Remember	Remember the definition of Distributed Systems	CO1
3	How user mode is different from kernel mode?	Understand	This would require the learner to recall about the kernel mode	CO 1
4	Define Multiprocessor system?	Remember	This would require the learner to recall about the multiprocessor system	CO 1
5	What is the purpose of system calls?	Remember	This would require the learner to recall the system call.	CO 1
6	Define interrupt?	Remember	This would require the learner to recall the interrupt	CO 1
7	Define Time Sharing Systems?	Remember	This would require the learner to recall the Time sharing system	CO 1
8	Write the various types of OS components?	Remember	This would require the learner to recall the types of OS components	CO 1
9	List any four functions of the Operating system?	Remember	This would require the learner to recall the Functions of OS	CO 1
10	List five services provided by an operating system?	Remember	This would require the learner to recall the services of OS	CO 1
11	Define a real time operating system.	Remember	This would require the learner to recall the RTOS	CO 1
12	Define Virtual Machine?	Remember	This would require the learner to recall the VM	CO 1
13	Explain how protection is provided for the hardware resources by the operating system.	Understand	This would require the learner to recall the hardware resources by OS	CO 1
14	Discuss about batch systems?	Remember	Recall the batch systems	CO 1
15	Explain about a parallel distributed system?	Understand	This would require the learner to recall and understand about distributed system	CO 1

16	Discuss about OS architecture?	Understand	This would require the learner to recall the OS architecture.	CO 1
17	Discuss about protection and security by OS?	Understand	This would require the learner to recall the protection and security	CO 1
18	What are the advantages of layered structure?	Remember	This would require the learner to recall the Layered Structure	CO 1
19	Define Virtual Memory?	Remember	This would require the learner to recall the VM	CO 1
20	Describe the use of fork () and exec () system calls?	Understand	This would require the learner to recall the System calls	CO 1
MODULE II				
SEARCHING AND TRAVERSAL TECHNIQUES				
PART A-PROBLEM SOLVING AND CRITICAL THINKING				
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
1	Suppose we have a single processor system, and jobs arrive at a rate of 10 jobs a Seconds, suppose each job takes an average of 50 milliseconds to complete. Assure that both distributions are exponential. State the expected number of jobs in the system and the average time in the system.	Apply	This would require the learner to apply the process management concepts	CO 2

<table>
<tr>
<td>2</td>
<td>Consider the following set of processes, with the length of the CPU burst time(BT) given in milliseconds:
<table>
<tr><th>Process</th><th>BT</th><th>Priority</th></tr>
<tr><td>P1</td><td>2</td><td>2</td></tr>
<tr><td>P2</td><td>1</td><td>1</td></tr>
<tr><td>P3</td><td>8</td><td>4</td></tr>
<tr><td>P4</td><td>4</td><td>2</td></tr>
<tr><td>P5</td><td>5</td><td>3</td></tr>
</table>
The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.
a. Find out Turnaround time, Waiting time for the following scheduling algorithm: FCFS, SJF, nonpreemptive priority (a larger priority number implies a higher priority), and RR (quantum = 2).
b. Which of the algorithms results in the minimum average waiting time (over all processes)?</td>
<td>Apply</td>
<td>This would require the learner to understand process scheduling.</td>
<td>CO 2</td>
</tr>
<tr>
<td>3</td>
<td>What are the 3 different types of scheduling queues?</td>
<td>Understand</td>
<td>This would require the learner to recall the Scheduling queues.</td>
<td>CO 2</td>
</tr>
<tr>
<td>4</td>
<td>Explain the advantage of using semaphores over Test And Set () and Swap () functions. Describe the use of wait () and signal () functions on semaphore and how these can provide the solution to the Critical section problem.</td>
<td>Understand</td>
<td>This would require the learner to explain the concept of semaphores.</td>
<td>CO 2</td>
</tr>
</table>

5	Consider three CPU-intensive processes, which require 10, 20 and 30 time units and arrive at times 0, 2 and 6, respectively. How many context switches are needed if the operating system implements a shortest remaining time first scheduling algorithm. Do not count the context switches at time zero and at the end.	Apply	This would require the learner to apply process scheduling concepts.	CO 2
6	Construct Process Control Block for any given example.	Understand	This would require the learner to recall the PCB	CO 2
7	Explain Four jobs to be executed on a single processor system arrive at time 0 in the order A,B,C,D their burst CPU time requirements are 4,1, 8, 1 time units respectively. The completion time of A under round robin scheduling with a time slice of one time unit is.	Apply	This would require the learner to apply process scheduling concepts.	CO 2
8	Explain the concept of multi-threading. Discuss the following multithreading models. a) Many-to-one b) One-to-one c) Many-to-many d) Two-level	Understand	This would require the learner to understand the Multi threading.	CO 2

<table>
<tr><td>9</td><td>Consider the following set of processes, with the arrival times(AT) and the CPU-burst times(BT) given in milliseconds
<table><tr><th>Process</th><th>AT</th><th>BT</th></tr><tr><td>P1</td><td>0</td><td>5</td></tr><tr><td>P2</td><td>1</td><td>3</td></tr><tr><td>P3</td><td>2</td><td>3</td></tr><tr><td>P4</td><td>4</td><td>1</td></tr></table>What is the average turnaround time for these processes with the preemptive Shortest Remaining Processing Time first (SRPT) algorithm?</td><td>Apply</td><td>This would require the learner to recall the concept of scheduling</td><td>CO 2</td></tr>
<tr><td>10</td><td>Consider three processes (process id 0, 1, 2, respectively) with compute time bursts 2, 4, and 8 time units. All processes arrive at time zero. Consider the longest remaining time first (LRTF) scheduling algorithm. In LRTF ties are broken by giving priority to the process with the lowerst process id. Find out the average turn around time and average waiting time.</td><td>Apply</td><td>This would require the learner to recall the concept of longest remaining time first</td><td>CO 2</td></tr>
<tr><td colspan="4">PART B-LONG ANSWER QUESTIONS</td></tr>
<tr><td>1</td><td>Describe process scheduling. Explain the various levels of scheduling.</td><td>Understand</td><td>This would require the learner to understand the process scheduling.</td><td>CO 2</td></tr>
<tr><td>2</td><td>Explain the process state transition diagram with examples.</td><td>Understand</td><td>This would require the learner to recall the state transition diagram.</td><td>CO 2</td></tr>
</table>

<table>
<tr><td>3</td><td>Consider the following set of processes(P) and burst time(B) in ms

<table><tr><td>P</td><td>P1</td><td>P2</td><td>P3</td><td>P4</td><td>P5</td></tr><tr><td>B</td><td>10</td><td>29</td><td>3</td><td>7</td><td>12</td></tr></table>
Find out average waiting time, average turn around time for First Come First Serve (FCFS), non-preemptive Shortest Job First (SJF) and Round Robin (RR) (quantam=10ms) scheduling algorithms.</td><td>Apply</td><td>This would require the learner to recall all types of scheduling algorithms</td><td>CO 2</td></tr>
<tr><td>4</td><td>What do you mean by PCB? Where is it used? What are its contents? Explain</td><td>Understand</td><td>This would require the learner to recall the PCB.</td><td>CO 2</td></tr>
<tr><td>5</td><td>Explore the context switching with its example. What is the need of context switching?</td><td>Understand</td><td>This would require the learner to explain about the context switching</td><td>CO 2</td></tr>
<tr><td>6</td><td>What do you mean of process? Explain the process state in deatl and draw the diagram of it.</td><td>Understand</td><td>This would require the learner to recall the concepts of process and its state.</td><td>CO 2</td></tr>
<tr><td>7</td><td>Distinguish between
a. Monitor and Semaphore
b. FCFS and SJF</td><td>Understand</td><td>This would require the learner to explain the monitor, semaphore and scheduling algorithms</td><td>CO 2</td></tr>
<tr><td>8</td><td>Discuss the attributes of the process. Describe the typical elements of process control block</td><td>Understand</td><td>This would require the learner to explain the PCB</td><td>CO 2</td></tr>
<tr><td>9</td><td>What is the purpose of the system calls & system programs?</td><td>Understand</td><td>This would require the learner to distinguish the System calls and programs & System programs</td><td>CO 2</td></tr>
<tr><td>10</td><td>Explore the term multilevel queue scheduling in detail.</td><td>Understand</td><td>This would require the learner to understand the multilevel queue scheduling</td><td>CO 2</td></tr>
</table>

11	What is the purpose of a command interpreter? Why is it usually separate from the kernel?	Understand	This would require the learner to recall the command interpreter.	CO 2
12	What are different differences between user level threads & Kernel supported threads?	Remember	This would require the learner to recall the threads.	CO 1, CO 2
13	Write short notes on : A. Scheduler B. Dispatcher	Understand	This would require the learner to recall the concept of scheduler and dispatcher.	CO 2
14	Discuss the following CPU scheduling algorithms: a) Round robin b) First come first serve	Understand	This would require the learner to recall the CPU scheduling.	CO 2
15	Discuss the following CPU scheduling algorithms a) Round robin b) Priority	Understand	This would require the learner to recall the CPU scheduling.	CO 2
16	Discuss the following. a) CPU-I/O burst cycle b) CPU schedule c) Pre-emptive and non-preemptive scheduling d) Dispatcher	Understand	This would require the learner to recall the CPU scheduling.	CO 2
17	Give the comparison between a.Job-scheduling & CPU-scheduling b. Dispatcher & Scheduler	Understand	This would require the learner to differentiate the CPU and job scheduling.	CO 2
18	Discuss the attributes of the process. Describe the typical elements of process control block.	Understand	This would require the learner to recall the PCB.	CO 2
19	Define semaphore. Explain the method of application of semaphore for process synchronization.	Understand	This would require the learner to recall the concept of semaphore.	CO 2
20	Discuss about following. a) Scheduling criteria b) Shortest job first c) Multiple processor scheduling d) Process synchronization	Understand	This would require the learner to recall the process.	CO 2

21	Give difference bewtween long term, short term and medium term sheduler	Understand	This would require the learner to recall the different type of schedulers	CO 2
PART C-SHORT ANSWER QUESTIONS				
1	Define process.	Remember	This would require the learner to recall the process.	CO 2
2	Define thread?	Remember	This would require the learner to recall the thread.	CO 2
3	Describe context switching	Understand	This would require the learner to explain the context switching.	CO 2
4	What is the information maintained in a PCB.	Remember	This would require the learner to recall the contents of PCB.	CO 2
5	Define process state and mention the various states of a process.	Remember	This would require the learner to recall the process.	CO 2
6	Define CPU scheduling.	Remember	This would require the learner to recall the CPU scheduling.	CO 2
7	State critical section problem	Remember	This would require the learner to recall the concept of critical Section problem.	CO 2
8	Distinguish between thread with process.	Understand	This would require the learner to recall the differences between process and thread	CO 2
9	Distinguish between user threads and kernel threads	Understand	This would require the learner to recall the thread.	CO 2
10	Define turnaround time.	Remember	This would require the learner to recall the turnaround time.	CO 2
11	List the various scheduling criteria for CPU scheduling.	Remember	This would require the learner to recall the CPU scheduling.	CO 2
12	Describe entry and exit sections of a critical section	Understand	This would require the learner to recall the concepts of critical section.	CO 2
13	Define semaphores.	Remember	This would require the learner to recall the semaphores.	CO 2

14	Explain different ways in which a thread can be cancelled.	Understand	This would require the learner to recall the concepts of thread.	CO 2
15	Write about Scheduling queues.	Remember	This would require the learner to recall the differnt types of queues.	CO 2
16	Explain the use of job queues, ready queues and device queues	Understand	This would require the learner to recall the job queues, ready queues and device queues.	CO 2
17	Explain bounded waiting in critical region.	Understand	This would require the learner to recall the critical region.	CO 2
18	State the factors on which the performance of the Round Robin CPU scheduling algorithm depends.	Remember	This would require the learner to recall the round robin CPU scheduling.	CO 2
19	Distinguish between semaphore and binary semaphore.	Understand	This would require the learner to recall the types of semaphores.	CO 2
20	Distinguish between preemptive and non-preemptive scheduling techniques		This would require the learner to recall the scheduling techniques	CO 2

MODULE III				
MEMORY MANAGEMENT AND VIRTUAL MEMORY				
PART A- PROBLEM SOLVING AND CRITICAL THINKING				
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
1	Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? Which algorithm makes the most efficient use of memory?	Apply	This would require the learner to recall the memory management algorithms.	CO 3
2	Describe the LRU page replacement algorithm, assuming there are 3 frames and the page reference string is 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1.Find the number of page faults.	Apply	This would require the learner to calculate the page faults.	CO 3
3	Consider the following page reference string 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. Find out the number of page faults in a) LRU b) FIFO	Apply	This would require the learner to recall the page replacement algorithms.	CO 3
4	The queue of requests in FIFO is 86, 147, 91, 177, 94, 150, 102, 175, 130. What is the total head movement needed to satisfy the requests for the following Scheduling algorithms FCFS, SJF, SCAN	Apply	This would require the learner to recall the Scheduling Algorithms	CO 5
5	Discuss the following page replacement algorithm with an example i) Optimal ii) LRU	Understand	This would require the learner to recall the Page replacement Algorithms	CO 3

<table>
<tr>
<td>6</td>
<td>A virtual memory system has the following specification: Size of the virtual address space=64k Size of the physical address space=4k Page size=512

<table>
<tr><th>Virtualpage</th><th>Physicalframe</th></tr>
<tr><td>0</td><td>0</td></tr>
<tr><td>3</td><td>1</td></tr>
<tr><td>7</td><td>2</td></tr>
<tr><td>10</td><td>4</td></tr>
<tr><td>12</td><td>5</td></tr>
<tr><td>30</td><td>6</td></tr>
<tr><td>31</td><td>7</td></tr>
</table>

i)find all the virtual addresses that will generate a page fault
ii)compute the main memory addresses for the following virtual addresses. 24,3784,10250,30780</td>
<td>Apply</td>
<td>This would require the learner to recall the Virtual and physical addresses</td>
<td>CO 4</td>
</tr>
<tr>
<td>7</td>
<td>A process references 5 pages A,B, C, D, E in the following order A, B, C, D, A, E, B, C, E, D Assuming that the replacement algorithm is LRU and FIFO, find out the number of page faults during the sequence of references, starting with an empty main memory With 3 frames.</td>
<td>Apply</td>
<td>This would require the learner to recall the Replacement algorithm.</td>
<td>CO 3</td>
</tr>
<tr>
<td>8</td>
<td>Consider the following page reference string 7,0, 1,2,0,3,0,4,2,3,0,3,2, 1,2,0, 1, 7, 10 0, 1. How many page faults would occur for FIFO page replacement algorithms, assuming three frames?</td>
<td>Apply</td>
<td>This would require the learner to recall the Replacement algorithm.</td>
<td>CO 3</td>
</tr>
</table>

9	Given memory partitions of 100 K, 500 K, 200 K, 300 K and 600 K (in order) how Would each of the first fit, best fit and worst fit algorithms workplace processes of 212 K, 417K, 112 K and 426 K (in order)? Which algorithm makes the most efficient use of memory?	Apply	This would require the learner to recall the efficient use of memory.	CO 3
10	Consider a logical address space of eight pages of 1024 words each mapped onto a physical memory of 32 frames a) How many bits are in the logical address. b) How many bits are in the physical address	Apply	This would require the learner to recall the physical Address.	CO 3
PART B-LONG ANSWER QUESTIONS				
1	Describe the following. a) Virtual Memory b) Cache Memory	Understand	This would require the learner to recall the categories of Memory	CO 3
2	A paging scheme using TLB. TLB Access Time 10 ns and main memory access time takes 50 ns. What is Effective Memory Access Time (in ns) if TLB hit ratio is 90% and there is no page fault?	Apply	This would require the learner to recall the page fault concept	CO3
3	With a diagram discuss the steps involved in handling a page fault.	Understand	This would require the learner to recall the page fault	CO 3
4	Explore the term Demand paging.	Understand	This would require the learner to recall paging concept	CO 3
5	Explain in detail the requirements that memory management technique needs to satisfy	Understand	This would require the learner to recall the memory management	CO 3

6	Describe a) Translation look-aside buffer b) Segmentation	Understand	This would require the learner to recall the Segmentation	CO 2
7	Describe contiguous memory allocation concept with advantages and disadvantages	Understand	This would require the learner to recall the memory management.	CO 3
8	Describe the following terms a.Hierarchical paging b.Inverted page Table	Understand	This would require the learner to recall the paging and page table	CO 3
9	Consider the following page reference string: 7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0 , 1. Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms? a.LRU replacement b.FIFO replacement c.Optimal replacement	Apply	This would require the learner to recall the concept of page replacement	CO 3
10	Explain briefly about paging with a neat diagram.	Understand	This would require the learner to recall the Paging	CO 3
11	Explain the uses of the following: a. Mutex object b. Semaphore object	Understand	This would require the learner to recall the Mutex and semaphore.	CO 3
12	Define page fault. When does a page fault occur?	Remember	This would require the learner to recall the page fault.	CO 3
13	Describe the action taken by OS when page fault occurs.	Understand	This would require the learner to recall the page fault.	CO 3
14	Write a note on file types and file structures .	Remember	This would require the learner to recall the files	CO 5
15	Explain with the help of supporting diagrams how TLB improves the performance of a demand paging system.	Understand	This would require the learner to recall the demand paging.	CO 4

16	Compare the terms Global and Local replacement algorithms	Understand	This would require the learner to recall the page replacement algorithms.	CO 3
17	What is virtual memory? Explain Suppose we have a demand paged memory. The page table is held in registers. It takes 8ms to service a page fault if an empty page is available or the replaced page is not modified, and 20ms if the replaced page is modified. memory access time is 100ns. Assume that the page to be replaced is modified 70% of the time. What is the maximum acceptable page fault rate for an effective access time of no more than 200ns?	Apply	This would require the learner to recall the Virtual memory concept	CO 4
18	Explain the basic concepts of segmentation with neat diagrams	Understand	This would require the learner to recall the concept of Segmentation.	CO 2
19	Describe the following terms: a) Logical Address b) Physical Address c)	Understand	This would require the learner to recall the concept of logical and physical address	CO 2
20	Explain frame allocation in detail.	Understand	This would require the learner to recall about frame allocation concept	CO 4
PART C - SHORT ANSWER QUESTIONS				
1	Define compaction.	Remember	This would require the learner to recall the compaction	CO 3
2	Define swapping.	Remember	This would require the learner to recall the swapping.	CO 3
3	Explain the main function of the memory-management unit	Understand	This would require the learner to recall the memory management.	CO 3

4	Distinguish between logical address and physical address.	Understand	This would require the learner to recall the logical address and physical address.	CO 3
5	Compare synthesized and inherited attributes?	Understand	This would require the learner to recall the inherited attributes	CO 3
6	Describe dynamic loading and dynamic linking.	Understand	This would require the learner to recall the Memory management.	CO 3
7	Distinguish between compile time, load time and execution time address binding.	Understand	This would require the learner to recall the memory management.	CO 3
8	Distinguish between internal and external fragmentation.	Understand	This would require the learner to recall the fragmentation.	CO 3
9	List dynamic storage allocation strategies in contiguous memory allocation schemes.	Remember	This would require the learner to recall the memory management.	CO 3
10	List and define non-contiguous memory allocation schemes.	Remember	This would require the learner to recall the memory allocation methods.	CO 3
11	What is virtual memory?	Remember	This would require the learner to recall the Virtual memory.	CO 3
12	Differentiate between demand paging and pure demand paging.	Understand	This would require the learner to recall the Paging.	CO 4
13	Differentiate between local and global page replacement strategies.	Understand	This would require the learner to recall the Paging concept	CO 4
14	Explain the need for page-replacement	Understand	This would require the learner to recall the Page replacement	CO 3
15	Distinguish between paging and segmentation	Understand	This would require the learner to recall the Paging	CO 3
16	Explain any two page replacement algorithms	Understand	This would require the learner to recall the Page replacement algorithms.	CO 4
17	List various page replacement algorithms.	Understand	This would require the learner to recall the page replacement	CO 4

18	Explain the concept of thrashing and why thrashing should be avoided in a system.	Understand	This would require the learner to recall the Thrashing.	CO 3
19	What is virtual memory and give its advantages	Understand	This would require the learner to recall the Virtual memory	CO 4
20	What is demand paging? Explain it.	Understand	This would require the learner to recall the demang paging concept.	CO 4
MODULE IV				
FILE SYSTEM INTERFACE, MASS-STORAGE STRUCTURE				
PART A-PROBLEM SOLVING AND CRITICAL THINKING				
1	A hard disk has 63 sectors per track, 10 platters each with 2 recording surfaces and 1000 cylinders. The address of a sector is given as a triple (c, h, s), where c is the cylinder number, h is the surface number and s is the sector number. Thus, the 0th sector is addressed as (0, 0, 0), the 1st sector as (0, 0, 1), and so on The address <400,16,29> corresponds to sector number:	Apply	This would require the learner to recall the mass storage structure.	CO 5
2	Explain the maximum file size supported by a file system with 16 direct blocks, single, double, and triple indirection. The block size is 512 bytes. Disk block numbers can be stored in 4 bytes.	Apply	This would require the learner to recall the file allocation methods	CO 5
3	Discuss the reasons why the operating system might require accurate information on how blocks are stored on disk. How could operating system improves file system performance with this knowledge?	Understand	This would require the learner to recall the disk storage and file system performance	CO 5

4	Discuss how OS could maintain a free-space list for a tape-resident file system. Assume that the tape technology is append-only and that it uses EOT marks and locate, space and read position command	Understand	This would require the learner to recall the concept of file system structure	CO 5
5	Compare the performance of write operations achieved by a RAID level 5 organization with that achieved by a RAID level 1 organization.	Understand	This would require the learner to recall the concept of storage structures.	CO 5
6	Is there any way to implement truly stable storage. Explain your answer	Understand	This would require the learner to recall the concept of storage structures	CO 5
7	What are file protection methods?	Remember	This would require the learner to recall the file protection	CO 6
8	Explain different types of files	Understand	This would require the learner to recall the files concept	CO 5
9	Suppose we have files F1 to F4 in sizes of 7178, 572, 499 and 1195 bytes. Our disks have fixed physical block size of 512 bytes for allocation. Explain how many physical blocks would be needed to store these four files if we were to use a chained allocation strategy assuming that we need 5 bytes of information to determine the next block in the link. Which file results in the maximum internal fragmentation (measured as a percentage of the file size itself).	Apply	This would require the learner to recall the fragmentation	CO 5

10	Consider that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is: 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130 Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending requests for each of the following disk scheduling algorithms. A. FCFS B. SSTF C. SCAN D. C-SCAN E. LOOK F. C-LOOK	Apply	This would require the learner to recall the scheduling algorithms .	CO 5
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
PART B- LONG ANSWER QUESTIONS				
1	Explain in detail the interrupts and interrupt handling features.	Understand	This would require the learner to recall the interrupts and handling features.	CO 5
2	Discuss about Disk space management	Understand	This would require the learner to recall the disk space management .	CO 5
3	Discuss about Swap –space management	Understand	This would require the learner to recall the Swap-space management.	CO 5
4	Describe the following Directory Implementation methods. a)Linear List b) Hash Table	Understand	This would require the learner to recall the Implementation Methods .	CO 5
5	Explain the concept of file sharing. What are the criteria to be followed in systems which implement file sharing	Understand	This would require the learner to recall the File Sharing.	CO 5

6	Explain the following file concepts: a) File attributes b) File operations	Understand	This would require the learner to recall the file concepts.	CO 5
7	Explain the following file concepts: a) File types b) Internal file structure	Understand	This would require the learner to recall the file concepts.	CO 5
8	Discuss the following a) File system mounting b)Thrashing	Understand	This would require the learner to recall the file concepts.	CO 5
9	Explain caching .	Understand	This would require the learner to recall the memory.	CO 3
10	Define buffering.	Remember	This would require the learner to recall the files.	CO 3
11	Write about spooling.	Remember	This would require the learner to recall the spooling	CO 5
12	Explain the techniques used for performing I/O	Understand	This would require the learner to recall the Techniques used for performing I/O	CO 5
13	Give an example of an application in which data in a file should be accessed in the following order: i. sequential ii. Random	Understand	This would require the learner to recall the File orders	CO 5
14	Explain the following in detail with respect to disk. a) Seek time b) Latency	Understand	This would require the learner to recall the seek time and latency with respect to disk	CO 5
15	Explain the following in detail with respect to disk. a)Access time b) Transfer time	Understand	This would require the learner to recall the access time and transfer time with respect to disk	CO 5
16	Define magnetic disk structure and its management.	Remember	This would require the learner to recall the magnetic disk structure and its management	CO 5
17	Explain swap space management.	Understand	This would require the learner to recall the swap space management	CO 5
18	Differentiate among the following disk scheduling algorithms. a) FCFS b) SSTF	Understand	This would require the learner to recall the scheduling algorithms	CO 5

19	Differentiate among the following disk scheduling algorithms. a) SCAN b) C-SCAN	Understand	This would require the learner to recall the scheduling algorithms	CO 5
20	Differentiate among the following disk scheduling algorithms. a)LOOK b) C-LOOK	Understand	This would require the learner to recall the scheduling algorithms	CO 5
PART C- SHORT ANSWER QUESTIONS				
1	Describe various file access method	Understand	This would require the learner to recall the files.	CO 5
2	Explain the following i)file types ii) file operation iii) file attributes.	Understand	This would require the learner to recall the files	CO 5
3	Define the terms – file, file path, directory.	Remember	This would require the learner to recall the files.	CO 5
4	Describe UFD and MFD.	Understand	This would require the learner to recall the UFD and MFD	CO 5
5	Describe file system mounting	Understand	This would require the learner to recall the files	CO 5
6	List the various layers of a file system.	Remember	This would require the learner to recall the file system,	CO 5
7	Explain the functions of the virtual file system (VFS).	Understand	This would require the learner to recall the virtual file system.	CO 4
8	Explain the allocation methods of a disk space.	Understand	This would require the learner to recall the disk space	CO 5
9	List the various layers of a file system.	Remember	This would require the learner to recall the layers of file system	CO 5
10	Describe about logical formatting of the disk.	Understand	This would require the learner to recall the formatting of the disk.	CO 5
11	List any four common file types and their extensions.	Remember	This would require the learner to recall the file types and extensions	CO 5
12	Explain any four common file attributes	Understand	This would require the learner to recall the file attributes.	CO 5

13	Explain any four file operations.	Understand	This would require the learner to recall the file operations.	CO 5
14	Distinguish between shared and exclusive locks.	Understand	This would require the learner to recall the locks.	CO 5
15	List any four secondary storage memory devices.	Remember	This would require the learner to recall the Storage memory devices.	CO 5
16	Define the terms with respect to disk I/O - seek time, latency time.	Remember	This would require the learner to recall the disk and its respective times	CO 5
17	Explain the information associated with an open file.	Understand	This would require the learner to recall the files.	CO 5
18	Discuss the advantages of contiguous memory allocation of disk space	Understand	This would require the learner to recall the disk space.	CO 5
19	Write a short note on procedures?	Remember	This would require the learner to recall the procedures.	CO 1
20	Discuss the drawbacks of contiguous allocation of disk space.	Understand	This would require the learner to recall the disk space.	CO 5
MODULE V				
DEADLOCKS, PROTECTION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING				
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
1	Consider the version of the dining-philosophers problem in which the chopsticks are placed at the center of the table and any two of them can be used by a philosopher. Assume that requests for chopsticks are made one at a time. Describe a simple rule for determining whether a particular request can be satisfied without causing deadlock given the current allocation of chopsticks to philosophers	Understand	This would require the learner to recall the concept of deadlock	CO 2

2	Consider a system consisting of m resources of the same type being shared by n processes. A process can request or release only one resource at a time. Show that the system is deadlock free if the following two conditions hold: a) The maximum need of each process is between one resource and m resources. b) The sum of all maximum needs is less than m +n.	Understand	This would require the learner to recall the resource sharing management	CO 2
3	Given 3 processes A,B and C, three resources x,y and z and following events, a. A requests x ii) A requests y iii) B requests y iv) B requests z v) C requests z vi) C requests x vii) C requests y Assume that requested resources should always be allocated to the request process if it is available. Draw the resource allocation graph for the sequences. And also mention whether it is a deadlock? If it is, how to recover the deadlock	Understand	This would require the learner to recall the resource allocation graph	CO 2
4	Explain how does the principle of least privilege aid in the creation of protection systems	Understand	This would require the learner to recall the protection of system	CO 6
5	Describe how the Java protection model would be compromised if a Java program were allowed to directly alter the annotations of its stack frame	Understand	This would require the learner to recall the annotations	CO 6
6	Describe the Coffman's conditions that lead to a deadlock.	Understand	This would require the learner to recall the Coffman's conditions	CO 2

7	A system contains three programs and each requires three tape units for its operation. Explain the minimum number of tape units which the system must have such that deadlocks never arise is	Understand	This would require the learner to recall the cocept of deadlock.	CO 2
8	A system has 6 identical resources and N processes competing for them. Each process can request at most 2 resources. Explain which one of the following values of N could lead to a deadlock.	Apply	This would require the learner to understand the deadlock avoidance criteria	CO 2
9	Define in detail the technique of deadlock avoidance	Understand	This would require the learner to recall the deadlock handling techniques.	CO 2
10	Explain briefly about purpose of the banker's algorithm.	Understand	This would require the learner to recall the deadlock avoidance methods.	CO 2
PART B- LONG ANSWER QUESTIONS				
1	What is the deadlock? Explain the necessary conditions for its occurrence	Understand	This would require the learner to recall the Deadlock conditions.	CO 2
2	Explain briefly resource allocation graph with examples	Understand	This would require the learner to recall the research algorithm graph concept	CO 2
3	Explain the methods for deadlock prevention	Understand	This would require the learner to recall the deadlock handling methods.	CO 2
4	Explain the resource allocation graph with atleast 5 process sharing 3 Resource types of 2 instances for each.	Understand	This would require the learner to understand the resource allocation graph.	CO 2
5	Differentiate the deadlock handling methods	Understand	This would require the learner to understand the Deadlock handling methods	CO 2

6	Explain Banker's algorithm for deadlock avoidance with an example	Understand	This would require the learner to understandthe banker's algorithm	CO 2
7	Discuss the various issues that need to be considered through the process of revocation of access rights	Understand	This would require the learner to recall the concepts of protection.	CO 6
8	State and explain the methods involved in recovery from deadlocks.	Understand	This would require the learner to understand the concepts of deadlock.	CO 2
9	Describe resource-allocation graph. Explain how resource graph can be used for detecting deadlocks	Understand	This would require the learner to understand the resource allocation graph.	CO 2
10	Describe the terms. a) Race condition b) Atomic transaction c) Critical section d) Mutual exclusion	Understand	This would require the learner to recall the race condition and atomic transaction and Critical section and mutual exclusion	CO 2
11	Describe how the access matrix facility and role-based access control facility are similar. How do they differ?	Understand	This would require the learner to recall the cocept of protection.	CO 6
12	Explain why a capability based system such as Hydra provides greater flexibility than the ring- protection scheme in enforcing protection policies.	Understand	This would require the learner to recall the protection mechanisms.	CO 6
13	Define Goals of protection	Remember	This would require the learner to recall the concept of protection.	CO 6
14	Define Principles of protection.	Remember	This would require the learner to recall the concept of protection	CO 6
15	Discuss about domain of protection	Understand	This would require the learner to recall the concept of protection	CO 6
16	Why do you need to provide protection to the system?	Remember	This would require the learner to recall the concept of protection.	CO 6

17	Discuss the access matrix implementation techniques.	Understand	This would require the learner to recall the protection mechanisms.	CO 6
18	Compare the various access matrix implementation techniques	Understand	This would require the learner to recall the protection mechanisms.	CO 6
19	Discuss deadlock detection method in detail.	Understand	This would require the learner to recall the concept of deadlock	CO 2
20	Explain various schemes to implement revocation for capabilities	Understand	This would require the learner to recall the protection mechanisms.	CO 6
PART C- SHORT ANSWER QUESTIONS				
1	Define Deadlock	Remember	This would require the learner to recall the concept of Deadlock	CO 2
2	Define resource.	Remember	This would require the learner to recall the structure of computer	CO 2
3	List some resources that a process might need for its execution	Remember	This would require the learner to recall the structure of computer	CO 2
4	Explain safe state	Understand	This would require the learner to recall the safe vs unsafe state.	CO 2
5	Explain unsafe state	Understand	This would require the learner to recall the unsafe state	CO 2
6	Define the purpose of banker's algorithm	Remember	This would require the learner to recall deadlock avoidance algorithm	CO 2
7	Describe the techniques for recovery from deadlock	Understand	This would require the learner to recall the deadlock handling techniques.	CO 2
8	List the goals of protection	Remember	This would require the learner to recall the concept of protection	CO 6
9	Describe any one language-based protection schemes	Understand	This would require the learner to recall the language basic protection	CO 6
10	State principle of least privilege.	Remember	This would require the learner to recall the concept of protection	CO 6

11	Describe role-based access control.	Understand	This would require the learner to recall the concept of protection	CO 6
12	List the schemes that implement revocation of capabilities	Remember	This would require the learner to recall the mechanisms of protection.	CO 6
13	Explain the sequence in which a process may utilize the resources in normal mode of operation	Understand	This would require the learner to recall the concept of process synchronization.	CO 2
14	Define the terms : a)object b)domain c) access right.	Remember	This would require the learner to recall the terms in protection	CO 6
15	Write the main differences between capability lists and access lists	Remember	This would require the learner to recall the protection mechanisms.	CO 6
16	Distinguish between deadlock avoidance and prevention strategies.	Understand	This would require the learner to recall the deadlock handling mechanisms.	CO 2
17	Why is deadlock state more critical than starvation?	Remember	This would require the learner to recall the Starvation and deadlock	CO 2
18	What are two options for breaking deadlock?	Remember	This would require the learner to recall deadlock handling mechanisms.	CO 2
19	What is meant by Starvation	Remember	This would require the learner to recall the starvation concept	CO 2
20	Write the format of an access matrix	Remember	This would require the learner to recall the concept of protection.	CO 6

Course Coordinator: **HOD CSE(AI & ML)**
Ms. K. Anjali, Assistant professor