

SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF COMPUTER APPLICATIONS
QUESTION BANK



III SEMESTER
PMC502 – OPERATING SYSTEMS AND SECURITY
Regulation–2024

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Preparedby
Ms.DEEPIKA.T,
Assistant Professor
Department of ComputerApplications



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SUBJECT : PMC502 – OPERATING SYSTEMS AND SECURITY

SEM/YEAR:III/ I

UNIT-1 : OPERATING SYSTEM OVERVIEW				
Computer-System Organization Architecture Operating-System Operations - Resource Management Security and Protection Distributed Systems Operating-System Services Operating System Design and Implementation - Building and Booting an Operating System.				
PART-A				
Q. No	Questions	BT Level	Competence	CO's
1.	Define an Operating System.	BTL1	Remembering	CO1
2.	What is Computer-System Organization?	BTL1	Remembering	CO1
3.	List the basic components of a computer system.	BTL1	Remembering	CO1
4.	What is meant by Computer-System Architecture?	BTL1	Remembering	CO1
5.	Differentiate between single-processor and multiprocessor systems.	BTL2	Understanding	CO1
6.	Define Operating-System Operations.	BTL1	Remembering	CO1
7.	What is an interrupt?	BTL1	Remembering	CO1
8.	State the purpose of dual-mode operation.	BTL1	Remembering	CO1
9.	What is the role of a timer in an operating system?	BTL1	Remembering	CO1
10.	Define a system call.	BTL1	Remembering	CO1
11.	List any four services provided by an operating system.	BTL1	Remembering	CO1
12.	What is resource management?	BTL1	Remembering	CO1
13.	Explain the functions of process management.	BTL2	Understanding	CO1
14.	What is memory management?	BTL1	Remembering	CO1
15.	Define security in an operating system.	BTL1	Remembering	CO1
16.	Differentiate between security and protection.	BTL2	Understanding	CO1
17.	What is a distributed system?	BTL1	Remembering	CO1
18.	State two advantages of distributed systems.	BTL1	Remembering	CO1
19.	What are operating system services?	BTL1	Remembering	CO1
20.	List the objectives of operating system design.	BTL1	Remembering	CO1
21.	What is operating system implementation?	BTL1	Remembering	CO1
22.	Define booting.	BTL1	Remembering	CO1
23.	Differentiate between cold booting and warm booting.	BTL2	Understanding	CO1
24.	What is a bootstrap program?	BTL1	Remembering	CO1

PART-B				
1.	Construct the Computer-System Organization with a neat diagram. (16)	BTL3	Applying	CO1
2.	(i) Analyze the single-processor and multiprocessor system architectures. (8) (ii) Analyze the multicore and clustered system architectures with their advantages. (8)	BTL4	Analyzing	CO1
3.	Analyze the Operating-System Operations including interrupt handling, dual-mode operation, timer, and system calls. (16)	BTL4	Analyzing	CO1
4.	Develop the various resource management functions performed by an operating system. (16)	BTL3	Applying	CO1
5.	Analyze the concepts of security and protection in an operating system with suitable examples. (16)	BTL4	Analyzing	CO1
6.	Analyze the architecture, advantages, and challenges of distributed systems. (16)	BTL4	Analyzing	CO1
7.	Examine the services provided by an operating system with a neat diagram. (16)	BTL4	Analyzing	CO1
8.	(i) Compare monolithic and layered operating system structures with suitable diagrams. (8) (ii) Compare microkernel and modular operating system structures with suitable diagrams. (8)	BTL4	Analyzing	CO1
9.	Analyze the design goals and implementation of operating systems. (16)	BTL4	Analyzing	CO1
10.	Construct the building and booting process of an operating system with a neat diagram. (16)	BTL3	Applying	CO1
11.	(i) Analyze the major design goals and requirements of an operating system. (8) (ii) Analyze the implementation techniques and important issues involved in operating system implementation. (8)	BTL4	Analyzing	CO1
12.	Analyze the interrupt handling mechanism in an operating system with a suitable diagram. (16)	BTL4	Analyzing	CO1
13.	Classify the concept of system calls and classify different types of system calls with examples. (16)	BTL4	Analyzing	CO1
14.	Analyze the importance of operating system services for users and system programs. (16)	BTL4	Analyzing	CO1
15.	Analyze the role of protection mechanisms in maintaining system security. (16)	BTL4	Analyzing	CO1
16.	Analyze the functions and significance of resource management in modern operating systems. (16)	BTL4	Analyzing	CO1
17.	Analyze the functions and responsibilities of an operating system in managing computer resources with suitable examples. (16)	BTL4	Analyzing	CO1
UNIT-2 : PROCESS MANAGEMENT				
Process Concept-Process Scheduling - Operation on Processes, Inter process Communication-Threads - Overview - Multithreading models - Threading issues; CPU Scheduling - Scheduling criteria, Scheduling algorithms; Process Synchronization critical- section problem. Deadlock -System model, Deadlock characterization, Methods for handling deadlocks. Deadlock prevention, Deadlock avoidance, Detection, Recovery.				
PART-A				

1.	Define a process.	BTL1	Remembering	CO2
2.	List the different states of a process.	BTL1	Remembering	CO2
3.	What is a Process Control Block (PCB)?	BTL1	Remembering	CO2
4.	What is process scheduling?	BTL1	Remembering	CO2
5.	Differentiate between long-term scheduler and short-term scheduler.	BTL2	Understanding	CO2
6.	What are the basic operations performed on a process?	BTL1	Remembering	CO2
7.	Define Interprocess Communication (IPC).	BTL1	Remembering	CO2
8.	List the two models of Interprocess Communication.	BTL1	Remembering	CO2
9.	Define a thread.	BTL1	Remembering	CO2
10.	List the advantages of multithreading.	BTL1	Remembering	CO2
11.	List the different multithreading models.	BTL1	Remembering	CO2
12.	What are threading issues?	BTL1	Remembering	CO2
13.	Define CPU scheduling.	BTL1	Remembering	CO2
14.	List the scheduling criteria used in CPU scheduling.	BTL1	Remembering	CO2
15.	What is First-Come, First-Served (FCFS) scheduling?	BTL1	Remembering	CO2
16.	Differentiate between preemptive and non-preemptive scheduling.	BTL2	Understanding	CO2
17.	Define process synchronization	BTL1	Remembering	CO2
18.	What is the critical-section problem?	BTL1	Remembering	CO2
19.	Define deadlock.	BTL1	Remembering	CO2
20.	List the four necessary conditions for deadlock occurrence.	BTL1	Remembering	CO2
21.	What is deadlock prevention?	BTL1	Remembering	CO2
22.	Define deadlock avoidance.	BTL1	Remembering	CO2
23.	What is deadlock detection?	BTL1	Remembering	CO2
24.	Define deadlock recovery.	BTL1	Remembering	CO2
PART-B				
1.	Construct the process concept and process states with a neat diagram. (16)	BTL3	Applying	CO2
2.	(i) Analyze the Process Control Block (PCB) and its components. (8) (ii) Analyze the various operations performed on processes. (8)	BTL4	Analyzing	CO2
3.	Analyze the process scheduling and discuss the functions of long-term, short-term, and medium-term schedulers. (16)	BTL4	Analyzing	CO2
4.	Apply the Interprocess Communication (IPC) and discuss the shared memory and message passing models.(16)	BTL3	Applying	CO2
5.	Analyze the concept of threads, multithreading models, and threading issues in detail. (16)	BTL4	Analyzing	CO2
6.	Analyze the CPU scheduling criteria and explain FCFS, SJF, Priority, and Round Robin scheduling algorithms with examples. (16)	BTL4	Analyzing	CO2
7.	Compare the preemptive and non-preemptive CPU scheduling algorithms with suitable examples. (16)	BTL4	Analyzing	CO2

8.	Analyze process synchronization and discuss the critical-section problem with suitable solutions. (16)	BTL4	Analyzing	CO2
9.	Apply the semaphores and monitors used for process synchronization with examples. (16)	BTL3	Applying	CO2
10.	Analyze the system model and necessary conditions for deadlock occurrence.(16)	BTL4	Analyzing	CO2
11.	Apply the various methods for handling deadlocks in operating systems. (16)	BTL3	Applying	CO2
12.	Analyze the deadlock prevention and deadlock avoidance techniques with suitable examples. (16)	BTL4	Analyzing	CO2
13.	Apply the Banker's Algorithm for deadlock avoidance with an example. (16)	BTL4	Analyzing	CO2
14.	Analyze the deadlock detection algorithms and recovery techniques in detail. (16)	BTL4	Analyzing	CO2
15.	(i) Apply the issues related to fork(), exec(), and signal handling in multithreaded systems. (8) (ii) Apply the thread cancellation, thread pools, and thread-specific data with suitable examples. (8)	BTL3	Applying	CO2
16.	Examine the performance of various CPU scheduling algorithms using scheduling criteria. (16)	BTL4	Analyzing	CO2
17.	Examine the various methods for handling deadlocks and compare their advantages and disadvantages. (16)	BTL4	Analyzing	CO2
UNIT-3 : MEMORY MANAGEMENT AND FILE SYSTEMS				
Main Memory - Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation -Virtual Memory - Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory. Mass Storage system. HDD Scheduling File System Structure, Directory implementation, Allocation Methods, Free Space Management.				
PART-A				
1.	Define main memory.	BTL1	Remembering	CO3
2.	What is memory management?	BTL1	Remembering	CO3
3.	Define swapping.	BTL1	Remembering	CO3
4.	What is contiguous memory allocation?	BTL1	Remembering	CO3
5.	Differentiate between internal and external fragmentation.	BTL2	Understanding	CO3
6.	Define paging.	BTL1	Remembering	CO3
7.	What is a page table?	BTL1	Remembering	CO3
8.	Define segmentation.	BTL1	Remembering	CO3
9.	Differentiate between paging and segmentation.	BTL2	Understanding	CO3
10.	What is virtual memory?	BTL1	Remembering	CO3
11.	Define demand paging.	BTL1	Remembering	CO3
12.	What is a page fault?	BTL1	Remembering	CO3
13.	List any four page replacement algorithms.	BTL1	Remembering	CO3

14.	What is thrashing?	BTL2	Understanding	CO3
15.	What is kernel memory allocation?	BTL1	Remembering	CO3
16.	Define mass storage system.	BTL1	Remembering	CO3
17.	What is HDD scheduling?	BTL1	Remembering	CO3
18.	Name any four disk scheduling algorithms.	BTL1	Remembering	CO3
19.	Define a file system.	BTL1	Remembering	CO3
20.	What is directory implementation?	BTL1	Remembering	CO3
21.	List the file allocation methods	BTL1	Remembering	CO3
22.	What is contiguous file allocation?	BTL1	Remembering	CO3
23.	Define linked file allocation.	BTL1	Remembering	CO3
24.	What is free space management?	BTL1	Remembering	CO3
PART-B				
1.	Analyze the background of main memory and memory management in detail. (16)	BTL4	Analyzing	CO3
2.	Construct the swapping and contiguous memory allocation with suitable examples. (16)	BTL4	Analyzing	CO3
3.	Compare the paging and segmentation with neat diagrams and compare their advantages and disadvantages. (16)	BTL4	Analyzing	CO3
4.	Apply the virtual memory and demand paging with a neat diagram. (16)	BTL3	Applying	CO3
5.	Analyze the various page replacement algorithms with suitable examples. (16)	BTL4	Analyzing	CO3
6.	Analyze the page allocation strategies and thrashing in detail. (16)	BTL4	Analyzing	CO3
7.	(i) Identify the kernel memory allocation and its requirements. (8) (ii) Apply the Buddy System and Slab Allocation techniques for kernel memory allocation. (8)	BTL3	Applying	CO3
8.	Analyze the architecture and functions of a mass storage system. (16)	BTL4	Analyze	CO3
9.	(i) Analyze the FCFS, SSTF, and SCAN disk scheduling algorithms with suitable examples. (8 Marks) (ii) Analyze the C-SCAN, LOOK, and C-LOOK disk scheduling algorithms with suitable examples. (8)	BTL4	Analyzing	CO3
10.	Analyze the file system structure with a neat diagram. (16)	BTL4	Analyzing	CO3
11.	(i) Compare the single-level, two-level, and tree-structured directories with suitable diagrams. (8) (ii) Compare the acyclic-graph and general-graph directory structures with suitable examples. (8)	BTL4	Analyzing	CO3
12.	Analyze the various file allocation methods with suitable examples. (16)	BTL4	Analyzing	CO3
13.	Compare the contiguous, linked, and indexed file allocation methods. (16)	BTL4	Analyzing	CO3
14.	Apply the free space management techniques used in file systems. (16)	BTL3	Applying	CO3
15.	(i) Analyze the paging and its address translation mechanism with a suitable example. (8 Marks)	BTL4	Analyzing	CO3

	(ii) Analyze the segmentation and its address translation mechanism, and compare it with paging. (8 Marks)			
16.	Analyze the performance of different page replacement algorithms using page fault analysis. (16)	BTL4	Analyzing	CO3
17.	Analyze the various memory management techniques and compare paging, segmentation, and virtual memory with suitable examples. (16)	BTL4	Analyzing	CO3
UNIT-4 : SECURE SYSTEMS AND VERIFIABLE SECURITY GOALS				
Security Goals – Trust and Threat Model – Access Control Fundamentals – Protection System – Reference Monitor – Secure Operating System Definition – Assessment Criteria – Information Flow – Information Flow Secrecy Models – Denning's Lattice Model – Bell-LaPadula Model				
	PART_A			
1.	Define information security goals.	BTL1	Remembering	CO4
2.	What are the primary security goals of a secure operating system?	BTL1	Remembering	CO4
3.	Define trust model.	BTL1	Remembering	CO4
4.	What is a threat model?	BTL1	Remembering	CO4
5.	Differentiate between trust model and threat model.	BTL2	Understanding	CO4
6.	Define access control.	BTL1	Remembering	CO4
7.	List the basic principles of access control.	BTL1	Remembering	CO4
8.	What is a protection system?	BTL1	Remembering	CO4
9.	Define reference monitor.	BTL1	Remembering	CO4
10.	Show the characteristics of a reference monitor.	BTL2	Understanding	CO4
11.	Define a secure operating system.	BTL1	Remembering	CO4
12.	What are the objectives of a secure operating system?	BTL1	Remembering	CO4
13.	What are security assessment criteria?	BTL1	Remembering	CO4
14.	Define information flow.	BTL1	Remembering	CO4
15.	What is an information flow policy?	BTL1	Remembering	CO4
16.	Define information flow secrecy model	BTL1	Remembering	CO4
17.	What is Denning's Lattice Model?	BTL1	Remembering	CO4
18.	Show the advantages of Denning's Lattice Model.	BTL2	Understanding	CO4
19.	Define Bell-LaPadula Model.	BTL1	Remembering	CO4
20.	Define the Simple Security Property of Bell-LaPadula Model.	BTL1	Remembering	CO4
21.	What is the *-Property (Star Property) in Bell-LaPadula Model?	BTL1	Remembering	CO4
22.	Differentiate between discretionary and mandatory access control.	BTL2	Understanding	CO4
23.	What is the principle of least privilege?	BTL1	Remembering	CO4
24.	What is complete mediation in a reference monitor?	BTL1	Remembering	CO4
PART-B				
1.	(i) Identify the concepts of confidentiality, integrity, and availability as security goals. (8) (ii) Identify the authentication, accountability, and non-repudiation as security goals with suitable examples. (8)	BTL3	Applying	CO4

2.	Analyze the trust model and threat model in secure systems. (16)	BTL4	Analyzing	CO4
3.	Apply the fundamentals of access control and its implementation in secure operating systems. (16)	BTL3	Applying	CO4
4.	Analyze the protection system and explain the concept of a reference monitor with a neat diagram. (16)	BTL4	Analyzing	CO4
5.	Analyze the characteristics and requirements of a secure operating system. (16)	BTL4	Analyzing	CO4
6.	(i) Identify the need and importance of security assessment criteria. (8) (ii) Analyze the major criteria used to assess the security of operating systems. (8)	BTL4	Analyzing	CO4
7.	Apply the concept of information flow and information flow policies in detail. (16)	BTL3	Applying	CO4
8.	Analyze the information flow secrecy models with suitable examples. (16)	BTL4	Analyzing	CO4
9.	Analyze the Denning's Lattice Model with a neat diagram and suitable examples. (16)	BTL4	Analyzing	CO4
10.	Analyze the Bell-LaPadula security model and its properties in detail. (16)	BTL4	Analyzing	CO4
11.	Analyze the concept of a secure operating system and discuss its essential characteristics and requirements. (16)	BTL4	Analyzing	CO4
12.	(i) Analyze the Discretionary Access Control (DAC) and its working with suitable examples. (8) (ii) Analyze the Mandatory Access Control (MAC) and its working with suitable examples. (8)	BTL4	Analyzing	CO4
13.	Apply the role of the reference monitor in enforcing system security. (16)	BTL3	Applying	CO4
14.	Analyze the the importance of information flow control in maintaining system confidentiality(16)	BTL4	Analyzing	CO4
15.	Analyze how access control mechanisms help in protecting secure operating systems. (16)	BTL4	Analyzing	CO4
16.	i) Examine the major security assessment criteria used for evaluating secure operating systems. (8) (ii) Analyze the effectiveness of these assessment criteria in modern computing environments with suitable examples. (8)	BTL4	Analyzing	CO4
17.	Analyze the Denning's Lattice Model and Bell-LaPadula Model with suitable examples, and discuss their role in ensuring information security. (16)	BTL4	Analyzing	CO4
UNIT-5 SECURITY IN OPERATING SYSTEM				
UNIX Security - UNIX Protection System - UNIX Authorization - UNIX Security Analysis - UNIX Vulnerabilities Windows Security Windows Protection System Windows Authorization -Windows Security Analysis - Windows Vulnerabilities.				
PART-A				
1.	Define UNIX security.	BTL1	Remembering	CO5

2.	What is the UNIX protection system?	BTL1	Remembering	CO5
3.	Define UNIX authorization.	BTL1	Remembering	CO5
4.	What are file permissions in UNIX?	BTL1	Remembering	CO5
5.	Differentiate between authentication and authorization in UNIX.	BTL2	Understanding	CO5
6.	What is UNIX security analysis?	BTL1	Remembering	CO5
7.	Define UNIX vulnerabilities.	BTL1	Remembering	CO5
8.	List any four common UNIX vulnerabilities.	BTL1	Remembering	CO5
9.	Define Windows security.	BTL1	Remembering	CO5
10.	What is the Windows protection system?	BTL1	Remembering	CO5
11.	Define Windows authorization.	BTL1	Remembering	CO5
12.	What is an Access Control List (ACL)?	BTL1	Remembering	CO5
13.	Define Security Identifier (SID).	BTL1	Remembering	CO5
14.	What is User Account Control (UAC)?	BTL1	Remembering	CO5
15.	Define Windows security analysis.	BTL1	Remembering	CO5
16.	What are Windows vulnerabilities?	BTL1	Remembering	CO5
17.	List any four common Windows vulnerabilities.	BTL1	Remembering	CO5
18.	Differentiate between UNIX and Windows security.	BTL2	Understanding	CO5
19.	Explain the principle of least privilege?	BTL2	Understanding	CO5
20.	Define discretionary access control in UNIX.	BTL1	Remembering	CO5
21.	What is mandatory access control?	BTL1	Remembering	CO5
22.	What is privilege escalation?	BTL1	Remembering	CO5
23.	State the importance of security auditing in operating systems.	BTL1	Remembering	CO5
24.	List any two methods to protect an operating system from vulnerabilities.	BTL2	Understanding	CO5
PART-B				
1.	(i) Identify the basic security architecture and security mechanisms of UNIX operating systems. (8) (ii) Identify the major components and features of UNIX security architecture. (8)	BTL3	Applying	CO5
2.	Analyze the UNIX protection system and explain UNIX file permissions with suitable examples. (16)	BTL4	Analyzing	CO5
3.	Analyze the UNIX authorization mechanisms and user authentication process. (16)	BTL4	Analyzing	CO5
4.	(i) Analyze the process and importance of UNIX security analysis. (8 Marks) (ii) Analyze common vulnerabilities in UNIX systems and their impact. (8)	BTL4	Analyzing	CO5
5.	Apply the Windows security architecture and its security features. (16)	BTL3	Applying	CO5
6.	Analyze the Windows protection system with a neat diagram. (16)	BTL4	Analyzing	CO5
7.	Analyze the Windows authorization, Access Control Lists (ACLs), and Security Identifiers (SIDs). (16)	BTL4	Analyzing	CO5

8.	(i) Analyze the process and importance of Windows security analysis. (8) (ii) Analyze the major methods used to enhance Windows security. (8)	BTL4	Analyzing	CO5
9.	Explain the common Windows vulnerabilities and suggest suitable countermeasures. (16)	BTL4	Analyzing	CO5
10.	Apply the UNIX security and Windows security with suitable examples. (16)	BTL3	Applying	CO5
11.	Analyze the protection mechanisms available in UNIX and Windows operating systems. (16)	BTL4	Analyzing	CO5
12.	Analyze the authorization mechanisms in UNIX and Windows operating systems. (16)	BTL4	Analyzing	CO5
13.	(i) Analyze the major security vulnerabilities of UNIX operating systems. (8) (ii) Analyze the major security vulnerabilities of Windows operating systems. (8)	BTL4	Analyzing	CO5
14.	Analyze the role of Access Control Lists (ACLs) and file permissions in operating system security. (16)	BTL4	Analyzing	CO5
15.	(i) Analyze the importance and process of security auditing in operating systems. (8 Marks) (ii) Analyze the vulnerability assessment and its role in identifying and reducing security risks. (8 Marks)	BTL4	Analyzing	CO5
16.	(i) Analyze the security features and protection mechanisms of UNIX in protecting system resources. (8) (ii) Analyze the security features and protection mechanisms of Windows in protecting system resources. (8)	BTL4	Analyzing	CO5
17.	Analyze the role of authentication and authorization in securing UNIX and Windows operating systems.	BTL4	Analyzing	CO5

Staff Prepared By
[Ms.DEEPIKA T]

HOD
[Dr.S.Parthasarathy]