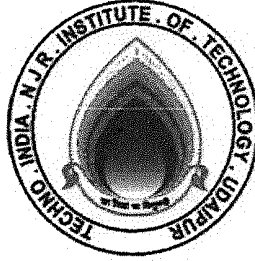


Techno India NJR Institute of Technology



Course File

Operating Systems (5CS4- 03)

Gaurav Kumawat
(Assistant Professor)
Department of CSE

For Techno India NJR Institute of Technology
पंकज पौरवाण
Dr. Pankaj Kumar Perwa
(Principal)



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year-V Semester: B.Tech. Computer Science and Engineering

SCS4-03: Operating System

Credit: 3

Max. Marks: 150(LA:30, ETE:120)

3L+0T+0P

End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	Introduction and History of Operating systems: Structure and operations; processes and files Processor management: inter process communication, mutual exclusion, semaphores, wait and signal procedures, process scheduling and algorithms, critical sections, threads, multithreading	04
3	Memory management: contiguous memory allocation, virtual memory, paging, page table structure, demand paging, page replacement policies, thrashing, segmentation, case study	05
4	Deadlock: Shared resources, resource allocation and scheduling, resource graph models, deadlock detection, deadlock avoidance, deadlock prevention algorithms Device management: devices and their characteristics, device drivers, device handling, disk scheduling algorithms and policies	15
5	File management: file concept, types and structures, directory structure, cases studies, access methods and matrices, file security, user authentication	07
6	UNIX and Linux operating systems as case studies; Time OS and case studies of Mobile OS	08
	Total	40

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Course Overview:

To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that is becoming vital now-a-days.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Synthesis	Students will be able to understand principles of operating systems, design and implementations, Understand the various components and functions of an operating system.
2	Synthesis	Students will be able to analyse and apply suitable Process Scheduling Algorithm and Memory Partition Techniques, Apply appropriate techniques to avoid control problems such as mutual exclusion and deadlocks
3	Design	Students will be able to memorize deadlock, Methods for handling deadlocks and memory management strategies
4	Synthesis	Students will be able to gain the knowledge of memory management algorithm and CPU scheduling techniques. Implement and evaluate operating system components in Windows and Unix environments
5	Synthesis	Students will be able to understand and memorize various file and disk management strategies.

Prerequisites:

1. Strong programming skills (Knowledge of C), elementary data structures and algorithms, computer architecture and an introduction to concurrency

Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcomes (PO's)												
	CO. NO.	Domain Specific (PSO)					Domain Independent (PO)						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	0	1	1	0	0	0	0	2	
CO2	3	2	1	3	2	1	1	0	0	0	0	2	
CO3	3	2	1	2	1	1	1	0	0	0	0	2	
CO4	3	2	1	2	1	1	1	0	0	0	0	2	

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CO5	3	2	1	3	2	1	1	0	0	0	0	2
1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)												

Course Coverage Module Wise:

Lecture No.	Unit	Topic
1.	1	Introduction to OS
1.	2	History of Operating systems:
1.	2	Structure and operations;
1.	2	processes and files
1.	2	Processor management
1.	2	inter process communication
1.	2	mutual exclusion
1.	2	Semaphores
1.	2	wait and signal procedures,
1.	2	process scheduling
1.	2	process scheduling and algorithms,
1.	2	critical section
1.	2	threads, multithreading
1.	3	Memory management: contiguous memory allocation
1.	3	virtual memory
1.	3	Paging
1.	3	page table structure,
1.	3	demand paging
1.	3	page replacement policies
1.	3	thrashing,
1.	3	Segmentation

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1.	4	Deadlock: Shared resources
1.	4	resource allocation and scheduling
1.	4	resource graph models
1.	4	deadlock detection
1.	4	deadlock avoidance
1.	4	deadlock prevention algorithms
1.	4	Device management: devices and their characteristics
1.	4	device drivers
1.	4	device handling
1.	4	disk scheduling algorithms and policies
1.	5	File management: file concept, types and structures
1.	5	directory structure
1.	5	access methods and matrices
1.	5	file security
1.	5	user authentication
1.	6	UNIX and Linux operating systems as case studies;
1.	6	Time OS
1.	6	Mobile OS
1.	6	Time OS and case studies of Mobile OS

TEXT/REFERENCE BOOKS

1. A. Silberschatz and Peter B Galvin: Operating System Principals, Wiley India Pvt. Ltd.
2. Achyut S Godbole: Operating Systems, Tata McGraw Hill
3. Tanenbaum: Modern Operating System, Prentice Hall.
4. DM Dhamdhere: Operating Systems – A Concepts Based Approach, Tata McGraw Hill
5. Charles Crowley: Operating System A Design – Oriented Approach, Tata McGraw Hill.

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CO.NO.	Problem description
1	A. Understand the basic functions of operating systems. B. In depth knowledge of the algorithms used for implementing the tasks performed by the operating systems
2	A. Simulation of Scheduling algorithms used for the tasks performed by the operating systems B. Simulation of Deadlock algorithms used for the tasks performed by the operating systems
3	A. Simulation of Memory Management algorithms used for the tasks performed by the operating systems
4	A. Simulation of File System used for the tasks performed by the operating systems
5	A. The simulation results such as average latency, hit & Miss Ratios or other performance parameters computation.

Assessment Methodology:

1. Theoretical Viva in the class once in a week
2. Assignments one from each unit.
3. Final paper at the end of the semester subjective.

Teaching and Learning resources unit-wise:

Unit-1

A. Introduction to Operating System

Video Tutorials:

https://www.youtube.com/watch?v=vBURTt97EkA&ab_channel=NesoAcademy

Theory concepts: <https://www.geeksforgeeks.org/introduction-of-operating-system-set-1/>

Sample Quiz: <https://mcqslern.com/cs/operating-systems/mcq/introduction-to-operating-systems-multiple-choice-questions-answers.php>

Unit-2

A. Process

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Video Tutorials:

https://www.youtube.com/watch?v=OrM7nZcxXZU&list=PLBlnK6fEYqRgKI0Mbl6kb15ffNt7BF8Fn&ab_channel=NesoAcademy

Theory concepts: <https://www.geeksforgeeks.org/introduction-of-process-management/>

Sample Quiz: <https://mcqslearn.com/cs/operating-systems/mcq/process-description-and-control-multiple-choice-questions-answers.php>

B. Threads and Multithreading

Video Tutorials:

https://www.youtube.com/watch?v=LOfGJcVnvAk&ab_channel=NesoAcademy

Theory concepts: <https://www.geeksforgeeks.org/thread-in-operating-system/>

Sample Quiz: <https://mcqslearn.com/cs/operating-systems/mcq/threads-smp-and-microkernels-multiple-choice-questions-answers.php>

Unit-3

A. Memory Management

Video Tutorials: https://www.youtube.com/watch?v=UDPYpf-nsDY&ab_channel=TutorialsPoint%28India%29Ltd.

Theory concepts: <https://www.geeksforgeeks.org/memory-management-in-operating-system/>

Sample Quiz: <https://www.geeksforgeeks.org/operating-systems-gq/memory-management-gq/>

Unit-4

A. Deadlock

Video Tutorials:

https://www.youtube.com/watch?v=rWFH6PLOIEI&ab_channel=GateSmashers

Theory concepts: <https://www.geeksforgeeks.org/introduction-of-deadlock-in-operating-system/>

Sample Quiz: <https://www.sanfoundry.com/operating-system-questions-answers-deadlock/>

B. Device Management

Video Tutorials:

https://www.youtube.com/watch?v=OAZ9DdEqoWQ&ab_channel=MiracleEducation

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Theory concepts: <https://www.geeksforgeeks.org/i-o-scheduling-in-operating-systems/>

Sample Quiz: <https://www.javatpoint.com/operating-system-mcq>

Unit-5

A. Unix/Linux OS and Time OS

Video Tutorials:

https://www.youtube.com/watch?v=_OHi608AbeA&list=PLVIQHNRLfIP8WncRgkwFqTOzRf_GSgl00&ab_channel=NareshiTechnologies

https://www.youtube.com/watch?v=YQZbIT9FcUk&ab_channel=GateSmashers

Theory concepts: <https://www.geeksforgeeks.org/features-of-unix/>

Sample Quiz: <https://mcqslearn.com/cs/operating-systems/mcq/operating-system-overview-multiple-choice-questions-answers.php>

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Computer Science & Engineering

B. Tech II Year (III Sem)

OBJECT ORIENTED PROGRAMMING

Assignment 1

Answer all questions. Each questions carries 5 marks.

1. Explain Data types in C++, and explain different types of operators. [CO1]
2. What do you mean by Structure? Explain with suitable example. How does object oriented programming differs from procedure-oriented programming. [CO1]
3. What is friend function in C++? What are the risks associated with the use of friend functions? [CO2]
4. Explain the concept of classes and object, write the syntax of both and give suitable example [CO2]
5. What is Constructor in C++? Explain different types of constructors with suitable example. [CO3]
6. Explain the concept of destructor, what is the role of destructor and when shall it be used? [CO3]

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Computer Science & Engineering

B. Tech II Year (III Sem)

OBJECT ORIENTED PROGRAMMING

Assignment 2

Answer all questions. Each questions carries 5 marks.

1. Define Inheritance. Explain all types of inheritance with the help of example. [CO3]
2. Explain Virtual Base class with the help of suitable example [CO3]
3. Explain the concept of virtual function [CO4]
4. What is polymorphism? What is the difference between Compile time & Run time polymorphism? Explain compile time polymorphism in detail. [CO4]
5. What do you mean by file handling? What are the different Stream classes of file handling? Explain with an example [CO5]
6. What is exception handling? Explain try, throw & catch mechanism with suitable example. [CO5]

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Computer Science & Engineering

B. Tech II Year (III Sem)

OBJECT ORIENTED PROGRAMMING

Viva-Voce Set of Questions

1. Explain what is a class in C++?
2. How can you specify a class in C++?
3. Explain what is the use of void main () in C++ language?
4. Explain what is C++ objects?
5. Define Constructors?
6. What is the difference between C & C++?
7. What do you mean by implicit conversion?
8. What is the difference between class and structure?
9. What is dynamic binding?
10. What is difference between function overloading and operator overloading?
11. What is friend function?
12. What is an iterator?
13. What are the differences between new and malloc?
14. What is an explicit constructor?
15. What do you mean by inline function?
16. What is the difference between a copy constructor and an overloaded assignment operator?
17. What is class invariant?
18. Define Encapsulation in C++?
19. Define access specifier and its various types in C++
20. Define a namespace?
21. Define a class template?
22. Define storage class in C++? Name some?
23. Explain 'this' pointer?
24. What does a Static member in C++ mean?
25. Define the Reference variable?
26. Define an Abstract class in C++?
27. Can we have a String primitive data type in C++?
28. Can we use access specifiers to achieve data hiding in C++?
29. Define Block scope variable?
30. What are the functions of the scope resolution operator?

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Computer Science & Engineering
B. Tech II Year (III Sem)
OBJECT ORIENTED PROGRAMMING

Quiz

Time: 15 Mins

Attempt all questions. Each questions carries 1 mark. No negative marking.

1. C++ was developed by ____
 - (A) Thomas Kushz
 - (B) John Kemney
 - (C) Bjarne Stroutstrup
 - (D) James Goling
2. Which one of the following is a keyword?
 - (A) Size
 - (B) Key
 - (C) Jump
 - (D) Switch
3. ____ is the smallest individual unit in a program
 - (A) Variable
 - (B) Control
 - (C) Character
 - (D) Token
4. Additive, Multiplicative, shift, Bitwise logical and assignment operators is ____ operator.
 - (A) Conditional

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- (B) Relational
 - (C) Unary
 - (D) Binary
5. ____ is a sequence of characters surrounded by double quotes.
- (A) Constant
 - (B) Numeric
 - (C) Character
 - (D) String literal
6. Which operator requires one operand?
- (A) Unary
 - (B) Binary
 - (C) Ternary
 - (D) Both (a) and (b)
7. In a class specified, data or functions and designated private are accessible
- (A) Only to public members of class
 - (B) Only if you know the password
 - (C) To any function in the program
 - (D) To member functions of that class
8. The body of function contains ____
- (A) Return statement
 - (B) A variable declaration part
 - (C) Processing part
 - (D) All the above

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9. In which type of constant, the Decimal numbers, integer and floating-point are related?

(A) Numeric

(B) String

(C) Char

(D) Boolean

10. _____ are data items whose value cannot be changed.

(A) Class

(B) Return

(C) Constants

(D) Variable

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Computer Science & Engineering

B. Tech II Year (III Sem)

OBJECT ORIENTED PROGRAMMING

Quiz Answer Key

1. C
2. D
3. D
4. D
5. D
6. A
7. D
8. D
9. A
10. C

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Previous Year Question Papers:

RTU
paper

5E5105	Roll No. _____	Total No of Pages: 4
	5E5105 B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016 Computer Science & Engineering 5CS5A Operating Systems Common with CS, IT	

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

UNIT - I

- Q.1 (a) What are the different services provided by the operating system? Explain all of them in detail? [8]
- (b) What are the five major activities of an operating system with regard to file management? [8]

OR

- Q.1 (a) What are the two models of interprocess communication? What are the strengths & weakness of the two approaches? [8]
- (b) What are the difference between user level threads & kernel Level threads, under what circumstances is one type better than the other? [8]

[5E5105]

Page 1 of 4

[6680]

RTU
paper

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UNIT - II

- Q.2 (a) In – connection with interprocess communication explain the following: [8]
- (i) Race Condition
 - (ii) Critical Condition
 - (iii) Sleep & Wake up
 - (iv) Sleeping Barber's Problem
- (b) Define scheduling criteria? Explain Quencing diagram for the CPU scheduling in detail? [8]

OR

- Q.2 (a) Describe the difference between short term, medium term, & long term scheduling? [8]
- (b) Consider the following set of processes, with the arrival times and the CPU burst times given in milliseconds. [8]

PROCESS	ARRIVAL TIME	BURST TIME
P1	0	5
P2	1	3
P3	2	3
P4	4	1

What is the average turn around time for these processes with the preemptive shortest remaining process time first algorithm?

UNIT - III

- Q.3 (a) Explain Banker's Algorithm for deadlock avoidance with an example? [8]

[5E5105]

Page 2 of 4

[6680]

- (b) Apply deadlock detection algorithm to the following data & show the results: [8]

$$\text{Available} = (2, 1, 0, 0)$$

$$\text{Request} = \begin{pmatrix} 2 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 2 & 1 & 0 & 0 \end{pmatrix}$$

$$\text{Allocation} = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 2 & 0 & 0 & 1 \\ 0 & 1 & 2 & 0 \end{pmatrix}$$

OR

- Q.3 (a) With the help of neat diagram Explain Memory hierarchy in detail? [8]
 (b) Explain the difference between Paging & Segmentation? [8]

UNIT - IV

- Q.4 (a) Write Short note on Page Replacement Algorithms in Detail? [8]
 (b) Let 620 frames are split between two processes, one of 100 pages & one of 1270 pages. Find the number of frames allocated for each process if proportional allocation method is used? [8]

OR

- Q.4 (a) What is Belady's Anamoly? In which algorithm does it occur? [8]
 (b) Consider the following segment table. [8]

SEGMENT	BASE	LENGTH
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

Calculate the physical address for the following logical addresses?

[5E5105]

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[6680]

UNIT - V

- Q.5 (a) Define file system? Explain file operations in detail? [8]
(b) Explain the classification of Allocation Methods? [8]

OR

- Q.5 (a) Explain the Concept of spooling with all its types and its advantages & disadvantages? [8]
(b) Suppose the head of moving head disk is currently servicing a request at track 60. If the queue of request is kept in FIFO order, what is the total head movement to satisfy these requests for the following disk scheduling algorithm: [8]
(i) FCFS
(ii) SSFT

REQUEST SEQUENCE	TRACK NUMBER
1	56
2	170
3	35
4	120
5	10
6	140

5E5105	Roll No. _____	Total No of Pages: 3
	5E5105 B. Tech V Sem. (Main/Back) Exam. Nov-Dec. 2015 Computer Science & Engineering 5CS5A Operating Systems Common with IT	

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks Main: 26

Min. Passing Marks Back: 24

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. NIL _____

2. NIL _____

UNIT-I

- Q.1 (a) What is need of BIOS? Explain Boot strop loader also. [8]
(b) Is there any difference between kernel level and user level threads? Justify your answer. [8]

OR

- Q.1 What are the benefits of threads? Explain context switching of processes and threads. [16]

UNIT-II

- Q.2 (a) What do you understand by semaphores? Can it be useful to solve reader – writer problem? Explain. [8]
(b) What are different algorithmic solutions of critical section problem? Explain. [8]

[5E5105]

Page 1 of 3

[6540]

OR

- Q.2 Compose FCFS, SJF and Round-Robin scheduling algorithms by computing average waiting time. There are 5 processes with CPU burst time as 10, 5, 17, 25, 6 and arrival times are 0, 1, 0, 2, 7 units. Assume time quantum for Round Robin scheduling as 5 units. [16]

UNIT-III

- Q.3 (a) What are the different deadlock prevention schemes? Explain. [8]
(b) Compare best Fit, worst fit and first fit memory allocation schemes. The given jobs are of memory sizes 13KB, 5KB only. [8]

Address	Size of free space
005	2
070	28
105	12
279	82
395	15

Show the allocated addresses and free space table after every job for all 3 schemes.

OR

- Q.3 (a) Write and explain Banker's algorithm for deadlock avoidance. [8]
(b) There are 2 jobs of sizes 25 and 12 to be allocated memory. The free space table is - [8]

Address	Size
005	02
009	17
210	89
383	13
490	11

Apply best fit, first fit and worst fit schemes and show allocated addresses and free space table after allocation.

UNIT-IV

- Q.4 (a) Is there any difference between pure paging and demand paging? Explain. [8]
(b) Compute page fault ratio. The pages referenced are 7, 5, 2, 1, 7, 5, 4, 5, 1, 2, 5, and 7 (12pages). The job is allowed 3 blocks. Compare LRU & FIFO page replacement schemes. [8]

OR

- Q.4 (a) Compute number of page faults for LRU, FIFO and optimal page replacement algorithms. The given page trace is 7, 5, 1, 2, 7, 4, 5, 4, 5, 4, 5, 7 (12 pages). The job is allowed 3blocks in primary memory. [8]
(b) What do you understand by Belady's Anomaly? Explain. [8]

UNIT-V

- Q.5 (a) Explain various features of file system of linux. [8]
(b) Compare FCFS and SSTF disk scheduling algorithms. Initially the Read/Write Head is at 50. The requests are. 63, 52, 01, 93, 72, 13, 81, 54, (8requests). Compute total movement of R/W Head. [8]

OR

- Q.5 (a) Explain various file system features of windows operating system. [8]
(b) Compare SCAN and C - SCAN disk scheduling algorithms. Read write Head is at 45. The requests are 63, 52, 01, 93, 72, 13, 81, and 54 (8 requests). Compute total movement of R/W Head. [8]

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(Principal)