

COMP 5 – 6 (RC)

T.E.(Comp.) (Semester – V) (RC – 2007 – 08) Examination, May/June 2018 OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

Instruction : Answer any five full questions by answering atleast one from each Module.

MODULE – 1

1. a) Explain the batch operating system and real time operating system. 6
- b) What do you understand by a critical section ? Explain. 4
- c) Write a short note on multithreading. 4
- d) Consider the following processes : 4

Process Arrival Time CPU Time

P₀

0

6

P₁

2

2

P₂

1.5

4

P₃

1.7

3

P₄

3

1

Using the preemptive shortest remaining time next algorithm, draw the Gantt chart and find the average waiting time and average turn around time. 6

2. a) What is a semaphore ? Give the implementation of the producer-consumer problem using semaphores. 6
- b) Draw and explain the process model with two suspend states. List and explain all the state transitions. 8
- c) What do you understand by critical section and critical region ? 6

MODULE – 2

3. a) Explain deadlock prevention in detail. 6
- b) With a neat diagram explain the inverted page table. 6

P.T.O.

c) Consider the following snapshot of a system :

Process	Max					Allocation				
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₁	R ₂	R ₃	R ₄	R ₅
P ₀	7	3	1	0	2	4	1	1	0	0
P ₁	3	4	0	1	1	2	2	0	0	1
P ₂	6	6	2	2	0	5	6	2	0	0
P ₃	8	4	5	1	1	7	2	4	1	0
P ₄	4	7	3	4	3	2	6	2	2	3
P ₅	9	8	5	1	2	8	3	4	0	0

Total instances of each resource type are :

$$R_1 = 33, R_2 = 24, R_3 = 17, R_4 = 8, R_5 = 8.$$

Using the Banker's algorithm :

- i) Calculate the need matrix and the available vector.
 - ii) Is the system in a safe state ? If yes, find the safe sequence.
 - iii) If P₄ makes an additional resource request of (0, 1, 1, 1, 0), can the request be granted immediately ?
4. a) List the different page replacement algorithms. Explain any three with examples. 12
- b) Differentiate between internal and external fragmentation. 4
- c) Explain the different deadlock recovery techniques. 4

MODULE – 3

5. a) Discuss the basic file operations.
- b) A disk has a total of 250 cylinders numbered from 0 – 249. The disk arm is currently at cylinder number 182. The queue of pending requests in FIFO order is

99, 10, 72, 143, 242, 89, 62, 87, 185, 221

Draw the arm movement chart and calculate the total head movement using :

- i) FCFS
- ii) SSTF
- iii) SCAN
- iv) LOOK
- v) C-LOOK



- c) Define the following terms :
- | | | |
|----------------|------------------------|---|
| i) CAV | ii) CLV | |
| iii) Seek Time | iv) Rotational Latency | 4 |
6. a) What are bad blocks ? Discuss the different methods to handle them. 6
- b) Describe the different directory structures. 8
- c) Discuss the different steps in DMA transfer. 6
- MODULE – 4
7. a) Explain the different malicious software. 8
- b) Write a shell program to compute the factorial of a number. 6
- c) Explain in detail the following shell command :
- Chmod 442 xyz.sh
8. a) With the help of examples, write shell commands to convert decimal numbers to :
i) Binary ii) Octal 6
iii) Hexadecimal 6
- b) Discuss the different types of threats. 8
- c) Write a shell program to :
i) Compute the fibonacci series
ii) Check whether a given year is a leap year or not.
-

COMP 5 – 6 (RC) 2007-08

T.E. (Comp.) Semester – V (RC 2007-08) Examination, Nov./Dec. 2017 OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

Instruction: Answer **any five full questions by selecting atleast one from each Module.**

MODULE – 1

1. a) With a neat diagram explain the process model with two suspend states. List and explain the different state transitions. 8
- b) What are real time systems ? Explain with examples the different real time systems. 6
- c) Consider the following processes : 6

Process	Arrival Time	Burst Time	Priority
A	0	5	4
B	2	7	2
C	3	3	1
D	8	6	3
E	9	2	5

Using the preemptive priority – based scheduling algorithm, draw the Gantt chart and find the average waiting time and average turnaround time.

2. a) Give and explain the different implementations to achieve mutual exclusion. 10
- b) Implement the Reader's – Writer's problem using Semaphores. 6
- c) Write a short note on multi-threading. 4

MODULE – 2

3. a) List the different page replacement algorithms. Explain any three with examples. 12
- b) Explain hierarchical paging and inverted page table with examples. 8

4. a) Consider the following shopsheet of a system

Process

	Max					Allocation				
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₁	R ₂	R ₃	R ₄	R ₅
P ₀	7	3	1	0	2	4	1	1	0	0
P ₁	3	4	0	1	1	2	2	0	0	1
P ₂	6	6	2	2	0	5	6	2	0	0
P ₃	8	4	5	1	1	7	2	4	1	0
P ₄	4	7	3	4	3	2	6	2	2	3
P ₅	9	8	5	1	2	8	3	4	0	0

Total instances of each resource type are :

$$R_1 = 33, R_2 = 24, R_3 = 17, R_4 = 8, R_5 = 8$$

Using the Banker's algorithm :

- i) Calculate the need matrix and the available vector.
- ii) Is the system in a safe state ? If yes, find the safe sequence.
- iii) If P₀ makes an additional resource request of (1, 0, 0, 1, 1), can the request be granted immediately ?

- b) Differentiate between internal and external fragmentation. What do you understand by segmentation ?
- c) Explain deadlock prevention in detail.

MODULE - 3

5. a) Discuss the different steps in DMA transfer.
- b) A disk has a total of 250 cylinders numbered from 0 – 249. The disk arm is currently at cylinder number 36. The queue of pending requests in FIFO order is 93, 177, 22, 46, 193, 219, 4, 231, 98, 72
- Draw the arm movement chart and calculate the total head movement using :
- i) FCFS
 - ii) SSTF
 - iii) SCAN
 - iv) LOOK
 - v) C-SCAN
- c) Define the following terms :
- i) CAV
 - ii) CLV
 - iii) Seek Time
 - iv) Rotational Latency



- | | | |
|----|---|---|
| 6. | a) What are bad blocks ? Discuss the different techniques to handle them. | 6 |
| | b) Describe the different directory structures. | 8 |
| | c) Discuss the basic file operations. | 6 |

MODULE – 4

- | | | |
|----|--|---|
| 7. | a) Discuss the different types of threats. | 6 |
| | b) Write a shell program to : | 8 |
| | i) Compute the Fibonacci series. | |
| | ii) Check whether a given year is a leap year or not. | |
| | c) Write a shell program to compute the factorial of a number. | 6 |
| 8. | a) With the help of examples, write shell commands to convert decimal numbers to : | |
| | i) Binary | 6 |
| | ii) Octal | |
| | iii) Hexadecimal | |
| | b) Explain in detail the following shell command
Chmod 442 abc.sh | 6 |
| | c) Explain the different malicious software. | 8 |

T.E. (Computer) (Semester – V) (RC) Examination, May/June 2017
OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

Instruction: Answer any five full questions selecting atleast one from each Module.

MODULE – I

1. a) Explain the different schemes of clustering along with the advantages and disadvantages associated with each type. 4
- b) What are the benefits of multi threaded programming ? Explain in detail. 3
- c) If a set of processes have the following arrival time and CPU time (in milliseconds) :

Process	Arrival time	CPU time
P ₁	0.12	2
P ₂	0	2
P ₃	3	4
P ₄	1	3
P ₅	2.3	1
P ₆	2.4	2

Calculate the average waiting time and average turn around time using the Robin Robin Scheduling algorithm for a time slice = 1 milliseconds.

Draw the Gantt chart. 6

- d) Describe the structure used to represent a process by the operating system. 3
- e) Write an algorithm/pseudocode for two co-operating processes A and B that serves as a perfect solution to the critical section problem. Justify if all the conditions are satisfied. 4

2. a) Discuss how threads are handled by windows operating system. 4
- b) How can a new process be created ? Provide a suitable pseudocode and explain the function of fork() system call used to create a new process. 5
- c) How is time sharing a logical extension of multiprogramming ? Explain the concept of multitasking in detail. 4

P.T.O.

COMP 5-6(RC)

d) Consider the following set of processes :

Process	Arrival time	CPU time	Priority
P ₁	6	1	1
P ₂	1	2	7
P ₃	2	3	3
P ₄	1	5	3
P ₅	4	5	2

Determine the average waiting time and average turn around time using shortest remaining time next algorithm. Draw the Gantt chart.

- e) What is a monitor ? Describe the structure of a monitor used to allocate a single resource among competing processes.

MODULE - II

3. a) Consider the following system :

Process	Allocated				Max				Available			
	R ₁	R ₂	R ₃	R ₄	R ₁	R ₂	R ₃	R ₄	R ₁	R ₂	R ₃	R ₄
P ₁	0	0	1	2	0	0	1	2	2	1	0	0
P ₂	2	0	0	0	2	7	5	0				
P ₃	0	0	3	4	6	6	5	6				
P ₄	2	3	5	4	4	3	5	6				
P ₅	0	3	3	2	0	6	5	2				

- i) Compute the NEED matrix.
- ii) Is the system in a safe state ? If yes determine the safe sequence.
- iii) Can a request (0, 1, 0, 0) from P₃ be granted safely ? Show the system state after the request has been granted and check if a safe sequence of execution can be obtained.
- b) Illustrate with an example the working set model used to examine page references. Consider the working set window to include 10 memory references.
- c) With the help of a suitable diagram explain the method of paging using a translation lookaside buffer.

- d) Consider a demand paged system where integers are stored in 4 bytes, pages are 256 bytes, LRU page replacement is used and each process is allocated 3 frames.

A process executes the following code :

```
int a[200][200], j, i;
i = 0;
j = 0;
while (i++ < 200)
{
    j = 0;
    while (j++ < 200)
        a[i][j] = 0;
}
```

How many pages are needed for the array assuming all elements are stored in contiguous locations ?

4. a) Consider a process that records the following logical address sequence : 6

0144, 0211, 0345, 0789, 0912, 0113, 0487, 0389, 0645, 0213, 0341, 0222, 0681

Using FIFO and optimal page replacement algorithms find the number of page faults generated and justify which algorithm is more efficient.

Consider number of frames = 3 and page size = 100 bytes.

- b) Explain the methods of memory allocation. Provide suitable examples of each. 4

- c) Differentiate between equal and proportional allocation methods using suitable examples. 3

- d) Draw a resource allocation graph for the following case :

Processes = {P₁, P₂, P₃}

Resource = {R₁, R₂, R₃, R₄}

Edges = {P₁ → R₁, P₂ → R₃, R₁ → P₂, R₂ → P₂, R₂ → P₁, R₃ → P₃}

Resource instances : R₁ = 1, R₂ = 2, R₃ = 1, R₄ = 3

- i) Convert the graph into a process wait for graph and check if a deadlock exists. If yes identify the deadlocked cycles.

- ii) If P₃ requests an instance of R₂ can a deadlock occur ? Represent the scenario.

- e) A system that uses a 2 level page table has 2¹² bytes pages and 32 bit virtual addresses. The first 8 bits of the address serve as an index into the first level page table.

- i) How many bits specify the second level index ?

- ii) How many maximum entries can level one page table have ?

Justify your answers.

3

5. a) Write a short note on file management in UNIX.
 b) Discuss the structure of an acyclic graph directory along with the advantages and disadvantages associated with its implementation.
 c) List the factors associated with selection of a disk scheduling algorithm.
 d) A disk has 200 cylinders and the disk arm is currently at cylinder 80. The previous read was at 122 and the pending requests are in the following order : 185, 15, 195, 65, 157, 170, 85, 91, 20

Draw the arm movement chart and calculate the total head movement using :

- i) C-SCAN ii) C-LOOK iii) SSTF iv) SCAN

6. a) Provide a detailed analysis of tree structured directories.
 b) How does UNIX operating system translate an application request for an I/O operation to network devices or disk sectors ?
 c) Explain the implementation of open and close operations in a UNIX environment.
 d) Does shortest seek time cause starvation of requests ? Justify your answer with a suitable example.
 e) What are bad blocks ? Explain in detail.

MODULE - IV

7. a) How are directories structured in Linux ? Explain.
 b) What is an access matrix ? Explain the various methods of implementing an access matrix.
 c) Write a shell script that displays a special listing showing the permissions, size, filename, last modification time, last access time of the filename supplied as input.
 d) Write a short note on system threats that result in misuse of system resources.
8. a) How is I/O redirection provided in Linux ? Explain with an example.
 b) Explain the use of the following commands :
 i) egrep ii) kill
 c) What are internal and external commands ? How will you determine if a command is internal or external ?
 d) Device a shell script to print the multiplication table of a number accepted from the user.
 e) Compare features of Windows and Linux.

T.E. (Computer) (Semester – V) (RC)
Examination, November/December 2016
OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

- Instructions:** 1) Answer **any five** questions selecting atleast **one** question from **each Module**.
 2) **Each** question carries **equal** marks.

MODULE – I

1. a) Provide a detailed description of special purpose operating systems used with rigid time constraints. 5
- b) What are scheduling queues ? With the help of a queuing diagram explain the concept of scheduling processes. 5
- c) How can a new process be created ? Provide a suitable Pseudo code and explain the function of fork () system call used to create a new process. 5
- d) Consider the following set of processes 5

Process	Arrival time	CPU time	Priority
P ₁	6	1	1
P ₂	1	2	7
P ₃	2	3	3
P ₄	1	5	3
P ₅	4	5	2

Determine the average waiting time and average turnaround time using a time slice = 1 unit and Round Robin scheduling algorithm.

Draw the Gantt Chart. 5

2. a) What are the actions taken by the Kernel to switch context between processes ? Provide a suitable diagram to support your answer. 4
- b) Compare swap with test and set instruction with the help of a pseudo code. Explain how test and set satisfies the criteria of a good solution to the critical section problem for n processes. 6
- c) Discuss the various multithreading models with respect to thread implementation. 4

COMP 5 – 6 (RC)

-2-

- d) Consider the following set of processes

Process	Arrival time	CPU time
A ₁	0.0	6
A ₂	0.5	4
A ₃	1.0	2
A ₄	1.0	2
A ₅	2	4

- i) Using the method of shortest remaining time next determine the average waiting time and average turn around time. Draw the Gantt chart.
- ii) Schedule the processes using the non preemptive implementation of shortest remaining time next.

MODULE – II

3. a) With the help of an example explain the hierarchical paging scheme for structuring the page table.
- b) What are the causes of thrashing ? How can the effects of thrashing be reduced ?
- c) A snapshot of resources of a system allocated to different processes is given below :

Total instances available of each resource type are :

$$R_1 = 10, R_2 = 5, R_3 = 7$$

Process	Allocated			Max.		
	R ₁	R ₂	R ₃	R ₁	R ₂	R ₃
P ₀	0	1	0	7	5	3
P ₁	2	0	0	3	2	2
P ₂	3	0	2	9	0	2
P ₃	2	1	1	2	2	2
P ₄	0	0	2	4	3	3



8

3

4

8

4

4

3

4

4

5

4

- i) Compute the NEED matrix.
 - ii) Is the system is a safe state ? If yes determine the safe sequence.
 - iii) Can a request of resources (1, 0, 2) by P_1 be granted immediately ? Justify your answer. Also check if the system is in a safe state after granting the request.
- d) Consider a logical address space of 12 pages of 1024 bytes each mapped onto a physical memory of 64 frames. What would be the minimum number of bits in the logical address and physical address ? What would be the size of the physical memory ?
4. a) Describe the hashed page table structure.
- b) Consider the following logical addresses generated by a process with a page size of 100 bytes and 3 page frames.
0100, 0432, 0101, 0612, 0102, 0103, 0104, 0101, 0611, 0102, 0103, 0104, 0101, 0610, 0102, 0103, 0104, 0101, 0609, 0102, 0105.
- Determine the number of page faults generated using
- i) Least recently used algorithm.
 - ii) Optimal page replacement algorithm.
- c) A process has a reference string of length p with n distinct page numbers. If the number of page frames is m (initially empty). What will be lower bound and upper bound of the page faults ? Justify your answer.
- d) How is demand paging different from pure demand paging ?

MODULE – III

5. a) Does shortest seek time first cause starvation of requests ? Justify your answer with a suitable example.
- b) Explain the implementation of open and close operations in a UNIX environment.
- c) Describe the elevation algorithm with a suitable example.
- d) How does the UNIX operating system translate an applications request for an I/O operation to network devices or disk sectors ? Explain in detail.
- e) List the common file types and the functions associated with each type. How are file types implemented by various operating systems ?

COMP 5 – 6 (RC)

6. a) Write a short note on Unix file management.
- b) Suppose a disk drive has 2500 cylinders numbered from 0 to 2499. The drive is currently serving a request at cylinder 143 and the previous request was at cylinder 125. The queue of pending request in FIFO order is 80, 400, 2300, 1500, 1050, 2411, 100, 1888, 1580, 1700 starting from the current head position. What is the total distance that the disk arm moves to satisfy all pending requests for each of the following algorithms ?
- C-SCAN
 - LOOK
 - C-LOOK
 - SSTF
 - SCAN

Draw the arm movement chart.

- c) Discuss the various issues of allowing an operating system to support multiple file structures.
- d) Define the following in context to hard disks :
- CLV
 - CAV

MODULE – IV

7. a) What are the various types of threats that result in misuse of operating system resources and user files ? Explain in detail.
- b) Explain the following commands with examples :
- Chmod
 - ls ? at
- c) Write a shell script to determine if a given file exists or not, the file name is supplied as a command line argument.
- d) What are internal and external commands ? How are they different ? Provide examples of each type.
8. a) What is an access matrix ? With the help of suitable examples explain the various rights associated with domains and objects in an access matrix.
- b) Explain the following Linux commands.
- grep
 - tee
- c) Write a shell script to carry out sorting of a set of integers.
- d) Compare the features of Windows and Linux operating system.
- e) What are the UNIX finger and send mail utilities ?

T.E. (Computer) (Semester – V) (RC) Examination, May/June 2016
OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

MODULE – 1

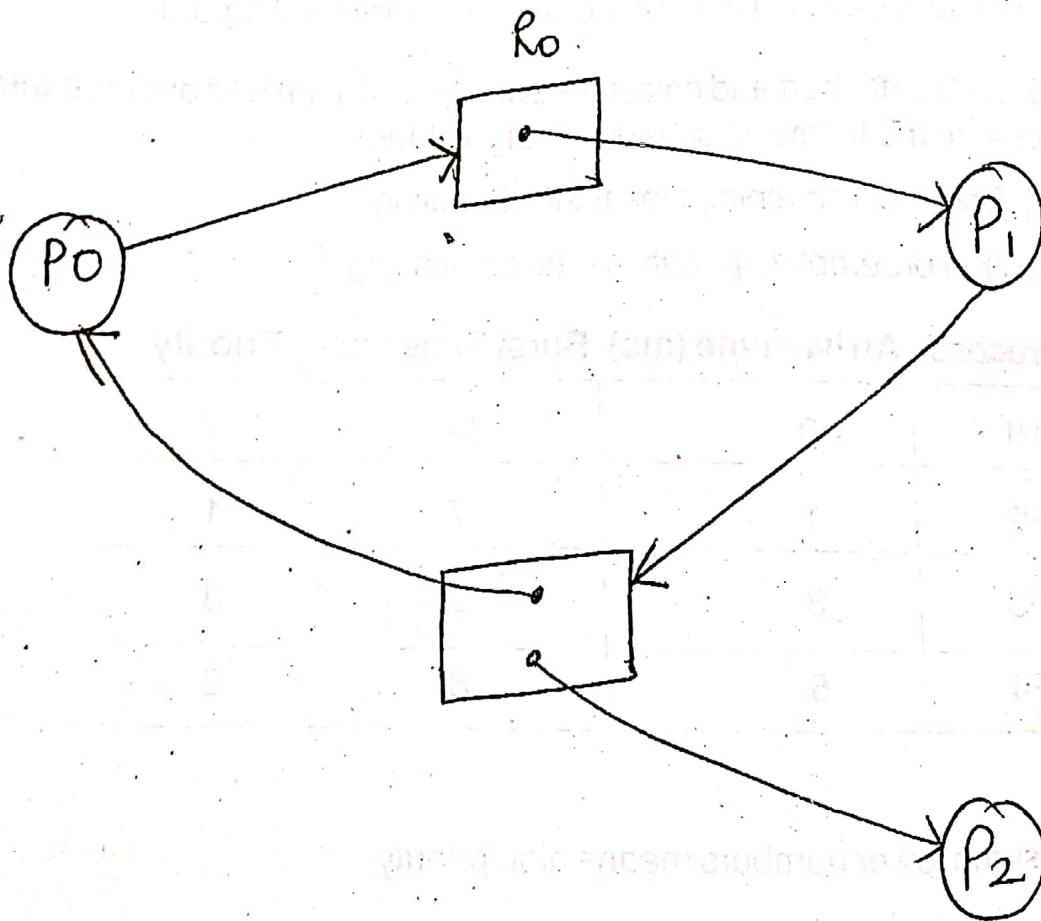
1. a) What is an operating system ? List and briefly explain any two operating systems known to you. 6
- b) Define critical section. How can we solve a critical section problem ? 8
- c) What is a semaphore ? State and explain the different types of semaphores. 6
2. a) Write a short note on real time scheduling. 6
- b) State and explain UNIX process state transition diagram. 6
- c) Draw Gantt chart and calculate average wait time and average turnaround time for the following scheduling algorithms.
 - i) Shortest remaining time first scheduling
 - ii) Non preemptive priority based scheduling. 8

Process	Arrival time (ms)	Burst Time (ms)	Priority
P1	0	14	7
P2	1	7	1
P3	3	2	3
P4	5	8	2

Assume lower numbers means high priority.

MODULE -2

3. a) Given memory partitions of 100Kb , 500 kb, 200 Kb, 300 Kb, 600 Kb. How would the first fit, best fit and worst fit algorithms place the process A : 215 Kb, process B : 418 Kb, process C : 113 Kb and process D : 428 Kb ?
- b) Can a process recover from deadlocks ? If so how does it accomplish it ?
- c) When do page fault occurs ? Describe the action taken by the operating system when page fault occurs.
4. a) Differentiate between a page and a frame.
- b) With the help of an example, explain LRU page replacement algorithm.
- c) What is multilevel paging ? What problem does it address ?
- d) Given the following resource allocation graph, draw the equivalent process waiting for graph. Is there a likelihood of a deadlock ? Justify your answer.



MODULE – 3

5. a) Discuss any 4 basic file operations. 8
 b) Describe acyclic graph directory structure. 6
 c) Discuss file allocation in UNIX file management. 6
6. a) Explain different steps in a DMA transfer. 6
 b) Explain any 2 key features of New Technology File System (NTFS). 6
 c) Is the following assertion true ? Justify your answer.
 "None of the disk scheduling disciplines, except FCFS, are truly fair (starvation may occur)". 4
 d) What is a buffer ? What is the significance of buffering ? 4

MODULE – 4

7. a) List the advanced antivirus techniques. Explain any one of them. 6
 b) Write a shell program to input two numbers from the user and display their product. 5
 c) Explain the following terms :
 i) Trojan Horse
 ii) Trapdoors. 6
 d) Write shell commands for the following :
 i) To display first 4 lines of a file
 ii) To change your password
 iii) To know your home directory. 3
8. a) Define intruders . State and explain the different classes of intruders. 6
 b) Write a shell script for the following menu :
 1) List of files
 2) Number of users of the system
 3) Todays date
 4) Quit to UNIX. 8
 c) What are the fundamental requirement addressed by computer security ? 6



COMP 5 – 6 (RC)

T.E. (Computer) (Semester – V) (RC) Examination, Nov./Dec. 2015 OPERATING SYSTEMS

Total Marks : 100

Duration : 3 Hours

Instruction : Attempt any five questions by selecting at least one question from each Module.

MODULE – 1

1. a) What is an operating system ? State its goals. 4
b) With the help of an appropriate diagram, explain process states and its transitions in a 5 state model. 8
c) What is priority inversion ? How can this problem be solved ? 4
d) Differentiate between preemptive and non preemptive scheduling. 4

2. a) Define Monitors. Write a solution to dining philosopher problem using monitors. 8
b) What do you mean by multithreading ? 4
c) Draw Gantt chart and calculate average wait time and average turnaround time for the following scheduling algorithms :
i) Preemptive priority based scheduling
ii) Shortest job first scheduling. 4

Process	Arrival Time (ms)	Burst Time (ms)	Priority
P ₁	1	2	3
P ₂	2	4	2
P ₃	2	1	1
P ₄	3	2	4

Assume lower numbers means high priority.

8



MODULE - 2

3. a) Explain paging as a memory management technique.
 b) How can we recover from deadlocks ?
 c) Consider the following snapshot of a system :

Processes	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	0	1	2	0	0	1	2	1	5	2	0
P1	1	0	0	0	1	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

Answer the following questions using the banker's algorithm :

- i) What is the content of the matrix need ?
 ii) Is the system in a safe state ? If so, find the safe sequence.

iii) Can a request (0, 4, 2, 0) from process P1 be granted immediately ?

4. a) Differentiate between external and internal fragmentation.
 b) What do you understand by the term fetch policy ?
 c) Write a point of difference between logical address space and physical address space.
 d) Consider the following page reference strings :

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

How many page faults will occur for the following page replacement algorithms ?
 Assume a set of 3 page frames.

- i) LRU
 ii) Optimal.

MODULE - 3

8

5. a) What are the different methods to handle bad blocks ?
 b) State the various file access methods.

6

6

- c) Define the following terms : 6
- i) Seek time 2
 - ii) Rotational latency. 6
- d) Suppose the disk has maximum 200 cylinders numbered from 0 to 199. The disk arm is currently at cylinder number 80 and the previous request was at 83. The queue of pending request in FIFO order is : 185, 15, 195, 65, 155, 85, 170, 90.
Starting from the current head position, what is the total head movement in tracks for each of the following disk scheduling algorithms ? 8
- i) Shortest seek time first 6
 - ii) SCAN. 6
6. a) How is swap space used ? Where is it located on a disk ? 6
- b) Write a short note on UNIX file management. 6
- c) Briefly explain the different directory structures. 8

MODULE – 4

7. a) What is digital immune system ? 6
- b) Write a shell script to find the area of a rectangle. 4
- c) Explain any two password selection strategies. 6
- d) Explain with an example the following shell commands : 4
- | | |
|----------|---------|
| i) Tail | ii) Who |
| iii) Man | iv) WC. |
8. a) Explain the purpose of salt in UNIX password protection technique. 3
- b) Write a shell script to print all prime numbers less than 20. 7
- c) What is a virus ? Explain the life cycle of a virus. 6
- d) Write shell commands for the following : 4
- i) To know the type of a file.
 - ii) To know your personal shell.
 - iii) To display the calender date of 21st January 2012.
 - iv) To change file permissions.

**T.E. (Computer) (Semester – V) (RC) Examination, May/June 2015
OPERATING SYSTEMS**

Duration : 3 Hours

Total Marks : 100

Instruction: Attempt any five questions by selecting atleast one question from each Module.**Module – I**

1. a) State and explain the readers and writers problem. Write a symbolic program or code for the same. 8
- b) Determine average waiting time and average turn around time using following scheduling algorithms :
 - i) Shortest Remaining Time Next (SRTN)
 - ii) Round Robin with time slice 3 units of time.7

Make use of Gantt charts. Assume lower number means higher priority. In case of tie use FCFS to break the tie.

Process	Arrival Time	Burst Time
P ₁	3	10
P ₂	1	04
P ₃	2	06
P ₄	0	12
P ₅	2	20

- c) Differentiate between Threads and Processes. 5

2. a) What is mutual exclusion ? What are the requirements for mutual exclusion. 6
- b) With the help of example explain Race condition. 4
- c) Explain and justify how multilevel queue scheduling different from multilevel feedback queue scheduling. 7
- d) Write short note on Monitors. 3

Module - II

3. a) Explain different steps in handling page fault.
- b) With the help of example explain what is deadlock? Also state and explain necessary conditions for deadlock.
- c) Consider following snapshot of a system and answer the following questions using Banker's algorithm.

Process	Allocated				Max				Available			
	R ₁	R ₂	R ₃	R ₄	R ₁	R ₂	R ₃	R ₄	R ₁	R ₂	R ₃	R ₄
P ₁	0	0	1	2	0	0	1	2	2	1	0	0
P ₂	2	0	0	0	2	7	5	0				
P ₃	0	0	3	4	6	6	5	6				
P ₄	2	3	5	4	4	3	5	6				
P ₅	0	3	3	2	0	6	5	2				

- i) Compute need matrix.
- ii) Is the system in safe state? Find safe sequence.
- iii) If a request from process P₃ arrives for (0, 1, 0, 0) can the request be granted immediately?

4. a) Write short note on Demand Paging. 4
- b) What is Belady's anomaly? Explain with an example. 6
- c) Explain multilevel paging and inverted page table. 6
- d) Differentiate between logical address space and physical address space. 4

Module - III

5. a) Write short note on windows file management. 8
- b) What is sector sparing? 6
- c) Write short note on DMA. 3
- d) What are bad blocks? What are the different methods to handle bad blocks? 5

- a) Write short note on unix file management.
 - b) Explain what do you mean by buffering and spooling with respect to Kernel I/O subsystem.
 - c) Suppose that a disk drive has 2500 cylinders numbered from 0 to 2499. The drive is currently serving the request at cylinder 143 and the previous request was at cylinder 125. The queue of pending request in FIFO order is : 80, 400, 2300, 1500, 1050, 2000, 100, 1888, 1580, 1700.

Starting from the current head position, what is the total distance that the disk arm moves to satisfy all pending requests for each of the following disk scheduling algorithms ?

Module – IV

7. a) Write short notes on :

 - i) Worms
 - ii) Access matrix

b) Explain following linux command :

 - i) pwd
 - ii) ls
 - iii) who

c) Write shell script to find simple interest values are to be taken from the user.

8. a) Explain types of threats.

b) Explain the use of chmod command in linux with an example.

c) Write shell script to print multiplication table of any number taken from the user.

d) What is digital immune system ?



COMP 5 – 6 (RC)

T.E. (Comp.) (Semester – V) (RC) Examination, Nov./Dec. 2014
OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

Instruction : Attempt **any five** questions by Selecting at least one question from each Module.

MODULE – I

1. a) Explain Bounded Buffer Producer consumer synchronization problem with implementation.
b) Solve the following using preemptive priority based scheduling algorithm. Draw Gantt chart and calculate wait time and turn around time of each job.

Job No.	Arrival Time	Execution Time	Priority
J ₁	1	2	3
J ₂	2	4	2
J ₃	2	1	1
J ₄	3	2	4

- c) Explain and justify how multilevel queue scheduling different from multilevel feedback queue scheduling.
d) What is critical section problem ?
- a) Draw and explain Microkernal architecture. List and explain advantages of Microkernal.
b) Write short note on windows threads.
c) What are Monitors ? How are they different from semaphores ? Explain.
d) Define essential properties of batch operating systems.

Q. 3. a) List different page Replacement Algorithms. Explain any two.

b) Write short note on Deadlock Recovery.

c) Consider following snapshot of a system and answer following questions using Banker's Algorithm.

i) Compute Need Matrix.

ii) Is the system in safe state?

iii) Find safe sequence.

iv) If a request from process P1 arrives for (0, 4, 2, 0); can the request be granted immediately.

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P ₀	0	0	1	2	0	0	1	2	1	5	2	0
P ₁	1	0	0	0	1	7	5	0				
P ₂	1	3	5	4	2	3	5	6				
P ₃	0	6	3	2	0	6	5	2				
P ₄	0	0	1	4	0	6	5	6				

- Q. 4. a) Explain with an example, Belady's Anomaly.
- b) Explain paging as a Memory Management technique.
- c) What is thrashing? How is it caused? How can it be eliminated?
- d) Write short note on Resident set Management.

- Q. 5. a) What is polling? Explain concept of Handshaking in I/O.
- b) Explain how file system management is done in linux operating system.

- c) On a disk with 200 cylinders membered from 0 – 199. Compute total head movement needed to satisfy all the requests in the disk queue. Assume that the disk is currently at track 100 and is moving in the direction of decreasing track number. The queue is FIFO order contains requests for the following :

TRACKS : 27, 129, 110, 186, 147, 41, 10, 64, 120.

Perform computation for the following scheduling algorithms.

8

i) FCFS

ii) SSTF

iii) SCAN.

6. a) Compare physical Formatting and Logical Formatting.

4

b) Describe Acyclic graph directory structure.

6

c) Explain different file access methods.

5

d) Write short note on Swap Space Management.

5

MODULE – IV

7. a) Write short notes on :

10

i) Viruses

ii) Digital Immune System.

b) Write shell program to check whether number entered by user is odd or even.

5

c) Write short note on windows security.

5

8. a) Write shell program to generate Fibonacci series upto "n" terms.

6

b) Explain shell commands given below with examples.

8

i) wc

ii) bc

iii) head

iv) cat

c) Write short notes on :

6

i) Intruders

ii) Security threats.



COMP 5 – 6 (RC)

T.E. (Comp.) (Sem. – V) (RC) Examination, Nov./Dec. 2013 OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

- Instructions :** 1) Answer any five questions by selecting at least one from each Module.
2) Assume appropriate data wherever necessary.

MODULE – I

1. a) What do you mean by Multitasking ? 2
 - b) Give the difference between a Thread and a Process. 3
 - c) Explain in detail a five-state process model with a diagram. 6
 - d) Differentiate between user-level and kernel-level threads. 5
 - e) Explain the criteria required for scheduling. 4
2. a) What are the requirements for mutual exclusion ? 6
 - b) Explain the dining philosopher problem. Give a solution using monitor. 6
 - c) Explain shortest remaining time policy. Differentiate it with Round Robin. 8

MODULE – II

3. a) Give any 3 mechanisms to recover from a deadlock. 6
 - b) With a neat diagram explain how paging process takes place. 6
 - c) Explain how deadlock can be detected by giving suitable example. 6
 - d) What is compaction ? 2
4. a) Discuss resident set management. 8
 - b) Explain multilevel paging and inverted page table. 7
 - c) How can paging performance improve by page buffering. 5

P.T.O.



MODULE - III

5. a) Discuss the 6 basic file operations.
b) Explain how file system management is done in linux operating system.
c) Explain briefly different directory structure.
6. a) Explain the process of disk formatting.
b) How is bad block recovery done ?
c) What is the difference between block-oriented devices and stream-oriented devices ?
d) Explain the following disk scheduling policies :
i) Short Service Time First
ii) Priority.
7. a) Discuss the types of threats.
b) Explain different Malicious software.
c) What are different phases of virus ? Explain.
8. a) Write a shell program to find factorial of a given number.
b) Write a shell script to generate the following pattern :

1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
6 6 6 6 6 6

MODULE - IV

- c) What is a digital Immune system ?
d) How do you display both date and time in the format dd-mm-yy hh:mm:ss ?



T.E. (Computer) (Semester – V) (RC) Examination, May/June 2013
OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

Instructions : 1) Answer any five questions by selecting at least one from each Module.

2) Sketch diagram wherever required.

3) Assume appropriate data wherever necessary.

MODULE – I

1. a) Define the essential properties of following types of operating systems.
 - i) Time sharing system
 - ii) Batch systems.
- b) Explain Process Control Block in detail.
- c) Explain user level threads and Kernel level threads.
- d) List any two benefits of Microkernel Organization. Explain any one.

MODULE – II

3. a) Explain Deadlock prevention.
- b) With the help of example explain Bankers algorithm.
- c) How to deal with recovery from deadlock ?
- d) Differentiate between Logical versus Physical address space.
4. a) Write a short note on inverted Page table.
- b) List different page replacement algorithms. Explain any two.
- c) What is cleaning policy ?
- d) Explain Protection and sharing in context to segmentation.

P.T.O



MODULE – III

5. a) List different schemes for defining the logical structure of directory. Explain any one.
- b) What is file ? List and explain its attributes and operations performed on it.
- c) Explain any two key features of NTFS.
- d) Write a short note on Unix File Management.
6. a) Explain different steps in a DMA transfer.
- b) What are bad blocks ? How they are handled ?
- c) List and explain different services provided by Kernel I/O subsystem.
- d) Differentiate between block and character devices.

MODULE – IV

7. a) Write a short notes on :
- Windows security
 - Access matrix
 - Worm
 - Intruder.
- b) Write a shell program to find squares of first 20 numbers.
8. a) What is Filter ? Explain any three types of filters in Unix shell.
- b) Explain following shell commands with example.
- ps
 - bc
 - chmod
 - ls
 - mv.
- c) Write a shell program to find the reverse of a number.

T.E. (Computer) (Semester – V) (RC) Examination, Nov./Dec. 2012
OPERATING SYSTEMS

Duration: 3 Hours

Total Marks: 100

- Instructions :** 1) Answer **any five** questions by selecting at least one from each Module.
2) Sketch diagram wherever required.
3) Assume appropriate data wherever necessary.

MODULE – I

1. a) What is an Operating System ? List and explain advantages of multiprocessor systems. 5
b) Explain the Process state transition diagram with one suspend state. 6
c) How threads are different from processes ? Explain. 4
d) Write a short note on Windows Threads. 5
2. a) List and explain different scheduling criteria for comparing CPU scheduling algorithms. 5
b) What do you mean by critical section ? What requirements must be satisfied by a solution to the critical section problem ? 5
c) What are Monitors ? How are they different from Semaphores ? Explain. 5
d) Write a short note on critical regions. 5
3. a) With the help of an example explain what is deadlock ? Also state and explain necessary conditions for deadlock. 5
b) With the help of an example explain bankers algorithm. 6
c) Write a short note on Deadlock Recovery. 5
d) Differentiate between Logical versus Physical address space. 4
4. a) List different page replacement algorithms. Explain any two. 6
b) What is Multilevel Paging ? Explain. 5
c) Explain different steps in handling page fault. 5
d) What is Cleaning Policy ? 4

P.T.O.

5. a) What is File ? List and explain its attributes and operations performed on it.
b) List different schemes for defining the logical structure of directory. Explain any two.
c) Write a short note on Unix File management.
6. a) List different I/O services provided by Kernel I/O subsystem. Explain any two.
b) Write a short note on polling.
c) What do you mean by CLV and CAV in context to hard disks ? Explain LOOK disk scheduling algorithm.
d) What is Sector Sparing ?

7. a) What is Virus ? Explain different phases of Virus. Also with the help of symbolic code explain virus structure.
b) Write a short note on :
i) Windows security
ii) Intruders.
c) Explain use of chmod command in Linux. Give example.
8. a) Write a shell program to generate the following series :
1, 3, 2, 4, 3, 5, 4, 6
b) Write a shell program to generate squares of first 30 numbers.
c) Explain following shell commands with example.
i) who
ii) pwd
iii) cp
iv) wc
v) head.

T.E. (Computer) (Semester – 5) (RC) Examination, May/June 2012
OPERATING SYSTEMS

Duration : 3 Hours

Total Marks: 100

- Instructions:**
- 1) Answer any five questions by selecting at least one from each Module.
 - 2) Assume appropriate data wherever necessary.
 - 3) Sketch diagram wherever required.

MODULE – I

1. a) What are the advantages of parallel systems ? Also explain types of it. 6
b) Draw and explain microkernel architecture. List and explain advantages of microkernel. 7
c) Explain and justify how multilevel queue scheduling different from multilevel feedback queue scheduling. 7
2. a) What is critical section problem ? What requirements must be satisfied by a solution to the critical section problem ? 4
b) State and explain dining philosopher problem. Also write symbolic code for this using Semaphores. 6
c) What are Messages ? How they are different from Semaphore variables ? 5
d) Write a short note on Monitors. 5

MODULE – II

3. a) What are characteristics of deadlock ? 4
b) Explain Banker's Algorithm with the help of an example. 6
c) Describe various methods for deadlock recovery. 5
d) Write a short note on thrashing. 5

P.T.O.

COMP 5 – 6 (RC)

4. a) What is demand paging ? Enumerate and explain briefly the page fault.

b) Write a short note on multilevel paging.

c) Explain segmentation as memory management technique.

d) What is Belady's Anomaly ? Explain with an example.

MODULE - III

5. a) Write a short note on Windows File Management.

b) What are Block and Character devices ?

c) Explain the directory structure used in UNIX.

d) What is polling ? Explain concept of handshaking in I/O.

6. a) Write a short note on swap space management.

MODULE – IV

7. a) Write short notes on : (5x4=20)

 - i) Intruders
 - ii) Worms
 - iii) Access matrix
 - iv) Viruses

8. a) Write a shell script to print largest number of the given 3 numbers. 4

b) Write a shell script to check whether number entered through keyboard is odd or even. If it is odd, then reverse the digits of the number and print it. 6

c) Explain following shell commands with example : 10

 - i) head
 - ii) ls - l
 - iii) mv
 - iv) cp
 - v) cat

T.E. (Comp.) (Semester - V) (RC) Examination, Nov./Dec. - 2011

OPERATING SYSTEMS

Total Marks : 100

Duration : 3 Hours

- Instructions :**
- 1) Answer any five questions by selecting at least one from each module.
 - 2) Assume appropriate data wherever necessary.
 - 3) Sketch diagram wherever required.

MODULE - I

- Q1)** a) Define the essential properties of batch operating systems. [3]
 b) How are threads different from processes? List the advantages of using threads in programming. [6]
 c) With the help of diagram explain Multilevel Feedback Queue scheduling. [6]
 d) Write short note on Multiprocessor Scheduling. [5]
- Q2)** a) With the help of example explain race condition? [4]
 b) Explain various methods of Hardware support for mutual exclusion. [6]
 c) With the help of symbolic code explain implementation of bounded buffer producer-consumer problem using Semaphores. [6]
 d) What are Messages? How they are different from Semaphore variables? [4]

MODULE - II

- Q3)** a) What is Deadlock? State necessary conditions for the occurrence of a deadlock. [5]
 b) Explain Banker's Algorithm with the help of an example. [6]
 c) Write a short note on Deadlock Recovery. [6]
 d) What do you mean by a logical address space and a physical address space? [3]
- Q4)** a) Write a note on compaction. [5]
 b) Explain segmentation as memory management technique. [5]
 c) What is Demand paging? Enumerate and explain briefly the steps in handling page fault. [6]
 d) What is Thrashing? [4]

P.T.O.

MODULE - III

- Q5)** a) Explain different file access methods.
b) Describe Acyclic graph directory structure.
c) Write a short note on Unix File management.
d) Explain steps in a DMA transfer with the help of diagram.

Q6) a) Describe different services offered by Kernel I/O subsystem.
b) Explain any two disk scheduling algorithms.
c) Write a short note on swap space management.

MODULE - IV



T.E. (Computer) (Semester - V) (Revised 07-08) Examination, Nov./Dec. 2019
OPERATING SYSTEMS

Duration : 3 Hours

Total Marks : 100

- Instructions :** 1) Answer any five questions by selecting at least one from each Module.
 2) Assume appropriate data wherever necessary.

MODULE - I

1. a) What is an operating system ? Differentiate between Hard Real Time Systems and Soft Real Time Systems. 5
- b) With the help of appropriate diagrams explain all transitions of five state process model. 6
- c) Differentiate between process and thread with respect to operating system. 4
- d) What are the essential properties of batch systems ? What is the disadvantage of batch system ? Explain. 5

2. a) Write a short note on Windows Process scheduling. 5
- b) Explain how critical region is used in process synchronization in operating system. 5
- c) Explain implementation of Bounded Buffer Producer Consumer synchronization problem with the help of Semaphores. 6
- d) What is race condition ? 4

MODULE - II

3. a) With the help of example explain Bankers algorithm for deadlock avoidance. 6
- b) Explain how deadlock can be detected by giving suitable example. 3
- c) What is demand paging ? 5
- d) With the help of an example explain FIFO page replacement algorithm. 5

4. a) What is segmentation ? How is sharing of segments done in a segmented memory system ? 6
- b) Explain External and Internal Fragmentation with respect to memory management. 5
- c) Explain Multilevel Paging and inverted page table. 6
- d) What is thrashing ? 3

P.T.O.

MODULE - III

5. a) Explain what do you mean by Buffering and Spooling with respect to kernel Subsystem.
- b) Write a short note on DMA.
- c) Explain how File system management is done in Linux operating system.
6. a) List various disk scheduling algorithms ? Explain any two with example.
- b) What are bad blocks ? What are the different methods to handle bad blocks ?
- c) What is the difference between physical formatting and logical formatting.
- d) Differentiate between block and character devices.

MODULE - IV

7. a) Differentiate between access control list and capability list.
- b) What are different phases of virus ? Explain.
- c) Write short notes on :
- i) Intruders
 - ii) Worms
8. a) Explain the use of following commands :
- i) echo
 - ii) passwd
 - iii) Cal
 - iv) pwd
 - v) od.
- b) Write a shell program to generate squares of first 20 numbers.
- c) Write notes on :
- i) Pipes in UNIX shell
 - ii) Redirection in UNIX shell.
- d) Write a shell program to find factorial of a given number.

**COMP 5-6 (EC)**

T.E. (Computer) (Semester – V) Examination, May 2010
(Revised Course)
OPERATING SYSTEMS

Duration : 3 Hours

Max. Marks : 10

- Instructions :**
- Answer five full questions by selecting at least one from each Module.
 - Make appropriate assumptions wherever necessary.
 - Write answers in the same sequence of questions.

MODULE – 1

- a) Give the process state transition diagram with one suspend state. Discuss the disadvantages and mechanisms to overcome these disadvantages. 10
- b) Explain Rate Monotonic scheduling. 10
- a) Explain the dining philosopher problem. Give a solution using monitor. 6
- b) What are two differences between user-level threads and kernel-level threads ? Under what circumstances is one type better than the other ? 4
- c) Explain UNIX SVR4 scheduling. 6
- d) Discuss any 4 characteristics of RTOS. 4

Measuring**MODULE – 2**

- a) Explain the necessary conditions for a deadlock. 6
- b) Discuss the Bankers algorithm. 6
- c) With the help of a neat diagram explain how paging process takes place. 8
- a) Explain clock page replacement algorithm and modified clock page replacement algorithm with the help of a diagram. For a frame size of 3, and the reference string as 2, 3, 2, 1, 5, 2, 4, 5, 3, 2, 5, 2 find the number of page faults. 10
- b) Explain multilevel paging and inverted page table. 8
- c) What is demand cleaning and pre cleaning ? 2

MODULE – 3

- a) Discuss the 6 basic file operations. 6
- b) Give the NTFS volume layout and explain. 6
- c) With the help of a neat diagram explain the UNIX I/O subsystem. 8

P.T.O.

- 6 a) Consider a disk drive with 250 cylinders numbered from 0-249, the disk head initially located at track 100, the requests tracks in the order received by disk scheduler are 55, 58, 39, 18, 90, 160, 150, 38, 184. What is the total distance in cylinders that the disk arm moves to satisfy all pending requests using SSTF scheduling algorithm ?
- b) With a neat diagram explain the UNIX i-node structure.
- c) How is bad block recovery done ? Explain.
- d) Explain the following terms, CAV, CLV, Seek time and rotational latency.

MODULE - 4

7. a) Explain the various categories of attack. 6
- b) Can a Trojan horse attack be prevented by using a trusted system ? Justify. 6
- c) Write a shell script to search 5 different patterns in a single file using shift statement and the positional parameters. 8
8. a) Write a shell script using the system time to display the message "good morning" or "good afternoon" or "good evening". 4
- b) Discuss the password selection strategies. 8
- c) Given the file emp.lst below perform the following operations : 8

Sr. No.	Name	Designation	Department
056	Mike	Assistant Professor	Electrical
036	Shabbi	Technical Assistant	Electronics
042	Arun	Lecturer	Mechanical
072	Melita	Lecturer	Civil

- 1) With a simple advanced filter place all the employees according to their designation to different files.
- 2) Use a advanced filter to replace only the first occurrence of the character “|” in every line with “@”.
- 3) Find out the unique designation from the above file using a simple filter.
- 4) Using a simple filter compress the alphabets ss in the word Assistant to a single s.

T.E. (Computer) (Semester - V) Examination, Nov./Dec. 2009
(Revised Course)
OPERATING SYSTEMS

Duration : 3 Hours

Max. Marks : 100

Instructions: i) Answer five full questions by selecting at least one from each Module.
 ii) Make appropriate assumptions wherever necessary.
 iii) Write answers in the same sequence of questions.

Module – 1

1. a) Define the essential properties of the following with respect to operating systems

i) Batch ii) Interactive

b) Under what circumstances would a user be better off using a time sharing system rather than a PC or a single user workstation.

c) What are threads ? Explain the various thread models.

d) Consider a set of 2 periodic tasks with the execution profile given below.

Process	Arrival Time	Execution Time	Ending deadline
A(1)	0	10	20
A(2)	20	10	40
A(3)	40	10	60
A(4)	60	10	80
A(5)	80	10	100
B(1)	0	25	50
B(2)	50	25	100

P.T.O.

Develop a scheduling diagram using

1) Fixed priority scheduling, where A has higher priority

2) Fixed priority scheduling, where B has higher priority

3) Earliest deadline scheduling using completion deadline

2. a) Consider a system that executes the following processes using Round Robin algorithm with a time slice of 4 ms

Process	Arrival Time	Processing Time
A	0	3
B	1	5
C	3	2
D	9	5
E	12	5

1) Draw a chart to illustrate the execution schedule.

2) What is the wait time for each process?

3) What is the average wait time?

b) Explain the producer consumer problem and give a solution to infinite buffer producer consumer problem using Binary semaphore.

c) Explain the following terms with respect to operating systems :

1) Convoy effect

2) Graceful degradation

Module - 2

- a) Give any three mechanisms to recover from a deadlock.
- b) What is segmentation? How is sharing of segments done in a segmented memory system?
- c) Explain how a page fault is handled.
4. a) Explain Fetch, Placement and Replacement policy.
- b) Discuss Resident set management.
- c) Consider the following snapshot of the system.

Using bankers algorithm

	Allocation			Max	Available				
	A	B	C			A	B	C	
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2	3	3	2
P2	3	0	2	9	0	2	3	3	2
P3	2	1	1	2	2	2	3	3	2
P4	0	0	2	4	3	3	3	3	2

1) What is the content of the matrix need?

2) Is the system in a safe state?

Module - 3

5. a) Explain in brief different directory structure.
- b) What is polling? Explain.
- c) Explain I/O Scheduling with respect to LINUX.

6. a) List two disk scheduling techniques and differentiate.

b) How is swap space used? Where is it located on the disk?

c) Write a short note on windows I/O manager.

d) Explain the process of Disk formatting.

Module - 4

7. a) Explain the nature of viruses and explain different types of viruses.

b) Explain UNIX password protection technique.

c) Given a string "Operating system"

i) Find the length of the string

ii) Display the last two characters of the string

iii) Find the position of the character "e" in the given string.

8. a) Write a shell script to generate the following pattern

1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
6 6 6 6 6 6
7 7 7 7 7 7 7

Collection A			
3	8	A	
0	1	0	0
0	0	C	1
5	0	E	2
1	1	S	3
5	0	0	4

b) Using shift statement and command line arguments write a shell script to search 6 different patterns in a file. If pattern is found then display the corresponding line if not display a message as pattern not found.

c) What is a digital Immune System?

10