

**B. E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING  
EXAMINATION, 2022**

(3rd Year, 2nd Semester )

**OPERATING SYSTEMS**

Time : Three hours

Full Marks : 100

**Part A:** Answer any 10 questions.

All questions carry equal marks

Marks 10x2=20

1. What is the purpose of the command interpreter?
2. Remote Procedure Call- Why is it so called?
3. What is the function of the stub?
4. Name the types of user interfaces used by operating systems.
5. How is interprocess communication carried out?
6. What is a bug? Hence what is a debugger?
7. Show the diagrammatic representation of process in memory.
8. Name the information contained in a PCB.
9. What is the utility of a pid?
10. What are zombie and orphan processes?
11. Illustrate the need for two types of buffers-unbounded and bounded.
12. Which functions do the processes use who communicate between themselves using the shared-memory model?
13. Show the difference between a single-threaded and a multithreaded process by a diagram.
14. Draw the multilevel feedback queue.
15. What is the constant angular velocity of a magnetic disk?

**Part B:** Answer any 3 questions.

All questions carry equal marks

Marks 10x3=30

1. Assume that a context switch takes T time. Suggest an upper bound in terms of T for holding a spinlock. If the spinlock is held for any longer, a mutex lock is a better alternative.
2. Consider a system consisting of processes  $P_1, P_2, \dots, P_3$ , each of which has a unique priority number. Write a monitor that allocates three identical printers to these processes, using the priority numbers for deciding the order of allocation.
3. Consider the following set of processes, with the length of the CPU burst given in ms:

Process	Burst Time	Priority
i. $P_1$	2	2
ii. $P_2$	1	1
iii. $P_3$	8	4
iv. $P_4$	4	2
v. $P_5$	5	3

The processes are assumed to have arrived in the order shown all at time 0.

- a. Draw the Gantt charts showing the execution of these processes using the following scheduling algorithms: FCFS, SJF, RR with quantum 2.
  - b. What is the turnaround time of each process for FCFS?
  - c. What is the waiting time of the processes for SJF?
4. Which of the following scheduling algorithms could result in starvation? Explain with examples.
- a. FCFS
  - b. Shortest Job First
  - c. Round Robin
  - d. Priority
5. Consider a system consisting of  $m$  resources of the same type being shared by  $n$  processes. A process can request or release only one resource at a time. Show that the system is deadlock free if the following two conditions hold:
- a. The maximum need of each process is between one resource and  $m$  resources.
  - b. The sum of all maximum needs is less than  $m+n$ .

**Part C:** Answer any 3 questions.

All questions carry equal marks

Marks  $10 \times 3 = 30$

6. A computer provides its users with a virtual memory space of  $2^{32}$  bytes while it has  $2^{22}$  bytes of physical memory. The virtual memory is implemented by paging, and the page size is 4096 bytes. A user process generates the virtual address 11123456. Explain how the system will establish the corresponding physical location.
7. Given six memory partitions of 300KB, 600 KB, 350 KB, 200 KB, 750 KB and 125 KB (in order), how would the first-fit, best-fit and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in order)? Rank the algorithms in terms of how efficiently they use memory.
8. a) What is segmentation in memory management?  
b) Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

- a. 0,430
- b. 1,10
- c. 2,500
- d. 3,400

e. 4,112

9. Consider the following page reference string:

7,2,3,1,2,5,3,4,6,7,7,1,0,5,4,6,2,3,0,1

Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms?

- a) LRU replacement
- b) FIFO replacement
- c) Optimal Replacement

**Part D:** Answer any 2 questions. All questions carry equal marks

Marks 10x2=20

10. A disk drive has 5000 cylinders numbered 0 to 4999. The drive at present is serving a request at cylinder 2150 while the previous request was at 1805. The queue of pending requests in FIFO order is 2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4956, 3681. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for FCFS scheduling algorithm?

11. Provide examples of applications that typically access files according to the following methods:

- a) Sequential
- b) Random

12. If an operating system has the information that a particular application will access data files in sequential manner, will this prior information be useful for improved performance?

13. a) Describe some advantages and disadvantages of using SSDs as a caching tier and as a disk-drive replacement compared with using only magnetic disks.

b) Also explain why SSDs often use an FCFS disk-scheduling algorithm.