



**AUTUMN END SEMESTER EXAMINATION-2024**

**7<sup>th</sup> Semester B.Tech**

**OPERATING SYSTEM**

**CS2002**

**(For 2022 (L.E), 2021 & Previous Admitted Batches)**

Time: 2 Hours 30 Minutes

Full Marks: 50

*Answer any FIVE questions.*

*Question paper consists of two SECTIONS i.e. A and B.*

*Section A is compulsory.*

*Attempt any Four question from Sections B.*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.*

**SECTION-A**

1. Answer the following questions. [1 × 10]

- (a) Is Context switching between threads in the same process is less expensive than switching between threads in different processes? Yes or No. Justify?
- (b) A counting semaphore S is initialized to 10. Then 6 WAIT operations and 4 SIGNAL operations were completed on this semaphore. What would be the resulting value of S?
- (c) Name two CPU scheduling policy where context-switching does not occur.
- (d) Assume every process requires 3 seconds of service time in a system with single processor. If new processes are arriving at the rate of 10 processes per minute, then estimate the fraction of time CPU is busy in system?
- (e) Consider the following state changes for a preemptive scheduling OS:
  - I. Ready to running                      II. Running to ready
  - III. Blocked to running                  IV. Blocked to readyWhich of the above statement(s) are TRUE?

- (f) Which of the following is a valid process state transitions?  
 a) Ready – Ready                      b) Ready – Waiting  
 c) Waiting – Ready                      d) Waiting – Running
- (g) A blocked process that is in waiting state can directly move to running state is true or false? Justify your answer.
- (h) Describe the importance of medium term scheduler with relation to long term scheduler.
- (i) Round Robin Scheduling is most suitable for interactive processes". Justify.
- (j) Calculate the size of memory if its address consists of 22bits and the memory is 2 byte addressable.

### SECTION-B

2. (a) Explain different types of Operating System and how multitasking operating system is different from multiprogramming operating system. [5]
- (b) The arrival time and duration of the CPU and I/O bursts for each of the three processes A, B, and C are given in the table below. Each process has a CPU burst followed by an I/O burst followed by another CPU burst. Assume that each process has its own I/O resource. [5]

Process	Arrival time	CPU burst	I/O burst	CPU burst
A	0	1	4	4
B	2	3	3	1
C	3	1	3	1

The multi-programmed operating system uses the shortest remaining time first (SRTF) scheduling. What are the completion times of the processes A, B, and C and find individual waiting times of processes?

3. (a) State different criteria for evaluating CPU scheduling algorithms and evaluate various CPU scheduling algorithms based on the criteria's. [5]
- Three processes are running on a system that uses Shortest Job First non-preemptive scheduling

Algorithm. Draw the Gantt chart and find out the average response time for the following processes:

Process Name	Arrival Time (in ms)	CPU Burst Time (in ms)
P1	0	6
P2	AA	4
P3	3	8

(Assume AA = Your Roll number MODULOS 10 + 2, for example AA = 6 if your roll number is 20205124)

- (b) Assume following processes arrive in the system with a single processor.

[5]

Process Id	Execution time	Arrival time	Priority no
P	55	0	4
Q	20	10	3
R	10	10	2
S	25	40	4
T	65	55	1

What will be the average waiting time and average turn around time if Round Robin CPU scheduling algorithm is followed with a time quantum 15units?

Considering the lowest number as the highest priority find the sequence of execution of processes along with individual waiting time of the processes for Preemptive priority Scheduling algorithm.

4. (a) Explain about Bounded buffer problem with suitable example.

[5]

- (b) Consider a system that contains four processes P0, P1, P2, P3 and the three resource types E, F and G as below.

[5]

Process	Allocation			MAX			Available		
	E	F	G	E	F	G	E	F	G
P0	1	0	1	4	3	1	3	3	0
P1	1	1	2	2	1	4			
P2	1	0	3	1	3	3			
P3	2	0	0	5	4	1			

Check the system is in deadlock or not. If not, find the safe sequence.

5. (a) If time slice size is of 3 units of time and only one process with 14 burst time is there in the ready queue, and RR CPU scheduling algorithm is applied, then what will be the number of context switches? [5]
- (b) Write necessary conditions to be satisfied to implement solution of a critical section. Explain how those conditions are satisfied in Peterson's two-process solution? [5]
6. (a) Calculate the number of bits required in the address for memory having size of 16GB. Assume the memory is 4 byte addressable. Consider the machine with 64MB physical memory and a 32 bit virtual address space. If the page size is 4KB, what is the approximate size of page table? [5]
- (b) Consider the methods used by processes P1 and P2 for accessing their critical sections whenever needed, as given below. The initial values of shared boolean variables S1 and S2 are randomly assigned. [5]

Method used by P1	Method used by P2
while (S1 == S2) ; Critical Section S1 = S2;	while (S1 != S2) ; Critical Section S2 = not (S1);

Which requirements of critical section problems are satisfied for the above code segment? Give explanation for the same.

7. (a) What is context switching in OS? Explain the steps involves in context switching of two processes with a neat diagram. What are the triggers that lead to context switches in a system? [5]
- (b) Explain the paging memory management scheme and describe the address translation. Describe the hardware implementation using TLB. [5]

\*\*\*\*\*