Final Assessment Test – November 2025

VIT
Vellore Institute of Technology

Course: **BITE303L - Operating Systems**

Class NBR(s): **3229 / 3236 / 3240**

Slot: **E2+TE2**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Knowledge on Operating systems and its different subsystems in controlling computer hardware.
CO2	Apply principles of process management, CPU scheduling and deadlocks.
CO3	Design the process synchronization and Inter Process Communication.
CO4	Develop memory management schemes.
CO5	Design and manipulate file system.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

1. Analyse the role of system calls in bridging user programs and the operating system. List the major types of system calls and its usage. Also, Identify the system calls invoked in the following program: **CO1 BL4**

```
#include <unistd.h>
int main() {
  int fd;
  char msg[] = "Operating Systems Lab\n";
  char buf[30];
  fd = creat("demo.txt", 0644);
  write(fd, msg, 22);
  lseek(fd, 0, SEEK_SET);
  read(fd, buf, 22);
  write(1, buf, 22);
  close(fd);
  return 0;
}
```

2. An operating system must balance performance, security, and ease of updates. Analyse how different structures of the OS kernel can influence this balance, giving a suitable real-world example. **CO1 BL1**

3. Enumerate the benefits of Kernel threads over User threads. Illustrate various types of multithreading models with their merits and demerits. CO2 BL2

4. Assume that you have the following jobs to execute with one processor, with the jobs arriving in the order listed here. CO2 BL4

Process	Arrival time	Burst time	Priority
P_1	0	8	1
P_2	1	4	3
P_3	2	3	2
P_4	3	4	4
P_5	4	6	5

Draw the Gantt charts illustrating the execution of these processes using FCFS, Round Robin Scheduling and Priority scheduling. Calculate the turnaround time for each process and the average turnaround time for each of the scheduling algorithms. Also calculate the waiting time for each process and the average waiting time for each of the scheduling algorithms.

5. Consider a system having five processes from P0 to P4. There are three types of resources having various instances. Type A has twelve instances, type B has seven, and type C has ten instances. A snapshot of the system is shown in Table. CO2 BL5

Process	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	1	2	1	8	6	4	4	4	3
P1	3	1	1	4	3	3			
P2	4	1	3	10	1	3			
P3	3	2	2	3	3	3			
P4	1	1	3	5	4	4			

Answer the following questions using the banker's algorithm:

a) What is the content of the need matrix?

b) Is the system in a safe state? If so, generate the safe sequence.

c) If a request from process P1 arrives for (1, 0, 2), can the request be granted immediately. If so, generate the safe sequence?

6.a)	Five autonomous robotic arms are positioned around a circular assembly station, each requiring two shared tools placed between them to perform an assembly task. Every arm alternates between calibration and assembly, but no two neighboring arms can assemble simultaneously. Design a synchronization mechanism using semaphores or monitors that ensures mutual exclusion, prevents deadlock and starvation, maintains fairness, and operates without busy waiting. Provide a suitable pseudocode and justification for your approach.	CO3	BL6
	OR		
6.b)	Two automated data-logging systems share access to a common results database. Both systems periodically attempt to update the same record, which may lead to inconsistent data if updates occur simultaneously. Design a software-based synchronization mechanism using shared variables (without hardware primitives) that ensures mutual exclusion, progress, and bounded waiting between the two systems. Present the pseudocode for both processes and explain how your approach guarantees correct coordination and consistency.	CO3	BL6
7.	Given six memory partitions of 300 KB, 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 115KB, 500KB, 358KB, 200KB, and 375KB (in order). Rank the algorithms in terms of how efficiently they use memory. Calculate the External fragmentation required for each algorithm.	CO4	BL4
8.	Consider the following pages in a reference string. 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 Implement FIFO, LRU, and optimal page replacement algorithms and calculate the total number of page faults, fault ratio, and hit ratios using three frames.	CO4	BL5
9.	Assume that there are 200 cylinders in a disk. Use FCFS, SSTF, C-SCAN and C-LOOK algorithms to calculate the total number of cylinder movements involved in each case. Assume that the head is currently in 70. 35, 80, 145, 75, 65,130,170, 105, 120, 45.	CO4	BL4
10.a)	Briefly discuss on File Attributes, File Operations and File system architecture.	CO5	BL3
	OR		
10.b)	Determine how different access methods and allocation methods impact the efficiency and performance of data storage systems? Provide examples to illustrate your answer.	CO5	BL3

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