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THIRD SEMESTER [MCA] Internal Examination, December 2022

Paper Code: MCA–105	**Subject: Operating Systems with Linux**

Time: 2 Hours **Maximum Marks: 45**

Note: Attempt THREE questions in all. Question No. 1 is compulsory, and attempt one question from each unit.

1. Answer all the following questions briefly: - 1.5 × 10 = 15

   (a) List various types of system calls by giving at-least two examples of each type. CO1

   (b) Differentiate between deadlock and starvation. CO1

   (c) Identify the reasons why programmers prefer application programming interface rather than system calls. CO1

   (d) Compare monolithic kernel and microkernel. Which kernel is used by the Microsoft Windows 10 operating system? CO1

   (e) Describe the working of nodes in peer-to-peer computing environment. CO1

   (f) Demonstrate (using an appropriate diagram) how a process becomes orphan process and how re-parenting is done. CO1

   (g) Discuss various scheduling criteria for CPU scheduling. CO3

   (h) Explain the dining-philosophers' problem in context to process synchronization and suggest appropriate approach for solution of dining-philosophers' problem. CO3

   (i) Identify the conditions to be fulfilled for the solution of a critical-section problem. CO3

   (j) Describe the working of multi-level feedback queue scheduling approach. CO3

UNIT - I

2. (a) Describe various services offered by an operating system? 5 CO1

   (b) Identify the reasons for processes' cooperation. Describe shared memory and message passing models of inter-process communication. 5 CO1

   (c) Explain the situation(s) when a process becomes a zombie process and orphan process. Identify the limitations of having multiple zombie processes in the process table. Discuss an appropriate approach for the parent process so that the zombie process could be removed from the process table. 5 CO1

3. (a) Describe the following types of operating systems: (a). Simple Batch Systems, (b). Multi-programmed Batch Systems, (c). Time-Sharing Systems, (d). Real-Time Embedded Systems, and (e). Distributed Systems 5 CO1

   (b) Differentiate between long-term scheduler and short-term scheduler. With a queuing diagram, explain the use of a medium-term scheduler in an operating system. 5 CO1

	(c)	Identify the data structure used to represent the process control block in Linux. List various sections of a process in memory. With a neat transition diagram, explain various steps involved in change of a process state.	5	CO1
4.	(a)	Three processes P1, P2 and P3 arrive at time zero. The total time spent by the process in the system is 10ms, 20ms, and 30ms respectively. They spent first 20% of their execution time in doing I/O and the rest 80% in CPU processing. What is the percentage utilization of CPU using FCFS scheduling algorithm?	5	CO3
	(b)	Explain the producer-consumer problem. Write algorithm (code snippet) to solve the producer-consumer problem using semaphore.	5	CO3
	(c)	Identify the limitation(s) of Lock approach for process synchronization. Describe TestAndSet() and Swap() approaches to address the limitations of Lock approach.	5	CO3
5.	(a)	Three processes P1, P2 and P3 arrive at time zero. Their total execution time is 10ms, 15ms, and 20ms respectively. They spent first 20% of their execution time in doing I/O, next 60% in CPU processing and the last 20% again doing I/O. For what percentage of time was the CPU free? Use Round robin algorithm with time quantum 5ms.	5	CO3
	(b)	Describe the Peterson's algorithm (with code snippet) for critical-section problem. Does Peterson's algorithm satisfy the requirements of solution of critical section problem? Identify the limitations of Peterson's algorithm.	5	CO3
	(c)	Explain the spinlock approach in semaphore. Identify the limitations of spinlock. Write algorithm (code snippet) to modify the definition of the wait() and signal() to address the problem of spinlock.	5	CO3