INTRODUCTION TO OPERATING SYSTEMS
(AML3102)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Modern Operating Systems are
(a) programmed-I/O driven (b) software-driven
(c) interrupt- driven (d) hardware-driven

(ii) Which of the following operating systems does not support more than one program at a time?
(a) Windows (b) Linux
(c) Unix (d) DOS

(iii) Which of the following is not a condition that causes deadlock?
(a) Mutual Exclusion (b) Pre-emption
(c) Hold and wait (d) Circular wait

(iv) Banker's algorithm is used
(a) To prevent deadlock (b) To avoid deadlock
(c) To detect deadlock (d) To recover deadlock

(v) If fork is called n times successfully how many child process executed simultaneously?
(a) n (b) 2^n -1
(c) 2^n (d) n-1

(vi) When a process is in a "Blocked" state waiting for some I/O service. When the service is completed, it goes to the _____.
(a) Terminated state (b) Suspended state
(c) Running state (d) Ready state

(vii) Which of the following is an advantage of segmentation?
(a) Simplicity (b) Efficient use of memory
(c) Ease of implementation (d) Supports modular programming

(viii) The process of loading pages into memory when they are needed is known as:
(a) Preloading (b) Demand Paging
(c) Segmentation (d) Paging

(ix) What is the full name of FAT?
(a) File attribute table (b) File allocation table
(c) Format allocation table (d) Font attribute table

(x) Elevator algorithm is another name of
(a) SCAN (b) SSTF
(c) FCFS (d) LOOK

Fill in the blanks with the correct word

(xi) The base and limit registers are updated for every process in _____ mode.

(xii) The _____ is the address used by the CPU to access a particular memory location, while the _____ is the actual location in physical memory.

(xiii) In a segmentation system, a program is divided into segments of _____ length, such as functions or data arrays.

(xiv) The _____ page replacement algorithm replaces the least recently used page in memory.

(xv) A path name that starts at root directory is _____.

Group - B

2. (a) Distinguish between multi programming and multitasking operating system. *[(CO1)(Compare/LOCQ)]*

(b) Write the purpose of using system call. Mention the different types of system calls. *[(CO1)(Remember/LOCQ)]*

(c) When a system call is made then describe how the mode bit of the system changes with the help of a suitable diagram? *[(CO1)(Remember/LOCQ)]*

4 + 4 + 4 = 12

3. (a) Write short notes on User Level Thread and Kernel Level thread. *[(CO1)(Remember/LOCQ)]*

(b) How is Parallelism achieved using Threads? How much Speedup can be achieved for a 60% serial, 40% parallel process by shifting from single to four cores? *[(CO1)(Apply/IOCQ)]*

(c) Write name of functions to create a new process. *[(CO1)(Remember/LOCQ)]*

4 + 6 + 2 = 12

Group - C

4. (a) Consider the following resource-allocation policy. Requests for and releases of resources are allowed at any time. If a request for resources cannot be satisfied because the resources are not available, then we check any threads that are blocked waiting for resources. If a blocked thread has the desired resources, then these resources are taken away from it and are given to the requesting thread.

The vector of resources for which the blocked thread is waiting is increased to include the resources that were taken away.
For example, a system has three resource types, and the vector Available is initialized to (4,2,2). If thread T0 asks for (2,2,1), it gets them. If T1 asks for (1,0,1), it gets them. Then, if T0 asks for (0,0,1), it is blocked (resource not available). If T2 now asks for (2,0,0), it gets the available one (1,0,0), as well as one that was allocated to T0 (since T0 is blocked). T0's Allocation vector goes down to (1,2,1), and its Need vector goes up to (1,0,1).
Can deadlock occur in this system? If you answer "yes," give an example. If you answer "no," specify which necessary condition cannot occur.
Can indefinite blocking occur? Explain your answer. *[(CO3)(Decide/HOCQ)]*

(b) Suppose that you have coded the Deadlock Avoidance safety algorithm that determines if a system is in a safe state or not, and now have been asked to implement the Deadlock Detection algorithm. Can you do so by simply using the safety algorithm code and redefining $Max_i = Waiting_i + Allocation_i$, where $Waiting_i$ is a vector specifying the resources for which thread i is waiting and $Allocation_i$ is as discussed in the standard Banker's Algorithm? Explain your answer.
[(CO3)(Apply /IOCQ)]

7 + 5 = 12

5. (a) Consider three processes, all arriving at time 0,1 and 3 with total execution time of 15, 8 and 10 units respectively. Each process spends the first 10% of execution time doing I/O, the next 50% of time doing computation then 25% doing I/O again and finally remaining 15% doing computations again. The operating system uses pre-emptive FCFS and schedules a new process either when the running process gets blocked on I/O or when the running process finishes execution. Find the number. of context switches that is taking place and also determine the CPU utilization. *[(CO2)(Analyse/HOCQ)]*

(b) Consider the set of 4 processes whose arrival time and burst time are given below:

Process	Arrival time	Burst time	I/O time	Burst time
P_1	0	3	2	2
P_2	0	2	4	1
P_3	2	1	3	2
P_4	5	2	2	1

If the CPU scheduling policy is Shortest Remaining Time First, calculate the average waiting time and average turn-around time. *[(CO2)(Analyze/IOCQ)]*

(c) How can starvation problem can solved in priority scheduling? *[(CO2)(Apply/LOCQ))]*

4 + 5 + 3 = 12

Group - D

6. (a) Compare and contrast fixed partitioning and variable partitioning in contiguous memory allocation. *[(CO4)(Analyse/HOCQ)]*

(b) Compare the memory organization schemes of contiguous memory allocation, pure segmentation and pure paging with respect to the following issues:
(i) External fragmentation
(ii) Internal fragmentation. *[(CO4)(Remember/LOCQ)]*

(c) Calculate the number of bits required in the address for memory having size of 16 GB. Assume the memory is 4-byte addressable. *[(CO4)(Apply/IOCQ)]*

4 + 6 + 2 = 12

7. (a) Calculate the number of page faults for the following reference string using FIFO and optimal scheduling algorithm with frame size as 3.

5	0	2	1	0	3	0	2	4	3	0	3	2	1	3	0	1	5

[(CO4)(Analyse/IOCQ)]

(b) What is the effective memory access time, given the TLB hit ratio to be 80 percent and it takes 100 nanoseconds to access memory also assume page table lookup takes one memory access? *[(CO4)(Remember/LOCQ)]*

(c) Discuss strategies to prevent or mitigate thrashing in a computer system. *[(CO4)(Apply/IOCQ)]*

6 + 3 + 3 = 12

Group - E

8. (a) Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The LOOK and C-LOOK scheduling algorithm is used. The head is initially at cylinder number 53 moving towards larger cylinder numbers on its servicing pass. The cylinders are numbered from 0 to 199. What is the total head movement (in number of cylinders) incurred while servicing these requests? *[(CO5)(Analyse/IOCQ)]*

(b) Describe different file attributes from user point of view. *[(CO5)(Remember/LOCQ)]*

(c) What are the functions of file management system? *[(CO5)(Remember/LOCQ)]*

(3 + 3) + 3 + 3 = 12

9. (a) Draw and explain DMA architecture. Write pros and cons of DMA data transfer technique. *[(CO5)(Analyse/HOCQ)]*

(b) Define buffering. How does it save I/O cycle? *[(CO5)(Remember/LOCQ)]*

(c) Define spooling. How is it different from buffering? *[(CO5)(Apply/LOCQ)]*

6 + 3 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	43.75	34.38	21.87