OPERATING SYSTEMS
(CSE2102)

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) The **Monolithic architecture** of an OS means:
(a) Each function runs in a separate process
(b) All OS functions are combined into a single large module
(c) The OS is divided into layers
(d) It uses a microkernel design

(ii) The part of the operating system that loads first and remains in memory is called the
(a) Scheduler (b) Kernel
(c) Driver (d) Assembler

(iii) Where is the list of processes that are prepared to be executed and waiting placed?
(a) Job queue (b) ready queue
(c) device queue (d) suspended queue

(iv) FCFS scheduling suffers from
(a) Ageing (b) Convoy effect
(c) Starvation (d) Deadlock

(v) What type of scheduling is round-robin scheduling?
(a) Non-pre-emptive (b) Pre-emptive
(c) Pre-emptive FCFS (d) Non-linear data scheduling

(vi) The term used for the mapping of logical addresses to physical addresses is:
(a) Address resolution (b) Address translation
(c) Memory mapping (d) Paging

(vii) If logical address = 16 bits and page size = 1 KB, the number of bits for **page number** and **offset** is:
(a) 6 & 10 (b) 8 & 8 (c) 10 & 6 (d) 12 & 4

(viii) The main benefit of using multithreading is:
(a) Slower execution (b) Better memory usage
(c) Faster context switching and concurrency (d) Increased hardware cost

(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) The time to position the disk head to the desired track is known as
(a) Seek Time (b) Latency (c) Spin Time (d) Thrashing

Fill in the blanks with the correct word

(xi) The OS running on virtual machine sometimes called guest OS is known as _____.

(xii) The operations that cannot be overlapped or interleaved with the execution of any other operation are known as _____.

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

(xiv) When multiple processes are running simultaneously and continuously swapping pages in and out of memory, the system experiences _____.

(xv) A system is in a **safe state** if there exists a _____ of processes that allows each to complete successfully.

Group - B

2. (a) Explain the seven-state process life cycle model with the help of a diagram. Describe the working and requirement of each state clearly. *[(CO1)(Explain/LOCQ)]*

(b) Explain the Process Control Block with the help of a diagram. Clearly mention the content and functioning of each module inside the block. *[(CO1)(Explain/LOCQ]*

7 + 5 = 12

3. (a) Explain briefly the different ways in which any two process can communicate? Also state the advantages and disadvantages of the respective methods? *[(CO1)(Remember/IOCQ)]*

(b) Write at least four benefits of diving a process into multiple threads. State the contents of Thread control block with help of a diagram. *[(CO1)(Remember/LOCQ)]*

(c) "Nowadays we prefer to use a hybrid model of both user and kernel level threads". Give a proper justification of the statement. *[(CO1)(Remember/HOCQ)]*

(3 + 2) + (2 + 3) + 2 = 12

Group - C

4. (a) P1 and P2 are processes which are sharing a common variable B. The initial value of B=2

```
P1()                    P2()
{                       {
C= B-1;                 D=2*B;
B= 2*C;                 B= D-1;
}                       }
```

How many different values B can have? Calculate them. *[(CO3)(Apply/IOCQ)]*

(b) Consider three concurrent processes P0, P1, p2 and three semaphores S0, S1, S2. Use wait( ) and signal( ) operations on the semaphore variables in the processes such that the following string will be printed: 002211002211. Justify your solution.

P0	P1	P2

do{
printf("0");
printf("0");
}while(1);
	do{
	printf("2");
	printf("2");
	}while(1);
		do{
		printf("1");
		printf("1");
		}while(1);

[(CO3)(Apply/IOCQ)]

(c) What is wait for graph? Explain with a suitable example how wait for graph detect a deadlock. What are the issues with wait for graph? *[(CO3)(Analyze/IOCQ)]]*

3 + 3 + (2 + 2 + 2) = 12

5. (a) Solve the following using Bankers Algorithm:

Pn	**Allocation**				**Max**				**Available**			
P0	0	0	1	2	0	0	1	2	1	5	2	0
P1	1	0	0	0	1	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

What is the content of the need matrix? Is the system is in safe state? Find the safety sequence. *[(CO3)(Remember/HOCQ)]*

(b) If a request from process P1 arrives for instances <0,4,2,0>, then what is the new content of the need matrix.? Is this state, a safe system state? Explain *[(CO3)(Remember/LOCQ)]*

(3 + 2 + 3) + 4 = 12

Group - D

6. (a) Consider a logical address space of eight pages of 1024 words each, mapped onto a physical memory of 32-page frames. Answer the following:
   (i) How many bits are there in the logical address?
   (ii) How many bits are there in the physical address? *[(CO4)(Apply/IOCQ)]*

(b) Consider a virtual memory system with combined implementation, segmentation and paging. Describe the address translation scheme along with necessary data structures. *[(CO4)(Analyze/IOCQ)]]]*

(c) Consider a paged memory system. Specify what information will be stored in PCB to support memory management. What is the purpose of modify bit in the page table? *[(CO4)(Analyze/IOCQ)]*

(2 + 2) + 4 + (2 + 2) = 12

7. (a) Consider a computer system with a **32-bit** logical address and **4-KB** page size. The system supports up to **512 MB** of physical memory. How many entries are there in a conventional, single-level page table? *[(CO4)(Apply/IOCQ)]*

(b) Under what circumstances do page faults occur? Describe the actions taken by the operating system when a page fault occurs. *[(CO4)(Understand/LOCQ)]*

(c) Consider the following page reference string: **1, 0, 2, 3, 1, 2, 5, 0, 1, 6, 7, 7, 1, 0, 5, 4, 6, 2** Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms? (i) LRU replacement (ii) FIFO replacement (iii) Optimal replacement. *[(CO4)(Apply/IOCQ)]*

2 + 4 + 6 = 12

Group - E

8. (a) The disk has 200 tracks (0–199), and the head is currently at track 53. The queue of pending requests (in order of arrival) is:
98, 183, 37, 122, 14, 124, 65, 67
Calculate the total head movement (in tracks) for:
(i) FCFS
(ii) SCAN
Show the Head Movement diagram for each algorithm also. *[(CO5)(Apply/IOCQ)]*

(b) Which algorithm provides the least average seek time and why? *[(CO5)(Remember/LOCQ)]*

(c) Explain different File Attributes. *[(CO5)(Recall/LOCQ)]*

6 + 3 + 3 =12

9. (a) Describe different bus arbitration technique with diagram. *[(CO5)(Analyse/HOCQ)]*

(b) What is the technique of data transfer in DMA. *[(CO5)(Remember/LOCQ)]*

(c) Write short not on Acyclic Graph Directory Structure with diagram. *[(CO5)(Remember/LOCQ)]*

5 + 4 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	39.6	44.8	15.6