OPERATING SYSTEMS
(INF3103)

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) System calls usually invoked by
(a) a software interrupt (b) polling
(c) an indirect jump (d) part of interrupt servicing

(ii) A problem encountered in multitasking when a process is perpetually denied necessary resources is called
(a) deadlock (b) inversion
(c) starvation (d) aging

(iii) When the event for which a thread is blocked occurs?
(a) thread moves to the ready queue (b) thread remains blocked
(c) thread completes (d) a new thread is provided

(iv) Which of the following scheduling algorithm gives minimum waiting time?
(a) SJF (b) FCFS (c) Round Robin (d) Priority

(v) A process stack does not contain
(a) function parameters (b) local variables
(c) return addresses (d) PID of child process

(vi) In a multiprocessor system, if multiple processors access shared data simultaneously without proper synchronization, it leads to:
(a) context switching (b) race condition
(c) process starvation (d) deadlock

(vii) Increasing the RAM of a computer typically improves performance because:
(a) Virtual memory increases (b) Larger RAMS are faster
(c) Fewer Page faults occur (d) Fewer segmentation faults occur.

(viii) In paging, the address generated by the CPU is called the
(a) physical address (b) logical address
(c) frame address (d) mapped address

(ix) Mapping of file is managed by _____
(a) file metadata (b) page table
(c) virtual memory (d) file system

(x) In a file system using indexed allocation, the index block contains:
(a) addresses of all blocks of the file (b) addresses of free blocks
(c) file metadata only (d) addresses of directory entries

Fill in the blanks with the correct word

(xi) _____ is an approach to restricting system access to authorized users

(xii) Consider a disk queue with requests for I/O to blocks on cylinders. 98 183 37 122 14 124 65 67. Considering FCFS (first come first served) scheduling, the total number of head movements is, if the disk head is initially at 53 is?

(xiii) The _____ program initializes all aspects of the system, from CPU registers to device controllers and the contents of main memory, and then starts the operating system.

(xiv) In FCFS disk scheduling, if the initial head position is 50 and requests are [45, 70, 10], the total head movement is _____.

(xv) If a page table has 256 entries and each entry is 4 bytes, the page table size is _____ bytes.

Group - B

2. (a) Explain zombie and orphan process with proper code example. *[(CO3)(Understand/LOCQ)]*

(b) Consider the given C code:

```
main()
{
int p; p=fork(); p=fork(); p=fork(); ...
}
```

How many processes will be created if this code executes? Explain your answer. IF we want to create exact 3 child process from a single parent process, which code we need to execute? *[(CO3)(Create/HOCQ)]*

5 + (3 + 4) = 12

3. (a) What do you mean by context of a process? "Context switching incurs overhead to the system." – Justify this statement. *[(CO3)(Analyse/HOCQ)]*

(b) With a clear diagram explain the working principle of RPC? *[(CO3)(Analyse/IOCQ)]*

(2 + 3) + 7 = 12

Group - C

4. (a) Consider the following set of processes assumed to have arrived at time 0 with the length of CPU burst given in milliseconds:

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

Draw Gantt chart for Priority scheduling. Calculate average waiting time. What is the major drawback of Priority Scheduling? *[(CO3)(Analyse/HOCQ)]*

(b) Briefly explain critical section problem. Explain the criteria which must be satisfied to solve critical section problem. What is semaphore? *[(CO3)(Remember/LOCQ)]*

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

5. (a) Explain the possible problem associated with priority scheduling. Suggest a solution of this problem. *[(CO3)(Understand/LOCQ)]*

(b) Consider the following snapshot of a system where r_i =(i=1..4) denotes resource types and P1 to P5 denotes processes. The vector available has usual meaning.
r1=2,r2=1,r3=0,r4=0(Available)

Process	Current Allocation				Maximum Demand			
	r1	r2	r3	r4	r1	r2	r3	r4
P1	0	0	1	2	0	0	1	2
P2	2	0	0	0	2	7	5	0
P3	0	0	3	4	6	6	5	0
P4	2	3	5	4	4	3	5	6
P5	0	3	3	2	0	6	5	2

(i) Is the system currently in safe state?

(ii) If a request from P3 arrives for (0 1 0 0) can that request be safely granted immediately? *[(CO3)(Analyse/HOCQ)]*

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

Group - D

6. (a) Explain Segmentation. *[(CO4)(Remember/LOCQ)]*

(b) "Both the first-fit and best-fit strategies for memory allocation suffer from external" fragmentation-Justify. *[(CO4)(Evaluate/HOCQ)]*

(c) In optimal page replacement algorithm, information about all future page references is available to the operating system (OS). A modification of the optimal page replacement algorithm is as follows:
1,3,2,4,2,3,1,2,4,3,1,4
The OS correctly predicts only up to next 4 page references (including the current page) at the time of allocating a frame to a page.
A process accesses the pages in the following order of page numbers:
If the system has three memory frames that are initially empty, what will be the number of page faults that will occur during execution of the process? Explain your calculation. *[(CO4)(Apply/IOCQ)]*

3 + 3 + 6 = 12

7. (a) What do you mean by dynamic loading and dynamic linking? What are the advantages of dynamic loading and linking over static ones? *[(CO4)(Remember/LOCQ)]*

(b) Differentiate between external and internal fragmentation? Explain with example. *[(CO4)(Analyze/IOCQ)]*

(c) Draw the connection valid invalid bit with respect to memory protection. *[(CO4)(Analyze/IOCQ)]*

(3 + 2) + 3 + 4 = 12

Group - E

8. (a) What is DMA? "DMA improves the performance of the computer"- Justify. *[(CO5)(Evaluate/HOCQ)]*

(b) Differentiate between vectored and non-vectored interrupt. *[(CO5)(Analyse/IOCQ)]*

(c) Draw and explain the block diagram showing PC Bus Structure. *[(CO5)(Understand/LOCQ)]*

(2 + 2) + 3 + 5 = 12

9. (a) "Spooling plays an important rule for output device"-Justify. *[(CO5)(Justify/HOCQ)]*

(b) Explain Error Handling with respect to IO device. *[(CO5)(Understand/LOCQ)]*

(c) Differentiate between program threat and system threat. *[(CO6)(Analyze/IOCQ)]*

5 + 4 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33.34	27.08	39.58