This question paper contains 4 printed pages. *Your Roll No. .....*

Sl. No. of Ques. Paper	**: 6116**	**F-5**
Unique Paper Code	**: 2341301**	
Name of Paper	**: Operating Systems**	
Name of Course	**: B.Tech. in Computer Science**	
Semester	**: III**	
Duration	**: 3 hours**	
Maximum Marks	**: 75**	

(Write your Roll No. on the top immediately on receipt of this question paper.)

Section A is compulsory. Attempt any four questions from Section B. Parts of a question must be answered together.

Q1 a What are real time systems and give examples where they are used? (2)

b. Despite of providing lowest page-fault rate among the page replacement algorithm, optimal page replacement algorithm is difficult to implement. Why? (2)

c. What is the purpose of the command interpreter? Why is it usually separate from the kernel? (2)

d. Illustrate how the semaphore can be used to ensure that S2 statement of process P2 must be executed always after S1 statement of process P1. (2)

e. Differentiate between the following:

i. thread and process

ii. relative path and absolute path

iii. trap and interrupt (3 X 2)

f. Why pager is also called as lazy swapper in pure demand paging? (2)

g. Consider a logical address space of 64 pages of 1024 words each, mapped onto a physical memory of 32 frames.

i. How many bits are there in the logical address?

ii. How many bits are there in the physical address? (2)

h. How does the distinction between kernel mode and user mode function as a rudimentary form of protection (security) system? (2)

i. Describe the bit vector method for free space management. (2)

j. How many processes are created by the program segment given below? Justify your answer.

```
main() {
        int pid = fork();
        if (pid != 0)
            fork();
}
```

(2)

k. Which scheduling policy is suitable for time sharing systems and why? (2)

l. Is it possible to have a deadlock involving only one single process? Justify. (2)

m. Name and compare the two models of interprocess communication. (3)

n. How do one-time passwords and biometrics help in user authentication? (4)

Q2 a. Consider the following set of processes, with the length of the CPU burst times, priority and arrival time given in milliseconds:

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

(i) Draw four Gantt charts illustrating the execution of these processes using **FCFS**, **Shortest remaining time first** (equal burst length processes are scheduled in FCFS), **non-preemptive priority** (small priority number means high priority, equal priority processes are scheduled in FCFS), and **RR** (quantum=1) scheduling.

(ii) Calculate waiting time of every process for each of the scheduling algorithms given in part (i)? (4+4)

b. Consider a multiprocessor system and a multithreaded program written using the many-to-many threading model. Let the number of user level threads in the program be more than the number of processors in the system. How many processors will be utilized in the following scenarios?

(i) The number of kernel threads allocated to the program is less than the number of processors.

(ii) The number of kernel threads allocated to the program is equal to the number of processors. (2)

Q3a. The concurrent processes P1 and P2 execute the following code segments in a uniprocessor environment:

P1: x=x+1

P2: x=x-1

Where x is a shared variable? What would be the problem of such concurrent execution? (5)

b Assume we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty page is available or the replaced page is not modified, and 20 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds. Assume that the page to be replaced is modified 70 percent of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds? (5)

Q4 a. Suppose that a disk drive has 5000 cylinders numbered from 0 to 4999. This drive is currently servicing a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests in FIFO order is 86, 1470, 913, 1774, 130.

Starting from the current head position, what is the total distance (in cylinder) that the disk arm moves to satisfy the entire pending request for the following disk scheduling algorithms?

i. SSTF

ii. LOOK (6)

b. Explain the disadvantage of indexed allocation. How Unix is able to handle large sized files by using only 15 pointers in its inode? (4)

Q5a. What are the disadvantages of variable partition memory management scheme? What are the possible solutions for the same? (5)

b. Draw a resource allocation graph for the following data

$P = \{P_1, P_2, P_3\}$

$R = \{R_1, R_2, R_3\}$

$E = \{R_1 \rightarrow P_1, R_1 \rightarrow P_3, P_2 \rightarrow R_1, R_2 \rightarrow P_2, R_3 \rightarrow P_2, P_3 \rightarrow R_3\}$

The number of instances of R_1 and R_2 is 2 and R_3 is 1.

Is there a cycle in the graph? Is the system in a deadlock state? If not, then give reason. (5)

Q6 Write short notes on (any *two*):

i. Layered approach to design an operating system

ii. Paging

iii. Acyclic graph directory structure (5+5)

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