7. Suppose a disk drive has 200 cylinders, numbered 0 to 199 starting from the outermost cylinder. The drive has just served I/O requests from cylinder 1 and then from cylinder 30. Next, I/O requests arrive at roughly the same time in the following sequence : 10, 125, 75, 190, 105, 50 and 145. Calculate the total distance (in cylinders) moved by the disk arm from the current position if the disk-scheduling algorithm is : (*i*) FCFS, (*ii*) SSTF, (*iii*) SCAN, (*iv*) C-SCAN, and (*v*) Elevator. 10

FCFS - 565

SJF - 230.

S-Scan - 260

C-Scan - 210

Elevator - 370

Year - 2015

(Set-L)

MCA-3rd
Operating Systems

Full Marks : 70

Time : 3 hours

Answer any **six** questions including **Q. No. 1** which is compulsory

The figures in the right-hand margin indicate marks

1. Differentiate between : 2 × 10

   (*a*) Multiprogramming and Time sharing OS.

   (*b*) Process and Thread.

   (*c*) Bootstrapping and BIST.

   (*d*) Context switch and Thread switch.

   (*e*) Synchronous and asynchronous communication among processes.

   (*f*) Monitor and Semaphores.

   (*g*) Paging and Segmentation.

   (*h*) Internal and External Fragmentation.

(*i*) Interrupt and Page fault.

(*j*) RAID level 2 and RAID level 3.

2. Consider an operating system that uses a pre-emptive, static priority-based scheduling algorithm. The priorities, arrival times, and CPU- and I/O- burst times for four processes are given below. Lower numbers denote higher priorities. Assume that all I/O requests are for different devices. 10

Process	Arrival time	Priority	CPU	I/O	CPU	I/O	CPU
P1	0	4	4	2	1		
P2	3	2	3	2	4		
P3	5	1	2	3	3	2	2
P4	8	3	2	4	3		

(*a*) Draw the Gantt chart for the processes.

(*b*) Calculate the cumulative waiting time and the response for each process.

3. State and solve producer-consumer problem using Semaphores. 10

4. (*a*) Assume a system with four resource types R1, R2, R3, and R4 with these many units <6, 4, 4, 2>, respectively, and the maximum claim on resources and the current allocation given below. Is this state safe ? Explain. 6

	Maximum request				*Current Allocation*				
Process	R1	R2	R3	R4	Process	R1	R2	R3	R4
P1	3	2	1	1	P1	2	0	1	1
P2	1	2	0	2	P2	1	1	0	0
P3	1	1	2	0	P3	1	1	0	0
P4	3	2	1	0	P4	1	0	1	0
P5	2	1	0	1	P5	0	1	0	1

(*b*) A 32-bit machine has a page/frame size of 1 kB. Suppose the memory address bus is 16-bit wide. 4

(*i*) What is the size of the complete one-level (primary) page table for a process ?

(*ii*) If page tables are also paged, how many levels of paging will be required ?

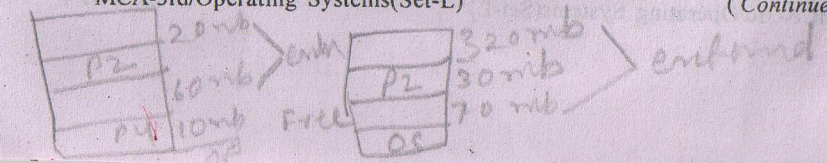
(*iii*) Suppose each memory reference takes 70 ns, and the machine uses a TLB that provides a 80% hit -ratio (on the average).

What is the effective memory reference time using the multi-level paging? (*I*) Neglect the time required for a TLB lookup ; (*II*) assume that a TLB lookup takes 20 ns.

5. Consider a system with 128 MB of physical memory, of which the first 8 MB are allocated to the kernel. The remaining 120 MB memory is allocated to processes in contiguous chunks. The creation time, finishing times, and the memory sizes of five processes are given below :

Process	Start Time	Finish Time	Memory (MB)
P1	10:01 AM	10:05 AM	70
P2	10:02 AM	10:10 AM	30
P3	10:04 AM	10:14 AM	30
P4	10:06 AM	10:15 AM	10
P5	10:12 AM	10:16 AM	25

Draw a figure showing when memory is allocated to these processes and how. Indicate the time(s) when external fragmentation is observed in the system. Assume FCFS allocation policy. 10



6. (*a*) Suppose we have a demand paging system in which the TLB can hold all the page descriptors of the running process. The normal memory access time is 50 ns on the average. The page fault service time is different in the two situations. It takes 25 ms to service a page fault if an empty frame is available or if the victim frame is not dirty. If the victim frame is dirty, the page fault service time is 50 ms. Assume that the victim frame is dirty 75 percent of the time. Find the maximum page fault rate for which the effective memory access time remains within 250 ns. 7

(*b*) Consider the following page reference string : 1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5, 2, 1. Suppose the process has four frames. The system follows local replacement policy. Draw the frame configuration for the reference string under (*i*) FIFO and (*ii*) Second Chance algorithms and find the number of page faults. 3