Course Code : CST 255 / CCT 205 / CDT 207 **KQLR/RS – 24 / 1050**

Fourth Semester B. Tech. (Computer Science and Engineering / Cyber Security / Data Science) Examination

OPERATING SYSTEMS

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions carry marks as indicated against them.

(2) Illustrate your answers with diagrams wherever necessary.

1. (a) How multiprocessor systems are advantageous over single–processor systems ? Elaborate with suitable examples. 5(CO1)

(b) Describe the microkernel approach to designing an operating system with a neat schematic. Bring out the specific merits and limitations of this approach. 5(CO1)

2. (a) Five processes arrive at following time, in the given order :

Process	**Arrival Time**	**Burst Time**	**Priority**
P1	0	10	4
P2	2	30	3
P3	3	3	1
P4	4	8	2
P5	5	6	5

Draw the Gantt chart; find average waiting time and average Turnaround time using Preemptive Priority and Round Robin (RR) algorithm where time quantum is 5. 6(CO2)

(b) Describe the different states that a process can be in within an operating system and explain the transitions between these states with the help of a diagram. 4(CO2)

3. (a) In a producer-consumer problem, producer and consumer threads share a bounded buffer. How would you use semaphores to implement synchronization between the producer and consumer threads to ensure that the buffer is not accessed concurrently by multiple threads ? 5(CO3)

(b) The first known correct software solution to the critical-section problem for two processes, P0 and P1, share the following variables :

```
boolean flag[2]; /* initially false */
int turn;
Structure of Process Pi is as follows :
do {
flag[i] = TRUE;
while(flag[j]) { }
// critical section
turn = j;
flag [i] = FALSE;
// remainder section
} while (TRUE);
```

The structure of process Pi (i == 0 or 1) is shown in above code, the other process is Pj (j == 1 or 0). Prove that the algorithm satisfies all three requirements for the critical-section problem. 5(CO3)

4. (a) How does deadlock avoidance differ from deadlock prevention ? Write about the deadlock avoidance algorithm in detail. 4(CO3)

(b) Consider the three resources, A, B and C. There are 4 processes P0 to P3. At T0 we have the following snapshot of the system :

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	1	0	1	2	1	1	2	1	1
P_1	2	1	2	5	4	4			
P_2	3	0	0	3	1	1			
P_3	1	0	1	1	1	1			

(i) Find the need matrix.

(ii) Is the system in safe state ? Give explanation in both cases (yes / no). 6(CO3)

5. (a) Compare the following main memory organization schemes : Contiguous memory allocation, pure segmentation and pure paging with respect to the following issues :

(i) External fragmentation.

(ii) Internal fragmentation. 4(CO2)

(b) Consider the following page reference string :

1, 2, 3, 4, 1, 2, 5, 6, 2, 1, 3, 1, 7, 6, 3, 2, 1, 2, 3, 6

Find out the number of page faults if there are 4-page frames, using the following page replacement algorithm :

(i) Least Recently Used (LRU).

(ii) Optimal. 6(CO2)

6. (a) Given the following track requests in the disk queue, compute for the Total Head Movement (THM) of the read / write head :—

95, 180, 34, 119, 11, 123, 62, 64

Consider that the read / write head is positioned at location 50. Prior to this track location 19 was serviced. Show the total head movement for a 200 track disk for each of the following disk-scheduling algorithms :

(i) Shortest Seek Time First (SSTF).

(ii) LOOK. 6(CO2)

(b) Compare various types of directory structures in different operating systems. 4(CO2)