USN	1	M	S							

RAMAIAH Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – JULY / AUGUST 2022

Program	:	**B.E. : Information Science and Engineering**	**Semester**	:	**IV**
Course Name	:	**Operating Systems**	**Max. Marks**	:	**100**
Course Code	:	**IS42**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT- I

1. a) What are system calls? Why are they needed? With a neat diagram describe the mechanism to differentiate between the execution of the user application and system calls. CO1 (05)

   b) Briefly describe the data structure maintained by operating system to store process specific information. CO1 (05)

   c) List and explain the different services provided by operating system that are helpful for the proper operation of computer system. CO1 (05)

   d) Differentiate between short term, long term and medium-term schedulers. CO1 (05)

2. a) Consider the following set of processes with the length of the CPU burst given in milli seconds and are assumed to arrive at the time specified below: CO1 (08)

Processes	Arrival time(ms)	Burst time(ms)	Priority
P1	0	6	4
P2	3	5	2
P3	3	3	6
P4	5	5	3

   i. Draw two Gantt chart to illustrate the execution of the following processes using Round Robin (with time quantum= 2ms) and Preemptive priority (higher priority number indicates least priority) scheduling algorithms.

   ii. Calculate the waiting time of each of these processes using each of these scheduling algorithms.

   iii. Calculate the average waiting time for each of these scheduling algorithms.

   b) "A process is an active entity". Justify. Explain with a neat diagram the activity of a process throughout its lifetime CO1 (08)

   c) Describe operating system from user and system perspective. CO1 (04)

UNIT – II

3. a) Considering a system with five processes P_0 through P_4 and three resources of type A, B, C. Resource type A has 10 instances, B has 5 instances and type C has 7 instances. Suppose at time t_0 following snapshot of the system has been taken: CO2 (10)

Process	Allocation	Max	Available
	A B C	A B C	A B C
P_0	0 1 0	7 5 3	3 3 2
P_1	2 0 0	3 2 2	
P_2	3 0 2	9 0 2	
P_3	2 1 1	2 2 2	
P_4	0 0 2	4 3 3	

Answer the following questions using Banker's Algorithm:

(i) What will be the content of the Need matrix?

(ii) Is the system in a safe state? If yes, then what is the safe sequence?

(iii) If process P1 requests one additional instance of resource type A and two instances of resource type C, can the request be granted immediately? Justify by giving the safe sequence of process execution.

b) Consider the following structure of philosopher i; CO2 (07)

```
do {
   wait (chopstick[i] );
         wait (chopStick[ (i + 1) % 5] );
                        //  eat
         signal (chopstick[i] );
         signal (chopstick[ (i + 1) % 5] );

              //  think
} while (TRUE);
```

What is the problem with the above algorithm? Give the solution to solve the same using monitors.

c) Illustrate Race condition with an example? CO2 (03)

4. a) Consider the following snapshot of a system: CO2 (10)

	Allocation A B C D	**Max A B C D**	**Available A B C D**
P_0	0 0 1 2	0 0 1 2	1 5 2 0
P_1	1 0 0 0	1 7 5 0	
P_2	1 3 5 4	2 3 5 6	
P_3	0 6 3 2	0 6 5 2	
P_4	0 0 1 4	0 6 5 6	

Answer the following questions using Banker's Algorithm:

(i) What is the content of Need matrix?

(ii) Is the system in a safe state? If yes, what is the safe sequence?

(iii) If a request from process P1 arrives for (0, 4, 2, 0) can the request be granted immediately? Justify by giving the safe sequence of process execution.

b) Describe the two hardware instructions used in implementing the statement – "No two processes can exist in the critical section at any given point of time". CO2 (08)

c) Give the solution for the priority inversion problem in process synchronization. CO2 (02)

UNIT – III

5. a) Consider a main memory with three-page frames and the following sequence of page references: 3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3. How many page faults would occur for the following page replacement algorithm? Remember that all frames are initially empty, so your first unique pages will cost one fault each. CO3 (06)

i. FIFO page replacement algorithm
ii. LRU page replacement algorithm
iii. Optimal page replacement algorithm

	b)	Memory access to a byte involving paging technique will consume more time. Describe how this can be addressed using TLB's.	CO3	(07)
	c)	If the logical address space of a process is greater than 32 bits, suggest a suitable technique to implement the page table.	CO3	(07)
6.	a)	Differentiate between internal and external fragmentation. Given five memory partitions of 100 KB, 500 KB, 200 KB, 400 KB, and600 KB (in order), how would each of the first-fit, best-fit, and worst fit algorithms place processes of 219 KB, 425 KB, 110 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?	CO3	(06)
	b)	For the following page reference string: 1,2,3,4,1,2,5,1,2,3,4,5. Calculate the number of page faults using FIFO and LRU page replacement algorithms for memory with 3 and 4 frames.	CO3	(08)
	c)	With suitable diagram describe the steps involved in handling page fault.	CO3	(06)

UNIT – IV

7.	a)	Compare bit-vector method with linked list method of implementing free space list. What is a consistency checker and what are its applications?	CO4	(06)
	b)	Suppose that a disk drive has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 60 and the previous request was at cylinder 58. The queue of pending requests in FIFO order is 87, 170, 40, 150, 36, 72, 66, 15. Starting from the current head position, what is the total distance that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms? i) FCFS ii) SSTF.	CO4	(08)
	c)	Illustrate how linked allocation solves the external fragmentation and size-declaration problems of contiguous allocation with an example.	CO4	(06)
8.	a)	List the differences between sequential and direct file access methods and illustrate the working of these two methods with an example.	CO4	(06)
	b)	Describe the working of tree structured directory and general graph directory structures with their advantages and disadvantages.	CO4	(08)
	c)	Illustrate Swap-space management with an example.	CO4	(06)

UNIT – V

9.	a)	Explain the goals & principles of protection in detail	CO5	(04)
	b)	What is an Access matrix? How can it be used as a model for protection?	CO5	(08)
	c)	Describe the Linux process model and illustrate how Linux schedules processes and provides inter process communication	CO5	(08)
10.	a)	Examine capability and language-based protection systems.	CO5	(10)
	b)	Illustrate process management and memory management in Linux system.	CO5	(10)

****