(c) (i) Write a shell script to enter 2 strings from the user. Print whether the entered strings are the same or not. Also check whether the length of each string is equal to zero or not and print appropriate messages.

(ii) Explain in brief *five* different types of shell environment variables. (CO3, 5)

H Roll No. .....

TCS–502

B. TECH. (CS/IT) (FIFTH SEMESTER)

END SEMESTER EXAMINATION, 2021-22

OPERATING SYSTEM

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) & (c) in each main question.

(iii) Total marks in each main questions are **twenty**.

(iv) Each question carries 10 marks.

1. (a) (i) What are the differences between Batch processing system and Real time processing system ?

(ii) What are the inconveniences that a user can face while interacting with a computer system, which is without an operating system ? (CO1, 2)

(b) (i) What is the purpose of command interpreter ? Why is it usually separate from the kernel ?

(ii) What do chmod, chown and chgrp commands do ? (CO1, 2)

(c) (i) What are the things which are not shared by each thread inside a process ?

(ii) Suppose a web server is running a process of 10 MB which listens to each incoming client requests and then creates a separate threads to service each client requests. Each thread takes 100 KB memory space. Consider web server has a total 1 GB of main memory and server memory stores only user processes, threads.

Find the number of maximum client connections supported by this server. (CO1, 2)

2. (a) What is critical section problem and what are the requirements that need to be satisfied by any solution to critical section problem ? Give a solution to a 2-process critical section problem. (CO2)

(b) A uni-processor computer system has three processes, which alternate 20 ms CPU bursts with 80 ms I/O bursts. All the processes were created at nearly the same time. The I/O of all the processes can proceed in parallel. What will be the CPU utilization (over a long period of time) using FCFS and Round Robin (time quantum 10 ms) for this system ? Show all calculations. (CO2)

(c) (i) Given a system using SJF algorithm for short-term scheduling and exponential averaging with $\alpha = 0.7$,

what would be the next expected burst time for a process with burst times of 5, 9, 3 and 5 and an initial value for T1 of 20 ?

(ii) Consider a preemptive priority scheduling algorithm based on dynamically changing priorities. Larger priority numbers imply higher priority. When a process is waiting for the CPU (in the ready queue, but not running), its priority changes at a rate of α ; when it is running, its priority changes at a rate β. All processes are given a priority of 0 when they enter the ready queue. The parameters α and β can be set to give many different scheduling algorithms.

(i) What is the algorithm that results from $\beta > \alpha > 0$?

(ii) What is the algorithm that results from $\alpha < \beta < 0$? (CO2)

(a) Answer the following questions :

(i) List the *two* differences between the *two* mechanisms/models of Inter-process communication in tabular form. (CO3)

(ii) Name a technique which is used to implement virtual memory concept. What is the motivation behind using that technique ? (CO3)

(iii) Consider a system having below segmentation memory management technique implemented. The virtual address is divided as follows : (CO3)

Segment Number (8 bits)	Offset (12 bits)

Then what can be the maximum size of process in this system ?

(iv) Why are page sizes always in powers of 2 ?

(v) What do you mean by thrashing ? List the *one* solution for it.

(b) Consider the following snapshot of a system. A, B , C, D are different types of resources :

	Max				Allocation			
Process	A	B	C	D	A	B	C	D
P0	0	0	1	2	0	0	1	2
P1	1	7	5	0	1	0	0	0
P2	2	3	5	6	1	3	5	4
P3	0	6	5	2	0	6	3	2
P4	0	6	5	6	0	0	1	4

Available : 1, 5, 2, 0

Answer the following questions using the Banker's algorithm : (CO4)

(i) Is the system in a safe state ? If yes, then find any *one* safe sequence showing all calculations. If not, then state the proper reason.

(ii) If a request from process P1 arrives for (0, 4, 2, 0), can the request be granted immediately ?

(c) (i) Consider a single level paging scheme. The virtual address space is 4 GB and page size is 128 KB. What is the maximum page table entry size possible such that the entire page table fits well in one page ?

(ii) Consider a main memory with five page frames and the following sequence of page references :

3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3.

Using Least Recently (LRU) page replacement policy, find the number of page faults and number of page hits. (CO5)

4. (a) (i) Name any *four* techniques used for managing the free space of secondary storage blocks ?

(ii) Name the *four* different types of directory structures w.r.t. secondary storage.

(iii) Find the number of hard disk blocks needed to store a 100 KB file, if each hard disk block size is 16 KB.

(iv) Define cylinder, track and sector in context of disk.

(v) What is shell and shell script w.r.t. operating system ? (CO5)

(b) Suppose that the disk drive has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 53. The queue of pending request, in FIFO order is : 98, 183, 37, 122, 14, 124, 14, 124, 65, 67. 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 each of the following disk scheduling algorithms ? (CO5)

(i) FCFS

(ii) SSTF

(iii) SCAN

(iv) C-SCAN

(c) Consider a 500 GB hard disk having 32 KB block sizes. The size of the block pointer is 2 bytes. File allocation table (FAT) based file system is used to keep track of allocated blocks on hard disk. Then : (CO5)

(i) What will be the total no. of entries in the FAT ?

(ii) Find the size of the file allocation table (FAT) in Megabytes (MB).

(iii) How many HDD blocks are needed to store FAT ?

(iv) How much percentage of HDD is used to store FAT ?

(v) Find the maximum size of a file that can be stored on this disk as per above FAT.

5. (a) (i) What is translation lookaside buffer ? What is stored inside it ?

(ii) What is page fault ? What actions are taken after page fault ?

(iii) On what factors does the allocation of minimum and maximum number of page frames to a process in a system depend ?

(iv) Draw a mechanism for enforcing memory protection in order to prevent a program from modifying the memory associated with other programs.

(v) Consider a computer system with 40-bit virtual addressing and page size of 16 KB. If the computer system has a one-level page table per process and each page table entry requires 48 bits, then find the size of the per-process page table in megabytes (MB).

(CO3, 5)

(b) Consider a demand-paging system with a paging disk that has an average access and transfer time of 20 ms. Addresses are translated through a page table in main memory, with an access time of 1 μ per memory access. Thus, each memory reference through the page table takes two accesses. To improve this time, we have added an associative memory that reduces access time to one memory reference, if the page-table entry is in the associative memory. Assume that 80% of the time the data or instructions are found in the associative memory, 10% of the remaining time, data or instruction access cause page faults and for the rest of the time; it is found in main memory. What is the effective memory access time ? (CO3, 5)