Duration: 3hrs **[Max Marks: 80]**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 Attempt **any FOUR** [20]

a Differentiate between monolithic and microkernel.

b What is the critical section problem? Mention three conditions that must be satisfied by its solution.

c Explain different types of thread in Operating System

d Explain external fragmentation with example

e Give different file access methods

2 a What are system calls? Explain different types of system calls with example. [10]

b Explain Deadlock and how to prevent it? [10]

3 a Consider the following set of processes. [10]

Process	Burst Time	Arrival Time
P1	10	0
P2	5	1
P3	2	2

1. Draw Gantt chart for FCFS, SJF(Preemptive) and Round Robin (Quantum=2).
2. Also calculate average waiting time and turnaround time for above scheduling algorithms.

b Explain how producer consumer problem can be solved using semaphore. [10]

4 a Explain the role of PCB. [10]

b Consider the following page reference string: 4,3,2,1,4,3,5,4,3,2,1,5. Assume frame size=3.How many page faults would occur for FIFO, Optimal and LRU algorithm? [10]

5 a How can Resource Allocation Graph be used to detect deadlock in the system? [10]

b Explain the concept of segmentation with an example. [10]

6 a Write a short note on file directory structure. [10]

b Suppose that a disk drive has 200 Cylinders, numbered 0 to 199. Queue = 98, 183, 41, 122, 14, 124, 65, 67. The drive is currently serving a request at cylinder 54 and the previous request was at cylinder 20.Find total number of head movements needed to satisfy the requests for the FCFS, SSTF and SCAN disk scheduling algorithm? [10]

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1		Attempt any FOUR	[20]
	a	Explain the following instructions: STOSB, DAA related to 8086.	
	b	Discuss in brief the protection mechanism of 80386DX	
	c	Explain the maximum mode of 8086	
	d	Explain in brief cache organization of Pentium processor	
	e	Write an assembly language program for 8086 to exchange contents of two memory blocks	
2	a	Draw the timing diagrams for Read and Write operations in minimum and maximum mode	[10]
	b	Explain hyper threading technology and its use in Pentium 4	[10]
3	a	Interface DMA controller 8257 with 8086 MP. Explain different data transfer modes of 8257 DMAC	[10]
	b	Write an ALP for 8086 to reverse a string of 10 characters.	[10]
4	a	Compare 80386 ,Pentium 1 ,Pentium 2 and Pentium 3 Processor.	[10]
	b	Explain MESI protocol	[10]
5	a	Explain the Register organization of 80386.	[10]
	b	Explain the Initialization command words (ICWs) and Operational command words(OCWs) of the 8259 PIC.	[10]
6	a	Design 8086 microprocessor-based on following Specifications: 1. MP 8086 working at 10MHz minimum mode. 2. 32 KB ROM using 8 KB Devices 3. 16 KB RAM using 4KB chips	[10]
	b	Explain 8255 with a block diagram and its operating modes	[10]

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(Time: 3 Hours) **Max. Marks: 80**

N.B. (1) Question No. 1 is compulsory.

(2) Answer any three questions from Q.2 to Q.6.

(3) Use of Statistical Tables permitted.

(4) Figures to the right indicate full marks

Q1 a) If $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$, then find the Eigen values of $4A^{-1} + A^3 + I$ [5]

b) Evaluate $\int_c |z|\, dz$, where C is the left half of unit circle $|z|$ =1 from z = - i to z = i. [5]

c) $Maximise \quad z = x_1 + 3x_2 + 3x_3$ [5]

Subject to $x_1 + 2x_2 + 3x_3 = 4$

$2x_1 + 3x_2 + 5x_3 = 7.$

Find all the basic solutions to the above problem. Which of them are basic feasible, non-degenerate, infeasible basic and optimal solution.

d) Tests made on breaking strength of 10 pieces of a metal wire gave the following results 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 in kgs. [5]

Test if the breaking strength of the metal wire can be assumed to be 577 kg ?

Q2 (a) Using Cauchy's residue theorem evaluate [6]

$\int_C \frac{(z+4)^2}{z^4+5z^3+6z^2} dz$, Where c is |z|=1.

(b) Find $Z\{f(k) * g(k)\} \quad if \quad f(k) = 4^k\, U(k)\, , g(k) = 5^k U(k).$ [6]

(c) Solve the following L.P.P by Simplex Method [8]

$Maximise \quad z = 3x_1 + 2x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 \quad + 2x_3 \leq 460$

$x_1 + 4x_2 \quad \leq 420$

$x_1, x_2, x_3 \geq 0$

Q3 a) Theory predicts that the proportion of beans in the four groups A, B, C, D should be 9: 3 :3 :1. In an experiment among 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental results support the theory? [6]

(Given that Critical value of chi-square 3 d. f and 5% L.O.S is 7.81)

b) Obtain Taylor's and Laurent's series expansion of $f(z) = \frac{z-1}{z^2-2z-3}$ [6]

c) Use the method of Lagrange's multipliers to solve the following N.L.P.P [8]

Optimize $z = 6x_1 + 8x_2 - {x_1}^2 - {x_2}^2$

Subject to $4\,x_1 + 3x_2 = 16$,

$3x_1 + 5x_2 = 15$

$x_1, x_2 \geq 0$

Q4a) fit a Poisson distribution to the following data [6]

No. of deaths	0	1	2	3	4
Frequencies	123	59	14	3	1

b) Find the inverse Z-transform of $\frac{1}{(z-2)(z-3)}$, $if\ ROC\ is\quad (i)\quad |z| < 2\quad (ii)\ 2 < |z| < 3$ [6]

c) Show that the matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix. [8]

Q5a) Using the method of Lagrange's multipliers to solve the following N.L.P.P [6]

Optimize $z = 4x_1 + 8x_2 - {x_1}^2 - {x_2}^2$

Subject to $x_1 + x_2 = 4,$

$x_1, x_2 \geq 0.$ [6]

b) Verify Cayley- Hamilton Theorem for the matrix $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$ [6]

c) Solve by the dual Simplex Method [8]

$Minimise\ z = 6x_1 + x_2$

Subject to $2x_1 + x_2 \geq 3,$

$x_1 - x_2 \geq 0$, $x_1, x_2 \geq 0$

Q6a) Find the Z-transform of $f\{k\} = \begin{cases} b^k, & k < 0 \\ a^k, & k \geq 0 \end{cases}$ [6]

b) The income of a group of 10,000 persons were found to be normally distributed with mean Rs.520 and standard deviation Rs.60. Find the lowest income of the richest 500. [6]

c) Using Kuhn Tucker conditions, solve the following NLPP [8]

$Maximise$ $z = 10x_1 + 4x_2 - 2{x_1}^2 - {x_2}^2$

Subject to $2\,x_1 + x_2 - 5 \leq 0$

$x_1, x_2 \geq 0$

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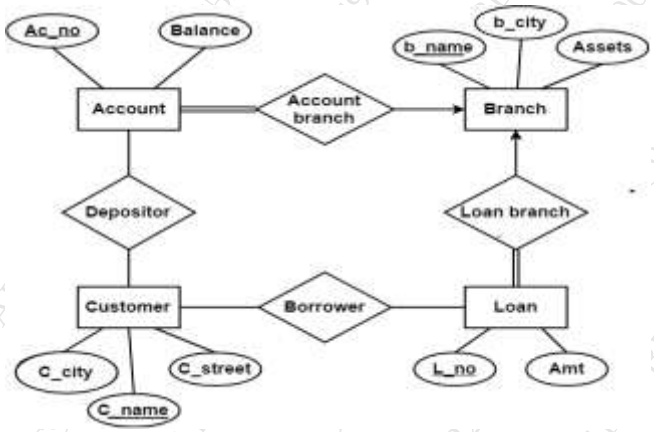
1 Attempt **any FOUR** **[20]**

a Identify different users of database management system

b Convert following E-R diagram to relational schema



c Explain all types of integrity constraints with an examples?

d List all functional dependencies satisfied by the relation.

X	Y	Z
X1	Y1	Z1
X1	Y2	Z1
X2	Y2	Z1
X2	Y2	Z1

e Discuss Log based recovery with an example

2 a Discuss three layer schema architecture with suitable diagram. What is Data Independence? Explain types of data independence. **[10]**

b What is deadlock? Give deadlock prevention methods with suitable example **[10]**

3 a Construct an ER diagram and convert it into a relational model for a company which has several employees working on different types of Projects. Several employees are working for one department, every department has a manager. Several employees are supervised by one employee. Employees have zero or more dependents **[10]**

b Explain the following Relational Algebra operations with suitable example. **[10]**

1) Generalized Project 2) Select

3) Union 4) Rename

5) Natural Join

4 a Write SQL queries for the given database **[10]**

Book(book_id, title,author, cost)
Store(store_no, city, state, inventory_val)
Stock(store_no, book_id,quantity)

(i)Modify the cost of DBMS books by 10%

(ii)Find the total number of books in Mumbai stores

(iii)Find title of all books whose title contains the word 'System'

(iv)Find title of the most expensive book

(v)Add a new record in Book(Assume values as per requirement)

b Why there is need of normalization? Explain 1NF, 2NF, 3NF and BCNF with example. **[10]**

5 a Describe ACID properties with examples **[10]**

b Give example of serial schedule and equivalent to serial schedule with respect to conflict serailizability. Discuss conflict serializability with example **[10]**

6 Write short note on the following **(Any four)** **[20]**

a Conversion of Specialization to relational schema with suitable example **[05]**

b Types of attributes **[05]**

c 2PL concurrency control protocol **[05]**

d Triggers **[05]**

e Lossless decomposition **[05]**

(Time: 3 Hours) **Total Marks: 80**

N.B: (1) Question No. 1 is compulsory.
(2) Attempt any three from the remaining questions.
(3) Figures to the right indicate full marks.

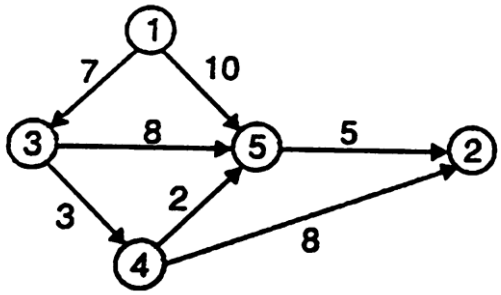
1. Attempt any four
   (A) Describe the relationship along P, NP, NP-hard, NP-complete? 5
   (B) What is the difference between divide and conquer approach and dynamic programming? 5
   (C) Explain Multistage graph with example. 5
   (D) Write an abstract algorithm for greedy design method. 5
   (E) What is Asymptotic analysis and define big Oh, big Omega and Theta notation? 5

2. (A) Sort the following numbers using Quick Sort. Also, derive the time complexity of Quick Sort. 50, 31, 71, 38, 77, 81, 12, 33. 10
   (B) What is Knuth Morris Pratt Method of Pattern Matching? Give Examples. 10

3. (A) Solve the following instance of Job sequencing with deadlines problem n=7, profits (p1, p2, p3, p4, p5, p6, p7) = (3, 5, 20, 18, 1, 6, 30) and deadlines (d1, d2, d3, d4, d5, d6, d7) = (1, 3, 4, 3, 2, 1, 2). Schedule the jobs in such way so as to get maximum profit. 10
   (B) Write and explain sum of subset algorithm for n = 5, W = {2, 7, 8, 9, 15} M = 17. 10

4. (A) Find Longest Common Subsequence for following strings 10
   X = acbaed
   Y = abcabe
   (B) Write an algorithm to find the minimum and maximum value using divide and conquer and also derive its complexity. 10

5. (A) Find a minimum cost path from 3 to 2 in the given graph using dynamic programming. 10



(B) Write an algorithm to solve N Queens problem. Show its working for N = 4. 10

6. Attempt any two 20

(A) Explain naïve string matching algorithm with example.

(B) Explain 0/1 knapsack problem using dynamic programming.

(C) To Find MST of following graph using prim's and kruskal's Algorithm.