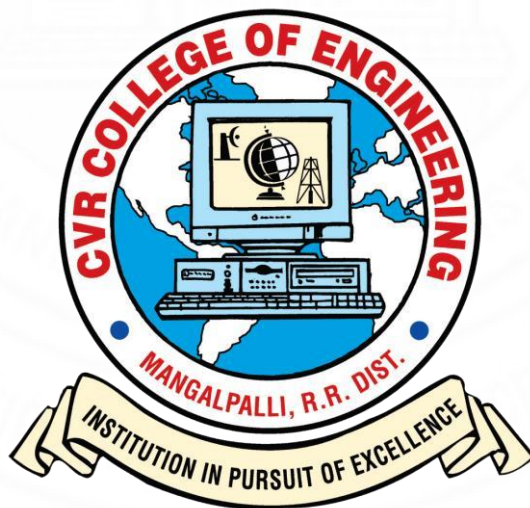


**COURSE FILE**  
**FOR**  
**B.TECH II YEAR II SEMESTER**  
**CSE-AI&ML, CSE-DS, CSE-CS**  
**2021-2022**



**CVR COLLEGE OF ENGINEERING**  
**(UGC Autonomous Institution)**  
**ACCREDITED BY NBA & NAAC**  
(Approved by AICTE & Govt. of Telangana and  
Affiliated to JNT University, Hyderabad)  
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# **CVR COLLEGE OF ENGINEERING**

## **VISION**

- ❖ To be a state of the art institution of engineering in pursuit of excellence, in the service of society.

## **MISSION**

- ❖ To excel in providing quality education at undergraduate and graduate levels.
- ❖ To encourage research and innovation.
- ❖ To provide infrastructure and facilities to meet the latest technological needs.
- ❖ To establish Centers of Excellence through active interaction with industry.
- ❖ To nurture students towards holistic development with human values and ethics.



# **CVR COLLEGE OF ENGINEERING**

## **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

### **VISION**

Towards a Global Knowledge Hub, striving continuously in pursuit of excellence in Education, Research, consultancy and Technological services to the society.

### **MISSION**

**M1:** To produce the best quality Computer Science professionals by imparting quality training, hands on experience and value education.

**M2:** To strengthen links with industry through partnerships and collaborative developmental works

**M3:** To attain self-sustainability and overall development through Research, Consultancy and Development activities

**M4:** To extend technical expertise to other technical institutions of the region and play a lead role in imparting technical education

**M5:** To inculcate work ethics and commitment in students for their future endeavors to serve the society.



## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

**PEO 1: Employability:** Computer Science & Engineering graduates will acquire capability to apply their knowledge and skills to solve various kinds of computational engineering problems.

**PEO 2: Professionalism:** Graduates will inculcate professional attitude, inter-disciplinary approach, ethics and ability to relate computer engineering issues with social awareness.

**PEO 3: Managerial skills:** Graduates will possess managerial skills to face challenges in the profession by working harmoniously in a team with effective communication skills.

**PEO 4: Continuous learning:** Graduates will continue to learn and adapt in a world of constantly evolving technologies and pursue research towards academic excellence.

**PEO 5: Adaptability:** Graduates of Computer Science & Engineering will have soft skills to adapt to the diverse global environment.

### **Program Specific Outcomes (PSOs)**

**PSO 1: Software Development Skills:** Analyze a problem, design an algorithm, define the computing requirements and implement it.

**PSO 2: Professional Skills:** Architect, evolve and integrate a working model, leading to secure software product development.

**PSO 3: Interdisciplinary Skills:** Understand software engineering practices and hardware integration for developing solutions over multi-disciplinary domains.

**PSO 4: Industry Readiness:** Use theoretical and practical concepts to realize new ideas for pursuing research, entrepreneurship, employment and higher studies.



## Program Outcomes

- PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9: Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12: Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



## INDEX

Sl. No.	Subject Name
1	Computer Algorithms Design & Analysis
2	Advanced Data Structures through Java
3	Data Base Management System
4	Computer Architecture and Micro Controllers
5	Artificial Neural Networks
6	Python for Data Science
7	Foundations of Cyber Security



# **Computer Algorithms Design & Analysis**



## **Course Objectives**

Upon completion of this course, students will be able to do the following:

### **Course Objectives:**

- To emphasize upon the demands of real-world problems in engineering solutions
- To make students conversant with the various paradigms of algorithms
- To handcraft the performance analysis of designed solutions
- To take students through various optimization principles of ill-posed problems

### **Course Outcomes**

CO1: Analyze worst-case running times using asymptotic analysis of algorithms

CO2: Describe the divide-and-conquer paradigm and Synthesize divide-and-conquer algorithms.CO3: Define optimization problems and solve them through various greedy policies

CO4: Describe the dynamic-programming paradigm and synthesize dynamic programmingalgorithms, and analyze them.

CO5: Reduce size of search space of the optimization problems by applying backtracking andbranch and bound tools. Appreciate the Non-Deterministic modeling of algorithms





**COURSE TO PROGRAM OUTCOME MAPPING:**

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
C A D A	3	2	3	2	1	2	1						3	2	2	1

**COURSE OUTCOMES AND PROGRAM OUTCOME MAPPING:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2		2									2	3	2	1
CO 2		3			1		1						2	2	1	2
CO 3		2	3	2		2							3	2	2	1
CO 4	3		3										3	2	1	
CO 5	2		3			2							3	1	2	1



## COMPUTER ALGORITHMS DESIGN & ANALYSIS

65255

Instruction : 3 periods / week  
Tutorial :  
Credits : 3

Sessional Marks :30Marks  
End Examination : 70 Marks  
End Exam Duration : 3 Hours

**UNIT I :** Fundamentals of algorithm analysis: introduction- Definition of algorithm, algorithmic problem solving, framework for analysis of algorithm- brute force and store and reuse method. Asymptotic notations-  $O$ ,  $\Omega$ , and  $\Theta$  notations, properties of asymptotic notations. Recursive algorithms and recurrence relations- toh problem.

**UNIT II :** Algorithm paradigms: Divide and Conquer- control abstraction, binary search algorithm and its complexity, max min search, stable and unstable algorithms, quick sort, its complexity, convex hull problem. Depth first search(dfs), topological sorting, breadth first search (bfs), articulation points.

**UNIT III :** Greedy paradigm: control abstraction, fractional knapsack problem, job sequencing problem, minimum spanning tree, Prim's algorithm, Disjoint subsets, Kruskal's algorithm, Huffman code, Dijkstra's algorithm.

**UNIT IV:** Dynamic programming: control abstraction, Multistage Graphs, OBST, Matrix chain multiplication, multiplicative optimization, reliability design, 0/1 knapsack problem.

**UNIT V:** Optimization problems as search problems: Back Tracking, n-queens problem, Graph coloring, Subset-sum modeling Branch and Bound- introduction, Data structure support and TSP. Randomized algorithms, P- problems, tractable algorithms, Definition of different NP problems.

### Text Books:

1. E. Horowitz and S.Sahni, Fundamentals of algorithms, 2nd edition Galgotia Publications, 2010.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, Introduction to algorithms, 2nd edition, PHI/Pearson Education, 2001.

### References:

1. Michael T.Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, Wiley India, 2006.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, PHI/Pearson Education, 1974.



**Lecture Schedule**  
**Computer Algorithms Design & Analysis**

Unit/Chapter	No. of periods	S.No. of periods	Topic to be covered
Unit-I	10	1	Introduction- Definition of algorithm, algorithmic problem solving
		2	Framework for analysis of algorithm-
		3	brute force and store and reuse method.
		4to7	Asymptotic Notation Big oh, Omega, Theta notations
		8	Properties of Asymptotic notations
		9	Recursive algorithms
		10	Recurrence relations- toh problem.
Unit-II	10	11	Algorithm paradigms: Divide and Conquer- control abstraction
		12	Binary search algorithm and its complexity,
		13	Max min search
		14	Stable and unstable algorithms
		15,16	Quick sort, its complexity, convexhull problem,
		17,18	Depth first search(dfs), Breadth firstsearch (bfs),
		19,20	Topological sorting, Articulation points.
Unit-II	9	21	Greedy paradigm, Control of abstraction
		22	Fractional knapsack problem
		23	Job sequencing problem,
		24,25	Minimum spanning tree, Prim's Algorithm



		26	Kruskal's algorithm,
		27	Disjoint Subsets
		28	Huffman code
		29	Dijkstra's algorithm.
Unit-III	1	30	Dynamic programming-general method
		31	Applications: multistage graphs
		32, 33	Optimal Binary search tree
		34	-do- (using dynamic programming)
		35, 36	Matrix chain multiplication
		37	Multiplicative optimization
		38,39	Reliability design
		40	0/1 knapsack problem
Unit-IV	8	41	Optimization problems as search problems: Back Tracking
		42	N-queens problem
		43	Graph coloring
		44	Subset-sum modeling
		45	Branch and Bound- introduction
		46	Data structure support and TSP.
		47	Randomized algorithms
		48	P- problems, Tractable algorithms, Definition of different NP problems



## UNIT -- I

### Short Type Questions

1. Define Algorithm
2. Define Time Complexity.
3. Define profiling.
4. How to validate algorithms?
5. How to device algorithms?
6. How to analysis algorithms?
7. How to test a program?
8. Find the time Complexity of conventional matrix multiplication algorithm.
9. Briefly explain about space complexity.
10. What is meant by Omega notation?
11. What is meant by little-o notation?
12. What are important problem types? (or) Enumerate some important types of problems.
13. What are algorithm design techniques?
14. How is an algorithm's time efficiency measured?
15. What is Big 'Oh' notation?
16. Define order of an algorithm.
17. How is the efficiency of the algorithm defined?
18. What are the characteristics of an algorithm?
19. What are the different criteria used to improve the effectiveness of algorithm?
20. Analyze the time complexity of the following  
segment:  

```
for(i=0;i<N;i++)  
    for(j=N/2;j>0;j--) sum++;
```
21. Write general plan for analyzing non-recursive algorithms.
22. Define the terms: pseudo code and flow chart
23. Write general plan for analyzing recursive algorithms.
24. Define Big Theta Notations.
25. Define best-case step count.
26. Define average-case step count



27. Sort the following in ascending order.  
 $O(n)$ ,  $O(1)$ ,  $O(2^n)$ ,  $(\log n)$ ,  $O(n^2)$ ,  $O(n \log n)$ ,  $O(n^3)$ ,  $O(3^n)$
28. Write algorithm using iterative and recursive function to find sum of n numbers.
29. Write short notes on brute-force approach.
30. Write short notes on Tower of Hanoi problem.
31. Write a recurrence relation for factorial of a +ve integer n.
32. Write a recurrence relation for  $n^{\text{th}}$  Fibonacci Number.
33. Prove that  $n^3 \leq 10n^2 \leq n^3$
34. Write an iterative algorithm for adding n values in an array.
35. Write a recursive algorithm for adding n values in an array.
36. What do you mean "framework of analysis of algorithm"?

### Essay Type Questions

1. Explain the different Asymptotic Notations with suitable examples.
2. Show the following equalities are correct.  

$$(i) 5n^2 - 6n = \Theta(n^2) \quad (ii) n! = O(n^n) \quad (iii) 33n^3 + 4n^2 = \Omega(n^3) \quad (iv) \sum_{i=0}^n t^2 \leq n^3$$
3. Write an algorithm for Selection Sort and compute the time complexity of the algorithm.
4. Write an algorithm for solving Towers of Hanoi problem and compute the time complexity of the algorithm.
5. Write the algorithms for finding  $n^{\text{th}}$  Fibonacci number using iterative method and recursive model.
6. Explain performance analysis and analysis the linear sort algorithm.
7. Explain recurrence relation and recursive algorithm with an example.
8. Write an algorithm for matrix multiplication of orders  $m \times n$ ,  $n \times p$  and obtain runtimes for  $n=1, 10, 20, 30$  and  $100$ .



9. Explain Brute-Force algorithm and write a brute force algorithm for search an element in an array.
10. (a) Compare the two functions  $n^2$  and  $2^n/4$  for various values of  $n$  and plot it. Determine when the second become larger than the first. (b) Write an Euclidean algorithm for GCD( $m,n$ ).

## UNIT -- II

### Short type Questions

1. Write short notes on divide and conquer algorithm design.
2. Write an algorithm for control abstraction of divide and conquer.
3. What is the general recurrence relation for divide and conquer algorithm?
4. Solve the following recurrence relation using substitution method.  

$$T(n) = \begin{cases} 1 & n \leq 4 \\ T(n/4) + C & n > 4 \end{cases}$$
5. What is the time complexity of Binary Search with input data size is  $n$ ? Estimate for  $n=100$ .
6. Write an algorithm for straight forward max-min algorithm.
7. What is the recurrence relation for max-min algorithm?
8. What is the time complexity of MergeSort?
9. Describe the recurrence relation of merge sort
10. When sorting method is stable?
11. Define partitioning element in QuickSort.
12. Verify that the QuickSort Algorithm takes maximum stack space needed is  $O(\log(n))$ .
13. What is the time complexity of QuickSort Algorithm? Estimate the time if  $n=1000$
14. Define convex hull with example.
15. What is graph? What do you mean traversal in a graph?
16. How depth first search traversal in a graph?
17. How breadth first search traversal in a graph?
18. Write the differences between DFS and BFS traversal in a graph..
19. Define "connected graph" with example



20. Define connected components in a graph.
21. Define articulation point with example.
22. What do you mean by spanning tree? How it will be generated.
23. When the graph G is biconnected?
24. Define maximal biconnected components.
25. What is depth first numbers of the vertices in a graph G?
26. Define breadth first spanning tree.
27. Define depth first spanning tree.
28. How we represent a graph as an adjacency list?
29. State any one reachability problem.
30. Define "forward" and "back" edges
31. Prove that if G is a connected undirected graph with n vertices and n-1 edges then G is a tree.
32. What is the diameter of the tree?

### Essay type Questions

- 1) Solve the recurrence relation  $T(n) = T(1)$  if  $n \leq 1$  for the following choices of a, b, f(n) and T(1)
 

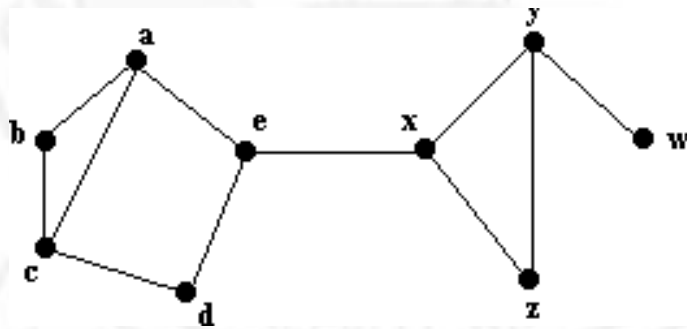
$aT(n/b) + f(n)$  if  $n > 1$

  - (i) for a=1, b=2, f(n)=cn and T(1)=1
  - (ii) for a=5, b=4, f(n)=cn<sup>2</sup> and T(1)=2
- 2) Explain detecting a counterfeit coin from a set of n(n>1) coins using divide and conquer methodology. How many weight comparisons are done?
- 3) Write an algorithm for recursive and iterative versions of binary search with data size n. Estimate the time complexity of the algorithms.
- 4) Write the recursive algorithm for Max-Min problem and derive the time complexity of the algorithm.
- 5) Write an algorithm for Quick sort and show how it sorts the following sequences of keys: 1, 1, 1, 1, 1, 1, 1 and 5, 5, 8, 3, 4, 3, 2.





- 6) Write Graham's scan algorithm for convex hull problem and estimate the time complexity.
- 7) Explain convex hull problem using divide and conquer approach and estimate the time complexity.
- 8) Prove that if H1 and H2 are two upper hulls with at most **m** points each, their common tangent can be computed in  $O(\log^2 m)$  time.
- 9) Write the algorithms for traversing in a graph (i) Depth First Search (ii) Breadth First Search.
- 10) Write an algorithm for determine bicomponent in a graph and test the algorithm with a simple graph.
- 11) Write an algorithm for compute **dfn** and L and test the algorithm with one simple graph.
- 12) Find Articulation point for the graph using the algorithm dfn().



## **UNIT -- III**

### **Short type Questions**

1. Write the objective function of Knapsack problem.
2. Write any two characteristics of Greedy algorithm?
3. Define Optimal & Feasible Solutions
4. What is the Greedy choice property?
5. Give the time complexity of Job Sequencing with deadlines.
6. Write the Control abstraction of Greedy Method.
7. Difference between Krushkal's algorithm and Prim's algorithm.
8. Why sets are used in Krushkal's algorithm.
9. Briefly explain logic of Prim's algorithm.
10. Write the constraints in the Knapsack problem.
11. Write the time complexity of Single source shortest path.
12. Justify the Knapsack problem fits the subset paradigm of Greedy Technique.
13. Name the two methods to find the minimum spanning tree.
14. Write two applications of Spanning tree.
15. Write a Knapsack problem algorithm.
16. Give brief description on Greedy method.
17. Define Huffman coding.
18. Explain Prim's algorithm with an example
19. Discuss Kruskal's algorithm with an example
20. Write a Simple FIND() algorithm.
21. Write a Weighted Union() algorithm.
22. Explain how disjoint sets can be represented.
23. Define - Huffman trees
24. Define - Dijkstra's Algorithm
25. Distinguish between BFS and DFS
26. Define - Spanning tree and MST
27. What are the applications or examples of greedy techniques?



### Essay type Questions

1. Prove that Prim's method generates minimum cost spanning trees.
2. Write the Prim's minimum cost spanning tree algorithm.
3. Write the Krushkal's minimum cost spanning tree algorithm.
4. Write short notes on Kruskal's Algorithm.
5. Explain how Knapsack problem is solved using Greedy method.
6. Write a Job sequencing problem with deadlines Algorithm.
7. Give the application of Greedy method. explain Job sequencing problem with deadlines. Let  $n = 4$   $(p_1, p_2, p_3, p_4) = (100, 10, 15, 27)$  and  $(d_1, d_2, d_3, d_4) = (2, 1, 2, 1)$ . Solve it.
8. Explain about single source shortest path problem and algorithms.
9. a). Write the general method and Control Abstraction of Greedy method  
b) Define i) Principles of optimality ii) Feasible solution iii) Optimal solution.  
c) Distinguish between Prim's and Kruskal's spanning tree algorithms.
10. a) State the Greedy Knapsack? Write the algorithm for Greedy knapsack and compute the time complexity.  
b) Find an optimal solution to the Knapsack instance  $n=7$  objects and the capacity of knapsack  $m=15$ . The profits and weights of the objects are  $(P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (10, 5, 15, 7, 6, 18, 3)$   $(W_1, W_2, W_3, W_4, W_5, W_6, W_7) = (2, 3, 5, 7, 1, 4, 1)$ .
11. a) State the Job sequencing deadline problem.  
b) Find an optimal sequence to the  $n=5$  jobs where profits  $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$  and deadlines  $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$ .
12. a) What is a Spanning tree? Explain Prim's Minimum cost spanning tree algorithm with suitable example and find the time complexity.  
b) What is a Minimum Cost Spanning tree? Explain Kruskal's Minimum cost spanning tree algorithm with suitable example and find the time complexity.
13. Discuss the Single source shortest paths (i.e. Dijkstra's) algorithm with suitable example and find the time complexity.
14. Discuss briefly about the minimum cost spanning tree.
15. Write a Greedy algorithm to the Job sequencing with deadlines.
16. Explain the Kruskal's algorithm with an example.
17. Write Dijkstra's Algorithm.
18. Explain Huffman coding with an example

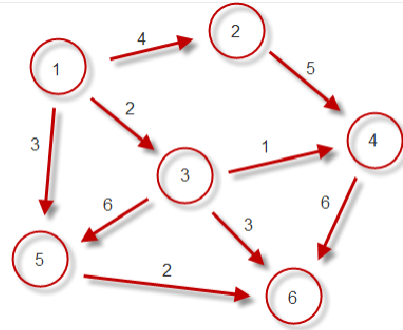


19. Discuss in detail about Disjoint Set Operations.
20. How simple Find (, Union ( ) operations are enhanced to Collapsing find and Weighted Union algorithms.
21. Explain in detail job sequencing with deadlines problem with an example
22. Explain Fractional knapsack problem with example
23. Write an algorithm Knapsack problem. Give example
24. Use an algorithm for greedy strategies for the knapsack to find an optimal solution to the knapsack  
instance  $n=7, m=15, (p_1, p_2, \dots, p_7)=(10, 5, 15, 7, 6, 18, 3)$ , and  $(w_1, w_2, \dots, w_7)=(2, 3, 5, 7, 1, 4, 1)$ .
25. Apply greedy algorithm to generate single-source shortest path with an example graph. Mention its time complexity.
26. Define spanning tree. Compute a minimum cost spanning tree for the graph of figure using prim's algorithm.
27. Derive time complexity of job sequencing with deadlines .Obtain the optimal solution when  $n=5$ ,  $(p_1, p_2, \dots)=(20, 15, 10, 5, 1)$  and  $(d_1, d_2, \dots)=(2, 2, 1, 3, 3)$ .
28. Write and analyze the Prim's Algorithm. How do you construct a MST using Kruskal's Algorithm? Define Spanning tree. Discuss the design steps in Kruskal's algorithm to construct MST with example
29. Construct a Huffman code for the following  

data: Character:	A	B	C	D	
Probability:	0.4	0.1	0.2	0.15	0.15.
30. Write Dijkstra's algorithm for single source shortest path? What modifications are required to the above algorithm so that it calculates all pair shortest paths?
31. Write and explain Dijkstra's algorithm for single source shortest distance problem. Also derive the time complexity of it.
32. Write Prim's algorithm to find the minimum cost spanning tree.
33. Explain the Job sequencing with dead line algorithm and also find the solution for the instance  $n=7, (P_1, P_2, \dots, P_7)=(3, 5, 20, 18, 1, 6, 30)$  and  $(D_1, D_2, \dots, D_7)=(1, 3, 4, 3, 2, 1, 2)$ .
34. Write Prim's algorithm under the assumption that the graphs are represented by adjacency lists.
35. Precisely analyze the computing time and space requirements of this new version of Prim's algorithm using adjacency lists.
36. What is the solution generated by the function job sequencing when  $n=7$  ,  $(P_1, P_2, \dots, P_7)=(3, 5, 20, 18, 1, 6, 30)$  and  $(d_1, d_2, \dots, d_7)=(1, 3, 4, 3, 2, 1, 2)$ .



37. Write the Prim's algorithm apply it to find a minimum spanning tree for the following graph.



## UNIT -- IV

### Short type Questions

1. Define Dominance rule.
2. Define the principle of optimality.
3. If you construct a Binary search tree for the given identifier set {for, do, while, int, if} then the average no of comparisons required searching an identifier in the worst case.
4. Write the objective function in Reliability design problem.
5. What are the features of Dynamic programming?
6. What are the drawbacks of Dynamic programming?
7. Define 0/1 Knapsack problem
8. What is the formula to calculate optimal solution in 0/1 Knapsack problem?
9. In Multistage graph  $G=(V, E)$ , first and last stage contains, how many vertices?
10. If  $r_1=0.99$  and  $m_1=2$ , theoretically find the stage I reliability value.
11. Construct two possible Binary search trees for the set  $(a_1, a_2, a_3) = (\text{do, if, while})$ .
12. Give the formula for finding the expected cost of a Binary search tree representing an identifier set  $\langle a_1, a_2, \dots, a_n \rangle$  given  $a_1 < a_2 < \dots < a_n$  in terms of  $p(i)$  and  $q(i)$ , where  $p(i)$  and  $q(i)$  probability for successful search and unsuccessful search respectively.
13. Define Dynamic programming.
14. Differentiate between Greedy method and Dynamic programming.
15. Differentiate between Divide and conquer and Dynamic programming.
16. Define Multistage graph.
17. Write the running time of 0/1 Knapsack problem.



18. Define optimal Binary search tree.
19. Give an application of Dynamic programming algorithm.
20. Give the running time of the optimal BST algorithm.
21. Write recurrence relation for 0/1 Knapsack problem.
22. Can we solve 0/1 knapsack problem with greedy method? Comment on your answer.
23. Write about Multiplicative Optimization.
24. Define the problem of Matrix Multiplication.
25. Write algorithms using divide and conquer technique.
26. Write algorithm for sequencing jobs with deadlines using greedy technique.
27. Apply greedy technique to solve 0/1 knapsack problem
28. Find minimum spanning trees using prims and Krushkal's technique based on greedy approach
29. Apply greedy approach for Single source shortest problem
30. Apply the principal of optimality.
31. Write algorithm for matrix chain multiplication
32. How can Principal of optimality be used for optimal binary search trees
33. Solve 0/1 knapsack problem, using dynamic programming
34. Do reliability design of resources using principal of optimality.

### **Essay type Questions**

1. Let  $n=4$  and  $(a_1, a_2, a_3, a_4) = (\text{do}, \text{if}, \text{int}, \text{while})$ . Let  $P(1:4)=(3,3,1,1)$  and  $U(0:4) = (2,3,1,1,1)$ . Construct the Optimal binary search tree using Dynamic programming.
2. Discuss how the Knapsack problem is solved using dynamic programming.
3. Discuss the Reliability design problem. Design a three-stage system with device types D1, D2, D3 with given costs as \$30, \$15, \$20 respectively. The cost of the system should not be more than \$105. Using dynamic approach in the design.
4. Show that the computing time of function OBST is  $O(n^2)$ .
5. Find maximum profit when  $(w_1, w_2, w_3, w_4) = (10, 15, 6, 9)$  and  $(P_1, P_2, P_3, P_4) = (2, 5, 8, 1)$  for the Knapsack problem using Dynamic programming.
6. Explain the application of Dynamic programming with an example of Matrix chain multiplication.





7. Explain the Multistage graph problem using both forward and backward approach with suitable example.
8. The principle of optimality does not hold for every problem whose solution can be viewed as the result of a sequence of decisions. Find two problems for which the principle does not hold. Explain why the principle does not hold for these problems.
9. Define merging and purging rules in 0/1 knapsack problem.
10. Write an algorithm for optimal Binary search tree Give example
11. Discuss Matrix chain multiplication with an example.
12. Write Matrix Chain multiplication algorithm
13. Describe about reliability design with an example.
14. Obtain the solution to knapsack problem by Dynamic Programming method  $n=6$ ,  $(p_1, p_2, \dots, p_6) = (w_1, w_2, \dots, w_6) = (100, 50, 20, 10, 7, 3)$  and  $m=165$ .
15. What is the difference between 0/1 Knapsack problem and fractional Knapsack problem?
16. Write short notes on optimal binary search tree. Or Write an algorithm to construct the optimal binary search tree given the roots  $r(i, j)$ ,  $0 \leq i \leq j \leq n$ . Also prove that this could be performed in time  $O(n)$
17. What is dynamic programming? Design an algorithm to solve the 0/1 knapsack problem using Dynamic programming.
18. What is the time and space efficiency of the algorithm for knapsack problem?
19. Using the algorithm OBST, compute  $W(i, j)$ ,  $R(i, j)$  and  $C(i, j)$ ,  $0 \leq i < j \leq 4$  for the identifier set  $(a_1, a_2, a_3, a_4) = (\text{end}, \text{goto}, \text{print}, \text{stop})$  with  $p(1)=1/20$ ,  $p(2)=1/5$ ,  $p(3)=1/10$ ,  $p(4)=1/20$ ;  $q(0)=1/5$ ,  $q(1)=1/10$ ,  $q(2)=1/5$ ,  $q(3)=1/20$  and  $q(4)=1/20$ . Using the  $R(i, j)$ 's construct the OBST.
20. 2. a) Solve the following 0/1 Kanpsack problem using Dynamic Programming  $P=(11, 21, 31, 33)$ ,  $W=(2, 11, 22, 15)$ ,  $m=40$ ,  $n=4$ .
21. Consider a four stage system with  $r_1=0.9$ ,  $r_2=0.8$ ,  $r_3=0.5$  and  $r_4=0.6$  and  $c_1=30, c_2=15, c_3=20$  and  $c_4=10$ , where the total cost of the system is  $C \leq 135$ . Find the reliability design for the system.
22. Consider  $n=5$  and  $a_1, a_2, a_3, a_4, a_5$  identifiers, the values of  $p$ 's and  $q$ 's are given as  $p(1:5)=(0.15, 0.10, 0.05, 0.10, 0.20)$ ,  $q(0:4)=(0.05, 0.10, 0.05, 0.05, 0.10)$ . Construct the Optimal Binary Search Tree(OBST).
23. Solve the following 0/1 Knapsack problem using dynamic programming  $P= (10, 20, 30, 32)$ ,  $W= (3, 10, 21, 14)$ ,  $C=35$ ,  $n=4$ .



## UNIT -- V

### Short type Questions

1. Write short notes on backtracking.
2. What is criterion function? Give an example
3. What is bounding function? Give an example
4. What is solution space? Give one solution for 4 queen problem.
5. Define state space tree. Draw the state space tree for 4-queen problem.
6. Prove that the size of the set of all subsets of  $n$  elements is  $2^n$ .
7. Define graph coloring. How many colors are required for coloring a Tree.
8. Define planar graph with example.
9. In LC search the next E-node is selected based on what.
10. In LC search, the functionality of Least( ) method .
11. What are the searching techniques that are commonly used in Branch-and-Bound method.
12. Define implicit constraint of a problem.
13. Define "Branch and Bound".
14. Explain about least cost search with suitable examples.
15. Explain briefly about FIFO branch and bounds search with suitable examples.
16. Explain briefly about LIFO branch and bound search with suitable examples.
17. Write an algorithm for sparse and dense representation of a polynomial.
18. Write a control abstraction for LC search.
19. Tree organizations that are problem instance dependent are called dynamic trees. (T/F)
20. Define a live node and dead node
21. What is NP hard problem ?
22. What is NP complete problem.?
23. What is Non deterministic algorithm. ?
24. Write the basic idea for cooks theorem.
25. Define "decision problem".
26. Define "optimization problem".
27. What is Satisfiability problem ?
28. Write short notes on traveling salesman problem.
29. Define nondeterministic algorithms.
30. Differentiate P and NP classes.





### Essay type Questions

1. Write a recursive backtracking algorithm for sum of subset problem.
2. Write the required algorithms to find the solution of n-queen problem.
3. Write the required algorithms to find all m-colorings of a graph.
4. Explain how LC branch and bound is different from backtracking, FIFO, LIFO branch and bound techniques.
5. Explain how the 15-puzzle problem is solved using Least cost-search.
6. Write about Branch and Bound general method and its application for traveling sales person problem.
7. Apply LC- Branch and Bound to solve 0-1 knapsack problem, where  $N=5$ ,  $P=(23, 19, 28, 14, 44)$ ,  $W=(8, 7, 11, 6, 19)$  and  $m=25$ .
8. Write a control abstraction of LC – Branch & Bound technique.
9. Solve given Travelling Sales Men Problem.

$\infty$	20	30	10	11
15	$\infty$	16	4	2
3	5	$\infty$	2	4
19	6	18	$\infty$	3
16	4	7	16	$\infty$

10. Explain non-deterministic algorithms and write the non-deterministic algorithm for sorting.
11. Explain the basic concepts for NP hard and NP complete Classes with example.
12. Explain satisfiability problem and write a non-deterministic algorithm for satisfiability.
13. Explain Knapsack decision problem and write a non-deterministic Knapsack algorithm.





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem.- I mid Exam Model Question Paper-1**

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-AI&ML, CSE-DS, CSE- CS)

**Branch: AI&ML**

**Time: 2 hours**

**Max. Marks: 40**

Answer **all questions** of Part – A and any **three** questions of Part – B.

## Part – A

**2x5 = 10 marks**

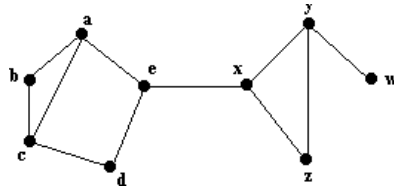
1. How to validate algorithms? [CO1]
2. Write a recursive algorithm for adding n values in an array [CO1]
3. What is the general recurrence relation for divide and conquer algorithm? [CO2]
4. What is depth first numbers of the vertices in a graph G? [CO2]
5. Write the Control abstraction of Greedy Method. [CO3]

## Part – B

**10x3 = 30 marks**

6. a) Explain the Asymptotic Notations O and  $\Omega$  with suitable examples [4+6]  
b) Write the recursive algorithm for Tower of Hanoi problem. [CO1]  
(or)
7. (a) Compare the two functions  $n^2$  and  $2^n/4$  for various values of n and plot it.  
Determine when the second become larger than the first.  
(b) Write an Euclidean algorithm for GCD(m, n). [CO1] [5+5]
8. Solve the recurrence relation  $T(n) = \begin{cases} T(1) & \text{if } n = 1 \\ aT(n/b) + f(n) & \text{if } n > 1 \end{cases}$  for the following  
choices of a, b, f(n) and T(1)  
(a) for a=1, b=2, f(n)=cn and T(1)=1  
(b) for a=5, b=4, f(n)=cn<sup>2</sup> and T(1)=2 [CO2][5+5]  
(or)
9. Find Articulation point for the graph using the algorithm dfn(). [CO2]



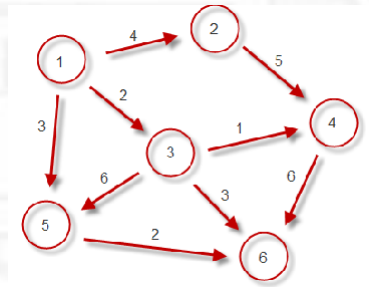


10. a) State the Job sequencing deadline problem. [CO3] [5+5]

b) Find an optimal sequence to the  $n=5$  jobs where profits  $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$  and deadlines  $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$ . [CO3]

(or)

11. Write the Prim's algorithms and apply it to find a minimum spanning tree for the following graph. [CO3] [10]



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# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem.- I mid Exam Model Question Paper- 2**

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-AI&ML, CSE-DS, CSE- CS)

**Time: 2 hours**

**Max. Marks: 40**

Answer **all questions** of Part – A and any **three** questions of Part – B.

## Part – A

**2x5 = 10 marks**

1. Define order of an algorithm. [CO1]
2. Define Big Theta Notations. [CO1]
3. Write short notes on divide and conquer algorithm design. [CO2]
4. Define articulation point with example. [CO2]
5. Define Huffman coding. [CO3]

## Part –B

**10x3 = 30 marks**

6. Explain the different Asymptotic Notations with suitable examples. [CO1]

OR

7. Explain Permutation Generator with example and write Recursive algorithm for Permutation Generator. [CO1]
8. Write an algorithm for recursive and iterative versions of binary search with data size n. Estimate the time complexity of the algorithms. [CO2]

OR

9. Write an algorithm for Quick sort and show how it sorts the following sequences of keys: 1, 1, 1, 1, 1, 1, 1 and 5, 5, 8, 3, 4, 3, 2. [CO2]
10. Find an optimal solution to the Knapsack instance n=7 objects and the capacity of knapsack m=15. The profits and weights of the objects are (P1, P2, P3, P4, P5, P6, P7) = (10, 5, 15, 7, 6, 18, 3) (W1, W2, W3, W4, W5, W6, W7) = (2, 3, 5, 7, 1, 4, 1). [CO3]

OR

11. a). Write the general method and Control Abstraction of Greedy method [CO3]  
b) Define i) Principles of optimality ii) Feasible solution iii) Optimal solution.  
c) Distinguish between Prim's and Kruskal's spanning tree algorithms.





# CVR COLLEGE OF ENGINEERING

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**B.Tech. II Year II Sem – I mid Exam Model Question Paper-3**

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-AI&ML, CSE-DS, CSE- CS)

**Time: 2 hours**

**Max. Marks: 40**

Answer **all questions** of Part – A and any **three** questions of Part – B.

**Part – A**

**2x5 = 10 marks**

1. Define Growth function. [CO1]
2. What are the characteristics of an algorithm? [CO1]
3. Write an algorithm for control abstraction of divide and conquer. [CO2]
4. When sorting method is stable? [CO2]
5. What is the Greedy choice property? [CO3]

**Part – B**

**10x3 = 30marks**

6. Explain recurrence relation and recursive algorithm with an example. [CO1]

**OR**

7. Write an algorithm for solving Towers of Hanoi problem and compute the time complexity of the algorithm. [CO1]
8. Write the recursive algorithm for Max-Min problem and derive the time complexity of the algorithm. [CO2]

**OR**

9. Explain convex hull problem using divide and conquer approach and estimate the time complexity. [CO2]
10. Give the application of Greedy method. explain Job sequencing problem with deadlines. Let  $n = 4$   $(p_1, p_2, p_3, p_4) = (100, 10, 15, 27)$  and  $(d_1, d_2, d_3, d_4) = (2, 1, 2, 1)$ . Solve it. [CO3]

**OR**

11. How simple Find (, Union ( ) operations are enhanced to Collapsing find and Weighted Union algorithms. [CO3]





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

B.Tech. II Year II Sem- II mid Exam Model Question Paper-1

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-AI&ML, CSE-DS, CSE- CS)

**Time: 2 hours**

**Max. Marks: 40**

Answer **all questions** of Part – A and any **three** questions of Part – B.

## **Part – A**

**2x5 = 10 marks**

1. What are the applications or examples of greedy techniques? [CO3]
2. Define Multistage graph. [CO4]
3. Define 0/1 Knapsack problem [CO4]
4. What is solution space? Give one solution for 4 queen problem. [CO5]
5. Differentiate P and NP classes [CO5]

## **Part – B**

**10x3 = 30 marks**

6. a) Explain Kruskal's algorithm. [5+5] [CO3]  
b) Explain Huffman code with example (or)
7. (a) Construct a Huffman code for the following data: [CO3] [5+5]  

Character:	A	B	C	D
Probability:	0.4	0.1	0.2	0.15 0.15.

  
(b) Write Dijkstra's algorithm for single source shortest path.
8. Find maximum profit when  $(w_1, w_2, w_3, w_4) = (10, 15, 6, 9)$  and  $(P_1, P_2, P_3, P_4) = (2, 5, 8, 1)$  for the Knapsack problem using Dynamic programming. [CO4] [10]  
(or)
9. Consider  $n=5$  and  $a_1, a_2, a_3, a_4, a_5$  identifiers, the values of p's and q's are given as  $p(1:5) = (0.15, 0.10, 0.05, 0.10, 0.20)$ ,  $q(0:4) = (0.05, 0.10, 0.05, 0.05, 0.05, 0.10)$ . Construct the Optimal Binary Search Tree (OBST). [CO4] [10]
10. Write the required algorithms to find the solution of n-queen problem. [CO5] [10]  
(or)
11. (a) Explain non-deterministic algorithms and write the non-deterministic algorithm for sorting. [CO5] [5+5]  
(b) Explain satisfiability problem and write a non-deterministic algorithm for satisfiability.





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem- II** mid Exam Model Question Paper-2

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-AI&ML, CSE-DS, CSE- CS)

**Time: 2 hours**

**Max. Marks: 40**

Answer **all questions** of Part – A and any **three** questions of Part – B.

## Part – A

**2x5 = 10 marks**

1. Define - Huffman trees [CO3]
2. Define Dominance rule. [CO4]
3. Write the running time of 0/1 Knapsack problem. [CO4]
4. What is criterion function? Give an example. [CO5]
5. Define state space tree. Draw the state space tree for 4-queen problem. [CO5]

## Part – B

**10x3 = 30 marks**

6. Discuss the Single source shortest paths (i.e. Dijkstra's) algorithm with suitable example and find the time complexity. [CO3]

OR

7. Precisely analyze the computing time and space requirements of this new version of Prim's algorithm using adjacency lists. [CO3]
8. Let  $n=4$  and  $(a_1, a_2, a_3, a_4) = (\text{do}, \text{if}, \text{int}, \text{while})$ . Let  $P(1:4)=(3,3,1,1)$  and  $U(0:4) = (2,3,1,1,1)$ . Construct the Optimal binary search tree using Dynamic programming. [CO4]

OR

9. Discuss Matrix chain multiplication with an example. [CO4]
10. Apply LC- Branch and Bound to solve 0-1 knapsack problem, where  $N=5$ ,  $P=(23, 19, 28, 14, 44)$ ,  $W=(8, 7, 11, 6, 19)$  and  $m=25$ . [CO5]

OR

11. Explain the basic concepts for NP hard and NP complete Classes with example. [CO5]







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**B.Tech. II Year II Sem- II mid Exam Model Question Paper-3**

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-AI&ML, CSE-DS, CSE- CS)

**Time: 2 hours**

**Max. Marks: 40**

Answer **all questions** of Part – A and any **three** questions of Part – B.

## **Part – A**

**2x5 = 10 marks**

1. Write a Weighted Union ( ) algorithm. [CO3]
2. What are the drawbacks of Dynamic programming? [CO4]
3. How can Principle of optimality be used for optimal binary search trees [CO4]
4. Define "Branch and Bound". [CO5]
5. Write the basic idea for cooks theorem. [CO5]

## **Part – B**

**10x3 = 30 marks**

6. Apply greedy algorithm to generate single-source shortest path with an example graph. Mention its time complexity. [CO3]  
OR
7. Write Prim's algorithm under the assumption that the graphs are represented by adjacency lists. [CO3]
8. Find maximum profit when  $(w_1, w_2, w_3, w_4) = (10, 15, 6, 9)$  and  $(P_1, P_2, P_3, P_4) = (2, 5, 8, 1)$  for the Knapsack problem using Dynamic programming. [CO4]  
OR
9. Consider a four stage system with  $r_1=0.9$ ,  $r_2=0.8$ ,  $r_3=0.5$  and  $r_4=0.6$  and  $c_1=30, c_2=15, c_3=20$  and  $c_4=10$ , where the total cost of the system is  $C \leq 135$ . Find the reliability design for the system. [CO4]
10. Write the required algorithms to find the solution of n-queen problem and trace with example. [CO5]  
OR
11. Explain satisfy ability problem and write a non-deterministic algorithm for sorting. [CO5]

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# CVR COLLEGE OF ENGINEERING

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**B.Tech. II Year II Sem- Substitution Exam Model Question Paper**

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-AI&ML, CSE-DS, CSE- CS)

**Time: 2 hours**

**Max. Marks: 40**

Answer **all questions** of Part – A and any **three** questions of Part – B.

## Part – A

**2x5 = 10 marks**

1. What are the characteristics of an algorithm? [CO1]
2. Define convex hull with example. [CO2]
3. Explain how disjoint sets can be represented. [CO3]
4. Define the principle of optimality. [CO4]
5. Define planar graph with example. [CO5]

## Part – B

**10x3 = 30 marks**

6. Explain the different Asymptotic Notations with suitable examples. [CO1]

OR

7. Write the recursive algorithm for Max-Min problem and derive the time complexity of the algorithm. [CO2]
8. Explain the Job sequencing with dead line algorithm and also find the solution for the instance  $n=7$ ,  $(P_1, P_2, \dots, P_7) = (3, 5, 20, 18, 1, 6, 30)$  and  $(D_1, D_2, \dots, D_7) = (1, 3, 4, 3, 2, 1, 2)$ . [CO3]

OR

9. Find minimum spanning trees using prims and Krushkal's technique based on greedy approach. [CO4]
10. Explain how LC branch and bound is different from backtracking, FIFO, LIFO branch and bound techniques. [CO5]

OR

11. Explain the basic concepts for NP hard and NP complete Classes with example. [CO5]





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**B.Tech. II Year II Sem. –Main Exam Model Question Paper**

**Subject: COMPUTER ALGORITHMS DESIGN & ANALYSIS**

Branch: (Common to CSE-**AI&ML**, **CSE-DS**, **CSE- CS**)

**Time: 3 hours**

**Max. Marks: 70**

Answer **all questions** of Part – A and any **three** questions Part – B.

**Part – A**

10x5 = 20marks

1. Sort the following in ascending order. [CO1]  
 $O(n)$ ,  $O(1)$ ,  $O(2^n)$ ,  $(\log n)$ ,  $O(n^2)$ ,  $O(n \log n)$ ,  $O(n^3)$ ,  $O(3^n)$
2. What do you mean by a control abstraction? [CO1]
3. What is a Spanning tree? [CO2]
4. What is meant by “back edges”? [CO2]
5. Prove that the recurrence relation  $T(n)=m. T(n/2)+an$  is satisfied by  $T(n) = O(n \log m)$ . [CO3]
6. Difference between krushkal’s algorithm and Prim’s algorithm. [CO3]
7. Define the principle of optimality. [CO4]
8. What are the drawbacks of dynamic programming? [CO4]
9. Define N- queen problem ? [CO5]
10. What is NP complete problem.? [CO5]

**Part – B**

**10x5 = 50 marks**

11.a) Define an algorithm? What are the different criteria that satisfy the algorithm?

b) Show the following equalities are correct. [CO1]

i)  $5n^2 - 6n = \phi(n^2)$  ii)  $n! = O(n^n)$  iii)  $n^3 + 10^5 n^2 = \phi(n^3)$

**(OR)**

12 a) Discuss briefly about the various Graph representations with suitable examples.

b) What is meant by performance analysis? Explain with an example? [CO1]



13 . Write the recursive algorithm for Max-Min problem and derive the time complexity of the algorithm. [CO2]

(OR)

14. Define articulation point. Write an algorithm to find articulation point [CO2]

15. Find an optimal solution to the Knapsack instance  $n=7$  objects and the capacity of knapsack  $m=15$ . The profits and weights of the objects are

$(P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (10, 5, 15, 7, 6, 18, 3)$

$(W_1, W_2, W_3, W_4, W_5, W_6, W_7) = (2, 3, 5, 7, 1, 4, 1)$ . [CO3]

(OR)

16. Give the application of Greedy method. explain job sequencing problem with deadlines.

Let  $n = 4$   $(p_1, p_2, p_3, p_4) = (100, 10, 15, 27)$  and  $(d_1, d_2, d_3, d_4) = (2, 1, 2, 1)$ . Solve it.

[CO3]

Write a sum of sub sets algorithm and construct a space tree for given sum of sub sets problem.  $n=6$ ,  $m=30$  and  $w[1:6] = \{5, 10, 12, 13, 15, 18\}$ .

[CO4]

(OR)

17. Given an  $n \times n$  chessboard, a knight is placed on an arbitrary square with coordinates  $(x, y)$ . The problem is to determine  $n^2 - 1$  knight moves such that every square of the board is visited once if such a sequence of moves exists. Present an algorithm to solve this problem.

[CO4]

18. Explain P and NP problems with examples. [CO5]

(OR)

19. Write a control abstraction of LC – Branch & Bound technique. [CO5]

Solve given Travelling Sales Men Problem?

$$\begin{pmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 41 & 1 \\ 31 & 5 & \infty & 20 & 4 \\ 19 & 8 & 18 & \infty & 13 \\ 16 & 2 & 7 & 16 & \infty \end{pmatrix}$$

b) sum of subsets problem.  $n=6$ ,  $m=30$  and  $w[1:6] = \{5, 10, 12, 13, 15, 18\}$ .

(10M) [CO5]

c) Explain non-deterministic algorithms and write the non-deterministic algorithm for sorting.



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(5M) [CO5]

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# **Advanced Data Structures Through Java**



## ADVANCED DATA STRUCTURES THROUGH JAVA (common to CSE-AI&ML,CSE-DS,CSE-CS and IT)

### Course Objectives :

1. To understand the importance of generic programming and Java's collection framework.
2. To implement various basic data structures like stacks, queues, linked lists etc using user defined generic classes and Java's collection classes.
3. To learn various data structures for implementing dictionaries.
4. To understand pattern matching algorithms and tries.

**Course Outcomes:** At the end of the course, student should be able to

CO1: Realize the power of generics in java

CO2: Understand Java's Collection class hierarchy and implement stacks, queues, dictionaries and trees using them.

CO3: Implement dictionaries using linear lists and hashing and compare their performances.

CO4: Implement dictionaries using various height balanced trees and also analyze the advantages and disadvantages of height balanced trees.

CO5: Evaluate various pattern and word matching algorithms in terms of their complexity and efficiency.

### Course to PO, PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PS O4
DSJ	3	2	2	2	1	-	-	-	2	-	-	2	3	2	-	1

### Course Outcome to PO, PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3	PS O4
CO1	2	-	2	-	-	-	-	-	1	-	-	3	3	1	-	1
CO2	3	2	3	2	1	-	-	-	2	-	-	2	2	1	-	1
CO3	3	2	3	2	2	-	-	-	2	-	-	2	2	2	-	2
CO4	2	2	2	-	1	-	-	-	2	-	-	2	2	2	-	1
CO5	2	-	1	1	1	-	-	-	2	-	-	-	3	2	-	1



## **ADVANCED DATA STRUCTURES THROUGH JAVA (common to CSE-AI&ML,CSE-DS,CSE-CS and IT)**

Instruction: 3 Periods / Week  
Tutorial : 1 Period / Week  
Credits : 3

Sessional Marks : 30 Marks  
End Examination : 70 Marks  
End Exam Duration: 3 Hours

### **Unit - I Generics:**

**Introduction to Generics**, simple Generics example, Generic Types, Generic methods, Bounded Type Parameters and Wild cards, Inheritance & Sub Types, Generic super class and sub class, Type Inference, Restriction on Generics

### **Unit - II 1D and 2D Collections:**

**1D Collection:** 1D Collection Interfaces: Collection, Set, List, NavigableSet, SortedSet, Queue, Dequeue. 1D Collection Classes- Hash Set, Linked HashSet, Tree Set, ArrayList, LinkedList.

**2D Collection:** 2D Collection Interfaces- Map, NavigableMap, SortedMap, 2D Collection Classes- HashMap, LinkedHashMap, TreeMap

### **Unit - III Dictionaries:**

**Introduction:** Dictionary definition, Dictionary ADT.

#### **Dictionaries implementation-I:**

**Linear List Representation:** Basics of linear list, implementation of sorted list using user defined generic classes and, LinkedList Collection class.

**Hashing:** basics, closed hashing- linear probing, quadratic probing, double hashing, rehashing, extendible hashing and their implementation, open hashing- separate chaining and its implementation using user defined generic classes.

**Binary Search Trees:** definition and basics, implementation of operations- searching, non-recursive traversals, insertion and deletion using user defined generic classes.

### **Unit - IV Dictionaries implementation-II**

**AVL Tree:** definition, height of an AVL tree, representation, operations- rotations, insertion, and searching deletion and their implementation using Java's Collection framework.

**Red Black Binary Search trees:** definition, insertion and deletion and searching operations.

**B-Trees:** B-Tree of order m, height of a B-Tree, searching, insertion, deletion operations.

### **Unit - V Priority Queues and Pattern Matching:**

**Priority Queue:** definition, max and min heaps, realizing priority queues using heaps, operations- insertion, deletion and their implementation using user defined generic classes, heap sort and its implementation using user defined generic classes.

**Pattern Matching:** Introduction, Brute Force algorithm, Boyer Moore algorithm, Knuth-Morris-Pratt algorithm and their implementation.

**Tries:** Standard Tries, Compressed Tries, Suffix tries.



**Text books:**

Java: The Complete Reference, Herbert Schildt, 10<sup>th</sup> Edition, McGraw-Hill Education, Oracle Press, 2017. (Units I and II)

Data Structures and Problem Solving using Java, Mark A. Weiss, 4<sup>th</sup> Edition, Pearson Education, 2009. (Units III and IV).

Data Structures and Algorithms in Java, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 6<sup>th</sup> Edition Wiley Publications, 2014. (Unit V).

**References:**

1. Data Structures, Algorithms, And Applications In Java, Sartaj Sahni, 2<sup>nd</sup> Edition, Universities Press , 2005.
2. Data Structures: Abstraction and Design Using Java, Elliot B. Koffman, Paul A. T. Wolfgang. Second Edition, Wiley publications, January 2010.
3. Head First Java, Kathy Sierra and Bert Bates , , 2<sup>nd</sup> Edition, OREILLY publications.,2005





### LESSON PLAN

Sl. No	Name of the Topic	No. of Classes required	Cumulative number of periods
<b>UNIT – I</b>			
1	Introduction to Generics	2	2
2	simple Generics example,		
3	Generic Types, Generic methods	2	4
4	Bounded Type Parameters and Wild cards	2	8
5	Inheritance & Sub Types	1	9
6	Generic super class and sub class	1	10
7	Type Inference, Restriction on Generics	2	12
<b>UNIT – II</b>			
8	1D Collection Interfaces--Set, List, Sorted Set	2	15
9	1D Collection Classes, Hash Set, Linked HashSet,	2	17
10	Tree Set, ArrayList, LinkedList	2	19
11	2D Collection Interfaces, Map, SortedMap	2	21
12	2D Collection Interface, HashMap,	1	22
13	LinkedHashMap, TreeMap	2	24
<b>UNIT – III</b>			
14	Sorted Lists , introduction, insertion and searching, Deletion	2	26
15	Hashing, hash table representation, hash functions	1	27
16	Collision resolution strategies, separate chaining	3	30
17	open addressing – linear probing, quadratic probing, double hashing	3	33
18	rehashing, extendible hashing	2	35
<b>UNIT – IV</b>			
19	Binary Search Tree , definition	1	36
20	implementation of operations: searching, traversals	2	38
21	implementation of operations: insertion and deletion	3	41
22	AVL Tree definition, height of an AVL tree, representation	2	43
23	operations rotations, insertion, searching and deletion	2	45
24	Red Black Binary search trees- definition, insertion, deletion	1	46
25	Search operation in Red Black trees	1	47
26	B-Tree, B-Tree of order m	2	49
27	height of a B-Tree, searching, insertion, deletion	2	51
<b>UNIT – V</b>			





28	Priority Queue, definition, max and min heaps	2	53
29	realizing priority queues using heaps	2	55
30	definition, insertion, deletion, heap sort	2	57
31	Pattern Matching: Introduction, Brute Force algorithm	2	59
32	Boyer Moore algorithm, Knuth-Morris-Pratt algorithm,	3	62
33	Tries, Standard Tries,	2	64
34	Compressed Tries, Suffix trees	2	66

## UNIT – I

### Short Answer Questions

- 1) What are generics?
- 2) Write the benefits of generics?
- 3) What are type parameters?
- 4) Write short notes on restriction on generics?
- 5) What is Type inference?
- 6) Write the benefits of Generic?
- 7) What is type Erasure ?
- 8) Write the syntax of Generic class?
- 9) Write the syntax of Generic methods?
- 10) Write the syntax of Generic Interfaces?
- 11) What are raw types?

### Essay Questions

1. Explain the following concepts in Generics, with an example program
  - i) Bounded Types
  - ii) Wild Card Arguments
2. If the compiler erases all type parameters at compile time, why should you use generics?
3. What is type erasure and explain the functionality of type erasure with example
4. Explain about restriction on Generic with example
5. Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes).
6. Write a Java program to implement a generic Queue using LinkedList collection
7. Write a generic method to exchange the positions of two different elements in an array.
8. The following program is supposed to print the string "Blue". Instead, it throws an error. Why?

```
import java.util.*;
public class SortMe {
    public static void main(String args[]) { SortedSet<StringBuffer> s =
        new TreeSet<StringBuffer>(); s.add(new StringBuffer("Red"));
```



```

        s.add(new StringBuffer("White"));
        s.add(new StringBuffer("Blue"));
        System.out.println(s.first());
    }
}

```

9. What is the following class converted to after type erasure?  
 public class Pair<K, V> {

```

        public Pair(K key, V value) {
            this.key = key;
            this.value = value;
        }
        public K getKey(); { return key; }
        public V getValue(); { return value; }

        public void setKey(K key) { this.key = key; } public void
        setValue(V value) { this.value = value; }

        private K key;
        private V value;
    }

```

- 10 Write a generic method to find the maximal element in the range (begin, end) of a list.

- 11 Given the following classes:

```

class Shape { /* ... */ }
class Circle extends Shape { /* ... */ }
class Rectangle extends Shape { /* ... */ }

```

```

class Node<T> { /* ... */ }

```

Will the following code compile? If not, why?

```

Node<Circle>nc = new Node<>();
Node<Shape> ns = nc;

```

- 12 How do you invoke the following method to find the first integer in a list that is relatively prime to a list of specified integers?

```

public static <T>
    int findFirst(List<T> list, int begin, int end, UnaryPredicate<T> p)

```

Note that two integers  $a$  and  $b$  are relatively prime if  $\text{gcd}(a, b) = 1$ , where gcd is short for greatest common divisor

- 13 What is the benefit of Generics in Collections Framework?

- 14 Explain about Generic super class and sub class with appropriate example ?

## **UNIT – II**

### **Short Answer Questions**

1. What is collection?
2. What is Java Collections Framework? List out some benefits of Collections framework?
3. Write short notes on Collection API?
4. What is the Collections API?
5. What is the List interface?
6. What is Set interface?
7. What is an Iterator interface?
8. What is the benefit of Generics in Collections Framework?
9. What are the basic interfaces of Java Collections Framework?
10. What is the importance of hashCode() and equals() methods?
11. What is difference between HashMap and Hashtable?
12. What are similarities and difference between ArrayList and Vector?
13. Why Collection doesn't extend Cloneable and Serializable interfaces?
14. Why Map interface doesn't extend Collection interface?
15. What is difference between Enumeration and Iterator interface?
16. What is different between Iterator and ListIterator?
17. What is the Map interface?
18. What is the Set interface?
19. Write the difference between HashSet and LinkedHashSet?
20. Write the difference between HashMap and LinkedHashMap?
21. Write the difference between ArrayList and LinkedList?
22. Write the difference between HashMap and Hashtable?

### **Essay Questions**

- 1) What is collection and explain Collection frame work in detailed?
- 2) List out various classes in "java.util" and explain them clearly.
- 3) What are the basic interfaces of Java Collections Framework?
- 4) Explain about Set interface and its implementing classes in detailed?.
- 5) Explain about List interface and its implementing classes in detailed?.
- 6) Consider the four core interfaces, Set, List, Queue, and Map. For each of the following four assignments, specify which of the four core interfaces is best suited, and explain how to use it to implement the assignment.
  - ☐ Whimsical Toys Inc (WTI) needs to record the names of all its employees. Every month, an employee will be chosen at random from these records to receive a free toy.
  - ☐ WTI has decided that each new product will be named after an employee — but only first names will be used, and each name will be used only once. Prepare a list of unique first names.



- ☐ WTI decides that it only wants to use the most popular names for its toys. Count the number of employees who have each first name.
- ☐ WTI acquires season tickets for the local lacrosse team, to be shared by employees. Create a waiting list for this popular sport.

- 7) Write the difference between Enumeration, Iterator and ListIterator ?
- 8) Explain about constructors and method associated with ArrayList with appropriate , examples?
- 9) Explain about constructors and method associated with LinkedList with an appropriate examples?
- 10) Explain about constructors and method associated with HashSet with appropriate examples?
- 11) Explain about constructors and method associated with LinkedHashSet with appropriate examples?
- 12) Explain about constructors and method associated with TreeSet with appropriate examples?
- 13) Explain about constructors and method associated with SortedSet with appropriate examples?
- 14) Explain about Map interface and its implementing class in detailed?.
- 15) Why Map interface doesn't extend Collection interface?
- 16) Explain about constructors and method associated with SortedMap with appropriate examples?
- 17) Explain about constructors and method associated with TreeMap with appropriate examples?
- 18) Explain about constructors and method associated with HashMap with appropriate examples?
- 19) Explain about constructors and method associated with LinkedHashMap with appropriate examples?
- 20) Explain how to implement customized sorting order in TreeSet with an example?
- 21) Write the difference between Comparable and Comparator with an example?

### **UNIT – III**

#### **Essay Questions**

1. What are dictionaries? Briefly explain the operations that are performed on them.
2. Explain how dictionaries can be represented using skip lists.
3. Implement a sorted list using Generics
4. Explain the insertion and deletion operations on a skip list.
5. Write the code for SkipNode and SkipList.
6. Explain about hashing , hash table and hash function with example?



7. What objective should be sought in the design of a hash function ?

8. What are the major application of hash table

9. Explain various collision resolution techniques in Hashing

10. Given the input

{4371, 1323, 6173, 4199, 4344, 9679, 1989} and hash function  
 $h(x) = x \bmod 10$  show the result for following:

a) Separate chaining hash table

b) open addressing hash table using linear probing

c) open addressing hash table using quadratic probing

d) open addressing hash table using with second hash function

$$h_2(x) = 7 - (x \bmod 10)$$

11. Explain about various open addressing hashing mechanism with example

12. Implement search function for hashing using Generics

13. Implement insert function for hashing using Generics

14. Explain about separate chaining hashing mechanism with example.

15. Implement Chained Hash Tables in JAVA.

## UNIT – IV

### Short Answer Questions

1. Define a binary search tree.

2. What is a degenerated tree.

3. What is a strictly binary tree?

4. Write the difference between fully, strictly, complete binary tree

5. What is an AVL tree?

6. List the rotations in AVL tree.

7. What are balanced trees?

8. List the rotations in AVL tree.

9. What is an indexed binary search tree?

10. Define height of an AVL tree.

11. Give an example for RR rotation.

12. Give an example for LL rotation.

13. Give an example for RL rotation.

14. What is an m-way search tree?

15. Define a B-tree.



16. List the applications of a B-tree.
17. List the applications of a red-black tree.
18. List the operations on a red-black tree.

### **Essay Questions**

1. Implement insertion into a binary search tree using Generics.
2. Implement deletion from a binary search tree using Generics.
3. Implement searching algorithm of a binary search tree using Generics.
4. Construct the binary search tree from following set of strings  
March, May, Nov., August, April, January, December, July, February, June,  
October, September. Show all the steps
5. Implement insertion into a AVL tree using Generics.
6. Implement deletion from a AVL tree using Generics.
7. Implement searching algorithm of a AVL tree using Generics.
8. Explain the RR rotation of AVL tree.
9. Explain the RL rotation of AVL tree.
10. Explain the LR rotation of AVL tree.
11. Explain the LL rotation of AVL tree.
12. List the properties of a m-way search tree.
13. Briefly explain insertion and deletion of an element in a m-way search tree.
14. Implement insertion function of B-tree using Generics
15. Implement deletion function of B-tree using Generics.
16. Explain insertion, deletion operations in Red Black Search trees.
17. Explain the search operation in Red Black Search trees.

### **UNIT – V**

#### **Short Answer Questions**

1. Define a circular queue.
2. When is a circular queue full?
3. Define a Priority queue.
4. Define a deque.
5. Define a heap.
6. Define a max heap
7. Define a min heap
8. List the different algorithms for pattern matching





9. Define looking glass heuristics.
10. Define Character jump heuristics
11. Define KMP failure function
12. Define a trie.
14. Define a standard trie.
15. Define a compressed trie
16. Define a suffix trie.
17. Give an example of standard trie.
18. Give an example of compressed trie.
19. Give an example of suffix trie.
20. What are inverted files.

### **Essay Questions**

1. What is a priority queue? Explain its applications.
2. Define a heap. Implement the following functions of heap in JAVA.  
Insertion  
Deletion  
Heapify
3. Write a **JAVA** program for heap sort.
4. Briefly explain the applications of heap.
5. Explain the brute force algorithm for pattern matching.
6. Consider a Text T = XYXZXXYXTZXYXZXYXXYY to match against the pattern P = XYXZXY by using Brute force algorithm.
7. Explain the Boyer-Moore algorithm for pattern matching with example.
8. Explain the Knuth-Morris-Pratt algorithm for pattern matching with example.
9. Write short notes on standard tries.
10. Write short notes on Compressed tries.
11. Write short notes on suffix tries.
12. Write a JAVA program for implementing Knuth-Morris pattern matching algorithm.
13. Compare and contrast the 3 pattern matching algorithms.
14. Write an algorithm for computing the KMP failure function.
15. Compare and contrast standard, compressed and suffix tries.







# CVR COLLEGE OF ENGINEERING

**An UGC Autonomous Institution - Affiliated to JNTUH**

B.Tech II Year II Sem – I Mid Examinations Model Paper -1

Subject : Advanced Data Structures through Java

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date :

Time : 2 Hours

Max. Marks : 40

## **PART – A** **Answer All questions**

1. Write the benefits of Generics [CO1]
2. What is collection [CO2]
3. Write difference between HashSet and Linked HashSet [CO3]
4. What is extendible hashing ? [CO3]
5. What is Collision ? [CO3]

## **PART – B** **Answer any THREE of the following**

- i) Explain the following concepts in Generics, with an example program  
Bounded Types
- ii) Wild Card Arguments

**OR**

- 7 a) What is type erasure and explain the functionality of type erasure with example [CO1]
- b) Explain about restriction on Generic with example [CO1]
8. a) Explain how to implement customized sorting order in TreeSet with an example [CO2]
- b) Explain about Set interface and its implementing classes in detail.

**OR**

- 9) Explain about Map interface and its implementing class in detail. [CO2]
- 10 Explain various collision resolution techniques in Hashing [CO3]

**OR**

10. Given the input {4371,1323,6173,4199,4344,9679,1989} and hash function  $h(x)=x \text{ mod } 10$  show the result for following: [CO3]

- e) Separate chaining hash table
- f) open addressing hash table using linear probing
- g) open addressing hash table using quadratic probing
- h) open addressing hash table using with second hash function  $h_2(x)=7-(x \text{ mod } 7)$





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**B.Tech. II Year IISem. – MID I Examinations**[MODEL PAPER -2

**ADVANCED DATA STRUCTURES THROUGH JAVA**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: 40

## **PART – A**

Answer all questions.

**10 x 2 = 20 Marks**

1. Write the syntax of Generic Interfaces? [CO1]
2. Compare and Contrast ArrayList and Vector [CO1]
- 3 Write difference between HashSet and LinkedHashSet [CO2]
4. Define dictionaries. [CO2]
5. List the operations performed on a Skip List. [CO2]

## **PART – B**

Answer any **THREE** of the following

**3x10= 30 Marks**

6. a) What is the benefit of Generics in Collections Framework? [CO1]
- b) Write a Java program to implement a generic Queue using LinkedList collection [CO1]
- OR
7. Write a generic method to find the maximal element in the range (begin, end) of a list. [CO1]
8. a) Write the difference between Comparable and Comparator with an example? [CO2]
- b) Explain about constructors and methods associated with TreeMap using an appropriate example? [CO2]
- OR
9. a) Explain about constructors and method associated with SortedSet using appropriate examples? [CO2]
- b) Explain the constructors and methods associated with LinkedHashSet using an appropriate example? [CO2]
10. a) Explain the insertion and deletion operations on a skip list. [CO2]
- b) Write the code for SkipNode and SkipList. [CO2]
- OR
11. a) Explain about hashing , hash table and hash function with example? [CO3]
- b) Implement insert function for hashing using Generics. [CO3]





# CVR COLLEGE OF ENGINEERING

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**B.Tech. II Year IISem. – I MID Examinations Model Paper -3**

**Subject: Advanced Data Structures through Java**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. Write the syntax of Generic class? [CO1]
2. Write the benefits of Generic? [CO1]
3. What is the List interface? [CO1]
4. What is the importance of hashCode() and equals() methods? [CO2]
5. List the operations on a dictionary. [CO2]

## **PART – B**

Answer any **THREE** of the following

**3x10= 30M**

6. a) Explain about Generic super class and sub class with appropriate example ? [CO1]  
b) Write a generic method to count the number of elements in a collection that have a specific property for example, odd integers, prime numbers, palindromes). [CO1]

**OR**

7. a) Describe the advantages of using Generics in Collections Framework. [CO2]  
b) How do you invoke the following method to find the first integer in a list that is relatively prime to a list of specified integers?  
public static <T>  
int findFirst(List<T> list, int begin, int end, UnaryPredicate<T> p)  
Note that two integers a and b are relatively prime if gcd(a, b) = 1, where gcd is short for greatest common divisor [CO2]

8. a) Why Map interface doesn't extend Collection interface? Explain with the help of an example. [CO2]  
b) Explain about constructors and method associated with HashMap with an appropriate example? [CO2]

**OR**

9. a) Explain about constructors and methods associated with ArrayList using appropriate examples? [CO2]  
b) Explain the constructors and methods associated with LinkedList using appropriate example? [CO2]
10. a) What are dictionaries? Briefly explain the operations that are performed on them. [CO2]  
b) Explain how dictionaries can be represented using skip lists. [CO2]

**OR**

11. a) Implement a sorted list using Generics [CO2]  
b) What objective should be sought in the design of a hash function ? [CO3]





# CVR COLLEGE OF ENGINEERING

**An UGC Autonomous Institution - Affiliated to JNTUH**  
**B.Tech. II Year II Sem.- II MID Examinations Model paper -1**  
**Subject: Advanced Data Structures through Java**  
**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 Hours

Max. Marks: 40

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. Define dictionaries [CO3]
2. Define a binary search tree [CO3]
3. What List the rotations in AVL tree. [CO4]
4. Define a max heap [CO4]
5. List the different algorithms for pattern matching [CO5]

## **PART – B**

Answer any **THREE** of the following **3 x 10=30M**

6. A) Explain about Various open addressing hashing mechanism with example [CO3]  
B) Explain about separate chaining hashing mechanism with example. [CO3]
7. Construct the binary search tree from following set of strings, March, May, Nov ....  
August, April, January, December, July, February, June, October, September. Show all the  
step [CO3]
8. Explain the RR rotation, RL rotation, LL rotation of AVL tree [CO3]
9. Briefly explain insertion and deletion of an element in a m-way search tree [CO4]
10. Define a heap. Implement the following functions of heap in JAVA.  
Insertion, Deletion, Heapify [CO4]
11. Consider a Text T = XYXZXXYXTZXZXZYXXYXXYY to match against the pattern P =  
XYXZXY by using Brute force algorithm. [CO5]





**CVR COLLEGE OF ENGINEERING**  
**An UGC Autonomous Institution - Affiliated to JNTUH**  
**B.Tech. II Year IISem. – MID II Examinations Model Paper -2**  
**ADVANCED DATA STRUCTURES THROUGH JAVA**  
**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS**

Date:

**MODEL PAPER**

Time: 2 hours

Max. Marks: 40

**PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. What is rehashing? [CO3]
2. Define a B-tree. [CO3]
3. Define height of an AVL tree. [CO4]
4. Define a circular queue [CO4]
5. Define a Priority queue. [CO4]

**PART – B**

Answer any **THREE** of the following

**3x10= 30M**

6. a) Explain about various open addressing hashing mechanism with example [CO3]  
b) Implement search function for hashing using Generics [CO3]  
OR
7. a) What are the major application of hash table [CO3]  
b) Explain various collision resolution techniques in Hashing [CO3]
8. a) Explain the insertion operation in a red-black tree. [CO4]  
b) Implement searching algorithm of a binary search tree using Generics. [CO4]  
OR
9. Implement insertion and deletion functions of B-tree using Generics [CO4]
10. a) What is a priority queue? Explain its applications. [CO4]  
b) Write a JAVA program for heap sort. [CO4]  
OR
11. a) Write a JAVA program for implementing Knuth-Morris pattern matching algorithm. [CO5]  
b) Write an algorithm for computing the KMP failure function. [CO5]





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year IISem. –II MID Examinations Model Paper -3**

**Subject: Advanced Data Structures through Java**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. What is double hashing? [CO3]
2. Name one advantage of open addressing over chaining? [CO3]
3. What is an m-way search tree? [CO4]
4. Explain the rules to be followed while inserting an element into a red-black tree? [CO4]
5. Define a standard trie. [CO5]

## **PART – B**

Answer any **THREE** of the following

**3x10= 30M**

6. a) Explain about Generic super class and sub class with appropriate example ? [CO3]  
b) Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes). [CO3]

**OR**

7. a) Explain about separate chaining hashing mechanism with example. [CO3]  
b) Implement Chained Hash Tables in JAVA [CO3]

9. Implement insertion and deletion into a binary search tree using Generics. [CO4]

**OR**

10. Implement insertion into a AVL tree using Generics. [CO4]

11. a) Briefly explain the applications of heap. [CO4]  
b) Write a JAVA program for heap sort. [CO4]

**OR**

12. a) Write short notes on suffix tries. [CO5]  
b) Write a JAVA program for implementing Knuth-Morris pattern matching algorithm. [CO5]







# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year IISem. –Substitution Examination Model Paper -1**

**Subject: Advanced Data Structures through Java**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. What are the benefits of generics? [CO1]
2. List out any four methods of List interface along with their prototypes. [CO3]
3. Give an ADT for a dictionary. [CO4]
4. Define an m-way search tree. [CO4]
5. What is double hashing? [CO3]

## **PART – B**

Answer any **THREE** of the following

**3x10= 30M**

6. a) Explain Generic Superclass and Generic Subclass with an example. [CO1]

b) Explain about Wildcard arguments with an example program.

[CO1]

**OR**

7. Explain about Map interface and its implementation classes in detail. [CO2]

8. Use quadratic probing, hash table with Table size =13, and the hash function  $f(k)=k \% \text{Table size}$ . Start with an empty hash table and insert elements whose Keys are 7,42,25,70,14,38,8,21,34,11. [CO3]

a) Draw the hash table following each insert

b) What is the loading factor of your table after the last insert?

c) What is the maximum number of collisions that occurred in a successful insertion? .

**OR**

9. Implement insertion into a AVL tree using Generics. [CO4]

10. a) Briefly explain the applications of heap. [CO4]

b) Write a JAVA program for heap sort. [CO4]

**OR**

11. a) Write short notes on suffix tries. [CO5]

b) Write a JAVA program for implementing Knuth-Morris pattern matching algorithm. [CO5]







# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year IISem. –Substitution Examination Model Paper -2**

**Subject: Advanced Data Structures through Java**

**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS and IT**

Date:

Time: 3 hours

Max. Marks: **70**

## **PART – A**

Answer **ALL** questions

**5x2 = 10** Marks

1. What is Type inference? [CO1]
2. What is type Erasure ? [CO1]
3. What is difference between Enumeration and Iterator interface? [CO2]
4. What is Java Collections Framework? List out some benefits of Collections framework [CO2]
5. When does a collision occur? [CO3]
6. Name one advantage of open addressing over chaining? [CO3]
7. Define height of an AVL tree. [CO4]
8. What is an m-way search tree? [CO4]
9. Define a max heap. [CO4]
10. Give an example of standard trie. [CO5]

## **PART – B**

Answer all questions.

10 x 5 = 50 Marks

- 11.a) Explain the following concepts in Generics, with an example program [CO1]
  - i) Bounded Types
  - ii) Wild Card Arguments
- b) Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes). [CO1]  
(OR)
- 12.a) Explain about Generic super class and sub class with appropriate example ? [CO1]
- b) How do you invoke the following method to find the first integer in a list that is relatively prime to a list of specified integers?  
public static <T>  
int findFirst(List<T> list, int begin, int end, UnaryPredicate<T> p)  
Note that two integers  $a$  and  $b$  are relatively prime if  $\text{gcd}(a, b) = 1$ , where gcd is short form for greatest common divisor [CO2]
- 13.a) Write the difference between Enumeration, Iterator and ListIterator ? [CO2]
- b) Explain the implementation of a LinkedList with appropriate examples? [CO2]  
(OR)
- 14.a) What are the basic interfaces of Java Collections Framework? [CO2]
- b) Explain about constructors and method associated with SortedMap with appropriate examples? [CO2]
15. a) What are dictionaries? Briefly explain the operations that are performed on them. [CO2]
- b) Implement a sorted list using Generics  
(OR)
- 16.a) Explain about various open addressing hashing mechanism with example [CO3]
- b) Implement insert function for hashing using Generics [CO3]



- 17.a) Construct the binary search tree from following set of strings March, May, Nov., August, April, January, December, July, February, June, October, September. Show all the steps. [CO4]  
b) Implement searching algorithm of a binary search tree using Generics. [CO4]

(OR)

18. a) Explain the RR rotation of AVL tree. [CO4]  
b) Implement deletion from a AVL tree using Generics. [CO4]

19. Define a heap. Implement the following functions of heap in JAVA. Insertion, Deletion, Heapify

(OR)

20. a) Explain the brute force algorithm for pattern matching. [CO4]  
b) Consider a Text T = XYXZXXYXTZXYXZXYXXYXXYY to match against the pattern P = XYXZXY by using Brute force algorithm. [CO5]





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem –Substitution** Examination Model Paper -3

Subject: **Advanced Data Structures through Java**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10** Marks

1. What is the use of Type Parameters? **CO1**
2. Write the syntax for Generic Method. **CO1**
3. Explain the hierarchy of 2D Collection framework. **CO2**
4. Give the prototype of any 5 methods in Map interface. **CO2**
5. Define Dictionary. **CO3**

## **PART – B**

Answer **ALL** questions

**3x10 = 30** M

6. a) Explain Bounded types with an example. **CO1**  
  
b) Write a Java Program to find min value from a given array using Generic methods. **CO1**  
**(OR)**
7. a) Explain Generic Superclass and Generic Subclass with an example. **CO1**  
b) Explain about Type Erasure with an example program. **CO1**
8. a) Write the constructors of ArrayList. Explain the methods of ArrayList with the help of a program. **CO2**  
b) Discuss the differences between a List and a Set. Write a program to demonstrate the use of any 5 methods of HashSet class.





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year IISem MID-I Examinations May 2021**

Subject: Advanced Data Structures through Java

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

1.

a) What are the rules to declare Generic Methods in Java?

[CO1][4M]

b) Trace the Java Program and Write the Output:

[CO1] [6M]

```
import java.util.*;
public class Test {
    public static void main(String[] args) { Test q = new Test();
    List<Integer> l = new ArrayList<>(); l.add(20);
    l.add(30);
    q.m1(l);
    }
    private void m1(List<?> l) { m2(l);
    }
    private <T> void m2(List<T> l) { l.set(1, l.get(0)); System.out.println(l);
    }}
```

**OR**

2.

a) Write a Java Program to convert Arrays to Lists and Vice-Versa

[CO1] [6M]

b) Write the output of the code snippet

[CO1] [4M]

```
String[] sa = {"ABC", "DEF", "PQR", "XYZ" };
PriorityQueue<String> pq3 = new PriorityQueue<String>(); for(String s : sa)
pq3.offer(s); for(String s : sa)
System.out.print(pq3.poll() + " ");
```

3.

a.) Write a Java Program that prints every second element of a linked list of strings called words?

[CO2] [5M]

b) Write a Java Program that removes all strings with length less than four from a linked list of strings called words.

[CO2] [5M]

**OR**

4. Write a Java program that keeps a map in which both keys and values are strings—the names of students and their course grades. Prompt the user of the program to add or remove students, to modify grades, or to print all grades. The printout should be sorted by name and formatted like this:

Rohit: B+

Sahit: C

Teju: A

[CO3] 10M

5

a) Given "n" names and phone numbers, assemble a phone book that maps friends' names to their respective phone numbers. For each name queried, print the associated entry from the phone book on a new line in the form name=phoneNumber; if an entry for name is not found, print Not found instead.

[CO3] [5M]

b) Draw a Hash Table for key values: 2, 3, 5, 7, 11, 17, 19, 23, 29, 31 (Assume Table size is 7 initially) by using Rehashing in a step-by-step manner.

[CO3] [5M]

**OR**

6



- a) Write a Java Program to replace a value associated with the given key using any map?  
[CO3][4M]
- b) Using the hash function 'key mod 7', insert the following sequence of keys in the hash table- 50, 700, 76, 85, 92, 73 and 101. Use separate chaining technique for collision resolution.





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH  
**B.Tech. II Year IISem MID-II** Examinations, July 2021

**Subject: Advanced Data Structures through Java**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## I. Answer the following questions. Each question carry 10 Marks.

1. Discuss the procedures to insert and delete a give key from a Binary Search Tree with suitable examples. Construct a Binary Search tree for given list of keys **43, 23, 9, 17, 10, 19, 78, 5, 16, 25** and display the order of its keys when traverse in Preorder. (CO4 )

**OR**

2. List out the important operations supported by Binary Search Trees. Write a menu-driven java program to perform those operations on a Binary Search Trees. ( CO4 )

3. State the important properties of B-Trees. Discuss the procedure to search a key in a B-Tree. Construct a B-Tree for the given set of keys: **10, 20, 30, 40, 50, 60, 70, 80, 90**. Assume the order of the B-Tree is 3. ( CO4 )

**OR**

4. Give any two examples of Balanced Binary Search Trees. State the important operations supported by AVL Trees besides highlighting its significance. Discuss the procedure to insert a node for a given AVL Tree. Construct AVL tree for the given list of keys: **63, 9, 19, 27, 18, 108, 99, 81**. (CO4 )

5. Discuss in detail how Knuth Morris Pratt's (KMP) algorithm performs pattern matching. Trace out the implementation of KMP pattern matching algorithm for the given Text and Pattern.

**Text: b a c b a b a b a b a c a a b**

**Pattern : a b a b a c a**

(CO5 )

**OR**

6. List out the important operations supported by priority queues. Write a java program to implement priority queues using Max Heap. Trace the sorting of a given list of keys **4, 7, 3, 6, 9, 2, 8, 5, 1, 10** using Heapsort sorting technique. (CO4 )





## CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year IISem. –Substitution Examination, August 2021**

**Subject: Advanced Data Structures through Java**

**Branch: Common to CSE and IT**

Answer the following questions.

**3x10= 30M**

1. Write a program to demonstrate wildcard arguments in generics.

**(co1)**

**OR**

2. Program to demonstrate TreeMap with Comparator constructor parameter.

**(co2)**

3. Construct Binary Search Tree from the following elements and write the 3 traversals (Inorder, Preorder and Postorder) : 11, 6, 8, 19, 4, 10, 5, 17, 43, 49, 31.

**(co3,co4)**

**OR**

4. Explain the various rotations in an AVL tree insertion with an example.

**(co4)**

5. Define a Priority Queue and a Max heap. Write a Java program to implement Heap sort using Max heap.

**OR**

**(co4)**

6. Explain the Knuth Morris algorithm for pattern matching with an example.

**(co5)**





Code No.: B22052705

Date: 07.08.2021



**CVR COLLEGE OF ENGINEERING**  
**UGC Autonomous Institution** - Affiliated to JNTUH

R18

**B Tech II Year II Sem. Main & Suppl. Examinations August-2021 (2019 & 2018 Batches)**  
**Subject: Advanced Data Structures through JAVA**

**Branch: Common to CSE and IT**

**Time: 3 hours**

**Max. Marks: 70**

**Answer Any Five Questions**  
**All Questions Carry Equal Marks**

**(5X14 = 70 Marks)**

1. a) How do Generic classes work? Explain with an example. (CO1)  
b) Explain the restrictions on Generics in Java with suitable example for each. [7+7]
2. a) Describe the following 1D collection classes in Java i) Hash Set ii) Linked HashSet. (CO2)  
b) Explain the need for 2 Dimensional Collections in java? Write a program to showcase the usage of Hash Map. [7+7]
3. a) Write a Java program to Insert, Delete and Search for an Employee record from a payroll list with emp\_no, emp\_name, emp\_addr by using Dictionary ADT. (CO3)  
b) Give Java implementation of separate chaining using user defined generic classes. [7+7]
4. a) Discuss the different rotation operations performed on AVL Tree. (CO4)  
b) Explain insertion algorithm of Red-Black tree and insert the following keys: 40, 10, 30, 35, 25, 27, 26, 60, 55, 61, 80. [7+7]
5. a) Explain Heap Sort implementation using user defined generic classes. (CO5)  
b) Explain the working of Boyer Moore algorithm by using the following example. Let TextT = <nyoo nyoo> and pattern P = <noyo> [7+7]
6. a) Explain and implement Linear probing to avoid collisions in Hashing. (CO3)  
b) Write a recursive function of Java to print pre-order traversal of a binary search tree? [9+5]
7. a) Construct AVL tree for the following numbers 14, 8, 12, 46, 23, 5, 77, 88, 20. (CO4)  
b) Enumerate the procedure to delete a node in AVL Tree with a suitable example. [7+7]
8. a) Explain standard and compressed B-tree data structures with suitable examples. (CO5)  
b) Assume that m=2. Draw the B-tree that will be created after inserting the following elements (in this order) A, B, C, D, G, H, K, M, R, W, Z. [7+7]

\*\*\*\*\*





# **Database Management Systems**



## **DATABASE MANAGEMENT SYSTEMS**

### **Course Objectives:**

- To introduce the role of database management system in an organization.
- To represent real world scenario using E-R diagrams.
- To model the database using relations avoiding redundancies.
- To learn transaction management and concurrency protocols to ensure data consistency.
- To understand query optimization and PL/SQL concepts.

### **Course Outcomes:**

At the end of the course, student should be able to

CO 1 : Demonstrate an understanding of database management system components and features. Design E-R Model to represent real-world database application scenarios.

CO 2 : Demonstrate mathematical approach towards querying database using relational algebra and relational calculus, and implement using SQL.

CO 3 : Convert E-R Model to relational Model and design proper relational database while eliminating anomalies.

CO 4 : Demonstrate the role of transaction management and concurrency control protocols.

CO 5 : Demonstrate an understanding of query optimization techniques and apply PL/SQL concepts for database manipulations with constraints.

### **Course to PO, PSO Mapping**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
DBMS	3	2	2	2	3	3	3	1	2	2	3	3	2	3	2	3

### **Course Outcome to PO, PSO Mapping**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1				3								3		
CO2			2				3									3
CO3		3			3					2			2		2	3
CO4				2				1			3				2	3
CO5		1							2			3	3		2	3



**Syllabus**  
**DATA BASE MANAGEMENT SYSTEM**  
(Common to CSE- AI&ML, CSE-DS, CSE-CS)

**Unit I**

**Introduction to DBMS**

History of DBMS, Concepts and overview of DBMS, Data models – ER model, Relational model, Levels of Abstraction in DBMS, Data base Languages, Architecture of DBMS, Data Base Users and Administrators.

**ER-Model**

Data base design and ER model, ER modeling Constructs, Additional features of ER Model, Class Hierarchies, Aggregation, Conceptual Design with ER model, Case study: ER design for Large Enterprises.

**Unit II**

**Relational Algebra and Calculus**

Introduction to relational model, Logical Database Design- ER to Relational, Relational Algebra - Selection and Projection, Set operations, Renaming, joins, Examples of Relational Algebra Relational Calculus- Tuple relational Calculus, Domain relational calculus.

**Introduction to Structured Query Language**

Form of Basic SQL Query, Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set Comparison Operator-Aggregate Operators, NULL values and Comparison using Null values ,Logical connectivity's – AND, OR and NOT, OUTER Joins, Disallowing NULL Values.

**Unit III**

**Schema Refinement**

Introduction to schema refinement, Problems caused by decomposition, Functional dependencies (FDs) and reasoning about FDs, Normal Forms (NF), Properties of Decomposition, Schema Refinement in Data Base Design, Case studies using Normal Forms

**Unit IV**

**Transaction Management-** Transaction concept & state, Implementation of atomicity and durability, Concurrent executions of transaction, Serializability and Recoverability, Implementation of Isolation, Testing for serializability, Lock-Based Protocols, Graph Based Protocol, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity.



## **Unit V**

### **Database Recovery System and PL/SQL**

Recovery and Atomicity, Log based Recovery, Recovery with concurrent transaction.

### **Query Optimization**

Cost based query optimization, Estimation of plan cost.

### **PL/SQL**

Basics of PL/SQL, Cursors, Procedures, Functions and Triggers.

### **TEXT BOOKS:**

1. Database System Concepts, A.Silberschatz,H.F. Korth, S.Sudarshan, , 6<sup>th</sup> edition, McGraw hill, 2006.
2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, , 3<sup>rd</sup> Edition, TMH,2003.

### **REFERENCE BOOKS:**

1. Fundamentals of Database Systems , Ramez Elmasri, Shamkant B.Navathe, 7th edition, Pearson Education,2008.
2. Database Systems: The Complete Book by Hector Garcia-Molina, Jeffery D.Ullman, Jennifer Widom, 2nd Edition, Pearson Education, 2008
3. Database Management System Oracle SQL and PL/SQL, P.K.Das Gupta, 2nd edition, PHI, 2013.



### **LECTURE SCHEDULE**

<b>S. No</b>	<b>Topic</b>	<b>Number of Classes</b>
<b>UNIT I</b>		
1	History of DBMS	1
2	Concepts and overview of DBMS	1
3	Data models and levels of abstraction	1
4	Database languages	1
5	Architecture of DBMS	1
6	Database users and administrators	1
7	Introduction to ER model	1
8	ER modeling constructs & Additional features of ER Model	3
9	Class hierarchies	1
10	Aggregation	1
11	Generalization and specialization	1
12	Conceptual design with ER Model	1
13	Case study	1
<b>Total</b>		<b>15</b>
<b>UNIT II</b>		
14	Introduction to relational model	1
15	ER Model to Relational Model	1
16	Relational Algebra - Selection and Projection ,Set operations, Renaming, joins	1
17	Examples of Relational Algebra	1
18	Relational Calculus- Tuple relational Calculus	1
19	Domain relational calculus	1
20	Form of Basic SQL Query, Examples of Basic SQL Queries,	1
21	Introduction to Nested Queries, Correlated Nested Queries	1
22	Set Comparison Operator- Aggregate Operators,	1



23	NULL values and their Comparisons, Logical operators	1
24	Joins & Disallowing Null Values	1
<b>Total</b>		<b>11</b>
<b>UNIT III</b>		
25	Introduction to schema refinement	1
26	Problems caused by decomposition	1
27	Functional dependencies (FDs) and reasoning about FDs	3
28	Normal Forms (NF), Properties of Decomposition	3
29	Schema Refinement in Data Base Design	3
30	Case studies using Normal Forms	1
<b>Total</b>		<b>12</b>
<b>UNIT IV</b>		
31	Transaction concept & state	1
32	Implementation of atomicity and durability	1
33	Concurrent executions of transaction	1
34	Serializability and Recoverability, Implementation of Isolation	2
35	Testing for serializability	1
36	Lock-Based Protocols, Graph Based Protocols	2
37	Timestamp-Based Protocols	1
38	Validation-Based, Protocols	1
39	Multiple Granularity	1
<b>Total</b>		<b>11</b>
<b>UNIT V</b>		
40	Recovery and Atomicity, Log based Recovery	2
41	Recovery with concurrent transaction	2





42	Cost based query optimization	2
43	Estimation of plan cost.	2
44	Basics of PL/SQL	1
45	Cursors	1
46	Procedures	1
47	Functions.	1
48	Triggers	1
<b>Total</b>		<b>13</b>



## **UNIT I**

### **Short Answer Questions**

1. Define the terms *database* and *database management system*.
2. Define an *entity*.
3. List the various kinds of *attributes* used in ER model.
4. Discuss the terms instance and schema.
5. Describe the concept of logical data independence.
6. What is the importance of physical data independence?
7. List the various data models that are popular.
8. What is weak entity set?
9. Why should we use descriptive attributes?
10. Enumerate the various mapping cardinalities.
11. What is meant by full and partial participation in a relationship?
12. Describe the key concept.
13. Explain the difference between a weak and a strong entity set.
14. Explain the distinction between disjoint and overlapping constraints.
15. What is a domain?
16. What is a super key and candidate key? Give an example to each.
17. What is generalization and specialization? Give an example to each.
18. What are various types of constraints? Give an example to each.
19. What are entities, attributes and relationships? Explain each with an example.
20. What is Aggregation?



### **Essay Type Questions**

1. Describe the various components that can be used in an ER diagram along with the symbolic notations and their purpose.
2. Discuss the various mapping cardinalities along with specific examples.
3. Compare generalization against specialization. Give suitable examples for their applications.
4. What is necessity of aggregation? Give an ideal example.
5. Discuss the various types of database users.
6. What are the levels of abstraction applicable to a database system?
7. Specify the merits of a DBMS as compared to a File Based System.
8. What is a database language? What are the desirable features of such a language?
9. Give a detailed account of the database architecture.
10. Design an ER diagram for a car rental agency. Think about entities such as Customers, Employees, Cars, and Registrations so on. List the core attributes of each entity and formulate appropriate relationships.
11. Describe the various attribute types.
12. List five core responsibilities of a database system.
13. What are the five main functions of a database administrator?
14. Consider the following information about a university database:
  - Professors have an SSN, a name, an age, a rank, and a research specialty.
  - Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget.
  - Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.).
  - Each project is managed by one professor (known as the project's principal investigator).
  - Each project is worked on by one or more professors (known as the project's co-investigators).
  - Professors can manage and/or work on multiple projects.
  - Each project is worked on by one or more graduate students (known as the project's research assistants).
  - When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.
  - Departments have a department number, a department name, and a main office.
  - Departments have a professor (known as the chairman) who runs the department.
  - Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.



- Graduate students have one major department in which they are working on their degree.
- Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

Design and draw an ER diagram that captures the information about the university. Use only the basic ER model here; that is, entities, relationships, and attributes. Be sure to indicate any key and participation constraints.

15. The Prescriptions-R-X chain of pharmacies has offered to give you a free lifetime supply of medicine if you design its database. Given the rising cost of health care, you agree. Here's the information that you gather:

- Patients are identified by an SSN, and their names, addresses, and ages must be recorded.
- Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.
- Each pharmaceutical company is identified by name and has a phone number.
- For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer.
- Each pharmacy has a name, address, and phone number.
- Every patient has a primary physician. Every doctor has at least one patient.
- Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.
- Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors.
- Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.
- Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract.
- Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

## **UNIT- II**

### **Short Answer Questions**

1. What is a null value?
2. What is a nested query?
3. Discuss the rename algebraic operation.
4. What are the various aggregate operators?



5. What is Cartesian product?
6. List two reasons why null values might be introduced into the database.
7. What is the purpose of selection operation?
8. Mention the usage of projection operation.
9. What is a view?
10. Discuss the importance of order by clause in SQL.
11. When to use the outer join operation.
12. What is a correlated nested query?
13. Define the concept of sub-query and where it can be used.
14. Mention the logical conditions that are used in SQL.
15. Specify the set comparison operators available in SQL.
16. Explain the group-by clause with an example.
17. What are relational algebra and relational calculus.
18. What is arity, cardinality ? Give an example to each.
19. Give the order of various clauses in a query.
20. Differentiate the sub query and correlated sub query.

### **Essay Type Questions**

1. Explain the fundamental concepts behind Relational Algebra and Relational Calculus.
2. Describe the join operation in relational algebra and its practical usage.
3. Provide a detailed account of Tuple Relational Calculus.
4. With examples describe the Domain Relational Calculus.
5. What are the properties of selection and projection operations? Give detailed examples of both.
6. Explain all of the set operations, with specific examples and their usage.
7. Explain in detail the various join operations allowed in SQL, with detailed examples.
8. What is the significance of nested queries in SQL? When should we use nested queries and what are the constraints in using them. Specify the alternatives to nested queries.
9. Assume a table student with the columns rollno, name, phone, course, joindate  
Write relational algebraic queries for the following.



- a) Select the names of all the students doing a specific course.
  - b) Find the count of students enrolled for a given course.
  - c) Find how many students have enrolled in multiple courses.
  - d) Find the details of students who enrolled on the same day.
10. Write the SQL queries for the above given problem.
11. Assume the tables employee and department. Let both tables have a common column called eno. Write SQL query and the equivalent queries using relational algebra, tuple relational calculus and domain relational calculus, to display the names of employees working for each department.
12. Explain all integrity constraints with an example for each.
13. Explain all types of joins with an example each.
14. Explain the alter command for renaming a table, renaming a column in a table, adding a new column, deleting a column and copying the content of the table to a new table.
15. Suppliers(sid: integer, sname: string, address: string)  
Parts(pid: integer, pname: string, color: string)  
Catalog(sid: integer, pid: integer, cost: real)  
Answer the following questions in TRC and DRC.
- (i) Find the names of suppliers who supply parts costing greater than 10,000.
  - (ii) Find the name of all the suppliers who supply yellow parts.
  - (iii) Find the name of suppliers who supply both Blue and Brown Parts.

### **UNIT III**

#### **Short Answer Questions**

1. Describe a functional dependency.
2. Enumerate the various Normal Forms.
3. Write the statement of Third Normal Form.
4. What is BCNF?
5. Explain the Fifth Normal Form.
6. What is multi-valued dependency?
7. Specify the Fourth Normal Form.
8. Why certain functional dependencies are called trivial functional dependencies?
9. What is loss less join decomposition?





10. What is dependency preservation?
11. What is partial dependency?
12. What is a candidate key?
13. What is the purpose of a primary key?
14. What is the closure of a set of FDs?
15. What is a canonical cover?
16. What are various anomalies? Explain each with an example.
17. Explain the attribute closure with an example.
18. Explain the closure of the functional dependency with an example.
19. What is a composite primary key?
20. What are alternate keys?

### **Essay Type Questions**

1. What are the problems caused by an un-normalized table?
2. What are the Armstrongs axioms? Give examples of each.
3. What is the necessity of schema refinement? Illustrate with an example.
4. Suppose that we decompose the schema  $R = (A, B, C, D, E)$  into  $(A, B, C)$  and  $(A, D, E)$ .

Show that this decomposition is lossless-join decomposition if the following set  $F$  of functional

dependencies hold:  $\{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$

5. Compute the closure of the following set  $F$  of functional dependencies for relation schema  
 $R = (A, B, C, D, E)$ .  
 $F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$ . List the candidate keys for  $R$ .
6. Explain in detail the concepts of dependency preservation and lossless decomposition with examples and counter examples.
7. Explain the Fourth Normal form, with a suitable example. Discuss the context in which 4NF is significant.
8. Discuss about the 5NF. Provide a suitable example. Discuss if a database needs to conform to this normal form.
9. Use Armstrong's axioms to prove the soundness of decomposition rule and pseudotransitivity rule.
10. In designing a relational database, why might we choose a non-BCNF design? Explain why 4NF is a normal form more desirable than BCNF.





11. If the same above relation with same set of FD's is decomposed into  $D=\{ABC, CD, DE\}$  Check whether decomposition is lossless or lossy
12. A relation  $R(ABCDEG)$  having following FD's  $F = \{AB \rightarrow C, BC \rightarrow A, AC \rightarrow B, B \rightarrow D, AC \rightarrow E, E \rightarrow G\}$  is decomposed into  $D = \{ABC, BD, ACEG\}$ . check whether lossless or lossy join decomposition and dependency preserving or not.
13. Consider a relation  $R(ABCDEFGHIIJ)$  with FD's  $\{AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ\}$  Convert it into 2NF and 3NF.
14. Convert the relation in above question into 3NF by using canonical cover.
15. Consider a relation  $R(ABCDEFGHIIJ)$  with FD's  $\{AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ\}$  Find the candidate key, closure of the attributes.

#### **UNIT IV**

##### **Short Answer Questions**

1. What is atomicity?
2. What is a schedule?
3. What is a cascadeless schedule?
4. Discuss briefly the various locks available.
5. Describe the term transaction.
6. What is a recoverable schedule?
7. What is a deadlock?
8. What is a locking protocol?
9. What is starvation in a locking protocol?
10. What is the role of a lock manager?
11. What is a database graph?
12. What is a timestamp?
13. What are the phases of a validation-based protocol?
14. What are the intention mode locks that we use?
15. Describe the phantom phenomenon.
16. What are the disadvantages of two-phase locking protocol?
17. What is conflict and view equivalence of a schedule?
18. What are the steps in graph based locking protocol?



19. What is Thomas write rule?
20. What is the use of precedence graph?

### **Essay Type Questions**

1. Explain the ACID properties of a transaction.
2. Draw and explain the state transition diagram of a transaction.
3. Explain about serializability and recoverability.
4. Explain in detail the two-phase locking protocol.
5. Discuss the nature of timestamp-based protocols.
6. Discuss about validation-based protocols.
7. Describe conflict serializability with an example.
8. What is view serializability and why is it necessary?
9. Differentiate a serial schedule and a serializable schedule.
10. Explain in detail about deadlock prevention techniques.
11. How to implement deadlock detection and subsequent recovery.
12. Consider the following two transactions:

T1	T2
read(A) read(B) if (A = 0) B = B + 1 write(B)	read(B) read(A; if (B = 0) A = A + 1 write(A)

Add lock and unlock instructions to transactions T1 and T2, so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock?

13. Check whether the schedules s1, s2, s3 are conflict equivalent or not.  
 r2(a),w2(a),r3(c),w2(b),w3(a),w3(c),r1(a),r1(b),w1(b),w1(b)
14. Explain two phase locking protocol, conservative two phase locking protocol, rigorous two phase locking protocol and strict two phase locking protocol with an example for each.
15. Explain the multiple granularity with an example.



## **UNIT V**

### **Short Answer Questions**

1. Differentiate a logical and system error.
2. What is stable storage?
3. When is a rollback operation performed?
4. What is a fuzzy checkpoint?
5. Differentiate redo and undo operations.
6. What is the use of a Trigger?
7. What is a log?
8. Give the structure of a log.
9. What is a cascading rollback?
10. What is the difference between deferred and immediate database modification?
11. What is a recovery system?
12. Write the difference among commit, rollback and checkpoint?
13. What is accomplished by shadow paging technique?
14. What is a Cursor?
15. What is Query Optimization?

### **Essay Type Questions**

1. Write about recovery and atomicity.
2. Explain the mechanisms of log-based recovery.
3. Compare the deferred- and immediate-modification versions of the log-based recovery scheme.
4. Explain the purpose of checkpoint mechanism. How does the frequency of checkpoints affect the recovery process?
5. Explain about shadow paging recovery scheme.
6. Explain the Cost based Query optimization in detail.
7. Explain the procedure to evaluate the cost of a Query?
8. Explain the concept of Trigger with example.
9. Explain the concept of Cursor with example.
10. Explain the different database recovery techniques in detail.





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH  
**B.Tech. II Year II Sem. Mid I Model Question Paper -1**

Subject: **Database Management Systems**  
Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

Answer **all** questions of Part A, and any **three** questions of Part – B.

## **Part – A**

**5×2 = 10 marks**

1. Discuss the terms instance and schema. CO1
2. Describe the term entity set. CO1
3. List and describe briefly any two set operators. CO2
4. Write about NULL value. CO2
5. Write the statement of the third normal form. CO3

## **Part – B**

**10×3 = 30 marks**

6. Discuss the various database users and the role of a database administrator  
CO1

**OR**

7. Write in detail about specialization and generalization with examples. CO1
8. Discuss the theory of Tuple relational calculus with examples. CO2

**OR**

9. Discuss the various conditions that are used in the where clause of a SQL query.  
CO2
10. Discuss the importance of schema refinement and the subsequent implications on database design. CO3

**OR**

11. Write in detail about the Third normal form with a suitable example. CO3

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# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. Mid I Model Question Paper -2**

Subject: **Database Management Systems**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

Answer **all** questions of Part A, and any **three** questions of Part – B.

## Part – A

**5×2 = 10 marks**

1. Write a short note on ER model. CO1
2. What are the advantages of using DBMS CO1
3. Give a tuple-relation-calculus expression to find the maximum value in relation r(A). CO2
4. What is the difference between a View and a Table? CO2
5. List out the problems with redundancy CO3.

## Part – B

**10×3=30 marks**

6. a) Discuss the various database users and the role of a database administrator CO1  
b) Explain In detail about Levels of Abstraction in a DBMS ? CO1

**OR**

7. Construct an ER diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient log of the various tests and examinations conducted. CO1

8. Consider the following schema: CO2

Customer (customer name, customer street, customer city)

Branch (Branch name, Branch city, assets)

Loan (Branch name, loan number, amount)

Depositor (customer name, account number)

Borrower ( customer name, loan number)

Write the following queries in SQL.

- a. Find all account numbers with a balance between \$ 1300 and \$1500.
- b. Find the all account numbers of account with a balance between \$1300 and \$2000.  
But not exactly \$ 1500.
- c. Find the loan numbers of all loans made jointly to Smith and Jones.
- d. Find the total balance of all accounts maintained at the perryridge Branch.

**OR**



9. a) Discuss the various conditions that are used in the where clause of a SQL query.

C02

b) Assume a table student with the columns rollno, name, phone, course, joindate

Write relational algebraic queries for the following.

C02

- a) Select the names of all the students doing a specific course.
- b) Find the count of students enrolled for a given course.
- c) Find how many students have enrolled in multiple courses.
- d) Find the details of students who enrolled on the same day.

10. Consider a relation R with five attributes ABCDE. You are given the following

dependencies:  $A \rightarrow B$ ,  $BC \rightarrow E$  AND  $ED \rightarrow A$ . a) list all keys for R. b) is R in 3NF c) is R in BCNF

C03

**OR**

11. Write in detail about the Third normal form with a suitable example.

C03

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# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. Mid I Model Question Paper -3**

**Subject: Database Management Systems**

**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

Answer **all** questions of Part A, and any **three** questions of Part – B.

**Part – A**

**5×2 = 10 marks**

1. Discuss the terms super key and candidate key. CO1
2. Describe the term entity, attribute and mention types of attributes. CO1
3. List and describe briefly aggregate functions. CO2
4. Write about group by and having clause. CO2
5. What are anomalies in database. Mention the types of anomalies.. CO3

**Part – B**

**10×3 = 30 marks**

6. a) Explain the two tier and three tier architecture of database. CO1
- b) Draw an ER-Diagram for an university consisting of departments, courses, faculty, students by assuming the constraints. CO1

**OR**

7. a) Write in detail about specialization and generalization with examples. CO1
- b) Explain about the weak entities. CO1
8. Discuss the theory of domain relational calculus with examples. CO2

**OR**

9. a) Discuss the various conditions that are used in the where clause of a SQL query. CO2
- b) Explain various types of joins. CO2
10. Discuss the importance of schema refinement and the subsequent implications on database design. CO3

**OR**

11. a) Write in detail about the Third normal form with a suitable example. CO3
- b) Define functional dependency(FD) ? what is meant by the closure of set of functional dependencies ? CO3

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# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. Mid II Model Question Paper 1**

**Subject: Database Management Systems**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

**Mid II Model Question Paper -1**

Date:

Time: 2 hours

Max. Marks: **40**

Answer **all** questions of Part A, and any **three** questions of Part – B.

**Part – A**

**5×2 = 10 marks**

1. State the fifth normal form. C03
2. What is a transaction? C04
3. Explain the concept of a lock. C04
4. What is a log? C05
5. What is a Trigger. C05

**Part – B**

**10×3 = 30 marks**

6. Discuss in detail about fourth and fifth normal examples with suitable examples. C03

**OR**

7. Explain 3NF and BCNF in detail. C03
8. Draw and explain the various states of a transaction. Also discuss the concept of serializability. C04

**OR**

9. Explain in detail about validation based protocol with an example. C04

**OR**

10. Explain in detail about the log based recovery and the two approaches involved. C05

**OR**

11. Discuss about Cursors with example. C05



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## CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. Mid II Model Question Paper 2**

Subject: **Database Management Systems**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

Answer **all** questions of Part A, and any **three** questions of Part – B.

**Part – A**

**5×2 = 10 marks**

1. Define 3NF and BCNF. C03
2. Define schedule, complete schedule, serial schedule. C04
3. Define Thomas write rule? C04
4. What is a checkpoint? C05
5. Define Cursor? C05

**Part – B**

**10×3 = 30 marks**

6. a) Consider the relation R(A,B,C,D,E) and FD's

C03

A->BC

C->A

D->E

F->A

E->D

Is the Decomposition R in to R1(A,C,D) , R2(B,C,D) and R3(E,F,D) loss less?

- b) Explain the requirement of lossless decomposition.

**OR**

7. a) Define Boyce-codd normal form and explain how it is differ from 3<sup>rd</sup> normal form? C03

- b) Define Multivalued dependency and explain 4<sup>th</sup> normal form In detail?

8. Draw and explain the various states of a transaction. Also discuss the concept of serializability. C04

**OR**

9. a) Explain in detail about validation based protocol with an example. C04

- b) Explain the types of two phase locking protocols.

10. Explain in detail about the log based recovery and the two approaches involved. C05

**OR**

11. Describe the concept of Triggers with an example. C05





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. Mid II Model Question Paper 3**

Subject: **Database Management Systems**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

Answer **all** questions of Part A, and any **three** questions of Part – B.

## Part – A

**5×2 = 10 marks**

1. Define dependency preserving and lossless join properties of decomposition? CO3
2. What is a locking protocol? list lock-based protocols CO4
3. What are the ACID properties? Define them. CO4
4. Define Query optimization. CO5
5. What information is maintained in the transaction table and dirty table? CO5

## Part – B

**10×3 = 30 marks**

6. Compute the closure of the following set F of functional dependencies for relation schema . CO3

$R = (A, B, C, D, E).$

$F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}.$  List the candidate keys for R.

**OR**

7. Consider a relation R(ABCDEFGHIJ) with FD's  $\{AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ\}.$  Find the canonical cover. CO3
8. Explain in detail about Time stamp based protocol with an example. CO4

**OR**

9. Check whether the schedules s1, s2, s3 are conflict equivalent or not.  
 $r2(a), w2(a), r3(c), w2(b), w3(a), w3(c), r1(a), r1(b), w1(b), w1(b).$  CO4
10. Explain in detail about the log based recovery and the two approaches involved. CO5

**OR**

11. Explain the Cost base Query Optimization in detail. CO5

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# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. – Substitution** Examinations Model Paper

Subject: **Database Management Systems**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. List types of attributes in ER Model with proper examples and notations. CO1
2. Define the concept of sub query and where it can be used? CO2
3. What is loss less join decomposition? CO3
4. What are the disadvantages of two-phase locking protocol? CO4
5. Write the difference among commit, rollback and checkpoint. CO5

## **PART – B**

Answer any **THREE** of the following

**3x10= 30M**

6. a) Explain the levels of abstraction in DBMS. CO1  
b) Draw an ER-Diagram for an university with your own assumptions.

**OR**

7. a) Describe the join operation in relational algebra and its practical usage. CO2  
b) Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

Catalog(sid: integer, pid: integer, cost: real)

Answer the following questions in TRC and DRC.

- (i) Find the names of suppliers who supply parts costing greater than 10,000.
- (ii) Find the name of all the suppliers who supply yellow parts.
- (iii) Find the name of suppliers who supply both Blue and Brown Parts.

8. Explain the Normal Forms with suitable examples. CO3

**OR**

9. a) Explain Time Stamp based protocols. CO4  
b) . Check whether the schedules s1, s2, s3 are conflict equivalent or not.

r2(a),w2(a),r3(c),w2(b),w3(a),w3(c),r1(a),r1(b),w1(b),w1(b)



10. Explain Remote Backup system for recovery using neat diagram.

CO5

**OR**

11. Explain the concept of Triggers with example.

CO5





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH  
B.Tech. II Year II Sem. – MAIN **Model Question Paper**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 3 hours

Max. Marks: 70

Answer **all** questions of Part – A, and all **five** questions of Part – B.

## Part – A

**10×2 = 20 marks**

1. Explain about logical data independence. CO1
2. Discuss how to deal with a weak entity set. CO1
3. Explain the rename relational algebraic operation. CO2
4. Discuss the significance of a null value. CO2
5. State the Third Normal form. CO3
6. Explain the concept of functional dependency. CO3
7. Explain the atomicity property of a transaction. CO4
8. What is recoverability? CO4
9. Mention the types of failure. CO5
10. What is a Cursor? CO5

## Part – B

**10×5 = 50 Marks**

11. Discuss the levels of abstraction in a database. What is the role of a database administrator? CO1

**OR**

12. Design an ER diagram for a database with entities students, courses and departments. Show appropriate mapping cardinalities, participation and relationships. Assume your own attributes. Use specialization and generalization where necessary. CO1
13. Discuss in detail the concept of relation calculus. Provide suitable examples by assuming a suitable table. CO2

**OR**

14. Discuss all the aggregate operators with examples. Explain in detail the significance of join operation. CO2
15. Explain how BCNF differs from 3NF. Discuss the importance of lossless decomposition with reference to these two normal forms. CO3

**OR**



16. Explain in detail about Fourth Normal Form. Provide a suitable example. When is it desirable? C03

17. Explain the ACID properties of a transaction. Discuss the concept of a serial schedule and compare that with a concurrent schedule. C04

**OR**

18. Give a detailed account of Time-stamp based protocols. C04

19. Write about Log based Recovery. C05

**OR**

20. Explain about Cursors. C05







# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH  
**B.Tech. II Year II Sem.- MID -I Examinations, February, 2020**  
Subject: **Database Management Systems**  
Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART - A**

Answer **ALL** questions

**5x2 = 10 M**

- 1) Define Schema. CO1
- 2) What is Weak Entity? Draw the notation used to represent it. CO1
- 3) List out basic operations of Relational Algebra with proper examples. CO2
- 4) What is a Nested Query? Give an example. CO2
- 5) Define Functional dependency. CO3

## **PART - B**

**3x10= 30M**

6. a) With a neat Diagram explain the levels of Abstraction in DBMS? CO1
- b) Compare file systems with database systems? CO1

**OR**

7. Discuss about the different components of ER Model in detail with examples. CO1

8. Write the Equivalent Relational algebra statements for the following queries? CO2

Sailors(sid: integer, sname: string, rating: integer, age: real);  
Boats(bid: integer, bname: string, color: string);  
Reserves(sid: integer, bid: integer, day: date).

- Q1) Find the Names of sailors who have reserved boat number 101.
- Q2) Find the Sids of sailors who have reserved red color boat.
- Q3) Find the names of sailors who have reserved a red boat or a green boat.
- Q4) Find the names of sailors who have reserved a red boat and green boat.
- Q5) Find the names of sailors who have reserved a red boat but not green boat.

**OR**

9. Write the Equivalent SQL statements for the following queries? CO2

Sailors(sid: integer, sname: string, rating: integer, age: real);  
Boats(bid: integer, bname: string, color: string);  
Reserves(sid: integer, bid: integer, day: date).

- Q1) Find the Names of sailors who have reserved boat number 101.
- Q2) Find the Sids of sailors who have reserved red color boat.
- Q3) Find the names of sailors who have reserved a red boat or a green boat.
- Q4) Find the names of sailors who have reserved a red boat and green boat.
- Q5) Find the names of sailors who have reserved a red boat but not green boat.

10. a) What is normalization? Explain the types of anomalies caused due to redundancy



b) From the table mentioned below:

CO3[5]

A	B	C
1	1	4
1	2	4
2	1	3
2	2	3
2	4	3

Find the validity of FD's:

- I.  $A \rightarrow B$
- II.  $A \rightarrow BC$
- III.  $AB \rightarrow C$
- IV.  $A \rightarrow C$
- V.  $AC \rightarrow B$

**OR**

11. Given  $R(A,B,C,D,E,F,G,H,I,J)$  with Functional Dependencies

CO3

{  
     $AB \rightarrow C$   
     $BD \rightarrow EF$   
     $AD \rightarrow GH$   
     $A \rightarrow I$   
     $H \rightarrow J$

**}. Find closure of AB,BD,AD,A,H and the candidate keys of R.**





Code No.: B22052225

Date 21.11.2020

## CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

R18

**B Tech II Year II Sem. Main Examinations November - 2020**  
**(2018 Batch) Subject: Database Management Systems**

**Time: 2 hours**

**Max. Marks: 70**

**Answer Any Five Questions (5 X 14 = 70 Marks)**

**All Questions Carry Equal Marks**

1. a) Define Data Abstraction and discuss levels of Abstraction? CO1  
b) Explain about different types of integrity constraints? CO1
2. a) Define Join? Explain different types of joins? CO2  
b) Discuss about Domain Relational calculus in detail? CO2
3. Explain BCNF and 3NF with examples? CO3
4. a) Explain Time stamp-Based Concurrency Control protocol and the Modifications implemented in it? CO4  
b) Explain the ACID properties. CO4
5. Explain different types of Log Based Recovery Techniques? CO5
6. a) Discuss about the components of ER Model? CO1  
b) Describe the Structure of DBMS? CO1
7. a) Illustrate Concurrent execution of transaction with examples? CO4  
b) Describe Validation-based locking protocols? CO4
8. Explain the different Relational Algebra operators with examples? CO2

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# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. Mid-I Examinations**, February 2020

Subject: **Database Management Systems**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Time: 1 hr 45min

Max. Marks: **40 M**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. Differentiate between primary key and foreign key? CO1
2. What is Identifying relationship? CO1
3. Define DRC. CO2
4. List out the aggregate functions of SQL. CO2
5. List out the problems caused by redundancy in a relation. CO3

## **PART – B**

Answer **ALL** questions

**3x10 = 30 M**

6. a) What is an attribute? Explain the different types of attributes? CO1
- b) Explain different types of database users and write the functions of DBA? CO1

**(OR)**

7. a) Compare generalization and specialization. Give suitable examples for their application CO1
  - b) Draw the ER- Diagram for Online shopping system? CO1
8. Write the Equivalent Relational algebra statements for the following queries? CO2

Sailors(sid: integer, sname: string, rating: integer, age: real);  
Boats(bid: integer, bname: string, color: string); Reserves(sid: integer, bid: integer, day: date).

- 1) Find the Sids of sailors who have reserved boat number 101.
- 2) Find the Names of sailors who reserved at least one boat.
- 3) Find the names of sailors who have reserved a red boat or a green boat.
- 4) Find the colors of boat reserved by Dustin.
- 5) Find the names of sailors who have reserved a red boat but not green boat.

**(OR)**

9. Write the Equivalent SQL statements for the following queries? CO2
- Sailors(sid: integer, sname: string, rating: integer, age: real);  
Boats(bid: integer, bname: string, color: string); Reserves(sid: integer, bid: integer, day: date).



- 1) Find the Sids of sailors who have reserved boat number 101.
- 2) Find the Names of sailors who reserved at least one boat.
- 3) Find the names of sailors who have reserved a red boat or a green boat.
- 4) Find the colors of boat reserved by Dustin.
- 5) Find the names of sailors who have reserved a red boat but not green boat.

10. a) List out the problems caused by un-normalized tables.

CO3

b) From the table mentioned below:

A	B	C
1	1	4
1	2	4
2	1	3
2	2	3
2	4	3

Find the validity of FD's:

- I. AC->C
- II. A->C
- III. AC->BC
- IV. C->A
- V. C->B

**(OR)**

11. Compute the closure of the following set F of functional dependencies for relationschema

R = (A, B, C, D, E).

F= {A → BC, CD → E, B → D, E → A}. Find the Closure of A,CD,B,D,E and List the candidate keys for R.

(CO3)

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## CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. – MID-II Examinations, July,**

**2021 Subject: Database Management Systems**

Branch: Common to **CSE-AI&ML, CES-CS, CSE-DS**

Time: 90 minutes

Max. Marks: **30**

**10 x 3 = 30 Marks**

- 1) a) A relation R (A, B, C, D) having two Functional dependencies sets  $X = \{A \rightarrow B, B \rightarrow C, AB \rightarrow D\}$   $Y = \{A \rightarrow B, B \rightarrow C, A \rightarrow C, A \rightarrow D\}$ . Check whether two F.D. sets are equivalent or not? [5]  
b) Find the highest normal form of a relation R(A,B,C,D,E) with FD set  $F = \{B \rightarrow A, A \rightarrow C, BC \rightarrow D, AC \rightarrow BE\}$ . [5]

**(OR)**

- 2) Consider a Schema R (A,B,C,D) and functional dependencies  $F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow A\}$ . Check whether the decomposition of R into R1(AB), R2(BC) and R3(CD) is lossless decomposition and dependency preserving or not? [10]
- 3) a) What is a Transaction? Discuss Transaction properties. [5]  
b) With neat sketch, explain states of a Transaction. [5]

**(OR)**

- 4) What is 2PL? Explain different variants of 2PL and list the advantages and disadvantages of variations of 2PL. [10]
- 5) Write a PL/SQL function that reads Department number as input and retrieve Department name, Number of Employees in that Department and different jobs existed in that department. (Assume EMPLOYEE and DEPARTMENT Tables). [10]

**(OR)**

- 6) Explain Log Based Recovery Techniques. [10]







# CVR COLLEGE OF ENGINEERING

**UGC Autonomous Institution** - Affiliated to JNTUH  
**B Tech II Year II Sem. Main & Suppl. Examinations August -2021**  
**(2019 & 2018 Batches)**

**R18**

**Subject: Database Management Systems**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Time: 3 hours

Max. Marks: 70

**Answer Any Five Questions (5 X 14 = 70 Marks) All Questions Carry Equal Marks**

1. a) Compare and Contrast file Systems with database systems?(CO1)  
b) Discuss about different types of Data models? [8+6]
2. a) Explain the basic operators in Relational Algebra. (CO2)  
b) Discuss about Tuple Relational Calculus in detail? [10+4]
3. Illustrate different normal forms with examples? (CO3)
4. a) Explain the 2-phase locking protocols? (CO4)  
b) How concurrency is performed? Explain the time stamp based protocols that are used to maintain the concurrency concept? [6+8]
5. Explain the deferred and immediate modification versions of the log based recovery scheme? (CO5)
6. a) Distinguish strong entity set with weak entity set? Draw an ER diagram to illustrate weak entity set? (CO1)  
b) Discuss additional features of the ER-Models? [7+7]
7. a) Discuss correlated nested queries in detail? (CO2)  
b) Explain the different aggregate functions of SQL? [7+7]
8. a) Explain ACID properties and illustrate them through examples? (CO4)  
b) Discuss how to implement Atomicity and Durability? [8+6]





The background features a large, faint watermark of the CVR College of Engineering logo. The logo is circular with the text 'CVR COLLEGE OF ENGINEERING' around the top and 'MANGALPALLI, R.R. DIST.' around the bottom. In the center is a computer monitor displaying a globe and a rocket. Below the monitor is a banner that reads 'INSTITUTION IN PURSUIT OF EXCELLENCE'.

# **COMPUTER ARCHITECTURE AND MICRO CONTROLLERS**



## COMPUTER ARCHITECTURE AND MICRO-CONTROLLERS

### Course Objectives:

1. To design an efficient computer system through cache, pipeline and multiprocessor machines.
2. To enable students to write assembly program to implement timers for 8051.
3. To enable students to handle i/o space using interrupts.

**Course Outcomes:** At the end of the course, the student should be able to

- CO1:** Describe fundamental concepts of parallel processing and multiprocessors.  
**CO2:** Discuss the problems involving in interfacing peripheral devices with a processor and study serial communication.  
**CO3:** Explore the internal architecture of 8051 and to create ready to run programs using 8051 assemblers.  
**CO4:** Explain the importance of Timers/ Counters in a micro-controller and learn how to program them.  
**CO5:** Describe the serial communication feature of 8051 and learn how to write interrupt handler programs.

### Course to PO, PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CAMC	2	1	2	2	1	1	-	-	2	-	-	2	2	1	-	1

### Course Outcome to PO, PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	2	1	-	-	-	-	1	-	-	3	3	1	-	1
CO2	2	2	2	2	1	1	-	-	2	-	-	2	2	1	-	1
CO3	2	2	2	2	2	1	-	-	2	-	-	2	2	1	-	2
CO4	2	2	2	-	1	1	-	-	2	-	-	2	2	1	-	1
CO5	2	-	1	1	1	-	-	-	2	-	-	-	3	1	-	1



**COMPUTER ARCHITECTURE AND MICRO-CONTROLLERS**  
**(Common to II Year II Sem CSE -AI&ML, CSE-DS & CSE-CS)**

Instruction	: 3 Periods / week	Continuous Internal Evaluation	: 30 Marks
Tutorial	:	Semester End Examination	: 70 Marks
Credits	: 3	Semester End Exam Duration	: 3 Hours

**Course Objectives:**

1. To design an efficient computer system through cache, pipeline and multiprocessor machines.
2. To enable students to write assembly program to implement timers for 8051.
3. To enable students to handle i/o space using interrupts.

**Unit – I**

Introduction to 8086 Architecture

**Pipeline and Vector Processing:** Parallel processing-Flynn's classification, Pipelining-Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

**Multiprocessors:** Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter Processor Communication and Synchronization, Cache Coherence.

**UNIT II**

**Input-Output Organization**

Peripheral Devices, Input – Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, DMA, Serial Communication, Bus Standards- USB, SCSI,SATA.

**Unit – III:**

**8051 - Microcontroller**

Overview of 8051 Microcontroller Family, Inside the 8051 Microcontroller, Program counter an ROM space, Flag bits and PSW Register, Register Banks and Stack, I/O port programming, Addressing Modes, Bit addresses for I/O and RAM

**Unit – IV**

**Basic Programming in 8051:** Arithmetic, Logic, JUMP, LOOP, CALL Instructions and Programs

**Timers / Counters**

8051 timers/ counters, Programming the 8051 timers, Counter Programming, Programming Timer 0 and Timer 1 in 8051

**Unit - V**

**Serial Port programming:**

Basics of serial communication, RS-232, Serial port Programming in 8051

**8051 Interrupts:** Introduction to 8051 Interrupts, Interrupt Priority and Interrupt programming in 8051



**Text Books:**

1. Computer Systems Architecture, M. Morris Mano and Rajib Mall, III Edition (Revised), Pearson, 2017
2. Muhammed Ali Mazdi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson 2008

**References:**

1. The 8051 Microcontroller, Kenneth J. Ayala, 3rd Edition, Cengage Learning, 2010.
2. Advanced Microprocessors and Peripherals, A. K. Ray and K. M. Bhurchandani, 2nd Edition, Tata McGraw-Hill, 2006.
3. Microprocessors and Interfacing, D.V. Hall, 2nd Edition, Tata McGraw-Hill, 2006.



### Lecture Schedule

	<b>UNIT 1:</b>	<b>Period</b>
1	Introduction to 8086 Architecture	2
	<b>Pipeline and Vector Processing</b>	
2	Parallel processing-Flynns classification	1
3	Pipelining-Arithmetic pipeline	2
4	Risc pipelining	1
6	Array Processors	1
	<b>Multiprocessors:</b>	
7	Characteristics of Multiprocessors,	1
8	Interconnection Structures	2
9	Inter-processor Arbitration	1
10	Inter Processor Communication and Synchronization	1
11	Cache Coherence	1
<b>UNIT I Total Number of Classes</b>		<b>14</b>
	<b>UNIT II: Input-Output organization</b>	
12	Peripheral Devices	1
13	Input-Output interface	1
14	Asynchronous data Transfer	1
15	Modes of Transfer	1
16	Priority Interrupt	1
17	DMA	1
18	Serial Communication	1
19	Bus standards-USB, SCSI,SATA	1
<b>UNIT II Total Number of Classes</b>		<b>8</b>
<b>UNIT III: 8051-Microcontroller</b>		
20	Overview of 8051 Microcontroller Family	2
21	Inside the 8051 Microcontroller	1
22	Program counter as ROM space	1
23	Flag bits and PSW register	1
24	Register Banks and Stack	1



25	I/O port Programming	1
26	Addressing Modes	1
27	Bit addresses for I/O and RAM	1
	<b>UNIT III - Total Number of Classes</b>	<b>10</b>
	<b>UNIT-IV</b>	
	<b>BASIC PROGRAMMING IN 8051</b>	
28	Arithmetic Instructions	1
29	Logic Instructions	1
<b>30</b>	JUMP Instructions	1
31	LOOP Instructions	1
32	CALL Instructions	1
33	Programs	1
	<b>Timers/Counters</b>	
34	8051 timers/counters	2
35	Programming the 8051 timers	1
36	Counter Programming	1
37	Programming Timer 0 and Timer 1 in 8051	1
	<b>UNIT IV Total Number of Classes</b>	<b>11</b>
	<b>UNIT V</b>	
	<b>Serial Port Programming</b>	
33	Basics of serial communication	2
34	RS-232	1
35	Serial Port Programming in 8051	1
	<b>8051 Interrupts</b>	
36	Introduction to 8051 interrupts	1
37	Interrupt Priority	1
38	Interrupt programming in 8051	1
	<b>UNIT V Total Number of Classes</b>	<b>7</b>
	<b>Total number of classes :50</b>	



## UNIT-1

### Short Answer Questions:

1. Differentiate between maximum mode and minimum mode of 8086 microprocessor.
2. What is microprocessor?
3. What is the use of INTA and INTR pin in 8086 microprocessors?
4. List the general-purpose registers in 8086 microprocessors.
5. What is parallel processing?
6. List the Flynn's classifications
7. What is inter processor arbitration?
8. What are the Characteristics of Multiprocessors?
9. What is the difference between tightly coupled and loosely coupled multiprocessors?
10. What is Synchronous and Asynchronous bus?
11. What is hardware lock? Give an example.
12. Construct a 4\*4 omega switching network.
13. What is meant by Cache coherence problem?
14. What do you mean by vector processing?
15. What do you mean by Inter processor Arbitration?
16. What do you mean by Inter processor Synchronization?
17. What do you mean by Shared Memory Multiprocessors?
18. Give the different cache coherence techniques?
19. What is omega switch?
20. What is pipelining?
21. Discuss pipeline conflicts.
22. What is meant by Delayed Branch in RISC pipeline?
23. What is memory interleaving?
24. Determine the number of clock cycles that it takes to process 200 tasks in a six-segment pipeline.
25. Define Delayed load and Branch target buffer.
26. What is meant by Superscalar processors?

### Long Answer Questions:

1. Explain 8086 architecture with a neat diagram.
2. List the register set of 8086 microprocessor and explain them.
3. Draw the pin diagram of 8086 microprocessor.
4. Explain pipelining with a neat example
5. Explain arithmetic pipeline with the flow chart.
6. Explain instruction pipeline with a neat diagram.
7. Explain what is RISC Pipeline?
8. What are data hazards or pipeline conflicts? What are the techniques used to overcome them?
9. What are array processors. Explain it with a neat diagram.
10. What is a vector processing? Explain it with a neat diagram.
11. Explain the interconnection structures for multiprocessors.
12. Explain serial and parallel arbitration techniques.
13. Explain cache coherence. Give the solutions to the cache coherence problem.
14. Explain how Flynn classified the processors into different streams by giving an example for each stream.
15. Explain how the parallel processing is established in a processor with multiple functional units with neat diagram.
16. Draw a space-time diagram for a six-segment pipeline showing the time it takes to





process eight tasks.

17. Explain how pipeline processing is done? (With example).
18. Draw and explain pipeline for floating-point addition and subtraction.
19. Draw and explain Four-segment CPU pipeline.
20. A non-pipeline system takes 50 ns to process a task. The same task can be processed in a six-segment pipeline with a clock cycle of 10 ns. Determine the speedup ratio of the pipeline for 100 tasks. What is the maximum speed up that can be achieved?
21. Explain the inter processor Synchronization.
22. Explain Shared Memory Multiprocessors.
23. How is Matrix Multiplication done on vector processors?
24. Explain the working of 8\*8 omega switching network.
25. Explain the working of Binary Tree network with 2\*2 switches.
26. What are the different physical forms available to establish an inter-connection network?

## **Unit-II**

### **Short answer questions:**

1. What are peripheral devices.
2. List the mode of transfer techniques.
3. List 10 input devices and 10 output devices.
4. What is an Interface? Why is an interface required in between the peripherals and central computer system?
5. What is the difference between synchronous and asynchronous transfer?
6. What is meant by burst transfer and cycle stealing in DMA?
7. Write short notes on PCI bus.

### **Essay answer Questions:**

1. Explain the four types of commands that an interface receives in a computer.
2. Explain the following a. Isolated I/O b. Memory-mapped I/O.
3. Draw and explain the I/O Interface unit.
4. Explain Asynchronous Data Transfer.
5. Explain the following modes of transfer a. Programmed I/O b. Interrupt -initiated I/O
6. What is DMA? Draw the block diagram of DMA controller and explain the use of DMA controller in a computer system.
7. What is meant by Priority interrupt? Explain Daisy Chain Priority Interrupt with a diagram.
8. Explain Parallel Priority interrupt with a diagram.
9. Explain BUS Standards?
10. Explain serial communication.

## **UNIT-III**

### **Short Answer questions:**

1. Write any two differences between microprocessor and microcontroller.
2. Define microcontrollers.
3. What is the size of RAM and ROM in 8051 microcontroller?
4. What is the use of EA pin in 8051 microcontroller?
5. How many register banks are there in 8051 microcontroller?
6. What is program counter?
7. What are the registers mostly used in 8051?
8. What is PSW in 8051?
9. List the flags in flag register of 8051?
10. List any 4 addressing modes of 8051.



11. Write format of PSW register.
12. List which pins are used to select the register bank.

**Long Answer questions:**

1. What is a microcontroller and what are the characteristics of microcontroller
2. Give the overview of 8051 microcontroller family.
3. Explain the architecture of 8051 with a neat diagram.
4. How to assemble and run an 8051 program with an example.
5. Explain how an 8051 program is stored in ROM and how it is executed.
6. Explain the PSW register format in 8051.
7. Explain about register banks in 8051 microcontroller.
8. Explain the use of stack in 8051 microcontroller.
9. Show the stack and stack pointer from the following assume the default stack area:  
MOV r1 #21  
MOV R4,#27  
MOV R6,#0F23  
PUSH 6  
PUSH 5  
PUSH 7
10. Draw the pin diagram and explain pins of 8051 microcontroller?
11. Explain about port0,port1,port2 and port3 in 8051 microcontroller.
12. Explain the addressing modes of 8051?
13. Explain bit addresses for RAM?

**UNIT-IV**

**Short Answer questions:**

1. List the arithmetic instructions of 8051.
2. Define loop.
3. List the logic instructions of 8051.
4. Show the flag register affected by the following instruction  
MOV A, # 0F5H  
ADD A, #0BH
5. Write a program to add 16-bit numbers.
6. Show the result of the following  
MOV A, #04H  
ORL A, #68H
7. Write the function of DJNZ instruction.
8. List the conditional Jump instructions of 8051 microcontroller.
9. List the unconditional Jump instructions of 8051 microcontroller.
10. List the call instructions of 8051 microcontroller.
11. Write format of timer register TMOD of 8051.
12. Which bit in the TMOD register decides the d=source for the timer.
13. Write the TCON register format.

**Long Answer Questions:**

1. Explain the Jump instructions with an example.
2. Explain the arithmetic instructions with an example.
3. Find the sum of the values 79H, F5H, E2H. Put the sum in the registers R0(Low byte) and R5(High byte).
4. Explain the following instructions
  - a. ANL
  - b. ORL



- c. XRL
- d. CPL
- 5. Explain the rotation instructions of 8051 with an example.
- 6. Explain the TMOD register format of 8051.
- 7. Indicate which mode and which timer are selected for each of the following
  - a. MOV TMOD, #10H
  - b. MOV TMOD, #20H
  - c. MOV TMOD, #12H
  - d. MOV TMOD, #24H
- 8. Explain the TCON register format.
- 9. Write an 8051 C program to toggle all the bits of PORT P1 continuously with some delay in between. Use Timer 0, 16-bit mode to generate the delay.
- 10. Write an 8051 C program to toggle only 1.5 continuously every 50 ms. Use Timer 0, 16-bit mode 1 to generate the delay.

## UNIT-V

### Short Answer Questions:

1. What is polling.
2. What is serial communication.
3. List the types of transmission.
4. Write the format of SCON register.
5. What is the use of pin DCD in RS 232?
6. What is the register used for serial communication?
7. Write the format of PCON register.
8. What is PCON register.
9. What is an interrupt.
10. Write the format of IE register.
11. What is the use of IE register?
12. What are the external interrupts of 8051?
13. What is the use of TCON register?
14. Write TCON register format.

### Long Answer questions:

1. Explain what serial communication is
2. Explain about data transfer rate.
3. Explain about RS-232 and pins.
4. Explain SCON register format.
5. Write an 8051 program for the 8051 to transfer letter "A" serially at 4800 baud continuously.
6. Write an 8051 program for the 8051 to transfer "YES" serially at 9600 baud, 8 bit data and 1 stop bit continuously
7. What is the importance of TI flag?
8. Write an 8051 program for the 8051 to receive bytes of data serially and put them in P1, set the baud rate at 9600 baud, 8-bit data and 1 stop bit continuously.
9. What is the use of ISR and explain how interrupts will be handled?
10. Explain the interrupt vector table of 8051 microcontroller.
11. Explain the edge triggered and level triggered interrupts.
12. Write a program in which the 8051 gets data from P1 and sends it to P2 continuously while incoming data from the serial port is sent to P0. Assume that XTAL=11.0592. Set the baud rate at 9600.
13. Write a program using interrupts to do the following: (a) Receive data serially and sent it to P0, (b) Have P1 port read and transmitted serially, and a copy given to P2,



- (c) Make timer 0 generate a square wave of 5kHz frequency on P0.1. Assume that XTAL=11,0592. Set the baud rate at 4800.
14. Explain about interrupt priority register.
  15. Program the IP register to assign the highest priority to INT1(external interrupt 1)
  16. discuss what happens if INT0, INT1, and TF0 are activated at the same time.  
Assume the interrupts are both edge-triggered.





**CVR COLLEGE OF ENGINEERING**  
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**B.Tech.II Year II Sem. – MID-I Examinations Model Paper-1**  
**Subject: Computer Architecture and MicroControllers**  
**Branch: (Common to CSE-AI&ML, CSE-DS,CSE- CS)**

Date:

Time: 2 hours

Max. Marks: **40**

**PART – A**

Answer **ALL** questions

**5x2 = 10 M**

- |  |            |
|--|------------|
| 1. What is the use of INTA and INTR pin in 8086 microprocessors? | <b>C01</b> |
| 2. List the Flynn's Classifications                              | <b>C01</b> |
| 3. List some input-output peripherals                            | <b>C02</b> |
| 4. Differentiate between Synchronous and Asynchronous Transfer   | <b>C02</b> |
| 5. Write the PSW register Format                                 | <b>C03</b> |

**PART – B**

Answer **ALL** questions

**3x10= 30M**

- |  |            |
|--|------------|
| 6. Draw 8086 Architecture and Explain it.                            | <b>C01</b> |
| <b>OR</b>  |            |
| 7. Describe vector Processing  | <b>C01</b> |
| 8. Explain Asynchronous Data Transfer?                               | <b>C02</b> |
| <b>OR</b>  |            |
| 9. Explain why we need an input output interface with a neat diagram | <b>C02</b> |
| 10. List the Characteristics of 8051 Microcontroller                 | <b>C03</b> |
| <b>OR</b>  |            |
| 11. Differentiate microcontroller and microprocessor?                | <b>C03</b> |

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# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

B.Tech.II Year II Sem. – MID-I Examinations Model Paper-2

Subject: **Computer Architecture and MicroControllers**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. List the general-purpose registers in 8086? **C01**
2. What is parallel Processing **C01**
3. Define interface? **C02**
4. Differentiate between Synchronous and Asynchronous Transfer **C02**
5. What is microcontroller? **C03**

## **PART – B**

Answer **ALL** questions

**3x10= 30M**

6. Draw 8086 Pin diagram and explain the use of each pin **C01**

**OR**

7. Describe the interconnection structures for microprocessors. **C01**
8. Explain modes of transfer with neat diagram? **C02**

**OR**

9. Explain DMA with neat diagram. **C02**
10. Explain 8051 microcontroller with a neat diagram? **C03**

**OR**

11. Explain 8051 microcontroller family? **C03**

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**CVR COLLEGE OF ENGINEERING**  
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**B.Tech. II Year II Sem. – MID-I Examinations Model Paper-3**  
**Subject: Computer Architecture and Microcontrollers**  
**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

**PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. Define microprocessor? **C01**
2. Define shared memory multiprocessors? **C01**
3. What is input -output interface. **C02**
4. Explain USB? **C02**
5. write the PSW register Format **C03**

**PART – B**

Answer **ALL** questions

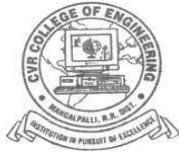
**3x10= 30M**

6. Explain Arithmetic instruction pipeline with a flow chart **C01**
- OR**
7. Describe Array processors with neat diagram? **C01**
8. Explain priority interrupt with a neat diagram. **C02**
- OR**
9. Explain Serial communication with a neat diagram **C02**
10. List the 8051 family and explain them. **C03**
- OR**
11. How to assemble and run an 8051 program with an example.? **C03**

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**CVR COLLEGE OF ENGINEERING**  
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**B.Tech. II Year II Sem. – MID-II Examinations Model Paper-1**  
**Subject: Computer Architecture and Microcontrollers**  
**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

**PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. Define microprocessor? **C01**
2. Define shared memory multiprocessors? **C01**
3. What is input -output interface. **C02**
4. Explain USB? **C02**
5. write the PSW register Format **C03**

**PART – B**

Answer **ALL** questions

**3x10= 30M**

6. Explain Arithmetic instruction pipeline with a flow chart **C01**

**OR**

7. Describe Array processors with neat diagram? **C01**
8. Explain priority interrupt with a neat diagram. **C02**

**OR**

9. Explain Serial communication with a neat diagram **C02**

10. List the 8051 family and explain them. **C03**

**OR**

11. How to assemble and run an 8051 program with an example.? **C03**





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**B.Tech. II Year II Sem. – MID-II Examinations Model Paper-2**

**Subject: Computer Architecture and Microcontrollers**

**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. What is program counter? **C03**
2. List the arithmetic instructions of 8051. **C04**
3. Show the result of the following **C04**  
MOV A, #04H  
ORL A, #68H
4. List the types of transmission. **C05**
5. List the interrupts of 8051 microcontroller **C05**

## **PART – B**

Answer **ALL** questions

**3x10= 30M**

6. Explain the use of stack in 8051 micro-controllers. **C03**  
**OR**
7. Show the stack and stack pointer from the following assume the default stack area: **C03**  
MOV r1 #21, MOV R4,#27, MOV R6,#0F23, PUSH 6  
PUSH 5  
PUSH 7
8. Explain the arithmetic instructions with an example. **C04**  
**OR**
9. Write an 8051 C program to toggle all the bits of PORT P1 continuously with some delay in between. Use Timer 0,16-bit mode to generate the delay. **C04**
10. Explain about RS-232 and pins. **C05**  
**OR**
11. Explain the interrupt vector table of 8051 microcontroller. **C05**





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B.Tech. II Year II Sem. – MID-II** Examinations Model Paper-3

Subject: **Computer Architecture and Microcontrollers**

Branch: Common to **CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. What is Register Bank? **C03**
2. List the call instructions of 8051 microcontroller. **C04**
3. Write format of timer register TMOD of 8051. **C04**
4. What is PCON register. **C05**
5. What is an interrupt ? **C05**

## **PART – B**

Answer **ALL** questions

**3x10= 30M**

6. Draw the pin diagram and explain pins of 8051 microcontroller? **C03**

**OR**

7. Explain about port0,port1,port2 and port3 in 8051 microcontroller. **C03**
8. Indicate which mode and which timer are selected for each of the following **C04**
  - a. MOV TMOD, #10H
  - b. MOV TMOD, #20H
  - c. MOV TMOD, #12H
  - d. MOV TMOD, #24H

**OR**

9. Explain the TCON register format. **C04**
10. Write an 8051 program for the 8051 to receive bytes of data serially and put them in P1, set the baud rate at 9600 baud, 8-bit data and 1 stop bit continuously. **C05**

**OR**

11. What is the use of ISR and explain how interrupts will be handled? **C05**

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**CVR COLLEGE OF ENGINEERING**  
**An UGC Autonomous Institution - Affiliated to JNTUH**  
**B.Tech. II Year II Sem. – Substitute Examinations**  
**Subject: Computer Architecture and Microcontrollers**  
**Branch: Common to CSE-AI&ML, CSE-CS, CSE-DS**

Date:

Time: 2 hours

Max. Marks: **40**

**PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. What is multiprocessor? **C01**
2. Define cycle stealing? **C02**
3. List the unconditional Jump instructions of 8051 microcontroller. **C03**
4. List the addressing modes? **C04**
5. What is the use of SCON register? **C05**

**PART – B**

Answer **ALL** questions

**3x10= 30M**

6. Explain serial and parallel arbitration techniques? **C01**
- OR**
7. Explain the four types of commands that an interface receives in a computer? **C02**
8. Give the overview of 8051 microcontroller family. **C03**
- OR**
9. Explain the rotation instructions of 8051 with an example **C04**
10. Write an 8051 program for the 8051 to transfer "YES" serially at 4800 baud, 8 bit data and 1 stop bit continuously **C05**
- OR**
11. what is the importance of Interrupt Register? **C05**



Code No.: B41056449

Date:



## CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

B Tech II Year II Sem. Main. Exams JUNE – 2022

Subject: Computer Architecture and Micro Controller

Branch: CSE-AI&ML, CSE-CS, CSE-DS

R15

Time: 3 hours

Max. Marks: 70

### PART – A (Answer ALL Questions)

10x2= 20 Marks

- |   |     |
|---|-----|
| 1. What is the importance of Instruction queue in 8086                  | CO1 |
| 2. What is the difference between shared memory and distributed memory? | CO1 |
| 3. What is the use of Input-output interface?                           | CO2 |
| 4. Define DMA.  | CO2 |
| 5. What is microprocessor?  | CO1 |
| 6. Define addressing mode?  | CO3 |
| 7. What is use of DA instruction?                                       | CO4 |
| 8. What is PCON register?   | CO4 |
| 9. What is serial communication?  | CO5 |
| 10. What is interrupt?  | CO5 |

### PART – B (Answer ALL questions)

5x10 = 50 Marks

- |                                       |         |
|---------------------------------------|---------|
| 11. Explain the register set of 8086? | CO1[10] |
|---------------------------------------|---------|

[OR]

12. What is the use of interconnection structures? Explain the interconnection structures of 8086.

CO1 [10]

13. List the mode of transfer? Explain DMA with a neat diagram

CO2 [10]

[OR]

14. Explain the Asynchronous mode of transfer

CO2 [10]

15. Explain about register banks in 8051 microcontroller.

CO3[10]

[OR]

16. Explain the use of stack in 8051 microcontroller.

CO3[10]

17. Explain the arithmetic instructions with an example.

CO4[10]

[OR]



18. Find the sum of the values 79H, F5H, E2H. Put the sum in the registers R0(Low byte) and R5(High byte). CO4[10]

19. Discuss what happens if INT0, INT1, and TF0 are activated at the same time. Assume the interrupts are both edge-triggered. CO5[10]

**[OR]**

20. Explain the basics of serial communication CO5[10]



The background features a large, faint watermark of the CVR College of Engineering logo. The logo is circular with the text 'CVR COLLEGE OF ENGINEERING' around the top and 'MAYORIPALLI, R.R. DIST.' around the bottom. In the center is a computer monitor displaying a globe. Below the monitor is a banner that reads 'INSTITUTION IN PURSUIT OF EXCELLENCE'.

# **ARTIFICIAL NEURAL NETWORKS**





**Course Objectives:**

- ❖ To understand the biological neural network and to model equivalent neuron models.
- ❖ To understand the architecture, learning algorithms
- ❖ To know the issues of various feed forward and feedback neural networks.
- ❖ To explore the Neuro dynamic models for various problems

**Course Outcomes:** At the end of the course, the student should be able to

**CO 1:** Understand the similarity of Biological networks and Neural networks and then Perform the training of neural networks using various learning rules

**CO 2:** Design Feed-forward neural networks for problems in AI

**CO 3:** Understanding the concepts of forward and backward propagations

**CO 4:** Design Neural networks based on Understand Self-Organizing maps for unsupervised learning

**CO 5:** Understand concept of Neuro-dynamics and build RNN and Hopfield models.

**Course to PO, PSO Mapping:**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
Artificial Neural Networks	3	3	2	3	2	3	2	3	3	3	3	3	1	1		1

**Course Outcome to PO, PSO Mapping:**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	3	3	1			2		1			2	3	3	3	2
CO2	1	1	1	3	2	1	2		2			2	1	2	3	3
CO3	3	3	3	3			1		3		1	1	2	2	3	3
CO4	2	2	2	2	1		2		2			1	3	3	3	1
CO5	3	2	3	3	2				3			2	3	3	3	2



**ARTIFICIAL NEURAL NETWORKS**  
**(Core)**  
**(CSE- AI&ML )**

Instruction	: 3 Periods / week	Continuous Internal Evaluation	: 30 Marks
Tutorial	: -	Semester End Examination	: 70 Marks
Credits	: 3	Semester End Exam Duration	: 3 Hours

**SYLLABUS:**

**UNIT -I**

A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

**UNIT -II**

Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

**UNIT -III**

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

Radial Basis Function Neural Network (RBFN): Introduction, RBFN, Architecture of RBFN, RBFN Learning, RBFN for the XOR problem, Comparison of RBF Network with FFNN, RBFN Applications

**UNIT- IV**

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification



## **UNIT -V**

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm **Recurrent Neural Network (RNN):** Introduction, RNN Architecture, Training of RNN. **Hopfield Models** – Hopfield Models, Boltzmann machine, Restricted Boltzmann machine.

### **TEXT BOOKS:**

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.
2. Saroj Kaushik and Sunitha Tiwari, "Soft Computing: Fundamentals, Techniques and Applications", Mc Graw Hill Education, 2018

### **REFERENCES:**

1. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
3. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005

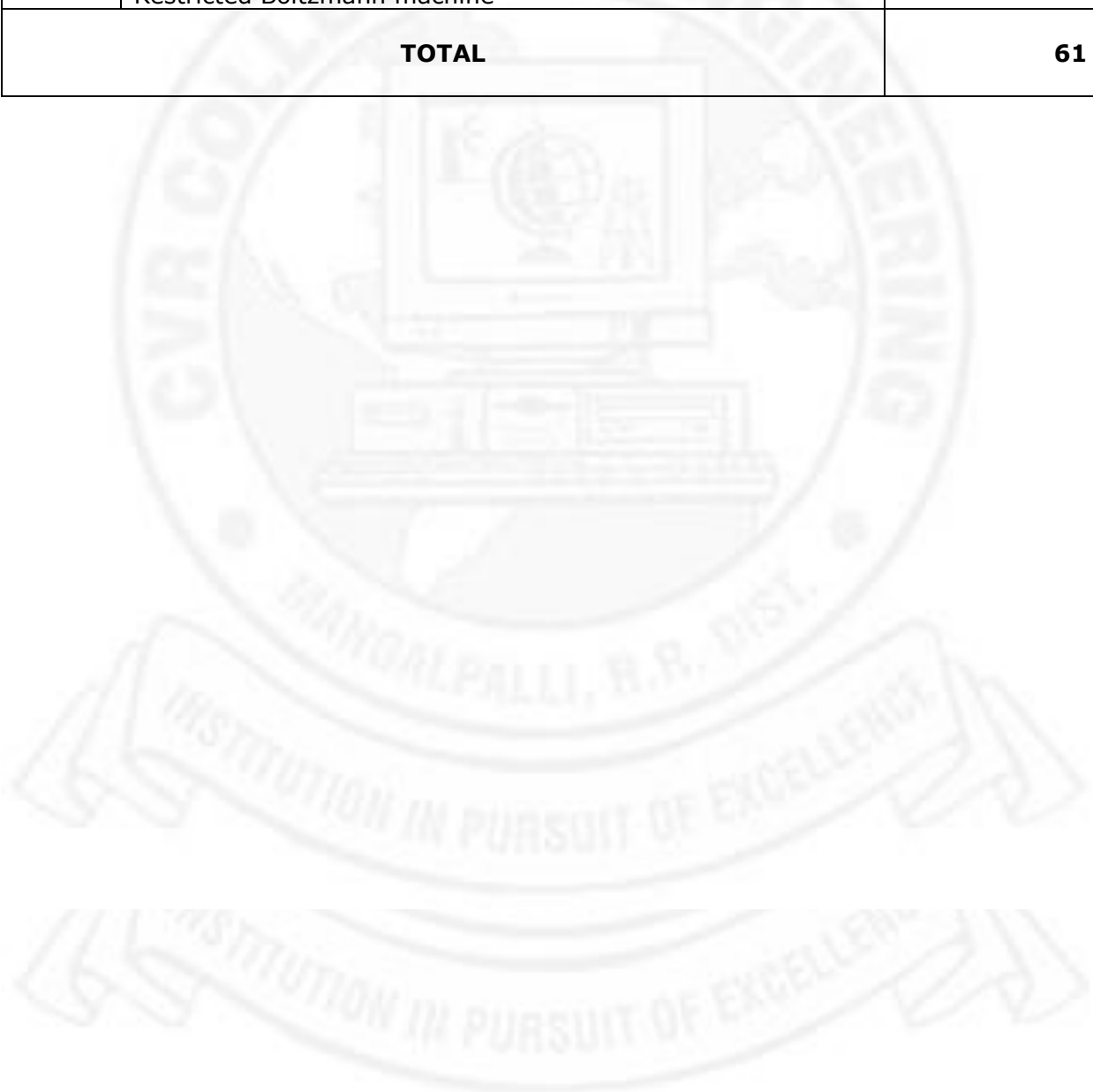


## LECTURE SCHEDULE

S. No	Name of the Topic	No. of classes required
<b>UNIT - I</b>		
1	A Neural Network, Human Brain, Models of a Neuron	2
2	Neural Networks viewed as Directed Graphs, Network Architectures,	3
3	Knowledge Representation, Artificial Intelligence and Neural Networks	1
4	Learning Process: Error Correction Learning, Memory Based	2
5	Hebbian Learning, Competitive, Boltzmann Learning	2
6	Credit Assignment Problem, Memory	3
7	Adaptation, Statistical Nature of the Learning Process	2
<b>UNIT - II</b>		
7	Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained Organization Techniques	2
8	Linear Least Square Filters, Least Mean Square Algorithm	2
9	Learning Curves, Learning Rate Annealing Techniques	2
10	Perceptron –Convergence Theorem	2
11	Relation Between Perceptron and Bayes Classifier for a Gaussian Environment	2
12	Multilayer Perceptron: Back Propagation Algorithm XOR Problem,	2
13	Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection	2
<b>UNIT - III</b>		
14	Back Propagation: Back Propagation and Differentiation,	2
15	Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques	3
16	Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning	2
17	Radial Basis Function Neural Network (RBFN): Introduction, RBFN, Architecture of RBFN, RBFN Learning	2
18	RBFN for the XOR problem, Comparison of RBF Network with FFNN, RBFN Applications	2
<b>UNIT - IV</b>		
19	Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map	3
20	SOM Algorithm, Properties of Feature Map, Computer Simulations	3
21	Learning Vector Quantization, Adaptive Pattern Classification	2
<b>UNIT - V</b>		
25	Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States,.	2



26	Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network	<b>3</b>
27	Paradigm <b>Recurrent Neural Network (RNN):</b> Introduction, RNN Architecture, Training of RNN	<b>3</b>
28	<b>Hopfield Models</b> – Hopfield Models, Boltzmann machine, Restricted Boltzmann machine	<b>3</b>
<b>TOTAL</b>		<b>61</b>



## **UNIT – I**

### **Essay Questions**

1. How do you Justify that brain is a parallel distributed processing system? (b) Explain the structure of a brain?
2. Explain about biological neuron with neat diagram? (b) Explain detail the properties of biological neuron?
3. Explain the model of neurons
4. Write briefly about rules of knowledge representation
5. Explain about Network Architecture?
6. Describe various types of activation function with their expression and benefits.
7. Discuss learning Process in the context of neural network.

### **Short Answer Questions**

1. What is an artificial neural network
2. Compare: biological neuron and artificial neuron
3. Block diagram of representation of nervous system
4. Mention types of Activation Function?
5. What are the AI system 3 key components.
6. Mention the neural network Architectures
7. list the characteristics of associative memory.
8. Define Adaptation.

## **UNIT – II**

### **Essay Questions**

1. State and prove perception convergence theorem?
2. Write and discuss about discrete perception training algorithm
3. Illustrate the back propagation algorithm and derive the expressions for weight up date relations?
4. Write and discuss about single layer continuous perception Training Algorithm?
5. Describe why a single layer perception network can't learn the EXCLUSIVE-OR Logic. Show how a two layer n\w can accomplish such a tasks?



6. Examine about adaptive filtering problem?
7. Demonstrate Optimization Techniques?
8. Explain gauss-Newton method? Explain about least-mean square algorithm?
9. Survey the limitations of the LMS algorithm?
10. Explain about learning rate annealing schedules?
11. Write brief notes on Bayes classifier?

### **Short Answer Questions**

1. Mention Unconstrained optimization techniques
2. Define Filtering and Adaptive process
3. Summarize the limitations of the Algorithm
4. Learning Rate Annealing Schedules graph means?
5. What is Weiner Filter
6. What is Positive definite matrix

## **UNIT – III**

### **Essay Questions**

1. Write a neat block diagram and flowchart of explain error back propagation algorithm?
2. Derive the learning rule for back propagation  $n \times w$  what are the major Drawbacks? suggest solution to overcome these drawbacks?
3. Demonstrate the main features of error back propagation algorithm applied to two layer  $n \times w$  with an example?
4. Explain about X-OR problem?
5. Explain about Heuristics for making the back propagation algorithm
6. How can you represent the output representation and decision rule?
7. Explain and write Bayesian decision boundary?
8. Explain about optimal number of hidden neurons? Explain about optimal learning and momentum constants?
9. Explain about two passes of computation in back propagation algorithm? Explain about evaluation of optimal network design?





### **Short Answer Questions**

1. Mention the Two passes of error back propagation learning
2. Show the Sigmoidal non Linearity
3. What is Parallel Distributed Processing
4. Tell the multilayer Perceptron 3 distinct characteristics
5. what are two type of signals identified for a multilayer perceptron
6. Define Rate of learning.
7. What is Hyperbolic Tangent Function
8. Show Bayesian Decision Boundary
9. what is a Fisher Linear Discriminate
10. Define Hessian Matrix
11. Present Fletcher-Reeves Formulae

### **UNIT – IV**

### **Essay Questions**

1. Label neat architecture of self-organizing-map and explain?
2. Compare the adaptive process phases in detail?
3. Develop kohonen's SOH algorithm with some factors? Explain about properties of the feature map?
4. Compile about Density matching? And Topological ordering?
5. Build a two-dimensional lattice distribution?
6. Give the extend knowledge about parameters effected for simulations?
7. What is meant by learning vector quantization, explain briefly?
8. Propose some adaptive pattern classification with examples?
9. Tell about hierarchical vector quantization? with example?
10. Outline contextual maps in detail?
11. compare the self-organizing map and hebb's postulate of learning



### **Short Answer Questions**

1. What is Competitive Learning
2. What is adaptation rule
3. Picture the Two-Self Organized Feature maps
4. Define a) Competitive process (b) cooperative process
5. List the phases of Adaptive Process
6. Mention 4 properties of Feature map
7. What is Topological Ordering
8. Outline the Learning Vector Quantization.

### **UNIT – V**

#### **Essay Questions**

- 1) Demonstrate Dynamical Systems?
- 2) Build Equilibrium States Classification of Second Order System
- 3) Discuss Lyapunov's Theorems.
- 4) Extend Attractors of Dissipative Systems
- 5) A detail note on Hop field Models
- 6) Elaborate the RNN Architecture
- 7) Give the Brief outline of Boltzmann Machine

### **Short Answer Questions**

1. Present the Lipschitz Condition
2. According to Divergence Theorem mention relation.
3. What is an Additive model
4. Mention characteristics of Neuro Dynamical model
5. Draw the NARX model
6. What are functional uses of Recurrent networks





# CVR COLLEGE OF ENGINEERING

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**B. Tech. II Year II Sem. MID-I Examination Model Paper I**

Subject: **Artificial Neural Networks**

Branch: (CSE-**AI&ML**)

Date:

Time: 2 hours

Max. Marks: 40

## PART – A

Answer **ALL** questions

**5x2 = 10 M**

1. Mention types of Activation Function CO1
2. What are the 3 key components of AI system CO1
3. Mention Unconstrained optimization techniques CO2
4. Define Filtering and Adaptive process CO2
5. What are gesture input devices CO3

## PART – B

Answer ALL questions

3x10= 30M

6. How do you Justify that brain is a parallel distributed processing system?  
Explain the structure of a brain? CO1  
(OR)
7. Describe various types of activation function with their expression and benefits. CO1
8. State and prove perception convergence theorem? CO2  
(OR)
9. Describe LMS in detail. CO2
10. Write a neat block diagram and flowchart of explain error back propagation algorithm? CO3  
(OR)
11. Derive the learning rule for back propagation n\w what are the major Drawbacks?  
suggest solution to overcome these drawbacks CO3

\*\*\*\*





# CVR COLLEGE OF ENGINEERING

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**B. Tech.** II Year II Sem. **MID-I** Examination Model Paper -2

Subject: **Artificial Neural Networks**

Branch: (CSE-**AI&ML**)

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

**5x2 = 10 M**

1. Compare: biological neuron and artificial neuron CO2
2. Block diagram of representation of nervous system CO2
3. What is Weiner Filter CO2
4. What is Positive definite matrix CO2
5. Mention multilayer Perceptron 3 distinct characteristics CO3

## **PART – B**

Answer ALL questions

3x10= 30M

6. Explain the model of neurons? CO1  
(OR)
7. Write briefly about rules of knowledge representation CO1
8. Examine about adaptive filtering problem? CO2  
(OR)
9. Demonstrate Optimization Techniques CO2  
(OR)
10. Explain about X-OR problem? CO3  
(OR)
11. Show error back propagation algorithm. CO3





# CVR COLLEGE OF ENGINEERING

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**B. Tech. II Year II Sem. MID-I Examination Model Paper-3**

Subject: **Artificial Neural Networks**

Branch: (CSE-**AI&ML**)

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

5x2 = 10 M

1. Block diagram of representation of nervous system CO1
2. Mention types of Activation Function CO2
3. Summarize the limitations of the Algorithm CO2
4. Learning Rate Annealing Schedules graph means CO3
5. Mention multilayer Perceptron 3 distinct characteristics CO3

## **PART – B**

Answer ALL questions

3x10= 30M

6. Explain the model of neurons CO1  
(OR)
7. Discuss learning Process in the context of neural network CO1
8. Examine about adaptive filtering problem? CO2  
(OR)
9. Survey the limitations of the LMS algorithm? CO2
10. Explain about X-OR problem? CO3  
(OR)
11. Explain about Heuristics for making the back propagation algorithm CO3





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID-II** Examination Model Paper -1

Subject: **Artificial Neural Networks**

Branch: (CSE-**AI&ML**)

Time: 2 hours

Max. Marks: **40**

Date:

## **PART – A**

Answer **ALL** questions

5x2 = 10 M

1. What is Competitive Learning C03
2. What is adaptation rule C03
3. Picture the Two-Self Organized Feature maps C04
4. Define a) Competitive process (b) cooperative process C04
5. Mention characteristics of Neuro Dynamical model C05

## **PART – B**

Answer ALL questions

3x10= 30M

6. Develop kohonen's SOH algorithm with some factors? Explain about properties of the feature map? C03
- (OR)
7. Tell about hierarchical vector quantization? with example? C03
8. Explain and write Bayesian decision boundary? C04
- (OR)
9. Explain about X-OR problem? C04
10. Discuss Lyapunovs Theorems. C05
- (OR)
11. Extend Attractors of Dissipative Systems C05





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech. II Year II Sem. MID-II Examination Model Paper -2**

Subject: **Artificial Neural Networks**

Branch: (CSE-**AI&ML**)

Time: 2 hours

Date:

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

5x2 = 10 M

1. what are two type of signals identified for a multilayer perceptron CO3
2. Define Rate of learning CO3
3. Mention 4 properties of Feature map CO4
4. What is Topological Ordering CO5
5. What is RNN ? CO5

## **PART – B**

Answer ALL questions

3x10= 30M

6. How can you represent the output representation and decision rule? CO3  
(OR)
7. Explain and write Bayesian decision boundary? CO3
8. Give the extend knowledge about parameters effected for simulations? CO3  
(OR)
9. What is meant by learning vector quantization, explain briefly? CO4
10. Give the Brief outline of Boltzmann Machine CO4  
(OR)
11. A detail note on Hop field Models CO5







# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID-II** Examination Model Paper -3

Subject: **Artificial Neural Networks**

Branch: (CSE-**AI&ML**)

Date:

Time: 2 hours

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

5x2 = 10 M

1. what is meant by sigmoidal non linearity C03
2. Define Fisher Linear Discriminate C03
3. Mention 4 properties of Feature map C04
4. What is Topological Ordering C04
5. What is Recursive RNN? C05

## **PART – B**

Answer ALL questions

3x10= 30M

6. Explain about optimal number of hidden neurons? Explain about optimal learning and momentum constants? C03

(OR)

7. Explain and write Bayesian decision boundary? C03

8. Outline contextual maps in detail? C04

(OR)

9. compare the self-organizing map and hebb's postulate of learning? C04

10. Discuss Lyapunov's Theorems. C04

(OR)

11. Extend Attractors of Dissipative Systems? C05





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech. II Year II Sem. II Substitution** Examination Model Paper

Subject: **Artificial Neural Network**

Branch: (CSE-**AI&ML**)

Time: 2 hours

Date:

Max. Marks: **40**

## **PART – A**

Answer **ALL** questions

5x2 = 10 M

1. What is ANN ? CO1
2. Define Active Function? CO2
3. Mention 4 properties of Feature map? CO3
4. What is Topological Ordering? CO4
5. What is Recursive RNN? CO5

## **PART – B**

Answer ALL questions

3x10= 30M

6. Explain Biological Neuron Model and Artificial Neuron Model? CO1  
(OR)
7. Explain and write Bayesian decision boundary? CO1
8. Outline Adaptive Filtering Problem in detail? CO2  
(OR)
9. compare the self organizing map and hebb's postulate of learning? CO3
10. Discuss Lyapunov's Theorems? CO4  
(OR)
11. Extend Attractors of Dissipative Systems? CO5





# CVR COLLEGE OF ENGINEERING

An UGC Autonomous Institution - Affiliated to JNTUH  
B.Tech. IV Year II Sem **External** Examinations Model Paper

Subject: **ARTIFICIAL NEURAL NETWORKS**

Branch: (CSE-**AI&ML**)

Time: 2 hours

Max. Marks:

Date:

## **PART – A**

Answer **ALL** questions

Short Answer Questions

**10x2 = 20 M**

1. Define ANN. C01
2. Mentions Types of Activation Function C01
3. Find definition of Filtering and Adaptive Process C02
4. What is Weiner Filter C02
5. Tell about Hessian Matrix? C03
6. List types of Signals identified in Multilayer Perceptron? C03
7. Illustrate the competitive learning with an example? C04
8. Build a Adaptation Rule? C04
9. Summarize the functional uses of Recurrent networks? C05
10. Mention Characteristics of Neuro Dynamical Model C05

## **PART – B**

Answer **ALL** questions

**5x10= 50M**

11. Write briefly about rules of knowledge representation C01  
(OR)
12. Explain about Network Architecture. C01
13. Demonstrate Optimization Techniques? C02  
(OR)
14. Explain gauss-Newton method? Explain about least-mean square algorithm. C02
15. Write a neat block diagram and flowchart of explain error back propagation algorithm? C03  
(OR)
16. Explain and Write Bayesian decision boundary? C03
17. Develop Kohonen's SOH algorithm with some factors? Explain about properties of the feature map? C04



(OR)

18. Build a two-dimensional lattice distribution?

C04

19. Discuss Lyapunov's Theorems.

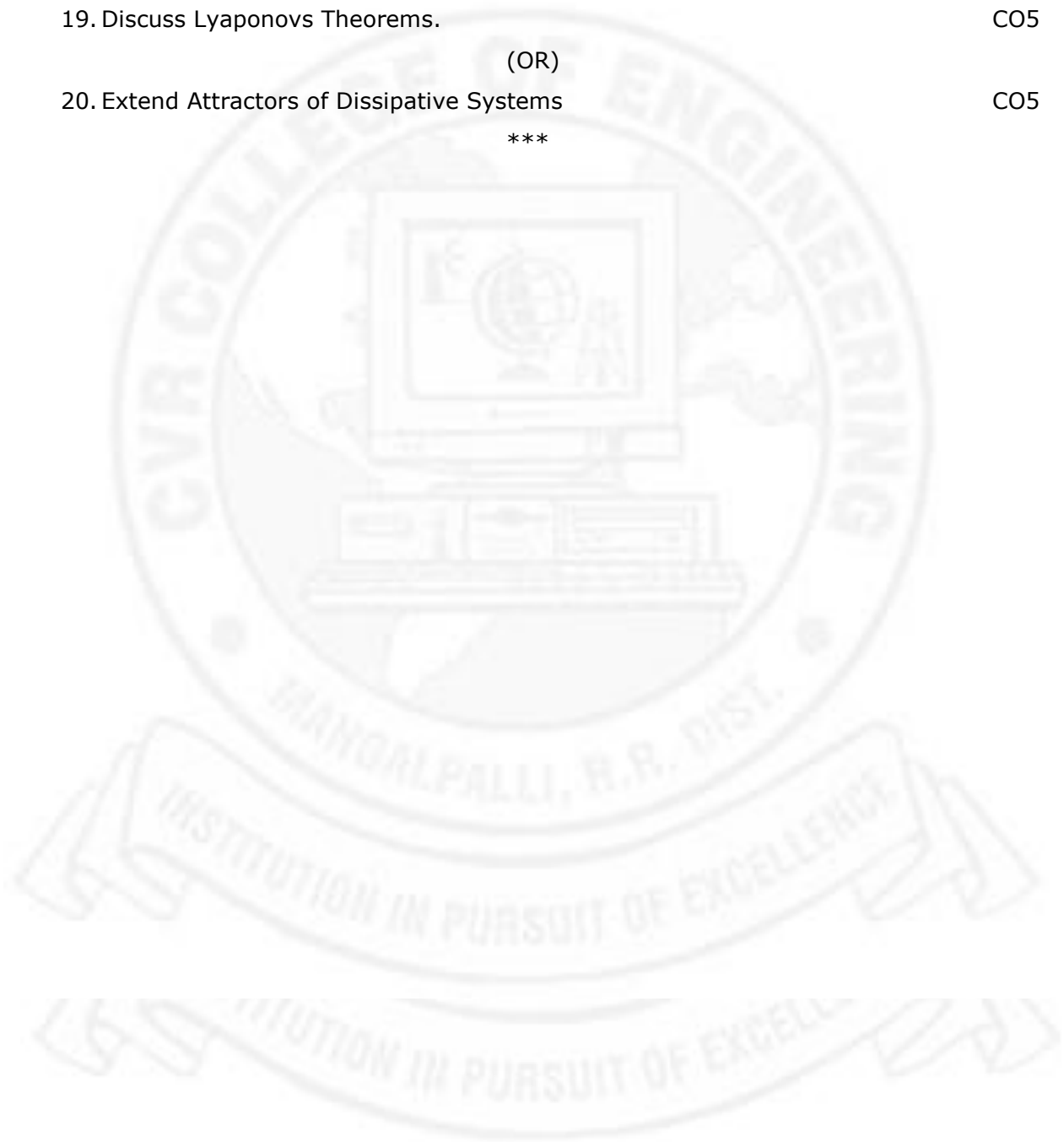
C05

(OR)

20. Extend Attractors of Dissipative Systems

C05

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# **PYTHON FOR DATA SCIENCE**



**Course Objectives:**

- ❖ To introduce the spirit of Data Sciences and to offer insights of data processing pipeline
- ❖ To enable the students to deal with data structures offered by python libraries to handle wide variety of data
- ❖ To acquire knowledge on predictive models and their behaviours

**Course Outcomes:** At the end of the course, the student should be able to

**CO1:** Gain expertise in data handling, and cleaning using python packages

**CO2:** Apply all the functional features of the NumPy to effectively manipulate the data present in Arrays.

**CO3:** Gain insights into descriptive statistics of categorical and time series data by applying the constructs of Pandas data structures.

**CO4:** Master the data interpretation using various exploratory models and gain insights

**CO5:** Build regression models by utilizing various basis functions and evolve prediction mechanisms

**Course to PO, PSO Mapping:**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO	3	2	3	2	2							1	3	2	1	1

**Course Outcome to PO, PSO Mapping:**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2							1	3	2		1
CO2	3	2	3	2	2							1	3	2		1
CO3	3	2	3	2	2							1	3	2		1
CO4	3	2	2	2	2							1	3	2	1	
CO5	3	2	2	2	2							1	3	2	1	



**SYLLABUS:  
PYTHON FOR DATA SCIENCE  
(CSE-DS)**

**UNIT I**

**Introduction to Data Science:**

Data Science. Data Objects and Attribute Types, Measuring Data similarity and dissimilarity, Data Preprocessing – Data Cleaning, Data Integration, Data Reduction, Data Transformation, and Data Discretization, Traits of Big data, Hypothesis and Inference, Analysis vs Reporting.

**UNIT II – Data Science Tool Kits: Numpy**

NumPy Basics: Arrays and Vectorized Computation. The NumPy ndarray, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Pseudorandom Number Generation, Advanced Array Manipulation, Reshaping Arrays, Concatenating and Splitting Arrays, Repeating Elements: tile and repeat, Fancy Indexing Equivalents: take and put, Broadcasting.

**UNIT III – Data Science Tool Kits: Pandas**

Pandas Basics: Introduction to pandas Data Structures: Series. Data Frame, Index Objects, Essential Functionality, Summarizing and Computing Descriptive Statistics, Data Wrangling: Join, Combine, and Reshape, Data Aggregation and Group Operations, Time Series, Categorical Data, Advanced Group by Use, Techniques for Method Chaining  
Matplotlib: Plotting and Visualization: Figures and Subplots, Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

**UNIT IV - Exploratory Data Analysis:**

Elements of Structured Data, Rectangular Data, Estimates of Location, Estimates of Variability, Exploring the Data Distribution, Exploring Binary and Categorical Data, Correlation, Exploring Two or More Variables. Data Sampling Distributions: The Bootstrap- Resampling vs Boot Strap, Comparison of distributions- KS Test. Introduction to Scipy

**UNIT V - ANOVA and Regression:**

ANOVA, F-Test, One-way Classification, Regression: Simple Linear Regression, The Regression Equation, Fitted Values and Residuals, Least Squares, Prediction versus Explanation (Profiling), Multiple Linear Regression, Examples. Prediction using Regression





**TEXT BOOKS:**

1. Data Science from Scratch: First Principle with Python, Joel Grus, O'Reilly, First Edition 2017.
2. Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce, Peter Gedeck, O'Reilly, Second Edition, 2020
3. Python for Data Analysis, Wes McKinney, O'Reilly, Second Edition, 2017

**REFERENCES:**

1. An Introduction to Statistics with Python, Thomas Haslwanter, Springer, 2016
2. Multivariate Data Analysis, Joseph F. Hair, William C Black, Barry J Babin, Pearson Education, 7th Edition, 2014.

**LESSON PLAN**

S.NO	Name of The Topic	No. Of Hours Required
<b>UNIT-I</b>		
1	Data Science. Data Objects and Attribute Types, Measuring Data Similarity and dissimilarity.	1
2	Data Preprocessing- Data Cleaning, Data Integration, Data Reduction	1
3	Data Transformation, and data Discretization, Traits of Big Data	1
4	Hypothesis and Inference	1
5	Analysis Vs Reporting	1
<b>UNIT-II</b>		
6	NumPy Basics: Arrays and Vectorized Computation	2
7	The NumPy ndarray, Universal Functions: Fast Element-Wise Array Functions,	2
8	Array-Oriented Programming with Arrays, File Input and Output with Arrays	1
9	Pseudorandom Number Generation, Advanced Array Manipulation	2
10	Reshaping Arrays, Concatenating and Splitting Arrays	1
11	Repeating Elements: tile and repeat	1
12	Fancy Indexing Equivalents: take and put, Broadcasting.	1
<b>UNIT-III</b>		
13	Pandas Basics: Introduction to pandas Data Structures: Series	1



14	Data Frame, Index Objects, Essential Functionality	2
15	Summarizing and Computing Descriptive Statistics	1
16	Data Wrangling: Join, Combine, and Reshape	1
17	Data Aggregation and Group Operations	1
18	Time Series, Categorical Data, Advanced GroupBy Use	2
19	Techniques for Method Chaining	1
20	Matplotlib: Plotting and Visualization: Figures and Subplots, Line Plots	1
21	Bar Plots, Histograms and Density Plots	2
22	Scatter or Point Plots.	2
<b>UNIT IV</b>		
23	Exploratory Data Analysis: Elements of Structured Data, Rectangular Data	1
24	Estimates of Location, Estimates of Variability	2
25	Exploring the Data Distribution, Exploring Binary and Categorical Data, Correlation, Exploring Two or More Variables	2
26	Data Sampling Distributions: The Bootstrap-Resampling vs Boot Strap	2
27	Comparison of distributions- KS Test.	1
28	Introduction to Scipy	1
<b>UNIT V</b>		
29	ANOVA	1
30	F-Test, One-way Classification	1
31	Regression: Simple Linear Regression, The Regression Equation,	2
32	The Regression Equation, Fitted Values and Residuals	1
33	Least Squares,	1
34	Prediction versus Explanation (Profiling)	1
35	Multiple Linear Regression	1
36	Examples	2
37	Prediction using Regression	2



## **UNIT-1**

### **Short Answer**

1. What is the difference between Similarities and dissimilarities?
2. How do you measure Similarity of data?
3. How do you measure dissimilarity of data?
4. List out the uses of similarity measure of data.
5. List out the uses of dissimilarity of measure of data.
6. What are the traits of Big Data?
7. What are the methods for data reduction?
8. List out the benefits of data reduction.
9. What is the difference between Hypothesis and Observation?
10. What are the two types of Hypothesis?
11. Define Null and Alternative Hypothesis.

### **Essay Questions**

1. Explain about measuring data Similarity and Dissimilarity.
2. What are the steps involved in Data Cleaning Process? Explain.
3. What is Data Integration? Explain Data Integration Techniques.
4. Discuss Data Reduction Techniques.
5. What is Data Transformation? Explain Data Transformation Strategies.
6. What is meant by Data discretization? Explain techniques of data discretization.

## **UNIT-2**

### **Short Answer**

1. Why we should use NumPy instead of Lists?
2. What is NumPy? How to install it?
3. What is an array and how it is different from a list?
4. What do you understand by rank of an ndarray?
5. What is the function used to return the indices of sorted elements?
6. What is broadcasting in NumPy Python?
7. How to broadcast a function in NumPy?



### **Essay Questions**

1. What are Universal functions in NumPy? Explain any Five of them.
2. Explain Array Oriented Programming with Arrays.
3. Discuss Binary Universal functions in NumPy.
4. Explain File Input and Output with Arrays.
5. Explain Broadcasting in NumPy.
6. Explain the following:
  - A) Pseudorandom Number Generation
  - B) Fancy Indexing Equivalents

### **UNIT-3**

#### **Short Answer**

1. What is scatter diagram? Show different types of Correlations using Scatter diagram.
2. What is a line plot and when it is used?
3. Define Descriptive Statistics.
4. What is Time Series Data?
5. What are the types of Time Series?
6. What is the use of Pandas?
7. How to create a Python Series?

#### **Essay Questions**

1. Write short notes on : a) Line Plots b) Bar Plots
2. Explain data aggregation and the various grouping methods.
3. What are the various operations performed on Time Series Data? Explain with one example.
4. Explain any five Index methods with syntax and example.
5. What are the various methods available to perform descriptive and summary statistics on data frame? Explain any five with example.
6. Discuss about the GroupBy Mechanics.



## **UNIT-4**

### **Short Answer**

1. What are the sources of structured data?
2. What are the examples of structured data?
3. What is meant by Rectangular data?
4. What is meant by Variability?
5. Why do we measure Variability?
6. What is meant by Categorical data?
7. What is the purpose of KS test?
- 8.

### **Essay Questions**

1. What is Exploratory Data Analysis? Explain with one example.
2. Discuss Elements of structured data.
3. Write short notes on Rectangular data with examples.
4. Explain about Binary and Categorical data.
5. Discuss data sampling distributions.
6. What is the purpose of KS Test? Explain.

## **UNIT-5**

### **Short Answer**

1. What is the ANOVA test used for?
2. What is calculated in ANOVA?
3. Define Regression.
4. What is the least square regression equation?
5. What is a fitted value?
6. How do you calculate fitted value?
7. What are residuals in Linear Regression?
- 8.

### **Essay Questions**

1. What is ANOVA? Explain ANOVA method in detail with example.
2. What is Binomial Distribution? Explain with one example.
3. What is Normal Distribution? Explain it with one example.



4. What are the types of Continuous Probability Distribution? Explain each with one suitable example.
5. What is Simple Linear Regression? Fit a Linear Model of Y on X based on the following data and obtain residuals.

Y:	1.2	2.4	1.7	2.6	1.0	4.3	3.3	3.8
X:	18	15	30	23	12	21	19	20

6. Write short notes on :
- a) Multiple Linear Regression Models
  - b) Coefficient of determination





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID-I** Examination Model Paper -I

Subject: **PYTHON FOR DATA SCIENCE**

Branch: (CSE- **DS**)

Date:

Time: 2 hours

Max. Marks: 40

## PART -A

**Answer all questions**

**5 X 2 = 10**

1. List out the benefits of data reduction. (C01)
2. What is the difference between Hypothesis and observation? (C01)
3. What is NumPy? How to install it? (C02)
4. What do you understand by rank of an ndarray? (C02)
5. Define Descriptive Statistics. (C03)

## PART - B

**Answer all questions**

**3 X10 = 30**

6. Explain about measuring data Similarity and Dissimilarity? (C01)

**(OR)**

7. What are the steps in Data Cleaning Process? Explain. (C01)
8. What are Universal functions in NumPy? Explain any five of them. (C02)

**(OR)**

9. Explain File Input and Output with Arrays. (C02)
10. What are the various operations performed on Time Series Data? Explain with one example. (C03)

**(OR)**

11. Explain data aggregation and various grouping methods. (C03)







# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID –I** Examination Model Paper -II

Subject: **PYTHON FOR DATA SCIENCE**

Branch: ( **CSE-DS** )

Date:

Time: 2 hours

Max. Marks: 40

## PART –A

**Answer all questions**

**5 X 2 = 10**

1. How do you similarity of data? **(CO1)**
2. List out the uses of similarity of data. **(CO1)**
3. What is the function used to return the indices of the Sorted elements? **(CO2)**
4. How to broadcast a function in NumPy? **(CO2)**
5. What are the types of Time Series? **(CO3)**

## PART – B

**Answer all questions**

**3 X10 = 30**

6. What is Data Integration? Explain Data Integration Techniques. **(CO1)**  
**(OR)**
7. What is Data Transformation? Explain Data Transformation Strategies. **(CO1)**
8. Explain Array-Oriented programming with Arrays. **(CO2)**  
**(OR)**
9. Explain Broadcasting concept in NumPy. **(CO2)**
10. What are the various methods available to perform descriptive statistics? Explain any five of them. **(CO3)**  
**(OR)**
11. Discuss about the advanced Group By use. **(CO3)**





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID-I** Examination Model Paper -III

Subject: **PYTHON FOR DATA SCIENCE**

Branch: (CSE-**DS**)

Date:

Time: 2 hours

Max. Marks: 40

## PART – A

**Answer all questions**

**5 X 2 = 10**

1. What is the difference between Similarities and Dissimilarities? **(C01)**
2. What are the traits of Big Data? **(C01)**
3. What is broadcasting in NumPy Python? **(C02)**
4. What is reporting & analytics? **(C02)**
5. What are the four components of Time Series? **(C03)**

## PART – B

**Answer all questions**

**3 X10 = 30**

6. What is meant by Data Discretization? Explain techniques of Data Discretization. **(C01)**

**(OR)**

7. Explain Data Reduction techniques. **(C01)**

8. Discuss Binary Universal functions in NumPy. **(C02)**

**(OR)**

9. Discuss File Input and Output with Arrays. **(C02)**

10. Explain about Data Wrangling with examples. **(C03)**

**(OR)**

11. Discuss techniques for method Chaining. **(C03)**





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech. II Year II Sem. MID-II Examination Model Paper -I**

Subject: **PYTHON FOR DATA SCIENCE**

Branch: (CSE-**DS**)

Date:

Time: 2 hours

Max. Marks: 40

## PART – A

**Answer all questions**

**5 X 2 = 10**

1. How to create a Series in Pandas? (C03)
2. What is meant by Variability? (C04)
3. What is Categorical data? (C04)
4. What is the ANOVA test used for? (C05)
5. What is a fitted value? (C05)

## PART – B

**Answer all questions**

**3 X10 = 30**

6. Explain Matplotlib with various examples. (C03)
- (OR)
7. Discuss Line Plots with suitable data. (C03)
8. What is EDA? Explain with one example. (C04)
- (OR)
9. Explain about Binary and Categorical Data. (C04)
10. What is ANOVA? Explain ANOVA method in detail with example. (C05)
- (OR)
11. Explain Binomial Distribution. (C05)





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID-II** Examination Model Paper -II

Subject: **PYTHON FOR DATA SCIENCE**

Branch: (CSE- **DS**)

Date:

Time: 2 hours

Max. Marks: 40

## PART – A

**Answer all questions**

**5 X 2 = 10**

1. What is a line plot and when it is used? **(C03)**
2. What are the three measures of Variability? **(C04)**
3. What are the examples of Binary Data? **(C04)**
4. Define Regression. **(C05)**
5. What is F-test used for? **(C05)**

## PART – B

**Answer all questions**

**3 X10 = 30**

6. Explain about Bar plots with examples. **(C03)**

**(OR)**

7. Write short notes on Histogram Plots **(C03)**
8. Write short notes on Rectangular data with one example. **(C04)**

**(OR)**

9. Discuss data sampling distributions. **(C04)**
10. What is Normal Distribution? Explain. **(C05)**

**(OR)**

11. Explain about types of Continuous Probability Distributions, **(C05)**





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech. II Year II Sem. MID-II Examination Model Paper -III**

Subject: **PYTHON FOR DATA SCIENCE**

Branch: (CSE-**DS**)

Date:

Time: 2 hours

Max. Marks: 40

## PART –A

**Answer all questions**

**5 X 2 = 10**

1. What is the used of Pandas? **(C03)**
2. What is the most reliable measure of variability? **(C04)**
3. What is the purpose of KS test? **(C04)**
4. What is a fitted value? **(C05)**
5. What are residuals? **(C05)**

## PART – B

**Answer all questions**

**3 X10 = 30**

6. Explain about Density Plots. **(C03)**

**(OR)**

7. Discuss Scatter Plots with an example. **(C03)**

**(OR)**

8. What is the purpose of KS Test? Explain. **(C04)**

**(OR)**

9. Discuss elements of Structured Data. **(C04)**

10. Discuss Simple Linear Regression with one example. **(C05)**

**(OR)**

11. Explain Multiple Linear Regression. **(C05)**





**CVR COLLEGE OF ENGINEERING**  
*UGC Autonomous Institution - Affiliated to JNTUH*  
B.Tech. II Year II Sem. – Substitute Examination  
Subject: **PYTHON FOR DATA SCIENCE**  
**SUBSTITUTE EXAMINATION MODEL PAPER**  
Branch: (CSE- **DS**)

Date:

Time: 2 hours

Max. Marks: 40

**PART – A**

**Answer all questions**

**5 X 2 = 10**

1. Define Null Hypothesis and Alternative Hypothesis. **(C01)**
2. What are the advantages of NumPy over regular Python Lists? **(C02)**
3. What is a Python Series? **(C03)**
4. What are some examples of Structured Data? **(C04)**
5. What is F-test used for? **(C05)**

**PART – B**

**Answer all questions**

**3 X10 = 30**

6. Explain about Measuring Data Similarity and Dissimilarity. **(C01)**

**(OR)**

7. Explain File Input and Output with arrays. **(C02)**
8. Explain any five Index methods with syntax and examples. **(C03)**

**(OR)**

9. Explain elements of Structured Data. **(C04)**

10. What is ANOVA? Explain ANOVA method in detail with example. **(C05)**

**(OR)**

11. Explain Simple Liner Regression with example. **(C05)**





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech. II Year II Sem MAIN EXAMINATION MODEL PAPER**

Subject: **PYTHON FOR DATA SCIENCE**

Branch: (CSE- **DS**)

Date:

Time: 3 hours

Max. Marks: 70

## **PART – A**

**Answer all questions**

**10 X 2 = 20**

1. List out the uses of similarity measure of data. **(C01)**
2. What are the methods for Data Reduction? **(C01)**
3. What is broadcasting in NumPy Python? **(C02)**
4. What is reporting and analytics? **(C02)**
5. What is Time Series Data? **(C03)**
6. What is the purpose of barplot? **(C03)**
7. What are sources of Structured Data? **(C04)**
8. What is meant by Rectangular Data? **(C04)**
9. What is F-test used for? **(C05)**
10. What are residuals in Linear Regression? **(C05)**

## **PART – B**

**Answer All questions**

**5 X10 = 50M**

11. Explain about Measuring Data Similarity and Dissimilarity. **(C01)**

**(OR)**

12. What is Data Integration? Explain various Data Integration techniques. **(C01)**
13. What are Universal Functions in NumPy? Explain any five of them. **(C02)**

**(OR)**

14. Explain about Broadcasting in NumPy. **(C02)**

15. Write short notes on :

- a) Line Plots **(C03)**
- b) Bar Plots

**(OR)**





16. Discuss any five Index methods with syntax and example. **(C03)**

17. Discuss data sampling distributions. **(C04)**

**(OR)**

18. What is the purpose of KS Test? Explain with example. **(C04)**

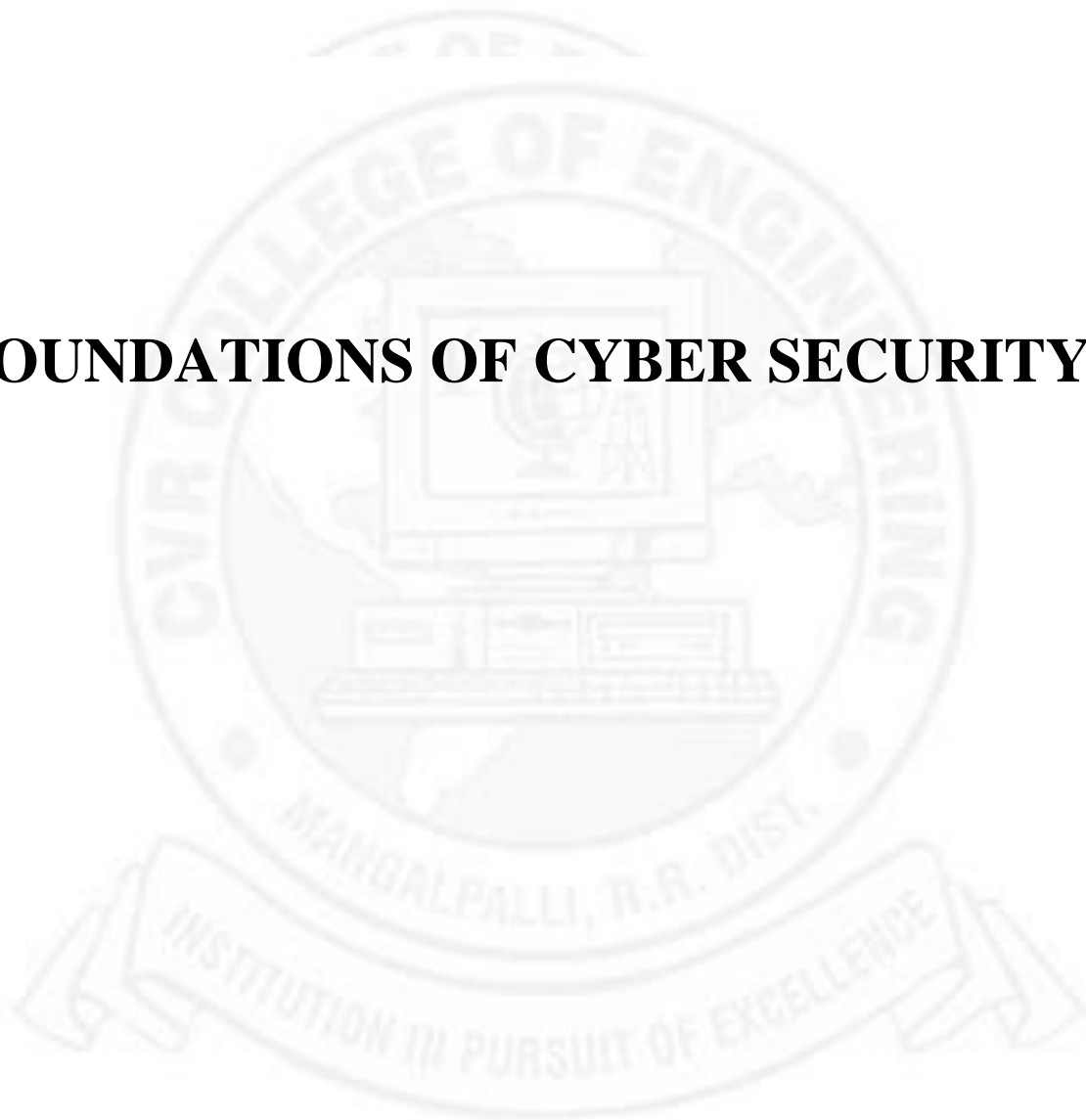
19. What is ANOVA? Explain ANOVA method in detail with example. **(C05)**

**(OR)**

20. What are the types of Continuous Probability Distributions? Explain each with one example. **(C05)**



# **FOUNDATIONS OF CYBER SECURITY**



**COURSE OBJECTIVES:**

1. To offer foundations of mathematical concepts involved in Cyber Security
2. To introduce the fundamentals of design and analysis of crypto systems.
3. To model the mechanisms for making the system secured.

**COURSE OUTCOMES:**

At the end of the course, student will be able to

CO1: Applying the information theory and compute the entropy from the given data set.

CO2: Appreciate the secured network interaction scenarios for exchanging the data.

CO3: Master the number theory concepts involved in cryptography.

CO4: Design crypto systems associated with the secured environment.

CO5: Implement IDS and antivirus models for realizing the system level security.

**COURSE TO PO, PSO MAPPING**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>FCS</b>	2	2	1	2	2	2			2	3	2	3	3	3	3	3

**COURSE OUTCOME TO PO, PSO MAPPING**

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	2	1			2	2			2	3		2		2	2	2
<b>CO2</b>	2	2	1		1				1	3	2	2		1	1	1
<b>CO3</b>	2	2	1		1				1	3	2	2		2	2	2
<b>CO4</b>	1					2			2	3	2	1		1	1	1
<b>CO5</b>	2	1	1	2	1	1			2	3	1	2	3	2	2	2

**Note: 1: Low, 2: Medium, 3: High**



**SYLLABUS**  
**Foundations of Cyber Security**  
**( CSE- CS)**

Instruction	: 3 Periods /week	Sessional Marks	: 30
		End Examination	: 70 Marks
Credits	: 3	End Exam Duration	: 3 Hours

**UNIT – I Information Theory**

Introduction -Entropy-Joint Entropy and Conditional Entropy- Relative Entropy and Mutual Information-Relationship Between Entropy and Mutual-Information -Chain Rules for Entropy, Relative Entropy and Mutual Information -Jensen's Inequality and Its Consequences -Log Sum Inequality and Its Applications - Data-Processing Inequality --Entropy Rates of a Stochastic Process-Markov Chains Entropy Rate, Example: Entropy Rate of a Random Walk on a Weighted Graph.

**UNIT – II- Introduction to Security**

Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

**UNIT –III – Number Theory**

Divisibility and The Division Algorithm, The Euclidean Algorithm, Modular Arithmetic Groups, Rings, and Fields Finite Fields of the Form  $(p)$  Polynomial Arithmetic Finite Fields of the Form  $(2^n)$ . Principles of Pseudorandom Number Generation, Pseudorandom Number Generators, True Random Number Generators, 1 Prime Numbers, Testing for primality.

**UNIT – IV Cryptography-Cipher**

Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography, Block Cipher Principles, Block Cipher Modes of Operation.

**UNIT – V System Security**

Intruders, Intrusion Detection, Password Management, Protection Password Selection Strategies, Types of Malicious Software, Viruses, Virus Countermeasures, Worms.



**Text Books:**

1. Elements of information theory, T.M. Cover and J. A. Thomas, 2<sup>nd</sup> Edition, John Wiley & Sons, 2012. (Unit I)
2. Cryptography and Network Security: Principles and Practice, W. Stallings, 4th Edition, Prentice Hall, 2006.

**Reference Books:**

1. Information Theory-A Tutorial Introduction, James V Stone, 1<sup>st</sup> Edition, Sebtel Press, 2015.
2. An Introduction to Mathematical Cryptography, Je rey-Ho stein, Jill-Pipher and Joseph H.-Silverman, 2<sup>nd</sup> Edition, Springer, 2014.
3. Fundamentals of Cryptology, Henk C.A. van Tilborg, 2<sup>th</sup> edition, Kluwer Academic Publishers, London,2002.

**LECTURE PLAN**

S.NO	TOPIC NAME	NO OF HOURS
<b>UNIT – I: Information Theory</b>		
1	Joint Entropy, Conditional Entropy- Relative Entropy	1
2	Mutual Information-Relationship Between Entropy and Mutual-Information	1
3	Chain Rules for Entropy and Mutual Information	1
4	Jensen's Inequality and Its Consequences	2
5	Log Sum Inequality and Its Applications	1
6	Data-Processing Inequality and Entropy Rates of a Stochastic Process	2
7	Markov Chains Entropy Rate Example: Entropy Rate of a Random Walk on a Weighted Graph	2
UNIT 1 Total Number of classes		10
<b>UNIT – II: Introduction to Security</b>		
8	Security Concepts	2
9	OSI Security Architecture	2
10	Security Attacks	2
11	Security Services	2



12	Security Mechanisms	2
13	A Model for Network Security	1
UNIT 2 Total Number of classes		11
<b>UNIT – III: Number Theory</b>		
14	Divisibility and The Division Algorithm	1
15	The Euclidean Algorithm and Modular Arithmetic Groups	2
16	Rings, and Fields Finite Fields of the Form(p) Polynomial Arithmetic Finite Fields of the Form (2 <sup>n</sup> )	2
17	Principles of Pseudorandom Number Generation	1
18	Pseudorandom Number Generators	1
19	True Random Number Generators, 1 Prime Numbers, Testing for primality.	2
UNIT 3 Total Number of classes		9
<b>UNIT – IV: Cryptography-Cipher</b>		
20	Symmetric Cipher Model	1
21	Substitution Techniques	1
22	Transposition Techniques	2
23	Rotor Machines	1
24	Steganography	1
25	Block Cipher Principles	1
26	Block Cipher Modes of Operation	1
UNIT 4 Total Number of classes		8
<b>UNIT –V: System Security</b>		
27	Intruders	1
28	Intrusion Detection	1
29	Password Management	1
30	Protection Password Selection Strategies	1
31	Types of Malicious Software	1
32	Viruses	1



33	Virus Countermeasures	1
34	Worms	1
UNIT 5 Total Number of classes		8
<b>Total Number of classes required</b>		<b>46</b>

### UNIT-I SHORT TYPE QUESTIONS

1. Differentiate Joint Entropy and Conditional Entropy.
2. Define Relative Entropy.
3. Identify the Relationship between Entropy and Mutual Information.
4. Identify the Relationship between Relative Entropy and Mutual Information.
5. What are the chain Rules for Entropy.
6. Define Stochastic Process.
7. Define Entropy.
8. Define Markov Chains.

### ESSAY TYPE QUESTIONS

1. Write in brief about Different Types of Entropy.
2. Explain about Jensen's Inequality and Its Consequences.
3. Describe about Log Sum Inequality and Its Applications.
4. Explain about Data-Processing Inequality.
5. Summarize Entropy Rates of a Stochastic Process.
6. Describe about Markov Chains Entropy Rate.
7. Explain about Entropy Rate of a Random Walk on a Weighted Graph.





**UNIT-II**  
**SHORT TYPE QUESTIONS**

1. Define Computer Security and Network Security.
2. What are the elements of Security Architecture?
3. Differentiate Passive and Active Attacks.
4. Define Data Integrity and Authentication.
5. Identify various types of Security mechanisms.

**ESSAY TYPE QUESTIONS**

1. Describe a Model for Network Security.
2. Explain in Detail about Various Security Mechanisms.
3. Explain different Security Services.
4. Write about OSI Security Architecture.
5. Explain Different types of Security Attacks with neat Diagrams.

**UNIT-III**  
**SHORT TYPE QUESTIONS**

1. What is the Divisibility and The Division Algorithm?
2. What is the Euclidean Algorithm?
3. What is Modular Arithmetic Group?
4. Define Ring and Field.
5. What is Pseudorandom Number?

**ESSAY TYPE QUESTIONS**

1. Explain Divisibility and The Division Algorithm.
2. Compare and Contrast Rings and Fields.
3. Explain about Euclidean Algorithm and Modular Arithmetic Group.
4. Describe about Principles of Pseudorandom Number Generation.



5. Explain about True Random Number Generators.
6. Define Prime Number and Explain about Testing for Primality.

#### **UNIT-IV**

#### **SHORT TYPE QUESTIONS**

1. Define Cipher.
2. Define Symmetric Cipher.
3. What is the Substitution Technique?
4. What is the Transposition Technique?
5. Differentiate Substitution and Transposition Techniques.
6. Define Steganography.
7. Differentiate Steganography and Cryptography.
8. What are the Block Cipher Principles?

#### **ESSAY TYPE QUESTIONS**

1. Write about Block Cipher Modes of Operation.
2. Explain about different Substitution Techniques.
3. Describe about Transposition Techniques.
4. Explain in detail about Rotor Machines.
5. Describe CBC, OFB Block Cipher Modes.
6. Describe about ECB Block Cipher Mode.

#### **UNIT-V**

#### **SHORT TYPE QUESTIONS**

1. Define Intruder.
2. Define Intrusion Detection System.
3. What is Password Management?
4. What is Virus?
5. What is Worm?
6. Define Malicious Software.



## ESSAY TYPE QUESTIONS

1. List the different types of Password Selection Strategies.
2. Explain in detail about Intrusion Detection System.
3. Explain in detail about types of Malicious Software.
4. Describe about Virus Countermeasures.
5. Compare and Contrast Viruses and Worms.
6. Discuss about Password Management.





## CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **I MID** Examination Model Paper -I

Subject: Foundations of Cyber Security

Branch: (CSE-**CS**)

**Time: 2 hours**

**Max. Marks: 40**

Answer **All questions** of Part – A and any **Three** questions of Part – B.

### Part – A

**5x2 = 10 Marks**

1. Categorize types of Entropy. CO1
2. Differentiate Joint Entropy and Conditional Entropy. CO1
3. Differentiate Passive and Active Attacks. CO2
4. Identify various types of Security mechanisms. CO2
5. What is the Divisibility and The Division Algorithm? CO3

### Part – B

**3x10 = 30 marks**

6. Write in brief about Different Types of Entropy. CO1

**OR**

7. Explain about Jensen's Inequality and Its Consequences. CO1
8. Describe a Model for Network Security. CO2

**OR**

9. Explain in Detail about Various Security Mechanisms. CO2
10. Explain Divisibility and The Division Algorithm. CO3

**OR**

11. Compare and Contrast Rings and Fields. CO3





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID-I** Examination Model Paper -II

Subject: Foundations of Cyber Security

Branch: (CSE-**CS**)

Mid Exam Question Paper

**Time: 2 hours**

**Max. Marks: 40**

Answer **All questions** of Part – A and any **Three** questions of Part – B.

## Part – A

**5x2 = 10 Marks**

1. Define Relative Entropy. CO1
2. Identify the Relationship between Entropy and Mutual Information. CO1
3. Define Computer Security and Network Security. CO2
4. What are the elements of Security Architecture? CO2
5. Define Cipher. CO3

## Part – B

**3x10 = 30 marks**

6. Write in brief about Different Types of Entropy. CO1

**OR**

7. Describe about Log Sum Inequality and Its Applications. CO1

8. Explain in Detail about Various Security Mechanisms. CO2

**OR**

9. Explain different Security Services. CO2
10. Explain about Euclidean Algorithm and Modular Arithmetic Group. CO3

**OR**

11. Describe about Principles of Pseudorandom Number Generation. CO3





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **MID-I** Examination Model Paper III

Subject: Foundations of Cyber Security

Branch: (CSE- **CS**)

**Mid Exam Question Paper**

**Time: 2 hours**

**Max. Marks: 40**

Answer **All questions** of Part – A and any **Three** questions of Part – B.

## **Part – A**

**5x2 = 10 Marks**

1. Identify the Relationship between Relative Entropy and Mutual Information. CO1
2. What are the chain Rules for Entropy? CO1
3. Define Data Integrity and Authentication. CO2
4. Identify various types of Security mechanisms. CO2
5. What is Pseudorandom Number? CO3

## **Part – B**

**3x10 = 30 marks**

6. Write in brief about Different Types of Entropy. CO1

**OR**

7. Explain about Jensen's Inequality and Its Consequences. CO1
8. Describe a Model for Network Security. CO2

**OR**

9. Explain Different types of Security Attacks with neat Diagrams. CO2
10. Explain Divisibility and The Division Algorithm. CO3

**OR**

11. Define Prime Number and Explain about Testing for Primality. CO3





# CVR COLLEGE OF ENGINEERING

**UGC Autonomous Institution - Affiliated to JNTUH**

**B. Tech. II Year II Sem. II MID Examination Model Paper I**

**Subject: Foundations of Cyber Security**

**Branch: (CSE-CS)**

Mid Exam Question Paper

**Time: 2 hours**

**Max. Marks: 40**

Answer **All questions** of Part – A and any **Three** questions of Part – B.

## **Part – A**

**5x2 = 10 Marks**

1. What is the Euclidean Algorithm? C03
2. Define Symmetric Cipher. C04
3. What is the Substitution Technique? C04
4. Define Intruder. C05
5. Define Intrusion Detection System. C05

## **Part – B**

**3x10 = 30 marks**

6. Explain about True Random Number Generators. C03

**OR**

7. Describe about Principles of Pseudorandom Number Generation. C03
8. Describe CBC, OFB Block Cipher Modes. C04

**OR**

9. Explain about different Substitution Techniques. C04
10. Explain in detail about Intrusion Detection System. C05

**OR**

11. Compare and Contrast Viruses and Worms. C05







# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **II MID** Examination Model Paper II

Subject: Foundations of Cyber Security

Branch: ( **CSE-CS** )

**Mid Exam Question Paper**

**Time: 2 hours**

**Max. Marks: 40**

Answer **All questions** of Part – A and any **Three** questions of Part – B.

## **Part – A**

**5x2 = 10 Marks**

1. What is Modular Arithmetic Group? CO3
2. Differentiate Substitution and Transposition Techniques. CO4
3. Differentiate Steganography and Cryptography. CO4
4. What is Password Management? CO5
5. Define Malicious Software. CO5

## **Part – B**

**3x10 = 30 marks**

6. Explain about Euclidean Algorithm and Modular Arithmetic Group. CO3

**OR**

7. Describe about Principles of Pseudorandom Number Generation. CO3
8. Write about Block Cipher Modes of Operation. CO4

**OR**

9. Explain about different Substitution Techniques. CO4
10. List the different types of Password Selection Strategies. CO5

**OR**

11. Explain in detail about Intrusion Detection System. CO5





# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

**B. Tech.** II Year II Sem. **II MID** Examination Model Paper III

Subject: Foundations of Cyber Security

Branch: (CSE-**CS**)

## Mid Exam Question Paper

**Time: 2 hours**

**Max. Marks: 40**

Answer **All questions** of Part – A and any **Three** questions of Part – B.

### Part – A

**5x2 = 10 Marks**

1. Define Ring and Field. C03
2. Differentiate Steganography and Cryptography. C04
3. Define Symmetric Cipher. C04
4. Define Intruder. C05
5. What is Worm? C05

### Part – B

**3x10 = 30 marks**

6. Define Prime Number and Explain about Testing for Primality. C03

**OR**

7. Explain about True Random Number Generators. C03
8. Describe about ECB Block Cipher Mode. C04

**OR**

9. Describe CBC, OFB Block Cipher Modes. C04
10. Discuss about Password Management. C05

**OR**

11. Compare and Contrast Viruses and Worms. C05

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# CVR COLLEGE OF ENGINEERING

**UGC Autonomous Institution - Affiliated to JNTUH**

**B.Tech. II Year II Sem. Examination Model Paper I**

**Subject: Foundations of Cyber Security**

**Branch: (CSE-CS) Substitution**

**Time: 2 hours**

**Max. Marks: 40**

Answer **All questions** of Part – A and any **Three** questions of Part – B.

## Part – A

**5x2 = 10 Marks**

1. Identify the Relationship between Relative Entropy and Mutual Information.  
CO1
2. What are the elements of Security Architecture? CO2
3. What is Modular Arithmetic Group? CO3
4. What are the Block Cipher Principles? CO4
5. Define Intrusion Detection System. CO5

## Part – B

**3x10 = 30 marks**

6. Write in brief about Different Types of Entropy. CO1

**OR**

7. Describe a Model for Network Security. CO2

8. Explain Divisibility and The Division Algorithm. CO3

**OR**

9. Write about Block Cipher Modes of Operation. CO4

10. Explain in detail about Intrusion Detection System. CO5

**OR**

11. Describe about Virus Countermeasures. CO5

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# CVR COLLEGE OF ENGINEERING

UGC Autonomous Institution - Affiliated to JNTUH

B . Tech. II Year II Sem **MAIN EXAMINATION MODEL PAPER**

**Subject: Foundations of Cyber Security**

Branch: (CSE-**CS**)

**Time: 3 hours**

**Max. Marks: 70**

## **PART – A**

**(10x2= 20 Marks)**

**(Answer ALL Questions)**

- |   |     |
|---|-----|
| 1. What are the chain Rules for Entropy?                    | CO1 |
| 2. Define Stochastic Process.                               | CO1 |
| 3. What are the elements of Security Architecture?          | CO2 |
| 4. Differentiate Passive and Active Attacks.                | CO2 |
| 5. What is Modular Arithmetic Group?                        | CO3 |
| 6. Define Ring and Field.                                   | CO3 |
| 7. Differentiate Substitution and Transposition Techniques. | CO4 |
| 8. Differentiate Steganography and Cryptography.            | CO4 |
| 9. What is Password Management?                             | CO5 |
| 10. Define Malicious Software.                              | CO5 |

## **PART – B**

**(5x10 = 50 Marks)**

**(Answer any FIVE questions)**

- |  |          |
|--|----------|
| 11. a) Write in brief about Different Types of Entropy.        | CO1      |
| b) Explain about Jensen's Inequality and Its Consequences.     | CO1[5+5] |
| <b>[OR]</b>  |          |
| 12. a) Describe about Log Sum Inequality and Its Applications. | CO1      |
| b) Explain about Data-Processing Inequality.                   | CO1[5+5] |
| <b>[OR]</b>  |          |
| 13. a) Describe a Model for Network Security.                  | CO2      |
| b) Explain in Detail about Various Security Mechanisms.        | CO2[5+5] |

**[OR]**



14. a) Explain different Security Services. C02  
b) Write about OSI Security Architecture. C02[5+5]
15. a) Explain Divisibility and The Division Algorithm. C03  
b) Compare and Contrast Rings and Fields. C03[5+5]
- [OR]**
16. a) Explain about Euclidean Algorithm and Modular Arithmetic Group. C03  
b) Describe about Principles of Pseudorandom Number Generation. C03[5+5]
17. a) Write about Block Cipher Modes of Operation. C04  
b) Explain about different Substitution Techniques. C04 [5+5]
- [OR]**
18. a) Describe about Transposition Techniques. C04  
b) Explain in detail about Rotor Machines. C04 [5+5]
19. a) List the different types of Password Selection Strategies. C05  
b) Explain in detail about Intrusion Detection System. C05 [5+5]
- [OR]**
20. a) Explain in detail about types of Malicious Software. C05  
b) Describe about Virus Countermeasures. C05[5+5]

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