

Roll No. ....

Total Pages : 04

BT-3/D-22

43216

MATHEMATICS FOR BIG DATA AND  
OPTIMIZATION  
BS-CS-AIDS-201-A

Time : Three Hours]

[Maximum Marks : 75

**Note :** Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

**Unit I**

1. (a) Expand  $x \sin x$  as sine series in  $0 < x < \pi$ . 7.5  
 (b) Find the Fourier series expansion of  $f(x) = 2x - x^2$  in  $(0, 3)$  and deduce that : 7.5

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} \dots - \infty = \frac{\pi}{12}$$

2. (a) Using Fourier integral representation, show that : 7.5

$$\int_0^{\infty} \frac{\cos x\alpha + \alpha \sin x\alpha}{1 + \alpha^2} d\alpha = \begin{cases} 0, & \text{if } x < 0 \\ \frac{\pi}{2}, & \text{if } x = 0 \\ \pi e^{-x}, & \text{if } x > 0 \end{cases}$$

- (b) Show that the function  $e^{-\frac{x^2}{2}}$  is self-reciprocal under Fourier transform. 7.5

### Unit II

3. (a) Solve the differential equation : 7.5

$$(3x^2 + 6xy^2)dx + (6x^2y + 4y^3)dy = 0$$

- (b) Solve the differential equation : 7.5

$$\frac{dy}{dx} + \frac{1}{x}y = 6x^2y^3.$$

4. (a) By variation of parameter, find the solution of

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \sin x. \quad 7.5$$

- (b) Solve : 7.5

$$(x+1)^2 \frac{d^2y}{dx^2} + (x+1) \frac{dy}{dx} + y = 4 \cos \log(1+x).$$

### Unit III

5. (a) Using the method of False position to find the root corrected to three places of decimal of the equation  $x^3 - 7x - 3 = 0$ . 7.5

- (b) Find the value of  $\sin(1.747)$  using the values given in the table below : 7.5

$x$	$\cos x$
1.70	0.9916
1.74	0.9857
1.78	0.9781
1.82	0.9691
1.86	0.9584

6. Find an approximate value of  $y(0.1)$  in the steps of 0.1, if  $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$ ,  $y(0) = 1$ ,  $y'(0) = 0$  by Runge-Kutta Method of fourth order. 15

#### Unit IV

7. (a) Give any *five* reasons why the study of unconstrained minimization methods is important. 7.5
- (b) Define the following terms : 7.5
- (i) Pattern directions
  - (ii) Conjugate directions
  - (iii) Simplex
  - (iv) Gradient of a function
  - (v) Hessian matrix of a function.

8. Minimize  $f = x_1^2 + 2x_2^2 + 3x_3^2$

Subject to the constraints

$$g_1 = x_1 - x_2 - 2x_3 \leq 12,$$

$$g_2 = x_1 + 2x_2 - 3x_3 \leq 8$$

using Kuhn-Tucker conditions.

15

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Total Pages : 02

BT-3/D-22

43217

OBJECT ORIENTED PROGRAMMING  
PC-CS-AIDS-203A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

**Unit I**

1. What is Object-Oriented Programming ? Describe the following in the context of Object-Oriented Programming :
  - (a) Objects and Classes
  - (b) Polymorphism
  - (c) Inheritance.
2. (a) Illustrate the structure of C++ program through an example application of your choice.  
(b) Bring out the distinction between abstraction and encapsulation using suitable examples.

**Unit II**

3. (a) Write a simple and complete C++ program to demonstrate Friend class.

- (b) How constructors are different from a normal member function ? Describe the characteristics and types of constructors.
4. Why and when do we use inheritance ? What is public, private and protected inheritance ? Also describe the types of inheritance in C++.

### Unit III

5. How is compile-time polymorphism achieved in C++ ? Illustrate using suitable examples.
6. (a) Describe the use of virtual functions. When is a virtual function called a pure virtual function ?
- (b) Describe how fractional numbers can be added using operator overloading.

### Unit IV

7. What are the advantages of exception handling and how is exception handling built up in C++ ? Give a brief description of standard exceptions.
8. Answer the following questions in brief :
- (a) What are the types of streams in C++ ?
- (b) What are templates and how do they work ?
- (c) Can there be more than one arguments to templates ? Justify using an example.

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Total Pages : 02

BT-3/D-22

43218

DATA STRUCTURES AND ALGORITHMS  
PC-CS-AIDS-205A

Time : Three Hours]

[Maximum Marks : 75

**Note :** Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

**Unit I**

1. (a) What is the importance of data structures in solving problems ? How are data structures classified ? Give *two* examples of each type to highlight their distinction.
- (b) What is meant by asymptotic analysis of an algorithm ? Describe the commonly used asymptotic notations used to represent the complexity of an algorithm.
2. (a) What are sparse matrix and two-dimensional arrays ? Explain using an example, how two-dimensional arrays and sparse matrix can be used to solve problems.

- (b) Describe, how an array will be sorted using bubble sort.

### Unit II

3. Show, how a stack is implemented using arrays. Write an algorithm for evaluating a postfix expression using a stack. Describe one more application of Stack.
4. What is the difference between Linear Queue, Circular Queue and Priority Queue ? What operations can be performed on Queues ? Also describe any *one* applications of Queues.

### Unit III

5. Describe the advantages of Linked Lists over arrays. How is an element inserted and deleted in a Linked List ?
6. (a) What are Circular and Doubly Linked List ?  
(b) Describe one application where a linked list may be used.

### Unit IV

7. Define binary tree and show how can it be traversed. Bring out the distinction between binary tree and threaded binary tree. How will a binary tree be created for a the following input.
- 10, 15, 12, 7, 8, 18, 6, 20
8. Describe the methods for representing graphs. What is depth first traversal of a graph ?



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Total Pages : 03

**BT-3/D-22**

**43219**

**INTRODUCTION TO ARTIFICIAL  
INTELLIGENCE  
PC-CS-AIDS-207A**

Time : Three Hours]

[Maximum Marks : 75

**Note :** Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

**Unit I**

1. (a) Explain the holistic view of expert systems with the help of some real time examples. **8**
- (b) Justify the basic usage of means-end analysis with the help of some practical examples. **7**
2. (a) Elaborate the concept of theorem proving and abstraction in artificial intelligence. **8**
- (b) Differentiate between depth first search and breadth first search problem solving techniques. **7**

**Unit II**

3. (a) Why is predicate logic used ? Explain the process of unification and modus ponens. **8**

- (b) Compare and contrast between declarative and procedural knowledge representation. 7
- 4. (a) Why is Alpha Beta Cutoff method used ? Explain its significance in game playing. 8
- (b) Differentiate between forward chaining and backward chaining. 7

### Unit III

- 5. (a) Compare and contrast between propositional versus first order logic. 8
- (b) Identify the relevance of first order logic, unification and lifting in knowledge engineering. 7
- 6. (a) Explain the usage, significance and real time characteristics of using fuzzy logic. 8
- (b) Compare and contrast between semantic and pragmatic processing in natural language processing. 7

### Unit IV

- 7. (a) Define neural networks and genetic algorithms. Explain with some real time applications where genetic algorithms and neural networks can be used. Also, identify the main technical differences among these two. 8

- (b) Differentiate between inductive and ensemble learning. 7
8. (a) What are the various forms of learning ? Explain the concepts of explanation based learning methods and statistical learning methods with the help of some practical examples. 8
- (b) Explain the case study of MYCIN with the help of its functional block diagram. 7

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Total Pages : 03

BT-3/D-22

43220

PROGRAMMING LANGUAGES

PC-CS-AIDS-209A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Differentiate between orthogonality and abstraction in the programming languages. 5
- (b) What are the major cost measures of any programming language ? 5
- (c) Define binding and binding times. What are the different design classes of binding times in the designing of programming languages ? 5
2. (a) Discuss the concept of optimization in a compiler. 5
- (b) Discuss the specification and implementation of subranges and enumerations in elementary data types. 5

- (c) Write down the BNF grammar and generate the parse tree for the following sentence :  
“We are playing the game of football for the last ten years.” 5

### Unit II

3. (a) What is the basic role of using structured data objects ? How to implement information hiding and overloaded subprograms ? 8  
(b) Discuss the specification and implementation of union, pointer and character strings. 7
4. (a) What are the main problems which are associated with the complex structured data types ? 8  
(b) Differentiate between linked storage representation and sequential storage representation. 7

### Unit III

5. (a) What is basic role of referencing environment ? Explain the concepts of call by reference and call by name for transmitting parameters. 8  
(b) Discuss the following by taking their relevant significance and roles : 7  
(i) Synchronization through semaphores  
(ii) Monitors  
(iii) Message passing.

6. (a) Explain the concept of static scoping and dynamic scoping by taking some practical examples of any programme language. 8
- (b) Discuss the role of short-circuit Boolean expressions in sequencing with the help of suitable examples. 7

#### Unit IV

7. (a) Define garbage and dangling references in storage management. 8
- (b) Differentiate between stack based storage management and heap storage management for variable and fixed size elements. 7
8. (a) Discuss the following concepts in relation to Ada and Smalltalk : 8
- (i) Subprograms and storage management
- (ii) Abstraction and encapsulation.
- (b) Differentiate between structural and logical programming languages by taking some programming examples. 7

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Total Pages : 02

BT-3/D-22

43221

BUSINESS INTELLIGENCE AND  
ENTREPRENEURSHIP  
HM-902-A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. What is entrepreneurial training ? Which entrepreneurial competencies or traits can be learnt through training and are required for successful entrepreneur ?
2. Which factors (economic and non-economic) affect the entrepreneurial growth ? Which challenges are faced by entrepreneurs now-a-days ?

Unit II

3. How search and identification of entrepreneurial opportunity is done ? How an entrepreneur can develop business idea and implement that idea ?
4. How market research is conducted ? How is industry analysis and competitor analysis done ?

### Unit III

5. Why are SSIs needed in India ? Which challenges are faced by SSIs in availing MSME schemes ?
6. How SSIs get registration ? What is the role of SSIs in economic development of the country ?

### Unit IV

7. Which institutions are working in India to support MSMEs ? Write on the functions of SIDBI and DIC.
8. What are the requirements for the formation of private/public limited companies in India ? Which legal issues are involved in the process of formation of company ?



BT-5/D-22

45261

## THEORY OF COMPUTATION

Paper-PC-CS-AIDS-301A

Time : Three Hours]

[Maximum Marks : 75

**Note :** Attempt *five* questions in all, selecting at least *one* question from each unit. Each question carry equal marks.

## UNIT-I

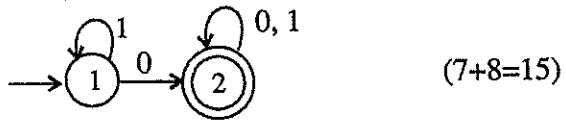
1. (a) If  $L$  is accepted by an NFA with  $\epsilon$ -transition then show that  $L$  is accepted by an NFA without  $\epsilon$ -transition.
- (b) Construct a DFA equivalent to the NFA.  $M = (\{p, q, r\}, \{0, 1\}, \delta, p, \{q, s\})$ . Where  $\delta$  is defined in the following table.

$\delta$	0	1
p	{q,s}	{q}
q	{r}	{q,r}
r	{s}	{p}
s	-	{q}

(7+8=15)

2. (a) Write short notes on precedence of Regular expression operators. Construct an NFA equivalent to the regular expression  $(0+1)^*(00+11)(0+1)^*$ .

- (b) Write about equivalence and minimization of NFA and DFA automata. Obtain the regular expression that denotes the language accepted by the following DFA.



### UNIT-II

3. (a) Let  $G$  be the grammar  $S \rightarrow aB/bA$ ,  $A \rightarrow a/aS/bAA$ ,  $B \rightarrow b/bS/aBB$ . Obtain parse tree for the string  $aaabbabbba$ .
- (b) Discuss closure properties of CFL.
- (c) Convert the grammar  $S \rightarrow AB$ ,  $A \rightarrow BS/b$ ,  $B \rightarrow SA/a$  into Greibach Normal Form. (5+5+5=15)
4. (a) Discuss Pumping lemma along with its advantages. State Pumping Lemma for Context free languages.
- (b) Define a Regular set using pumping lemma. Show that the language  $L = \{0i^2 \mid i \text{ is an integer } i \geq 1\}$  is not regular. (7+8=15)

### UNIT- III

5. Write a detailed note on the representation, equivalence and designing of Mealey and Moore machines. (15)
6. What are the different ways in which a PDA accepts the language? Define them. Is it true that non-deterministic PDA is more powerful than that of deterministic PDA? Justify your answer and explore the potential applications of PDA. (15)

## UNIT- IV

7. (a) What is Turing machine? Explain in detail : "The Turing Machine as a Computer of integer functions".  
(b) Explain time and tape complexity measures of Turing machines. (7+8=15)
8. (a) When a problem is said to be decidable or undecidable? Give an example of decidable and an undecidable.  
(b) What is Post's Correspondence problem (PCP)? Discuss. (7+8=15)
-

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Total Pages : 4

BT-5/D-22

45262

DESIGN AND ANALYSIS OF ALGORITHMS

Paper-PC-CS-AIDS-303 A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions.

1. Answer following questions in brief. Each part is of 3 marks.
  - (a) What is priority queue? Explain with the help of example.
  - (b) Write the master theorem for solving recurrence relation.
  - (c) What is topological sort? Show with example.
  - (d) What is merging network? Illustrate with example.
  - (e) Define Binomial heap with example. (3×5=15)
  
2.
  - (a) Explain Big-oh, Big-omega and Big-theta notations of the complexity. Also show each with the help of example and graph. (7)
  - (b) What is task scheduling problem? Compute the optimal sequence of task for following deadlines. (8)

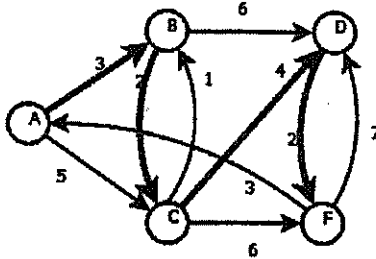
Task	Deadlines	Profit
T <sub>1</sub>	8	21
T <sub>2</sub>	2	23
T <sub>3</sub>	3	11
T <sub>4</sub>	5	9
T <sub>5</sub>	7	5
T <sub>6</sub>	1	17
T <sub>7</sub>	4	28
T <sub>8</sub>	6	14
T <sub>9</sub>	2	33

3. (a) Explain Strassen's matrix multiplication algorithm and compute the matrix multiplication of following using Strassen's algorithm.

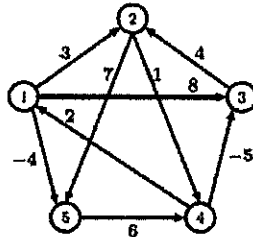
$$X = \begin{bmatrix} 3 & 2 \\ 4 & 8 \end{bmatrix} \quad Y = \begin{bmatrix} 1 & 5 \\ 9 & 6 \end{bmatrix}. \quad (7)$$

- (b) Define Fibonacci heap. Write the pseudo code for insertion and union operation in the Fibonacci heap. (8)
4. (a) What is the minimum spanning tree? Explain the Kruskal's Algorithm to find the minimum cost spanning tree with its steps. (7)
- (b) Write the properties of red-black tree. Explain the insertion and deletion operation of red-black tree in detail. (8)

5. (a) Explain Dijkstra's algorithm for single source shortest path. Find shortest path from vertex A to each other vertex using Dijkstra's algorithm. (8)



- (b) Explain the following terms with example: class P, class NP, NP hard problem. Also draw the overlapping sets of P, NP, NP hard, and NP complete. (7)
6. (a) Explain Bitonic sorting network with example. (7)
- (b) Explain Floyd-Warshall Algorithm to find all pair shortest path. Find all pair shortest path of following problem also analyze its complexity. (8)



7. (a) Explain breadth first search algorithm for graph traversal and write its pseudo code. Also analyze its time complexity. (8)
- (b) Explain Quick sort algorithm with example. Also write pseudo code and analyze its complexity. (7)

8. (a) What is greedy algorithm? Explain travelling salesman problem using greedy approach. Write its basic steps. (8)
- (b) Solve following recurrence relation using substitution method. (7)

$$T(n) = \begin{cases} 1 & \text{if } n = 1 \\ 2T\left(\frac{n}{2}\right) + \theta(n) & \text{if } n > 1. \end{cases}$$

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Total Pages : 2

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45263

COMPUTER NETWORK

Paper-ES-CS-AIDS-305A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions.

1. Answer each part in brief. Each of it is of 3 marks.
  - (a) What is ALOHA? Compare different ALOHA protocols.
  - (b) Explain the meaning of P/F field in HDLC control field.
  - (c) Discuss the MAC sublayer Design issues.
  - (d) Write the HTTP Response message formats.
  - (e) What is Medium Access Control Sublayer? (3×5)
  
2.
  - (a) Explain IEEE 802.11 architecture and addressing mechanism in detail. (8)
  - (b) What is CSMA? Explain CSMA with Collision Detection. (7)
  
3.
  - (a) Describe the functional differences between statistical and synchronous time division multiplexing. (7)
  - (b) Show the generation of codeword at the sender site and check the same at the receiver site using CRC where data word is 1010011010 and the deviser is 10111. (8)

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388 [P.T.O.



4. (a) Differentiate static, dynamic and active documents used in World Wide Web. (7)
- (b) What is public key encryption algorithm? Explain RSA cryptosystem with encryption and decryption in details. (8)
  
5. (a) List the similarities and dissimilarities between OSI & TCP/IP reference models. (7)
- (b) Explain Leaky bucket algorithm and token bucket algorithm for congestion control. Also write its steps. (8)
  
6. (a) What is the relevance of sliding window protocol in the improvement of link utilization? Explain sliding window protocol in detail. (8)
- (b) What is the difference between symmetric key and asymmetric key cryptography? Explain it with example. (7)
  
7. (a) What are responsibilities of data link layer? Explain each of the reasonability of data link layer in details with is associated mechanism. (8)
- (b) What is the working mechanism of ISDN? Explain the conceptual difference between narrowband ISDN and broadband ISDN. (7)
  
8. (a) What is HTTP? Explain Non-persistent and Persistent connections of HTTP. (7)
- (b) What is IPv6 addressing? Explain the concept behind unicast and multicast protocol with example. (8)

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Total Pages : 2

**BT-5/D-22**

**45264**

**MACHINE LERNING WITH USING PYTHON**

**Paper-PC-CS-AIDS-307-A**

Time : Three Hours]

[Maximum Marks : 75

**Note :** Attempt *five* questions in all, selecting atleast *one* question from each unit. All questions carry equal marks.


### **UNIT-I**

1. (a) What is the list data structure in Python? What are its characteristic features? Write the code in Python to access the list elements using for loop.  
(b) What is function? How is it defined in Python? How is the default value passed as parameter to a function in Python? Illustrate.
  
2. (a) What do you understand by dictionary? Explain the following methods with an example :  
(i) pop( ), (ii) update( ), (iii) clear( ), (iv) get( ).  
(b) What is a class? How is it defined in Python? Discuss the use of `__init__()` method using suitable example.

### **UNIT-II**

3. (a) What is the difference between supervised and unsupervised learning? Discuss.  
(b) Write a note on significance of numPy in deep learning.

45264/150/KD/993

 [P.T.O.]

4. (a) How are the data files read using pandas? Also illustrate the procedure of feature extraction.
- (b) Write a detailed note on applications of Machine Learning.

### UNIT-III

5. (a) What is logistic regression? What is the use of it in learning? Discuss its implementation in Python.
  - (b) What do you understand by decision tree? Write a code in Python illustrating the use of decision tree.
6. (a) What is the K means clustering algorithm? How is the elbow method used to decide the value of K? Explain.
  - (b) What is a recommender system? Explain the methodology of collaborative filtering in recommender system.

### UNIT - IV

7. What is IBM systemML? What are its characteristic features? Discuss.
  8. What is Apache Spark? Discuss the use of Scala in machine learning in Spark.
-

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Total Pages : 2

**BT-5/D-22**

**45265**

**COMPUTER ARCHITECTURE**

**Paper – ES-CS-AIDS-309-A**

Time : Three Hours]

[Maximum Marks : 75

**Note :** Attempt any *five* questions selecting at least one question from each unit.

**UNIT-I**

1. Explain memory hierarchy in detail with a neat and clean diagram. (15)
2. Explain :
  - (a) Principal of locality of reference in detail.
  - (b) Perform addition and subtraction using BOOTH's algorithm.
  - (c) Explain Von Neumann architecture. (15)

**UNIT-II**

3. Explain :
  - (a) Addressing modes in detail with examples.
  - (b) How address mapping works in associative memory? (10+5=15)
4. Explain :
  - (a) Memory read, memory write and opcode fetch using timing diagrams.

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 [P.T.O.]

- (b) Explain instruction cycle and also write difference between hardwired and micro programmed control unit. (8+7=15)

### UNIT-III

5. Explain :
- (a) Explain Zero, One, Two and Three address instructions with a suitable example.
  - (b) Write a detailed note on array processors. (10+5=15)
6. Write detailed notes on :
- (a) Differences between RISC and CISC instruction set.
  - (b) Vector processors and also highlight key points of pipeline processing. (7+8=15)

### UNIT-IV

7. Explain in detail :
- (a) Interrupt and its types.
  - (b) Programmed IO and interrupt driven IO. (5+10=15)
8. Write notes on (any *four*) :
- (a) Daisy chaining.
  - (b) DMA and its controller.
  - (c) Serial Communication.
  - (d) Handshaking.
  - (e) Types of buses in the system. (15)

BT-5/D-22

45266

ARTIFICIAL NEURAL NETWORKS

Paper-PC-CS-AIDS-S-311A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt five questions in all, selecting atleast one question from each unit. All questions carry equal marks.

UNIT-I

- 1. (a) What do you mean by biological neurons? What are the issues on which biological networks proves to be superior than AI networks? (7)
- (b) What is the role of activation function in neural networks? List down the names of some popular Activation Functions used in Neural Networks. (8)
- 2. Explain various Optimization Algorithms for Training Neural Network with its advantages and disadvantages. (15)

UNIT-II

- 3. (a) How the feedforward neural network works ? (7)
- (b) Explain the backpropagation algorithm. How it train the ANN? (8)

4. (a) What is RBFN? What are its advantages over MLP with error backpropagation learning? (8)
- (b) Explain approximation properties of RBNF. (7)

### UNIT-III

5. What is pattern association in associative memory network? Explain Hebb and Delta rule with its implementation. (15)
6. (a) Write retrieve algorithm for recurrent associative memory. (7)
- (b) Discuss the architecture of Bi-directional associative memory in detail. (8)

### UNIT-IV

7. Explain Perceptron neural network algorithm with its implementation in Python. (15)
  8. Write short notes on :
    - (a) Adaline Network.
    - (b) Recall Neural Network.
    - (c) BPN. (15)
-