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

N.B: 1) Question **number 1** is compulsory.

2) Attempt **any three** out of remaining.

3) Assume suitable data if **necessary** and justify the assumptions.

4) Figures to the **right** indicate full marks.

Q.1   A)   Determine Power and Energy of a Unit Step Signal.   05

     B)   Compare FIR systems with IIR Systems   05

                                                               05

     C)   Consider the analog signal

$X_a(t) = 3 \cos 2000 \, \Pi \, t + 5 \sin 6000 \, \Pi \, t + 10 \cos 12000 \, \Pi \, t$

a) Determine the minimum required sampling rate to avoid aliasing.

b) If Fs=5000 samples per unit time, what is the discrete time signal obtained after sampling?

     D)   For $x(n) = \{ 4, \ 2, -1, 1, 3, 2, 4, 2 \}$ find the following   05

1) $x(n-2)$
2) $x(1-n)$
3) $x(n+3)$
4) $x(n).u(n-1)$
5) $x(n-2) + \partial(n-1)$

Q.2   A)   Perform the linear convolution between x(n) and h(n) given below in time domain.   12

i) $x(n) = \left(\frac{1}{3}\right)^n u(n-2) \, , h(n) = (3)^n u(-n)$

ii) $x(n) = \begin{cases} 1 & for \ n = -2, 0, 1 \\ 2 & for \ n = -1 \\ 0 & else \ where \end{cases}$

$h(n) = \partial(n) - \partial(n-1) + \partial(n-2) - \partial(n-3)$

     B)   Find the auto correlation of the signal x(n)= { 3, 2 ,1, 2}   08

Also, explain what is the significance of the value corresponding to origin?

Page 1 of 2

58027

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Q.3   A)   Given a 6 point sequence   10

$$x(n) = 3\partial(n) + 4\,\partial(n-1) + 6\,\partial(n-3)$$

a) $if\ P(K) = W_N^{3K}\,X(K)$, find p(n)
b) $if\ Q(K) = X(K-3)$, find q(n)
c) $if\ R(K) = Real\,\{\,X(K)\}$, find r(n)

B)   Compute the Inverse DFT of the following 4 point sequence.   10

$$X(K) = \{\,4, 1-j, -2, 1+j\,\}$$

Q.4   A)   Find the circular convolution of following two sequences using concentric circle method.   10

$$x1(n) = \{1, -1, 2, -4, 2\}$$
$$x2(n) = \{1, 2, 3\}$$

B)   Apply DIT- FFT algorithm on the following 8 point sequence.   10
x(n)={ 1, 2, 3, 4, 4, 3, 2, 1 }

Q.5   A)   Check whether the given system $y(n) = x(2n) - x(n-1)$ is   10

a) Static or dynamic
b) Linear or Non Linear
c) Stable or unstable
d) Causal or Non causal
e) Time variant or Time Invariant

B)   Find the output y(n) whose impulse response is $h(n) = \{1, 1, 1\}$ and input signal $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$ using overlap add method.   10

Q.6   Attempt any two questions from the following   20

a) Explain in detail any five DFT properties.
b) Explain Carl's correlation coefficient algorithm with the help of suitable example.
c) Write a detailed note on biomedical application of DSP processor.

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58027

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(3 hours)   **Total Marks: 80**

N.B.   1. Question **No. 1** is compulsory
       2. Attempt any **three** out of remaining
       3. Assume suitable data if **necessary** and justify the assumptions
       4. Figures to the **right** indicate full marks

Q1   Answer the following   20
       [a] Every image has unique histogram but vice-versa is not true. Justify the
           statement.
       [b] List various steps in Digital Image Processing.
       [c] Explain unitary matrix by giving example.
       [d] Give any two objective fidelity criteria.

Q2   A For the given 4 bpp image apply   10
       [i] Digital Negative operation
       [ii] Contrast stretching operation with r1 = 4, r2=12, s1=8 and s2 = 12

4	5	9	14
4	6	11	14
3	6	5	11
3	8	8	9

     B What is segmentation explain (i) Region Growing (ii) Region Splitting and   10
        (iii) Thresholding

Q3   A Explain Chain code with example and show that how first difference makes chain code   10
        rotation invariant.

     B Find the DFT of the following image.   10

5	4	3	2
5	4	3	2
5	4	3	2
5	4	3	2

Q4   A Explain Thickening along with example.   10

     B Explain with example graph theoretic technique used for image segmentation.   10

Q5   A Write 8x8 Hadamard transform matrix and its signal flow graph. Using   10
        butterfly diagram, compute Hadamard transform for x(n)={1, 2, 3, 4, 1, 2, 3, 4}.

     B Explain Arithmetic coding with example.   10

Q6   Write a short note on   20
            [a] Hough Transform
            [b] Vector Quantization
            [c] Differential PCM
            [d] Morphological Boundary Extraction Method

58028

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

1. Question No 1 is **compulsory**.
2. Attempt any **three** out of the remaining five questions.

Q1. **Solve any four**: (5 marks for each)
   (a) Why is padding done in MD5 and SHA?   **05**
   (b) What are the properties of cryptographic hash functions?   **05**
   (c) Explain with examples, poly-alphabetic & mono-alphabetic ciphers.   **05**
   (d) What are the different types of viruses? Explain in brief.   **05**
   (e) With examples explain Denial of service attack.   **05**

Q2. (a) Justify why DES is a fiestel cipher. Explain the different operations in DES.   **12**
     How are the subkeys generated in each round different from each other?

   (b) Design a double transposition cipher and use it to encrypt "Enemy attacks tonight".   **08**
     Column Key to be used is [5,2,4,3,1].

Q3. (a) What is a digital certificate? Explain the significance of X.509 certificate in   **10**
     PKI. How is a digital certificate verified by the receiver during a communication?

Q3. (b) How is single sign-on achieved in Kerberos? What is the role of each server in   **10**
     the protocol?

Q4   (a) A and B use RSA to communicate securely. B choses public key (**e,n**) as   **10**
     (7,221). Calculate p,q and Φn. Compute the private key, **d**. A choses public key as
     (Ea,Na). A wishes to send message m=5 to B such that confidentiality is maintained.
     With what key will A encrypt the message?

Q4. (b) What is session hijacking? What are the different ways to prevent session   **10**
     hijack attacks?

Q5. (a) What are the different types of firewalls? Differentiate between working of the   **10**
     statefull and stateless inspection firewalls.

Q5. (b) Discuss how authentication and integrity is achieved in SET payment protocol?   **10**

Q6. (a)   Write in brief about (any two):   **10**
     i)   Database Security.
     ii)   Key generation in IDEA
     iii)   SSL record protocol.

Q6. (b) How does the IPSec protocol help in achieving authentication and integrity?   **10**

……………………………………

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

Note:
    (i) Each question carries 20 marks
    (ii) Question 1 is compulsory
    (iii) Attempt any three (3) from the remaining questions
    (iv) Assume suitable data wherever required

Q1.		Attempt **any four (4)** questions from the following	[20]
	(a)	Give PEAS description for a **Personal Assistant in Smartphone**. Characterize its environment.	
	(b)	Give the initial state, goal test, successor function, and cost function for an "**N Queens problem**".	
	(c)	Draw and explain architecture of Utility Based Agent.	
	(d)	Define Turing test and explain its significance in AI.	
	(e)	What are universal and existential quantifiers? Illustrate its usage in predicate logic with a suitable example	

Q2	(a)	Explain termination conditions in a decision tree learning algorithm with an example for each condition. What are decision rules? How to use it for classifying new samples?	[6+2+2]
	(b)	Consider the following sentences:	[10]
		Anyone passing his history exams and winning a lottery is happy. But anyone who studies or is lucky can pass all his exams. John did not study but he is lucky. Anyone who is lucky wins the lottery.	
		Answer "**Is John happy**?" using proof by resolution	

Q3	(a)	Design a suitable planning agent for cleaning the kitchen. Give **any 2** STRIPS style operators that might be used. When designing the operators take into account considerations such as --- Cleaning the stove or refrigerator will get the floor dirty.	[10]
	(b)	Explain the Bayesian Belief Networks (BBN) with a suitable example. What types of inferences can be drawn from such networks?	[10]

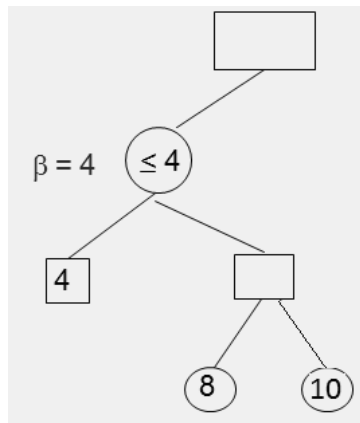|			
Q4	(a)	Define heuristics. Give a suitable heuristic function to solve a **tic-tac-toe** problem in AI. Illustrate its application to any state of a tic-tac-toe problem	[6]
Q4	(b)	Write a pseudo code for alpha-beta algorithm. Consider a section of min-max tree shown in Figure 1. Is there any Beta Cut Off possible? If possible, Where and Why?	[4+2+4]

Figure 1

(c) What are the frustrations that occur in hill climbing algorithm? [4]

Q5 (a) Explain how Genetic algorithms work with a suitable example? Define the terms chromosome, fitness function, crossover and mutation for the same example. [10]

(b) Consider the graph given in Figure 2 below. Assume that the initial state is S and the goal state is G. Show how **A* Search** would create a search tree to find a path from the initial state to the goal state [10]
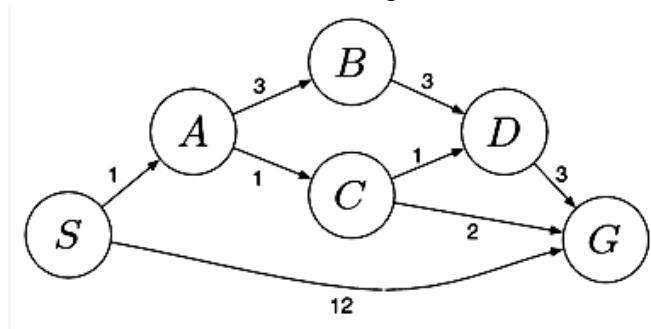

Figure 2

Assuming the straight-line distance as the heuristics function: h(S)=4, h(A)=2, h(B)=6, h(C)=2, h(D)=3 and h(G)=0.

Q6 Answer any two (2) of the following [20]

(a) How would you differentiate between Expert System and just an AI program? Draw and illustrate expert systems architecture. Use an example to support your claims.

(b) What are steps involved in natural language processing (NLP) of an English sentence? Explain with an example sentence. Briefly explain any one application of NLP

(c) Write a short note on simulated annealing.

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

N.B. (1) Question No 1 is compulsory
    (2) Attempt any 3 Questions out of the remaining six questions

Q1 **(a)** For following dataset, Class 'X' data points are P1(1,2), P2(1,1) and class 'O'   **5**
data points are Q1(2,3), Q2(-1,1), Q3(3,2). Plot the points and determine that
the given dataset is linearly separable or not.

(b) State activation functions used in Neural network? Plot each of them with its   **5**
equation.

(c) State the differences between derivative based and derivative free   **5**
optimization

(d) Derive identity for unipolar continuous function : f'(net)= O(1-O)   **5**

Q2 **(a)** What is Multi-Layer Perceptron? With the Block Diagram explain the   **10**
algorithm used to adjust weights at each layer. Show it for two layers.

(b) Use perceptron learning rule for computing weights after one iteration for the   **10**
data given bellow: (use Binary Bipolar function.
X_1=[1 -2 0 -1]^T; X_2=[0 1.5 -0.5 -1]^T;X_3=[-1 1 0.5 -1]^T. Initial weight
W^1=[1 -1 0 0.5]. The learning constant is given by c=0.1. Desired output for
X_1, X_2, X_3 are [-1,-1 1] respectively.

Q3 **(a)** Design a Fuzzy system to predict price of the Resale cars. Assume Total
Mileage and year of Manufacturing as input variables (attributes) and Sale price
as an output variable. Assume 3 descriptors (values of variables) for each input
attributes and 5 descriptors for output attributes.
  1.Show clearly the units used for & universe of discourse of each attribute.   **02**
  2.Create Fuzzy Rulebase for Price prediction Problem.   **03**
  3.Define fuzzy membership functions for all Input and Output attributes   **05**

(b) Explain Kohanan's Self Organizing Map w.r.t its architecture, Layers, How to   **10**
determine no. of neurons in the layers (may give example), Neighborhood,
Stopping conditions and applications.

Q4 **(a)** For the given Fuzzy sets M (Medium) & H (High), Find fuzzy set 1. Very High   **10**
2. Medium and High   3. Medium or High   4. $M_{\alpha=0.5}$ (Alpha level) 5. NOT
High.
M = {0.2/a + 0.4/b + 1/c + 0.8/d + 0/e}
H = {0.1/a + 0.4/b + 0.3/c + 0.6/d + 0.8/e}

(b) Design Mc- Culloch-Pitt's Neuron model to solve following functions   **10**
1.   2.

X1	X2	D
0	0	0
0	1	0
1	0	1
1	1	1

X1	X2	D
0	0	0
0	1	0
1	0	0
1	1	1

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Q5 (a) Explain Centre of Sums defuzzification techniques with suitable example. **04**

(b) Determine the weights after two iterations for Hebbian learning of a single neuron network using Bipolar Binary activation function starting with initial weights w = [-1,-1] **08**
and input patterns are Xl = [1.3,-1], X2 =[2.1,3.2], X3 = [-1.2,-1.8] and c= 1

(c) Describe Roulette wheel and Tournament selection methods in Genetic Algorithms. **08**

Q6 (a) Differentiate Winner Take All and Learning Vector Quantization in terms of weight updation, Learning type, topological neighborhood, applications. **04**

(b) Why we need Hybrid systems? Draw and explain architecture of ANFIS. **10**

(c) State the differences between derivative based and derivative free optimization **06**

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