

QP Code : 5994

(3Hours)

[80 Marks]

- N.B. : 1) Question No.1 is compulsory  
 2) Attempt any Three questions out of remaining.  
 3) Assume suitable data wherever necessary and state them clearly.

1. Answer the following:- (20)  
 (a) What do you understand by zero memory operation.  
 (b) Discuss different discontinuities in image.  
 (c) What is an Unitary matrix .  
 (d) Define Morphological operations Erosion and Dilation
2. (a) Discuss color models for a digital image. (19)

- (b) For the given 3 bits per pixel, 4 x 4 size image perform following operations. (10)  
 (i) Intensity level slicing with background,  $r_1 = 3$  and  $r_2 = 5$   
 (ii) Bit plane slicing.

6	2	3	2
1	5	0	7
4	3	2	1
2	5	7	6

3. (a) Explain: The first difference makes the chain code invariant to rotation. (10)  
 (b) Explain Homomorphic filtering with the help of block diagram. (10)

4. (a) Write 8 x 8 Hadamard transform matrix and its signal flow graph for fast Hadamard transform. Using this butterfly diagram (Signal flow graph) compute Hadamard transform for  $x(n) = \{1, 2, 1, 1, 3, 2, 1, 2\}$  (10)

- (b) Find the DCT of the given Image using matrix multiplication method. (10)

$$f(x, y) = \begin{bmatrix} 2 & 4 & 4 & 2 \\ 4 & 6 & 8 & 3 \\ 2 & 8 & 10 & 4 \\ 3 & 8 & 6 & 2 \end{bmatrix}$$

5. (a) Discuss the different types of redundancies in images with examples. (10)  
 (b) Construct Improved Gray Scale (IGS) quantization code for given gray scale data, (10)  
 $\{100, 110, 124, 124, 130, 200, 210\}$ . Also Compute  $e_{rms}$  (root mean square error).

6. Write detail notes on (any Two) (20)  
 (a) Edge Linking using Hough transform .  
 (b) Thinning with example.  
 (c) Differential Pulse Code Modulation (DPCM)  
 (d) Segmentation techniques: Region growing and split and merge.

MD-Con. 10765-15.

- N.B. : (1) Question No 1 is compulsory  
 (2) Attempt any three Questions out of remaining five questions.  
 (3) Assume suitable data wherever required and clearly specify it,  
 (4) Figures to the right indicate full marks.

1. (a) State the condition for stability of LTI system, determine the range of values of a and b for which the impulse time-invariant system with following given impulse response is stable. 5

$$h(n) = \begin{cases} a^n & n \leq 0 \\ b^n & n < 0 \end{cases}$$

- (b) Find the Energy of the signal  $x(n) = 0.5^n u(n) + 8^n u(-n-1)$  5  
 (c) Find the value of  $x(n) = \cos(0.25 \pi n)$  for  $n=0, 1, 2, 3$ . Compute the DFT of  $x(n)$  using FFT flow graph. 5  
 (d) Find the cross correlation of the sequences  $x(n) = \{1, 2, 3, 4\}$  and  $h(n) = \{2, 4, 6\}$  5

2. (a) Determine whether or not the following signals are periodic. If periodic specify its fundamental period. 10

- (i)  $x_1(n) = \cos(0.5 \pi n + 0.3)$   
 (ii)  $x_2(n) = \cos(0.3 \pi n) + 10 \sin(0.25 \pi n)$

- (b) Compute Linear convolution of causal  $x(n)$  and  $h(n)$  using overlapp add method in time domain 10

$$x(n) = \{1, 2, 3, 4, 5, 6, 7, 8\}, \quad h(n) = \{1, 1, 1\}$$

3. (a) Check whether the given system  $y(n) = x(2n) - x(n-1)$  is : 10  
 (i) Static or Dynamic (ii) Linear or non-linear  
 (iii) Shift invariant or variant (iv) Causal or non-causal  
 (v) Stable or unstable.

- (b) State the following DFT properties : 10  
 (i) Linearity property  
 (ii) Periodicity  
 (iii) Time shift  
 (iv) Convolution  
 (v) Time Reversal

4. (a) For the causal LTI digital filter with impulse response given by  $h(n) = 0.3 \delta(n) - \delta(n-1) + 0.38 \delta(n-3)$  sketch the magnitude spectrum of the filter. Using DFT. 10
- (b) Let  $X(K) = \{20, 0, -4+4j, 0, -4\}$  is the 8 point DFT of a real valued sequence  $x(n)$  10
- (i) Find  $X(K)$  for  $K=5, 6, 7$ .
- (ii) Find the 8 point DFT  $P(K)$  such that  $p(n) = (-1)^n x(n)$  Using DFT property. 10
5. (a) Find circular convolution and linear using circular convolution for the following sequences  $x_1(n) = \{1, 2, 3, 4\}$  and  $x_2(n) = \{1, 2, 1, 2\}$ . Using Time Domain formula method. 10
- (b) Derive radix 2 DIT FFT flow graph and find the DFT of the sequence  $x(n) = \{0, 1, 2, 3\}$  10
6. (a) Write a detailed note on DSP Processor. 10
- (b) Write a detailed note on Carls' Correlation Coefficient Algorithm. Justify the necessary of Algorithm by given suitable example.

-----

ENGINEERING, KHARGPUR, 14-01-2016 14:48:17

**Note:**

- (i) Each question carry 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) Define heuristic function. Give an example heuristics function for Blocks World Problem.
  - (b) Find the heuristics value for a particular state of the Blocks World Problem.
  - (c) Define Rationality and Rational Agent. Give an example of rational action performed by any intelligent agent
  - (d) Compare and Contrast problem solving agent and planning agent
  - (e) Represent the following statement into FOPL.
    - (i) Anyone who kills an animal is loved by no one.
    - (ii) A square is breezy if and only if there is a pit in a neighboring square (Assume the wumpus world environment).
    - (iii) Give the PEAS description for an Internet shopping agent. Characterize its environment

**Q2. (a) Consider the graph given in Figure 1 below. Assume that the initial state is S [10]**  
 and the goal state is 7. Find a path from the initial state to the goal state using A\* Search.  
 Also report the solution cost. The straight line distance heuristic estimates for the nodes are as follows:  $h(1) = 14, h(2) = 10, h(3) = 8, h(4) = 12, h(5) = 10, h(6) = 10, h(S) = 15$ .

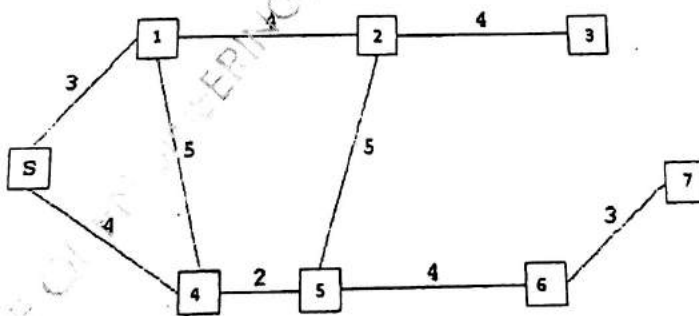


Figure 1.

- (b) Draw and describe the architecture of expert system. [6]
  - (c) Convert the following propositional logic statement into CNF [4]
- $$A \rightarrow (B \leftrightarrow C)$$

TURN OVER

S.C

QP Code : 6000

(3 Hours)

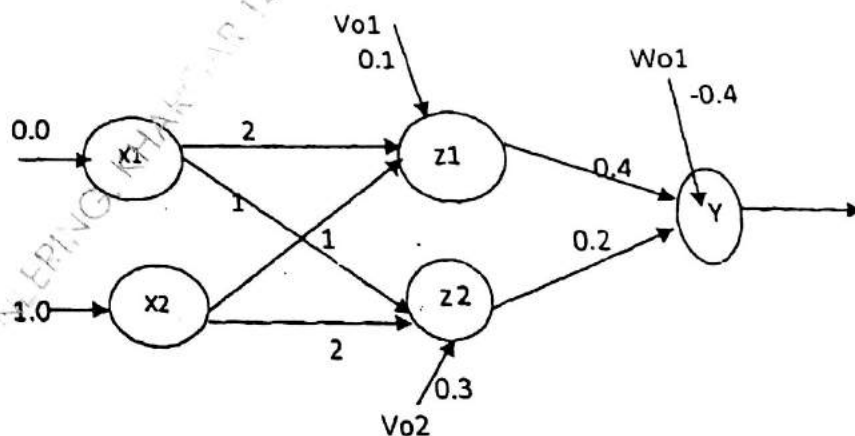
[Total Marks : 80

- N.B. 1) Question No. 1 is compulsory  
 2) Attempt any three questions out of remaining 5 questions  
 3) Draw neat labeled diagram wherever necessary.

- 1 Solve any four : 20
- A Define soft computing? Distinguish between soft computing and hard computing.
  - B Determine (alpha)  $\alpha$ -level sets and strong  $\alpha$ -level sets for the following fuzzy set.  
 $A = \{(1, 0.2), (2, 0.5), (3, 0.8), (4, 1), (5, 0.7), (6, 0.3)\}$ ;
  - C Prove that the first order derivative of a unipolar continuous activation function is  $f'(net) = 0(1-0)$
  - D Draw the five layer architecture of ANFIS and explain each layer in brief.
  - E What are the differences between derivative free and derivative based optimization.
  - F Distinguish between Supervised and Un-supervised learning

- 2 Design a fuzzy controller for a train approaching station. Inputs are speed and Distance and output is Break power. Use triangular membership function. Consider two descriptor for input and three descriptors for output. Derive a set of rules for control action and defuzzification. The design should be supported by figures wherever possible. Design a fuzzy controller for a train with high speed and small distance. 20

- 3 A Apply Backpropagation Algorithm to find the final weights for the following net. 10  
 Inputs:  $x = [0.0, 1.0]$ , Weights between Hidden and Output Layers :  $w = [0.4, 0.2]$ , Bias on the Output Node O is  $W_o = [-0.4]$ , Weights between Input and Hidden Layer:  $v = [2, 1; 1, 2]$ , Bias on Hidden Unit nodes are  $V_o = [0.1, 0.3]$ , Desired output :  $d = 1.0$ ,



- B What is self-organizing map? Draw and explain architecture of Kohonen Self Organization Feature Map KSOFM. 10
- 4 A What are the different types of encoding, selection, crossover, mutations of GA. Explain each type with suitable examples 10
- B Explain with suitable examples Linearly and Non-linearly separable pattern classification 10

[TURN OVER

MD-Con. 10767-15.

- 5 A Explain Learning Vector Quantization Algorithm? 10
- B The formation of algal solutions in surface water is strongly dependent on pH of water, temperature and oxygen content. T is a set of water temperatures from a lake given by  $T = \{50, 55, 60\}$  and O is oxygen content values in water given by  $O = \{1, 2, 6\}$ .  
The fuzzy set of T is given by  $\{0.7/50 + 0.8/55 + 0.9/60\}$  and  
fuzzy set of O is given by  $\{0.1/1 + 0.6/2 + 0.8/6\}$  10
- Find  $R = T \times O$  for Given  $I = \{0.5/50 + 1/55 + 0.7/60\}$
  - Find  $S = I \circ R$  using max-product composition
  - Find  $S = I \circ R$  using max-min composition
- 6 Write short notes on any two: 20
- Steepest Descent algorithm
  - Newton Method
  - Fuzzy inference system

MD-Com. 10767-15.