Time: 3 Hours **Marks: 80**

N.B.: (1) Question No. 1 is compulsory.
(2) Solve any three questions from the remaining five
(3) Figures to the right indicate full marks
(4) Assume suitable data if necessary and mention the same in the answer sheet.

Q1. Attempt **any 4** questions 20M

A) Explain the need of layered protocol architecture in OSI reference model. [5]
B) Give comparison among coaxial, optical fiber and twisted pair cables. [5]
C) Explain the persistent strategies of CSMA. [5]
D) Draw and explain IPv6 Datagram format. [5]
E) Distinguish between TCP and UDP transport layer protocol. [5]
F) Analyze how SMTP protocol in application layer helps to deliver the electronic mail? [5]

Q2.) A) Explain physical, logical, port addressing and socket addressing in networking. [5]
B) Explain in brief DSL, and HFC. [5]
C) Give classification of routing protocol. Explain in brief the link state and distance vector algorithm with example. [10]

Q3) A) Compare Static Routing and Dynamic Routing. [5]
B) Explain the fields related to the fragmentation in the IP datagram header. [5]
C) Explain the classful addresses of IPv4 with net ID and host ID. [5]
D) Identify class, subnet mask, network address and broadcast address of the following IP addresses: [10]
1. 214.25.6.3 2. 191.5.8.9 3 5.6.45.4 4. 230.45.89.63

Q4) A) Draw and explain User datagram Protocol (UDP) Header. [5]
B) Compare TELNET and SSH application layer protocol. [5]
C) Draw and explain User datagram Protocol (UDP) Header. [5]
D) Explain in brief working of DHCP. [5]

Q.5) A) For the classless address 129.65.33.01/24 find
1. Number of addresses in the block N 2. First address 3. Last address [6]
B) Explain congestion control techniques used in TCP. [4]
C) Explain in detail the Routing protocols OSPF. [5]
D) Give comparison between Star, Mesh and Bus Topology. [5]

Q.6) A) Explain Go-Back –N ARQ and Selective Repeat ARQ. [5]
B) Compare Repeaters, Hubs, Bridges, Switches, Routers network hardware devices. [5]
C) Explain in brief working of HTTP application layer protocol [5]
D) Draw and explain different fields of TCP header. [5]

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[Time: Three Hours] **[Marks:80]**

N.B: **1. Question number one is compulsory**
2. Attempt any three out of remaining

Q.1 **Attempt any FOUR:** **(20)**

a. Derive wave equation for electric fields.
b. Define the terms near field and far field for antenna
c. Derive continuity equation for electric fields
d. Explain ground wave propagation
e. Why Maxwells equations need to be modified for time varying fields

Q.2
a. Define loop antenna. Mention the disadvantages of loop antenna **(10)**
b. Design rectangular micro strip antenna for 2.4 GHZ frequency using FR-4 Substrate of dielectric value 4.4 & thickness 1.6mm. **(10)**

Q.3
a. Compare broadside and end fire array. **(10)**
b. Derive FRIIS Transmission Equation & Explain its Significance **(10)**

Q.4
a. With neat sketch explain parabolic Reflector antenna. List feed mechanism used **(10)**
b. Derive wave equations for magnetic fields and explain what is TEM wave **(10)**

Q.5
a. Explain H-plane sectoral horn a antenna and describe various configuration of horn **(10)**
b. antenna **(10)**
What are the advantages of array antenna? Describe principle of pattern multiplication and sketch radiation pattern of a 3-element array separated at $\lambda/2$

Q.6 Write short notes on (any four questions, each carry five marks) **(20)**

a) Sky wave propagation
b) Power in EM wave
c) Retarded potential
d) Equivalent noise temperature of antenna
e) Radiation pattern

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

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

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

a Specify formulas for computing Euclidian distance, City-block distance and Chess-board distance in digital images. Draw the locus of each them.

b Justify/contradict: Salt-pepper noise in a digital image can be better removed by a median filter rather than an averaging filter.

c State what is the cause of the 'Ringing effect' when a digital image is filtered in frequency domain. How can the effect be minimized?

d Explain with a diagram what are support vectors in a SVM. Do they affect the classification process? If yes, how?

e Illustrate with an example what is grey level co-occurrence matrix in texture analysis.

2 a Given a grey scale image as follows: **[10]**

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

i. Draw Histogram of the image.
ii. Perform histogram equalization on the image.
iii. Draw transformation function.
iv. Draw output image histogram.

b Describe the Canny Edge Detection method step-by-step. Support your answer with appropriate diagrams. **[10]**

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3 a For the 2x2 transform matrix **[10]**

$A = \frac{1}{\sqrt{2}}\begin{bmatrix}\sqrt{3} & 1\\ -1 & \sqrt{3}\end{bmatrix}$ and a sub-image $U = \begin{bmatrix}2 & 3\\ 1 & 2\end{bmatrix}$ compute the image transform and the basis images.

b Write an expression for a two-dimensional DCT. Form a 4x4 DCT matrix and compute the DCT of the following sub-image. **[10]**

$$I = \begin{bmatrix}1 & 2 & 2 & 1\\ 2 & 1 & 2 & 1\\ 1 & 2 & 2 & 1\\ 2 & 1 & 2 & 1\end{bmatrix}$$

4 a Explain the Hit-and-Miss transform in Morphology. Explain how morphology can be used for boundary detection. **[10]**

b Differentiate between shape and region descriptors. State their examples. Explain signatures in detail. **[10]**

5 a For the given image, perform region based segmentation by split and merge technique. Illustrate the splitting technique with a quad tree graph. Use the Predicate P>=10 for splitting and merging. **[10]**

13	12	13	12	11	12	11	12
13	13	63	63	61	11	12	11
11	12	63	62	61	62	12	12
13	13	62	63	62	61	13	13
12	11	62	63	62	11	12	11
62	62	63	61	61	62	13	13
62	61	61	62	13	12	13	11
61	62	63	11	12	11	12	12

b Explain smoothening and sharpening filters in frequency domain. **[10]**

6 a Explain the need of good classifiers in object recognition. List different classifiers. Explain the Bayesian classifier in detail. **[10]**

b Explain the K-means clustering algorithm with a suitable example. **[10]**

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

N.B. : (1) Questions No.**1** is **compulsory**.
(2) Solve any **three** questions out of **remaining**
(3) Draw neat labeled diagram whenever necessary
(4) Assume suitable data if necessary

Q1 Answer **any four** questions

a. Write any four properties of fuzzy sets. **05**

b. With necessary equations, list the different types of activation functions used in Neural networks **05**

c. What do you mean by K means algorithm? Where is it used? **05**

d. If A and B are two fuzzy sets with membership functions: $\mu_a(\chi) = \{1, 0.2, 0.2, 0.7\}$ and $\mu_b(\chi) = \{0.2, 0.6, 0.4, 0.5\}$, find the union and intersection between two fuzzy sets. **05**

e. What is the use of pooling and padding in CNN architectures? **05**

Q2.a. Develop perceptron network to implement two input AND function. Consider inputs and the outputs as unipolar. Assume initial weights and bias value equal to zero. Consider learning rate equal to 1. **10**

b. Discuss linearly separable and linearly non-separable classification functions each with a graph. **10**

Q3.a. Construct a Kohonen Self Organizing map to cluster given vectors [0 0 1 1], [1 0 0 0], [0 1 1 0] and [0 0 0 1]. The number of clusters to be formed is 2. Consider the learning rate as 0.5. The weight matrix is given by **10**

$$w_{ij} = \begin{bmatrix} 0.2 & 0.9 \\ 0.4 & 0.7 \\ 0.6 & 0.5 \\ 0.8 & 0.3 \end{bmatrix}$$

b. Draw the architecture of simple Convolution neural network. Discuss the use of CNN in deep learning **10**

Q4.a. Construct a discrete Hopfield network to store the patterns [1 1 1 1 1], [1 -1 -1 1 -1], [-1 1 -1 -1 -1]. Calculate the energy of the stored patterns. **10**

b. What are the various types of neural network architectures? With neat diagram, briefly discuss the architectures. **10**

Q5.a. With neat flow chart, describe the various steps used in the training process of error back propagation algorithm. **10**

b. What is Support Vector Machine (SVM)? Analyze binary classifier using SVM. **10**

Q6.a. What is defuzzification? Explain any two methods of defuzzification. **10**

b. Design a fuzzy controller to decide the wash time of a washing machine. **10**

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