

22/05/2025 TE EXTC SEM-VI C-SCHEME ANNF QP CODE: 10080980

Time: (3 Hours)

Total Marks: 80

N.B: 1. Question No 1 is Compulsory

2. Answer any 3 questions from the remaining questions

- 1 Answer **any 4** of the following:
- a) What are fuzzy rules? Explain with an example how IF-THEN rules are used in fuzzy systems. [05]
 - b) Explain the basic concept of deep learning. [05]
 - c) What is a competitive learning network? How does it differ from other neural networks? [05]
 - d) Explain in brief what you mean by linearly separable and linearly non-separable systems. [05]
 - e) How does an error function contribute to the performance of a neural network? Why is minimizing the error function crucial in the training process? [05]
- 2
- a) What is an activation function in a neural network? Describe at least four activation functions with their mathematical formula, graphical representation and applications. [10]
 - b) Discuss the training algorithm of Kohonen self-organizing network. [10]
- 3
- a) Discuss the stopping criteria used during the training of an artificial neural network. [10]
 - b) Explain any two techniques of de-fuzzification. [10]
- 4
- a) What are the key steps involved in the error backpropagation algorithm? Illustrate with a flowchart or diagram. [10]
 - b) With examples, explain supervised, unsupervised and reinforcement learning in artificial neural networks. [10]
- 5
- a) Explain the complete architecture of a Convolutional Neural Network (CNN) with a detailed block diagram. Describe the function of each layer in the network. [10]
 - b) Discuss Mamdani fuzzy inference system in detail. [10]
- 6
- a) Discuss the concept of support vector machines. What are the applications of support vector machines? [10]
 - b) With the help of a suitable example, explain the working of K-Means clustering algorithm. [10]
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- N.B. : (1) Question No.1 is compulsory
(2) Write any three questions from Q. 2 to Q.6.
(3) Draw a neat diagram if necessary.

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- Q1 Solve any four 20**
- a Describe classful addressing.
 - b Explain the working of HFC.
 - c Compare star, bus, and mesh topology.
 - d Compare Telnet and SSH.
 - e Describe various networking devices in computer networks and map them to their respective OSI model layers.
- Q2 a What is the purpose of ICMP? Explain all message types of ICMP. 10**
- b Explain Pure and Slotted ALOHA with neat diagrams. 10**
- Q3 a Explain wired transmission media and compare them. 10**
- b An ISP is granted a block of addresses starting with 150.80.0.0/16. The ISP needs to distribute this address to two groups of customers as follows: 10**
- a. The first group has 200 medium-sized businesses: each needs 128 addresses.
 - b. The second group has 400 small business customers: each needs 16 addresses.
 - c. The third group has 2048 households: each needs 4 addresses
- Design the subblocks and determine how many addresses are available after these allocations.
- a Differentiate between TCP and UDP. 10**
The following is the dump of the UDP header in hexadecimal format. 0632 000D 001C E217
- Q4 a. What is the source port number? 10**
- b. What is the destination port number?**
- c. What is the total length of the user datagram?**
- d. What is the length of data?**
- e. Is the packet directed from the client to the server or vice versa?**
- b Explain ARQ error control mechanisms and compare them. 10**
- a Draw the IPV4 header and explain the meaning of various associated fields. 10**
- Q5 Differentiate between IPV4 and IPV6**
- b Explain Distance Vector Routing. What is the Two-Node Instability Problem, and how can it be mitigated? 10**
- Q6 Write a short note on (Solve any 2) 20**
- a TCP Header Format
 - b DHCP
 - c CSMA/CD

(3 Hours)

(Maximum Marks: 80)

- NB. 1. Que number one is compulsory**
2. Attempt any three out of remaining five questions
3. Assume suitable data
4. Figures to the right indicate the maximum marks.

- Q.1 Attempt any 4 questions: [20]**
(a) State and explain Biot Savart law. Also express it in vector form.
(b) Define the terms: Critical frequency, MUF, Virtual height, skip distance as measures of ionospheric propagation.
(c) State the Poynting theorem and explain the various terms associated with it.
(d) A 60m diameter parabolic reflector is fed by a nondirectional antenna at 1430 MHz. Calculate Beam width between Half power points and between Nulls.
(e) Derive Laplace's and Poisson's equations.
- Q.2 (A) Derive Maxwells equations in integral form and point form. Give the word statements. [10]**
(B) State and derive FRII'S transmission equation. Explain its significance. [10]
- Q.3 (A) Describe the construction and radiation pattern of Log periodic antenna. Why is it called Log periodic? [10]**
(B) Derive the Helmholtz wave equations for free space in terms of electric and magnetic fields. [10]
- Q.4 (A) State and explain principle of pattern multiplication. Explain the concept of array factor. [10]**
(B) Compare Broadside and End-fire Array. [10]
- Q.5 (A) Explain skywave propagation with reference to D, E, and F regions and multiple reflections. [10]**
(B) Describe the structure of Microstrip antenna. Also discuss the feeding techniques for rectangular and Circular patch antenna. [10]
- Q.6 (A) What is near field and far field radiation for an antenna. Explain its importance in communication and its applications. [10]**
(B) Derive radiation resistance for an infinitesimal dipole. p[10]

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 What is supervised learning? How is regression different than classification? [05]
 b Explain the A* algorithm with admissibility conditions. [05]
 c Differentiate between propositional logic and first order predicate logic with suitable examples. [05]
 d What is machine learning? List and explain types of learning. [05]
 e State and explain prisoner's dilemma strategic game and discuss the Nash equilibrium strategy profile. [05]

		Suspect 2	
		Quiet	Fink
Suspect 1	Quiet	2,2	0,3
	Fink	3,0	1,1

- 2 a What is Game Theory? What are the properties of a Game? Discuss the following terms: [10]
 (a) Pay off Matrix
 (b) Saddle point
 (c) Two Persons zero sum game
 (d) Strategies of a Game.
 b Describe different types of environments applicable to AI agents. [10]
 Characterize the task environment properties of a Part Picking Robot.
- 3 a What is an agent? Explain basic building blocks of learning agent? [10]
 b Explain hill climbing algorithm with suitable example. [10]
- 4 a Explain the steps involved in converting the propositional logic statements into CNF with a suitable example. [10]
 b Discuss types of learning can be accomplished by Hidden Markov Model? [10]
 Discuss state transition diagram of HMM.

- 5 a Find optimal hyperplane for the set of data points: [10]
 $\{(3,1), (3,-1), (6,1), (6,-1), (1,0), (0,1), (0,-1), (-1,0)\}$
 Class 1: $\{(3,1), (3,-1), (6,1), (6,-1)\}$
 Class 2: $\{(1,0), (0,1), (0,-1), (-1,0)\}$
- b Explain the steps in developing the machine learning application considering [10]
 any suitable example.
- 6 a What is Heuristic Search? Explain Hill climbing policy with its drawbacks. [10]
- b Apply Apriori algorithm for the given dataset on The Grocery Store to [10]
 discover strong association rules, assume that With Minimum Support
 $S = 40\%$ and Minimum Confidence $C = 70\%$, Generate association rules
 from the frequent itemsets. Calculate the confidence of each rule and identify
 all the strong association rules.

Transaction ID	Items Bought
1	{ Bread, Butter, Milk }
2	{ Bread , Butter }
3	{ Egg, Cookies, Diapers }
4	{Milk, Diapers. Bread, Butter}
5	{ Egg, Diapers}

Duration: 3hrs

[Max Marks:80]

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

- a For given 5x5 image compute the D_e , D_4 , D_8 distances between pixels p and q .
 Let V be the set of gray levels to define the similarity criteria, where $V = \{2, 3\}$

1	2	1	2	3 (q)
3	1	0	3	1
2	3	2	0	2
0	3	2	2	3
2 (p)	1	3	2	3

- b Compare filtering in frequency domain versus filtering in spatial domain.
 c Explain the role of illumination and reflectance in image segmentation using global thresholding.
 d Explain the terms: Hyperplane, Support vectors, Margin and Kernel function in relation to support vector machine (SVM).
 e Calculate accuracy, precision, recall and F1-score for the binary classification model performance shown below.

		PREDICTED	
		Predicted: Healthy	Predicted: Not Healthy
ACTUAL	Healthy	500	100
	Not Healthy	50	350

- 2 a What are different point-processing techniques for enhancement? Explain Contrast Stretching in detail. [10]
- b Derive Haar transform matrix for $N=4$. Also draw the basis Haar basis functions for the same. [10]

- 3 a Equalize the given histogram. Draw input and equalized histogram. [10]

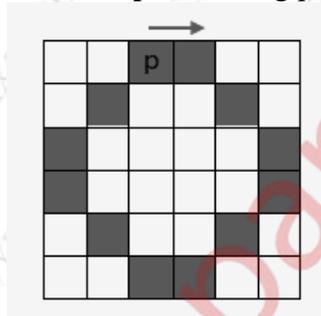
What will be the result of histogram equalization on input image?

Grey level	0	1	2	3	4	5	6	7
No. of pixels	100	80	10	10	0	0	0	0

- b Explain the following morphological operations. [10]

- a) Opening and Closing
b) Hit or Miss Transform

- 4 a What are the chain codes? Obtain 8 directional chain code and shape factor for the boundary shown below. Consider **p** as starting point. [10]



- b What is the principle of image segmentation based on similarity? [10]

Explain split and merge algorithm.

- 5 a Explain the significance of Gray Level Co-occurrence Matrix (GLCM) in texture analysis. [10]

Find GLCM matrix for the following image with direction shown.

1	1	2	3	3
3	1	3	4	4
2	3	4	2	3
1	2	3	1	3
3	4	2	2	3

- b Explain canny edge detection algorithm step by step. What are the advantages of canny edge detection over Prewitt and Sobel. [10]

- 6 a What are shape descriptors? Explain how Fourier descriptors are used for boundary detection. [10]

- b Explain K-means clustering algorithm using a suitable example. [10]

Duration: 3hrs

[Max Marks:80]

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- 1 **Attempt any FOUR.** [20]
- a Compare Physical Design of IoT and Logical Design of IoT
 - b What is the function of Apache Spark?
 - c Explain how MapReduce is used for batch data analysis.
 - d Explain how Apache Hadoop is useful for data management
 - e Explain the Publish-Subscribe Communication Model.
- 2 **Attempt the following**
- a Explain Cyber Physical Systems in relation to Industry 4.0. [10]
 - b Describe how healthcare applications function in IIOT [10]
- 3 **Attempt the following**
- a Explain the architectures of COAP and MQTT in detail, highlighting their differences. [10]
 - b Explain in detail the IIOT Architecture. [10]
- 4 **Attempt the following**
- a How is Sigfox connectivity technology used for IoT? [10]
 - b Explain the design challenges and solutions of the IoT for Industry 4.0. [10]
- 5 **Attempt the following**
- a Explain SOAP and REST architectures and differentiate between them [10]
 - b Discuss the role of artificial intelligence in Industry 4.0.. [10]
- 6 **Attempt the following** [20]
- a Explain Human machine Interaction in Industry 4.0
 - b Explain NBIIoT protocol in detail with example

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Marks: 80

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4. Assume Suitable data, if required and state it clearly.

- 1 Attempt **any four**: 20
- (a) What do you mean by random variables? Explain Bayes theorem
 (b) Explain Poisson probability distribution with one example.
 (c) What is statistical inference?
 (d) Discuss in detail Quantitative Data, Descriptive Statistics, Variables, Categorical data, Quantitative Data.
 (e) Why is sampling necessary? Describe population and sample mean.
- 2 (a) What is null and alternate hypothesis? Explain type I and type II error? 10
 (b) An agent sells life insurance policies to five equally aged, healthy people. According to recent data, the probability of a person living in these conditions for 30 years or more is $2/3$. Calculate the probability that after 30 years:
 (a) All five people are still living. 10
 (b) At least 3 people are still living.
 (c) Exactly 2 people are still living.
- 3 (a) Explain time series. Discuss Moving averages and Exponential Smoothing. 10
 (b) Differentiate between Simple Linear Regression, Multiple Regression 10
- 4 (a) What is Logistic Regression? 10
 (b) Find the simple linear regression equation that fits the given data.
- | | | | | | | |
|------|----|-----|----|----|-----|----|
| Bill | 35 | 118 | 62 | 88 | 100 | 54 |
| Tip | 5 | 15 | 10 | 10 | 15 | 5 |
- 5 (a) You have just taken ownership of a pizza shop. The previous owner told you that you would save money if you bought the mozzarella cheese in a 4.5-pound slab. Each time you purchase a slab of cheese, you weigh it to ensure that you are receiving 72 ounces of cheese. The results of 7 random measurements are 70, 69, 73, 68, 71, 69 and 71 ounces. Are these differences due to chance or is the distributor giving you less cheese than you deserve?
 a. State the hypotheses.
 b. Calculate the test statistic.
 c. Would the null hypothesis be rejected at the 10% level? The 5% level? The 1% level? 10
 (b) Derive Simple Linear Regression parameters to predict the value of the output.
- 6 (a) What do you mean by Sign Test? Explain Wilcoxon Signed-Rank Test. 10
 (b) Explain the following (**any two**): 10
 i. Kruskal-Wallis Test
 ii. Scatter diagram
 iii. Sample space
 iv. Discrete probability distribution