



M.E DEGREE EXAMINATIONS: DEC 2015

(Regulation 2014)

Third Semester

APPLIED ELECTRONICS

P14AETE74: Pattern Recognition & Artificial Intelligence

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The following are distance functions CO1 [K₂]
1. Euclidean 2. Manhattan 3. Cosine
a) 1,2,3 b) 2,3
c) 1,2 d) 1,3
2. Which one of the following is an external measure for evaluating clusters? CO2 [K₂]
a) Precision - Recall b) Sum of Squared Error
c) Scatter Criteria d) Both a & b
3. KL transform has CO3 [K₃]
a) Classifier inbuilt in it b) the minimum representation entropy property
c) Data compression property d) A stochastic grammar inbuilt in it.
4. Matching type item with multiple choice code CO4 [K₄]

List I	List II
A. Clustering	i. probability and statistics
B. Bayes classifier	ii. No crisp boundary
C. KL transform	iii. recognition
D. Fuzzy logic	iv. feature extraction

- a) A-iii, B-i, C-iv, D-ii b) A-iv, B-iii, C-i, D-ii
c) A-ii, B-i, C-iv, D-iii d) A-iv, B-i, C-ii, D-iii

5. Which one of the following is used in feature reduction? CO4 [K₂]
- a) KL transform b) PCA
 c) SVM d) Fuzzy logic
6. Which algorithm is used for solving temporal probabilistic reasoning? CO5 [K₂]
- a) Hill-climbing search b) Depth-first search
 c) Hidden markov model d) Breadth-first search
7. Fuzzy logic has rapidly become one of the most successful of today's technologies for developing sophisticated control systems. The reason for this is: CO4 [K₄]
- Assertion (A): Fuzzy logic mimics the human way of thinking.
 Reason (R): Fuzzy logic enables the ability to generate precise solutions from certain or approximate information.
- a) Both A and R are wrong b) Both A and R are correct
 c) A is correct and R is wrong d) A is wrong and R is correct
8. An appropriate learning algorithm for the SVM is CO4 [K₄]
- a) Quadratic programming of soft margins b) Quadratic programming via Gradient Descent
 c) Gradient Descent with Lagrange Multiplier constraints d) Quadratic programming via Sequential Minimal Optimization
9. Identify the order of the steps used in Genetic Algorithms. COL [K₂]
1. evolution 2. Selection 3. Reproduction 4. mutation
- a) 1,2,3,4 b) 1,2,4,3
 c) 1,3,2,4 d) 1,4,2,3
10. What are the three essential components of a learning system? CO1 [K₂]
- a) Model, gradient descent, learning algorithm b) Error function, model, learning algorithm
 c) Accuracy, Sensitivity, Specificity d) Model, error function, cost function

PART B (10 x 2 = 20 Marks)

11. Write the general principle of the maximum-likelihood estimation. CO2 [K₂]
12. Distinguish between supervised and unsupervised learning. CO2 [K₂]

- | | | |
|---|-----|-------------------|
| 13. Name the two schemes of Hierarchical clustering algorithms. | CO2 | [K ₁] |
| 14. Name at least four cluster validation techniques. | CO2 | [K ₁] |
| 15. Mention the goal of parsers. | CO3 | [K ₂] |
| 16. List out atleast two advantages of using formal grammars in structural pattern recognition. | CO3 | [K ₃] |
| 17. SVMs may be viewed as state-of-the-art linear discriminant functions – Justify. | CO4 | [K ₄] |
| 18. Name the three types of problems that can be solved by Hidden Markov models. | CO4 | [K ₁] |
| 19. How fuzzy sets are different from crisp sets? | CO5 | [K ₂] |
| 20. Why do you use mutation in genetic algorithms? | CO5 | [K ₂] |

PART C (6 x 5 = 30 Marks)

- | | | |
|---|-----|-------------------|
| 21. Explain the relevance of Discriminant Functions by showing the derivation of Multicategory case. | CO1 | [K _L] |
| 22. To which category of clustering schemes does the c-means algorithm belong? What is its major advantage? Which are the factors that influence the computational duration of this algorithm? | CO2 | [K ₂] |
| 23. Explain how functional approximation is helpful in feature selection. | CO3 | [K ₂] |
| 24. What do you mean by dimension reduction? Discuss Principal Component Analysis (PCA) algorithm for dimension reduction. | CO4 | [K ₃] |
| 25. What do you mean by fuzzy decision making? Also discuss the fuzzy classification using suitable example. | CO5 | [K ₃] |
| 26. Consider the three patterns $(1, 1)^t$ and $(2, 2)^t$ from class X and $(2, 0)^t$ from class O. Use the perceptron learning algorithm and show that the decision boundary is $x - 3y - 1 = 0$. | CO5 | [K ₃] |

PART D (4 x 10 = 40 Marks)

27. State the Bayes Rule and explain how it is applied to pattern classification problems. Show that in a multiclass classification task the Bayes decision rule minimizes the error probability CO2 [K₄]
28. Explain how stochastic grammars are helpful in structural pattern recognition. CO3 [K₂]
29. In what way hierarchical clustering methods and graph theoretic clustering methods are related? Explain. □ CO2 [K₂]
30. Suppose a genetic algorithm uses chromosomes of the form $x = abcdefgh$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: $f(x) = (a + b) - (c + d) + (e + f) - (g + h)$, and let the initial population consist of four individuals with the following chromosomes: CO5 [K₃]
- $x_1 = 6\ 5\ 4\ 1\ 3\ 5\ 3\ 2$
 $x_2 = 8\ 7\ 1\ 2\ 6\ 6\ 0\ 1$
 $x_3 = 2\ 3\ 9\ 2\ 1\ 2\ 8\ 5$
 $x_4 = 4\ 1\ 8\ 5\ 2\ 0\ 9\ 4$
- a) Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last.
- b) Perform Single point cross over at 'e' on all individuals
- c) Suppose the new population consists of the six offspring individuals received by the crossover operations in the above question. Evaluate the fitness of the new population, showing all your workings. Has the overall fitness improved? □
