# SRM VALLIAMMAI ENGINEERING COLLEGE

## (An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

### DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

### QUESTION BANK


**VI SEMESTER**

**1904012 MACHINE LEARNING**

**Academic Year 2024 – 25 (Even Semester)**

*Prepared by*

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## Unit -IINTRODUCTION

Machine learning: What and why? - Examples of Machine Learning Applications - Types Of Machine Learning Supervised Learning - Machine Learning Process- The Curse of Dimensionality, Over fitting - Training, Testing, and Validation Sets-The Confusion Matrix & Basic Statistics-Bias-Variance Tradeoff.

### PART A

| Q.No | Questions | Course Outcome | BT Level | Competence |
|---|---|---|---|---|
| 1. | What is Machine learning? | CO1 | BTL 1 | Remembering |
| 2. | List applications of machine learning. | CO1 | BTL 1 | Remembering |
| 3. | Distinguish between supervised and unsupervised learning. | CO1 | BTL 2 | Understanding |
| 4. | Mention the features of classifier in machine learning. | CO1 | BTL 2 | Understanding |
| 5. | Outline the important objectives of machine learning? | CO1 | BTL 1 | Remembering |
| 6. | Write the standard approach to supervised learning? | CO1 | BTL 2 | Understanding |
| 7. | Mention the issues in machine learning. | CO1 | BTL 2 | Understanding |
| 8. | Interpret the term dimensions in context to machine learning. | CO1 | BTL 2 | Understanding |
| 9. | Summarize the steps involved in ML process. | CO1 | BTL 1 | Remembering |
| 10. | What is data preprocessing? | CO1 | BTL 1 | Remembering |
| 11. | Write the applications of Machine Learning. | CO1 | BTL 1 | Remembering |
| 12. | What is reinforcement learning? | CO1 | BTL 1 | Remembering |
| 13. | In machine learning what does the term curse of dimensionality refer? | CO1 | BTL 2 | Understanding |
| 14. | How can u detect over fitting in machine learning ? | CO1 | BTL 2 | Understanding |
| 15. | How to avoid over fitting while learning. | CO1 | BTL 1 | Remembering |
| 16. | Define generalization in ML. | CO1 | BTL 2 | Understanding |
| 17. | What is ‘Training set’ and ‘Test set’? | CO1 | BTL 1 | Remembering |
| 18. | Compare the terms precision and recall. | CO1 | BTL 2 | Understanding |
| 19. | Write an example for Data sparsity. | CO1 | BTL 1 | Remembering |
| 20. | Illustrate the components of the confusion matrix. | CO1 | BTL 2 | Understanding |
| 21. | What is the accuracy metrics in confusion matrix? | CO1 | BTL 1 | Remembering |
| 22. | Summarize the significance of the terms variance and covariance. | CO1 | BTL 2 | Understanding |
| 23. | Differentiate data mining and machine learning. | CO1 | BTL 2 | Understanding |
| 24. | How does the bias-variance trade-off relate to over fitting? | CO1 | BTL 2 | Understanding |

### PART B

| | | | | | |
|---|---|---|---|---|---|
| 1. | Explain about the regression in supervised learning algorithm with an example? | (13) | CO1 | BTL 3 | Applying |
| 2. | (i)Elaborate in detail about Supervised learning.<br>(ii)Summarize the Classification problem in machine learning. | (7)<br>(6) | CO1 | BTL 2 | Understanding |
| 3. | (i)What is the role of preprocessing of data in machine learning? Why it is needed?<br>(ii)Compare the supervised and unsupervised machine learning model with an example | (7)<br>(6) | CO1 | BTL 3 | Applying |
| 4. | Outline the various accuracy metrics for a machine learning algorithm with supporting mathematical expressions. | (13) | CO1 | BTL 2 | Understanding |
| 5. | Describe the key steps involved in the machine learning process. | (13) | CO1 | BTL 2 | Understanding |
| 6. | Categorize the machine learning algorithms and explain in detail. | (13) | CO1 | BTL 4 | Analyzing |
| 7. | Summarize in detail about types of Regression and Classification in Supervised Learning. | (13) | CO1 | BTL 4 | Analyzing |
| 8. | (i)How does the curse of dimensionality occur and how to solve it?<br>(ii)Categorize the dimensionality reduction methods. | (6)<br>(7) | CO1 | BTL 2 | Understanding |
| 9. | Explain the significance of Training, Testing and Validation sets in machine learning with an appropriate example. | (13) | CO1 | BTL 3 | Applying |

<table>
<tr><td>10.</td><td>Summarize the common causes of overfitting in machine learning models. How can these causes be mitigated or prevented?</td><td>(13)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>11.</td><td>Illustrate the key components and the concept of Naïve Bayes Classification.</td><td>(13)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>12.</td><td>How to calculate confusion matrix for a 2-class classification problem, explain with an example.</td><td>(13)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>13.</td><td>Given a sample of 12 individuals, 8 that have been diagnosed with cancer and 4 that are cancer-free. Assume that the classifier developed makes 9 accurate predictions and misses 3: 2 individuals with cancer wrongly predicted as being cancer-free and 1 person without cancer that is wrongly predicted to have cancer. Construct a confusion matrix and determine Sensitivity, Specificity and Accuracy of the classifier model.</td><td>(13)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>14.</td><td>Suppose 10000 patients get tested for flu; out of them, 9000 are actually healthy and 1000 are actually sick. For the sick people, a test was positive for 620 and negative for 380. For the healthy people, the same test was positive for 180 and negative for 8820. Construct a confusion matrix for the data and compute the accuracy of the test.</td><td>(13)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>15.</td><td>(i)Analyze the performance parameters that can be computed from the confusion matrix.<br>(ii)From the given confusion matrix of a binary classification problem, compute accuracy, precision and recall.
<table>
<tr><th rowspan="2">ACTUAL</th><th colspan="2">PREDICTED</th></tr>
<tr><td>Spam</td><td>Not spam</td></tr>
<tr><td>Spam</td><td>80</td><td>20</td></tr>
<tr><td>Not spam</td><td>10</td><td>890</td></tr>
</table></td><td>(7)<br><br>(6)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>16.</td><td>Describe in detail about the statistics involved in Machine Learning.</td><td>(13)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>17.</td><td>(i)Illustrate how the bias-variance tradeoff is achieved in machine learning?<br>(ii) How does bias- variance tradeoff impact model performance, and what strategies can be employed to strike a balance?</td><td>(7)<br><br>(6)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td colspan="6">PART C</td></tr>
<tr><td>1.</td><td>With the process flow diagram explain how does each processing step contribute to the development of an effective machine learning model?</td><td>(15)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>2.</td><td>With the following data construct the confusion matrix and estimate the accuracy, precision and recall from the matrix values.<br>Actual values :<br>The patients who actually don’t have a heart disease = 41<br>The patients who actually do have a heart disease = 50<br>Predicted values :<br>Number of patients who were predicted as not having a heart disease = 40<br>Number of patients who were predicted as having a heart disease = 51</td><td>(15)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>3.</td><td>Analyze how Machine Learning Algorithms can be tested with necessary examples.</td><td>(15)</td><td>CO1</td><td>BTL 3</td><td>Applying</td></tr>
<tr><td>4.</td><td>Describe Learning Process and explain Supervised Learning in detail, give necessary examples.</td><td>(15)</td><td>CO1</td><td>BTL 4</td><td>Analyzing</td></tr>
<tr><td>5.</td><td>(i) With the bull’s eye diagram explain the bias- variance trade off in machine learning.<br>(ii) Write a note on the importance of statistics in machine</td><td>(7)<br><br>(8)</td><td>CO1</td><td>BTL 4</td><td>Analyzing</td></tr>
</table>

| | | | | | |
|---|---|---|---|---|---|
| | learning and summarize the basics statistics involved in defining the model. | | | | |

**Unit -IINEURONS, NEURAL NETWORKS, AND LINEAR DISCRIMINANTS**

Hebb's Rule - Neural Networks - The Perceptron – Linear Separability & Linear Regression. The Multi-layer Perceptron: Biases, Algorithm - Local minima and Stochastic gradient Descent Examples Of Using The MLP : Regression Problem & Classification Example - Deriving Back-Propagation

**PART A**

| Q.No | Questions | Course Outcome | BT Level | Competence |
|---|---|---|---|---|
| 1. | State the Hebb's Rule. | CO2 | BTL 1 | Remembering |
| 2. | Draw the McCulloch and Pitts model of neuron. | CO2 | BTL 2 | Understanding |
| 3. | Interpret characteristics of neural networks. | CO2 | BTL 1 | Remembering |
| 4. | Outline the significance of the layers in neural networks. | CO2 | BTL 2 | Understanding |
| 5. | Differentiate feed forward and feedback neural network. | CO2 | BTL 1 | Remembering |
| 6. | List the requirements of an activation function. | CO2 | BTL 2 | Understanding |
| 7. | What is Perceptron in Machine Learning? | CO2 | BTL 2 | Understanding |
| 8. | How perceptron learning algorithm is used? | CO2 | BTL 1 | Remembering |
| 9. | What is error function? | CO2 | BTL 2 | Understanding |
| 10. | Write about Linear Separability & Linear Regression. | CO2 | BTL 2 | Understanding |
| 11. | State Perceptron Convergence theorem. | CO2 | BTL 1 | Remembering |
| 12. | Draw the structure of the multi layer perceptron. | CO2 | BTL 2 | Understanding |
| 13. | Define Biases. | CO2 | BTL 1 | Remembering |
| 14. | How local minima is used for optimization in machine learning? | CO2 | BTL 2 | Understanding |
| 15. | Summarize the features stochastic gradient descent algorithm. | CO2 | BTL 1 | Remembering |
| 16. | Differentiate optimal separating hyperplane and soft margin hyperplane. | CO2 | BTL 2 | Understanding |
| 17. | Name few examples of using MLP. | | BTL 1 | Remembering |
| 18. | How does a regression problem differ from a classification problem. | CO2 | BTL 1 | Remembering |
| 19. | Interpret how classification is performed with MLP. | CO2 | BTL 2 | Understanding |
| 20. | Compare hard-max activation function and soft-max activation function. | CO2 | BTL 1 | Remembering |
| 21. | Define the term back propagation | CO2 | BTL 1 | Remembering |
| 22. | List the steps of deriving Back Propagation. | CO2 | BTL 1 | Remembering |
| 23. | Summarize Back propagation of error | CO2 | BTL 2 | Understanding |
| 24. | Write any two conditions under which the back propagation algorithm can be employed. | CO2 | BTL 2 | Understanding |

**PARTB**

| | | | | | |
|---|---|---|---|---|---|
| 1. | Draw the structure of a biological Neuron and explain in detail. | (13) | CO2 | BTL 1 | Remembering |
| 2. | Differentiate Biological neural network from artificial neural network. | (13) | CO2 | BTL 3 | Applying |
| 3. | (i)Describe the McCulloch and Pitts Neuronal Model.<br>(ii)Write the limitations of the McCulloch and Pitts Neuronal Model. | (7)<br>(6) | CO2 | BTL 3 | Applying |
| 4. | For the network shown in figure, Calculate the net input to the output neuron Y. | (13) | CO2 | BTL 3 | Applying |

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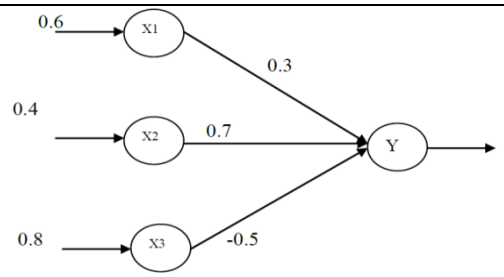
| |  | | | | |
| 5. | Discuss about the learning rate and bias input for a perceptron. | (13) | CO2 | BTL 3 | Applying |
| 6. | With the support of mathematical equations, describe the three steps in the perceptron learning algorithm. | (13) | CO2 | BTL 3 | Applying |
| 7. | Implement AND function using perceptron networks for bipolar inputs and targets. | (13) | CO2 | BTL 3 | Applying |
| 8. | Develop a neural model for OR logic function by using perceptron. | (13) | CO2 | BTL 2 | Understanding |
| 9. | What are the limitations of learning in perceptron? Explain with example. | (13) | CO2 | BTL 3 | Applying |
| 10. | Illustrate the Perceptron Convergence Theorem with a supporting example | (13) | CO2 | BTL 3 | Applying |
| 11. | Write the Single layer perceptron learning algorithm with the governing mathematical expressions. | (13) | CO2 | BTL 4 | Analyzing |
| 12. | Describe a multi-layer perceptron algorithm. | (13) | CO2 | BTL 3 | Applying |
| 13. | Explain why XOR problem cannot be solved by a single layer perceptron and how it is solved by a Multilayer Perceptron? | (13) | CO2 | BTL 2 | Understanding |
| 14. | Explain the linearly separable problem with an example. | (13) | CO2 | BTL 3 | Applying |
| 15. | Illustrate the linearly in separable problem with an example. | (13) | CO2 | BTL 4 | Analyzing |
| 16. | Write the algorithm for Back propagation in neural networks. | (13) | CO2 | BTL 3 | Applying |
| 17. | Explain how to learn Multilayer Networks using Backpropagation Algorithm. | (13) | CO2 | BTL 4 | Analyzing |
| **PART - C (15 MARK)** | | | | | |
| 1 | Describe the steps involved to use the Multi-layer Perceptron when presented with a dataset. | (15) | CO2 | BTL 3 | Applying |
| 2 | (i)Explain the Linear Regression with example .<br>(ii)Analyze the functionalities of the Linear Separability. | (8)<br>(7) | CO2 | BTL 4 | Analyzing |
| 3 | Illustrate some examples of using MLP and the four types of problems that are generally solved using MLP. | (15) | CO2 | BTL 3 | Applying |
| 4 | Illustrate with diagram a perceptron with two input features, $x_1$ and $x_2$, and corresponding weights $w_1$, w2 respectively and with a bias term b . The activation function is a step function, which produce output as 1 if the weighted sum of inputs plus the bias is greater than or equal to zero, and 0 otherwise.<br>The weights and bias are initialized as follows: $w_1$=0.5, $w_2$=−0.2,b=0.3.<br>For the following set of input vectors, determine the output of the perceptron for each input.<br>(i) $x_1$ =0.2, $x_2$ =0.4<br>(ii) $x_1$ = -0.5 , $x_2$ = 0.7<br>(iii) $x_1$ = 0.6, $x_2$ = -0.1 | (15) | CO2 | BTL 4 | Analyzing |
| **5** | Apply the multi-layer perceptron to develop a neural model for XOR logic function. | (15) | CO2 | BTL 3 | Applying |
| **Unit -III DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS** | | | | | |

Linear Discriminant Analysis (LDA) - Principal Components Analysis (PCA), Factor Analysis - Independent Components Analysis - Probabilistic Model - Gaussian Mixture Models : EM Algorithm - Nearest Neighbour Methods - Support Vector Machines

**PART - A**

| Q.No. | Questions | Course Outcome | BT Level | Competence |
|---|---|---|---|---|
| 1. | Define LDA. | CO3 | BTL1 | Remembering |
| 2. | List the primary goals of Linear Discriminant Analysis in machine learning. | CO3 | BTL1 | Remembering |
| 3. | Mention the characteristics of Principal Component Analysis. | CO3 | BTL2 | Understanding |
| 4. | Differentiate the LDA and PCA in machine learning. | CO3 | BTL1 | Remembering |
| 5. | Analyze the PCA and its relation with Multi Layer Perceptron. | CO3 | BTL2 | Understanding |
| 6. | What is Kernel PCA? | CO3 | BTL2 | Understanding |
| 7. | Summarize the algorithmic steps in PCA. | CO3 | BTL1 | Remembering |
| 8. | Classify the different techniques used for dimensionality reduction. | CO3 | BTL2 | Understanding |
| 9. | Mention the characteristics of Factor Analysis. | CO3 | BTL1 | Remembering |
| 10. | Define Independent Component analysis. | CO3 | BTL2 | Understanding |
| 11. | Explain blind signal separation, and why is it important? | CO3 | BTL1 | Remembering |
| 12. | Examine probabilistic modeling in machine learning | CO3 | BTL2 | Understanding |
| 13. | Categorize the probabilistic models. | CO3 | BTL1 | Remembering |
| 14. | Interpret Naïve Bayes algorithm in probabilistic model. | CO3 | BTL2 | Understanding |
| 15. | When the Gaussian Mixture Model is applied to the data points? | CO3 | BTL1 | Remembering |
| 16. | What is Gaussian Mixture Models. | CO3 | BTL2 | Understanding |
| 17. | Define EM algorithm. | CO3 | BTL1 | Remembering |
| 18. | What is Convergence in the EM algorithm? | CO3 | BTL1 | Remembering |
| 19. | State the General Expectation-Maximisation (EM) Algorithm. | CO3 | BTL2 | Understanding |
| 20. | What is meant by Nearest Neighbour methods. | CO3 | BTL2 | Understanding |
| 21. | Point out the distance measure in Nearest neighbor methods. | CO3 | BTL2 | Understanding |
| 22. | What is Support Vector Machine? | CO3 | BTL1 | Remembering |
| 23. | Summarize the advantages of SVM. | CO3 | BTL2 | Understanding |
| 24. | What is SVM Regression? | CO3 | BTL2 | Understanding |

**PART-B (13 MARK )**

| | | | | | |
|---|---|---|---|---|---|
| 1. | How the reduction in dimension is achieved using Linear Discriminant Analysis? | (13) | CO3 | BTL3 | Applying |
| 2. | (i)What is Principal Component Analysis.<br>(ii)Write the algorithm of PCA. | (7)<br>(6) | CO3 | BTL3 | Applying |
| 3. | (i)Describe the PCA relation with MLP.<br>(ii)Explain Kernel PCA Algorithm. | (7)<br>(6) | CO3 | BTL 4 | Analyzing |
| 4. | (i)Compare the LDA with PCA<br>(ii)Mention the advantages and disadvantages of dimensionality reduction. | (7)<br>(6) | CO3 | BTL2 | Understanding |
| 5. | Illustrate the trade-offs involved in choosing the number of principal components to retain after applying PCA. | (13) | CO3 | BTL3 | Applying |
| 6. | Classify the types of Factor Analysis in an unsupervised system and explain the process of extraction. | (13) | CO3 | BTL4 | Analyzing |
| 7. | How Independent Component Analysis is done? | (13) | CO3 | BTL4 | Analyzing |
| 8. | Categorize the dimensionality reduction techniques. Explain any two methods in detail. | (13) | CO3 | BTL4 | Analyzing |
| 9. | Discuss the Probabilistic Learning methods involved in Machine Learning. | (13) | CO3 | BTL2 | Understanding |
| 10. | Illustrate the Expectation-Maximization Algorithm with necessary example. | (13) | CO3 | BTL3 | Applying |

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|---|---|---|---|---|---|
| 11. | Explain the Nearest Neighbor methods with example. | (13) | CO3 | BTL3 | Applying |
| 12. | (i) List and explain the different methods to calculate the distance between the points in Nearest Neighbor method.<br>(ii)How the K factor is determined in the Nearest Neighbor method. | (8)<br>(5) | CO3 | BTL 4 | Analyzing |
| 13. | (i) Describe the Nearest Neighbor Algorithm.<br>(ii)Write in detail about Nearest Neighbor Smoothing. | (7)<br>(6) | CO3 | BTL3 | Applying |
| 14. | Elaborate the process of constructing the KD-Tree | (13) | CO3 | BTL 4 | Analyzing |
| 15. | Illustrate the concept of Support Vector Machine with necessary examples. | (13) | CO3 | BTL3 | Applying |
| 16. | Explain optimal Separation in Support Vector Machine. | (13) | CO3 | BTL3 | Applying |
| 17. | Describe the Kernel functions in support Vector Machine. | (13) | CO3 | BTL 4 | Analyzing |

**PART - C (15 MARKS)**

| | | | | | |
|---|---|---|---|---|---|
| 1. | Explain the EM Algorithm considering the flipping of a coin as an example. | (15) | CO3 | BTL 4 | Analyzing |
| 2. | Analyze in detail the working of Support Vector Machine, its implementation and examples. | (15) | CO3 | BTL3 | Applying |
| 3. | What is multi modal data? When and how to use the GMM in machine learning, illustrate with a graphical representation. | (15) | CO3 | BTL 4 | Analyzing |
| 4. | Justify the need of Dimensionality Reduction by explaining the following methods<br>(i) Linear Discriminant Analysis<br>(ii) Principal Component Analysis<br>(iii) Independent Component Analysis | <br>(5)<br>(5)<br>(5) | CO3 | BTL 4 | Analyzing |
| 5. | Using the Principal Component Analysis algorithm reduce the dimension of the given features from 2 to 1. | (15) | CO3 | BTL3 | Applying |

| Feature | Example 1 | Example 2 | Example 3 | Example 4 |
|---|---|---|---|---|
| **X1** | 4 | 8 | 16 | 7 |
| **X2** | 11 | 4 | 5 | 14 |

## UNIT 4

Evolutionary Learning - The Genetic Algorithms (GA)-Reinforcement Learning -Decision Trees – CLASSIFICATION AND REGRESSIONTREES (CART)-EnsembleLearning:Boosting,Bagging,Random Forests - Unsupervised Learning : K-Means – Algorithm - Vector Quantisation.

| Q.No. | Questions | Course Outcome | BT Level | Competence |
|---|---|---|---|---|
| 1. | Distinguish between crossover and mutation. | CO4 | Understand | BTL2 |
| 2. | Define Genetic Algorithm. | CO4 | Remember | BTL1 |
| 3. | Write the concept involved in evaluating fitness. | CO4 | Understand | BTL2 |
| 4. | Define mutation. | CO4 | Remember | BTL1 |
| 5. | Describe about Genetic Algorithm. | CO4 | Understand | BTL2 |
| 6. | Discover the use of Vector Quantisation. | CO4 | Understand | BTL2 |
| 7. | Write the disadvantage of Genetic Algorithm. | CO4 | Remember | BTL1 |
| 8. | Define Boosting and Bagging. | CO4 | Understand | BTL2 |
| 9. | Define Markov property. | CO4 | Remember | BTL1 |
| 10. | Write a simple example of a Markov decisionProcess. | CO4 | Understand | BTL2 |
| 11. | How K-Means Algorithm is used in Unsupervised Learning. | CO4 | Remember | BTL1 |
| 12. | Express the basic concept involved in CART. | CO4 | Understand | BTL2 |
| 13. | Define Gini Impurity. | CO4 | Remember | BTL1 |
| 14. | Identify how reinforcement learning maps states to action. | CO4 | Understand | BTL2 |
| 15. | Examine Genetic Programming. | CO4 | Remember | BTL1 |
| 16. | Discuss about reward function. | CO4 | Understand | BTL2 |
| 17. | Discover entropy function.. | CO4 | Remember | BTL1 |
| 18. | Differentiate Sarsa and Q-learning. | CO4 | Understand | BTL2 |
| 19. | What is ID3. | CO4 | Remember | BTL1 |
| 20. | Describe shortly Random Forest Algorithm. | CO4 | Understand | BTL2 |
| 21. | Write about single point crossover. | CO4 | Remember | BTL1 |
| 22. | What is the effects of mutation on a string? | CO4 | Understand | BTL2 |
| 23. | List the Basic Genetic Algorithm steps. | CO4 | Remember | BTL1 |
| 24. | Summarize the advantages of reinforcement learning cycle. | CO4 | Understand | BTL2 |

| PART-B (13 MARK ) | | | | | |
|---|---|---|---|---|---|
| 1. | (i) Write the use of Genetic Algorithm.<br>(ii) Discuss an example that illustrate the use of Genetic Algorithm. | (7)<br>(6) | CO4 | Analyze | BTL4 |
| 2. | Discuss in detail about Reinforcement Learning and elaborate on Markov Decision Process. | (13) | CO4 | Understand | BTL2 |
| 3. | (i) Write in detail about Decision Tree.<br>(ii) Write in detail Classification and Regression Tree(CART). | (7)<br>(6) | CO4 | Apply | BTL3 |
| 4. | Describe Random Forest Algorithm with an example. | (13) | CO4 | Analyze | BTL4 |
| 5. | (i) Explain in detail about Boosting<br>(i) Discover the use of Bagging. | (7)<br>(6) | CO4 | Apply | BTL3 |
| 6. | Explain the concept and algorithm involved in Unsupervised LearningEnvironment. | (13) | CO4 | Apply | BTL3 |
| 7. | (i) Describe Knapsack Problem using Genetic Algorithm.<br>(ii) Describe about Limitations involved in Genetic Algorithm. | (7)<br>(6) | CO4 | Analyze | BTL4 |
| 8. | (i)Describe in detail about Generating Offspring Genetic Operators. (7)<br>(ii)Discuss the Basic Genetic Algorithm. | (7)<br>(6) | CO4 | Apply | BTL3 |
| 9. | (i)Identify the difference between Sarsa and Q-learning.<br>(ii)Discuss an example for the reinforcement learning. | (7)<br>(6) | CO4 | Analyze | BTL4 |

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|---|---|---|---|---|---|
| 10. | Describe Knapsack problem for GA. | (13) | CO4 | Apply | BTL3 |
| 11. | (i)Write in detail about reinforcement learning.<br>(ii)Illustrate the use of reinforcement learning. | (7)<br>(6) | CO4 | Analyze | BTL4 |
| 12. | (i) Write about the ID3.<br>(ii) Generalize how Classification is done with an Example. | (7)<br>(6) | CO4 | Analyze | BTL4 |
| 13. | (i) Write in detail about CART.<br>(ii) List the different ways to combine classifiers. | (7)<br>(6) | CO4 | Apply | BTL3 |
| 14. | Describe in detail about K-Means Clustering algorithm. | (13) | CO4 | Analyze | BTL4 |
| 15. | Illustrate in detail about Vector Quantisation. | (13) | CO4 | Analyze | BTL4 |
| 16. | Explain the peaks Problem in GA. | (13) | CO4 | Analyze | BTL4 |
| 17. | Describe the bagging as a variance reducing algorithm. | (13) | CO4 | Apply | BTL3 |

**PART - C (15 MARKS)**

| | | | | | |
|---|---|---|---|---|---|
| 1. | Generalize Decision Tree and explain the implementation of Decision Tree | (15) | CO4 | Analyze | BTL 4 |
| 2. | Write in detail about Reinforcement Learning, Give an Example implementation and write down its uses. | (15) | CO4 | Apply | BTL3 |
| 3. | Choose two destination with different routes connecting them. Apply genetic algorithm to find the optional path based on distance. | (15) | CO4 | Analyze | BTL 4 |
| 4. | (i) Explain about K-Means Algorithm with an example.<br>(i) Explain about Normalization and Vector Quantization. | (8)<br>(7) | CO4 | Apply | BTL3 |
| 5. | Analyze in detail the working of ID3 Algorithm. | (15) | CO4 | Analyze | BTL 4 |

## Unit -V

Bayesian Networks - Markov Random Fields - Hidden Markov Models (HMMS) - Markov Chain Monte Carlo (MCMC) Methods - Deep Belief Networks (DBN)

| Q.No. | Questions | Course Outcome | BT Level | Competence |
|---|---|---|---|---|
| 1. | Point the concept involved in Bayesian Networks. | CO5 | Understand | BTL2 |
| 2. | Define MCMC. | CO5 | Remember | BTL1 |
| 3. | Distinguish random numbers and Gaussian Random numbers | CO5 | Understand | BTL2 |
| 4. | Define Deep Belief Network. | CO5 | Remember | BTL1 |
| 5. | Describe Markov Chains | CO5 | Understand | BTL2 |
| 6. | Discover Graphical models use. | CO5 | Remember | BTL1 |
| 7. | List the Various MCMC methods. | CO5 | Remember | BTL1 |
| 8. | Define graphical models. | CO5 | Remember | BTL1 |
| 9. | Define HMM. | CO5 | Remember | BTL1 |
| 10. | Write Variable Elimination Algorithm. | CO5 | Understand | BTL2 |
| 11. | List the purpose of Gibbs Sampling. | CO5 | Remember | BTL1 |
| 12. | Express Bayesian Belief network | CO5 | Understand | BTL2 |
| 13. | Difference Deep learning and Machine Learning. | CO5 | Remember | BTL1 |
| 14. | Write about Baum–Welch or Forward–Backward Algorithm | CO5 | Remember | BTL1 |
| 15. | List the various tracking methods. | CO5 | Remember | BTL1 |
| 16. | Discuss the concept of Deep Learning. | CO5 | Understand | BTL2 |
| 17. | Discover the Markov Random Field Image Denoising Algorithm. | CO5 | Understand | BTL2 |
| 18. | State in detail about Viterbi algorithm. | CO5 | Understand | BTL2 |

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| 19. | Define Markov Random Fields. | CO5 | Understand | BTL2 |
| 20. | Describe the Forward algorithm. | CO5 | Understand | BTL2 |
| 21. | Write about Gibbs sampler. | CO5 | Understand | BTL2 |
| 22. | What is the simulated annealing? | CO5 | Remember | BTL1 |
| 23. | State the Metropolis–Hastings. | CO5 | Remember | BTL1 |
| 24. | List out the use of random walk. | CO5 | Remember | BTL1 |

**PART-B (13 MARK )**

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|---|---|---|---|---|---|
| 1. | Analyze the concept involved in Markov Random Fields. | (13) | CO5 | Analyze | BTL4 |
| 2. | Discuss Gaussian Random numbers.<br>Describe Markov Random Fields. | (7)<br>(6) | CO5 | Apply | BTL3 |
| 3. | Write the Rejection Sampling Algorithm.<br>Show the histogram of a mixture of two Gaussians. | (7)<br>(6) | CO5 | Apply | BTL3 |
| 4. | Describe Sampling –importance resampling algorithm.<br>Describe Gibbs Sampling. | (7)<br>(6) | CO5 | Analyze | BTL 4 |
| 5. | Explain in detail about MCMC.<br>Discover Simulated Annealing by a distribution. | (7)<br>(6) | CO5 | Apply | BTL3 |
| 6. | (i)Structure two graphical models and show the various relationship between the nodes.<br>ii) Explain about conditional table. | (7)<br>(6) | CO5 | Apply | BTL3 |
| 7. | (i).Describe variable elimination algorithm.<br>(ii)Describe the Approximate Inference. | (7)<br>(6) | CO5 | Analyze | BTL 4 |
| 8. | Describe the concept involved in Simulated Annealing and Gibbs Sampling. | (13) | CO5 | Apply | BTL3 |
| 9. | Explain the decoding problem by viterbi algorithm. | (13) | CO5 | Analyze | BTL 4 |
| 10. | Describe in detail Markov Random fields.<br>Write the Markov Random Field Image Denoising Algorithm.(6) | (7)<br>(6) | CO5 | Apply | BTL3 |
| 11. | (i)Write in detail forward algorithm.<br>(ii)Discuss HMM forward algorithm. | (7)<br>(6) | CO5 | Apply | BTL3 |
| 12. | Write a HMM Baum-Welch(forward –Backward )algorithm. (13) | (13) | CO5 | Apply | BTL3 |
| 13. | Write about Tracking methods.<br>Identify hidden Markov models in detail. | (7)<br>(6) | CO5 | Analyze | BTL 4 |
| 14. | (i)Describe in detail about Kalman Filter Algorithm.<br>(ii)Discuss about The particle Filter. | (7)<br>(6) | CO5 | Analyze | BTL4 |
| 15. | Illustrate in detail about the effects of adding noise to the estimate of the covariance in the training data with the squared exponential kernel. | (13) | CO5 | Analyze | BTL4 |
| 16. | Explain the data and the model based on random parameters the fitted model in covariance function. | (13) | CO5 | Apply | BTL3 |
| 17. | Describe the two nodes in a Markov Random Field (MRF). | (13) | CO5 | Analyze | BTL4 |

**PART - C (15 MARKS)**

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| 1. | Discuss about Bayesian Network and discuss in detail with “Exam Fear” example. Also explain the making of Bayesian Networks. | (15) | CO5 | Analyze | BTL4 |
| 2. | Write the concept involved in Deep Belief Network and its algorithm also justify how Deep learning is the most prominent field in current generation. | (15) | CO5 | Apply | BTL3 |
| 3. | Explain about Markov Chain Monte Carlo Methods, algorithm and Implementation with example. | (15) | CO5 | Apply | BTL3 |

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| 4. | Describe in detail about the Hidden Markov Models.(HMMS) also generate the Forward, Viterbi and BaumWelch Algorithm. | (15) | CO5 | Evaluate | BTL 5 |
| 5. | Analyze in detail of Hopfield network with Schematic diagram. | (15) | CO5 | Analyze | BTL 4 |