INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

Course Title	**MACHINE LEARNING**				
Course Code	ACSB21				
Program	B.Tech				
Semester	V	IT			
Course Type	CORE				
Regulation	IARE-R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr. C Shantaiah, Associate Professor				

COURSE OBJECTIVES:

The students will try to learn:

I	The fundamental concepts, issues and challenges of machine learning associated to data for model selection.
II	The supervised learning methods such as decision trees, Naïve Bayes classifier, k-nearest neighbor learning for building data models and basics of unsupervised learning methods.
III	The knowledge used for making predictions or decisions without human intervention on real-world problems.

COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Recognize** the characteristics of machine learning that make it useful to real-world problem.	Remember
CO 2	**Discuss** the steps involved in designing a learning system by consideringwell posed learning problems.	Understand
CO 3	**Analyze** the underlying mathematical relationships within and across machine learning algorithms.	Analyze
CO 4	**Relate** he hypothesis space searchfor an application using decision treelearning.	Remember

CO 5	**Explain** models for reasoning with uncertainty as well as the use of unreliable information.	Understand
CO 6	**Identify** appropriate learning functions as activation function for neural network design.	Understand
CO 7	**Make use** of optimizing function for reducing the error in prediction model.	Apply
CO 8	**Develop** artificial neural networkusing back propagation algorithm for different applications.	Apply
CO 9	**Demonstrate** Naïve Bayes algorithm based on Bayes theorem for classification problem.	Apply
CO 10	**Make Use of** k-nearest neighbor algorithm for solving both classification and regression problems.	Apply
CO 11	**Discuss** he reinforcement learning by observing the current environmentstate.	Understand
CO 12	**Identify** appropriate machine learning techniques and computing environment suitable for the applications.	Understand

QUESTION BANK:

MODULE I				
TYPES OF MACHINE LEARNING				
PART-A PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
1	Mention three computer applications for which machine learning approaches seem appropriate and three for which they seem inappropriate.	Understand	The learner to recall the concept of machine learning approaches and also able to identify the applications which are in need of machine learning approaches.	CO1
2	Let consider designing a program to learn play checkers, with the goal of entering it in the world checkers tournament. Propose a target function to be learned and a target representation.	Apply	The learner to recall the checkers learning program and mention the appropriate target function and its representation.	CO2

<table>
<tr><td>3</td><td>For the given dataset, derive the hypothesis for the Enjoy Sport task by using Find-S algorithm.
<table><tr><th>Example</th><th>Sky</th><th>AirTemp</th><th>Humidity</th><th>Wind</th><th>Water</th><th>Forecast</th><th>EnjoySport</th></tr><tr><td>1</td><td>Sunny</td><td>Warm</td><td>Normal</td><td>Strong</td><td>Warm</td><td>Same</td><td>YES</td></tr><tr><td>2</td><td>Sunny</td><td>Warm</td><td>High</td><td>Strong</td><td>Warm</td><td>Same</td><td>YES</td></tr><tr><td>3</td><td>Rainy</td><td>Cold</td><td>High</td><td>Strong</td><td>Warm</td><td>Change</td><td>NO</td></tr><tr><td>4</td><td>Sunny</td><td>Warm</td><td>High</td><td>Strong</td><td>Warm</td><td>Change</td><td>YES</td></tr></table></td><td>Apply</td><td>The learner to recall the Find-S algorithm and should appropriately derive hypothesis for a problem domain.</td><td>CO4</td></tr>
<tr><td>4</td><td>Explain inductive and deductive learning in detail.</td><td>Understand</td><td>The learner to recall the different ways of learning.</td><td>CO5</td></tr>
<tr><td>5</td><td>For the given dataset, derive the set of hypothesis for the Enjoy Sport task by using candidate elimination algorithm.
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<tr><td>8</td><td>Explain most general hypothesis and most specific hypothesis and how they are represented with examples. Explain their importance in candidate elimination algorithm.</td><td>Understand</td><td>The learner to recall the concept of version space to mention its boundaries.</td><td>CO12</td></tr>
</table>

9	Explain more general than or equal to relation in terms of sets of instances that satisfy any two hypothesis.	Understand	The learner to recall the concept of ordering of hypothesis in order to mention relationship between hypotheses.	CO3
10	Explain the biased hypothesis space in candidate elimination algorithm	Understand	The learner to recall the bias concept and how it is included in obtaining version space for a problem domain.	CO4
PART B-LONG ANSWER QUESTIONS				
1	Describe the Enjoy Sport concept learning task and hypothesis space of Enjoy sport.	Understand	The learner to mention concept learning and with the help of the example of Enjoy Sport and also the hypothesis space concerned with the task.	CO4
2	Explain Find-S algorithm with respect to Enjoy Sport concept learning task.	Understand	The learner to explain Find-S algorithm and with the help of the example of Enjoy Sport task.	CO12
3	Explain in detail the issues in Find-S algorithm.	Understand	The learner to recall the Find-S algorithm and should mention all issues in that.	CO5
4	Describe List-Then-Eliminate algorithm and its drawback.	Understand	The learner to mention List-Then-Eliminate algorithm and should mention all drawbacks in that.	CO5
5	Explain version space and also define general and specific boundary with an example.	Understand	The learner to describe version space and how general and specific boundaries are related to it.	CO5
6	Distinguish data mining and machine learning.	Understand	The learner should know the limitations of data mining to differentiate with machine learning.	CO1
7	Compare artificial intelligence, machine learning and deep learning with their relationship.	Analyze	The learner to mention the purpose of these three disciplines and the way they are inter-related.	CO1

8	Explain different algorithm approaches in machine learning	Understand	The learner to recall the various ways the machine learning techniques are present and explain the ways they are implemented.	CO1
9	Explain inductive bias in candidate elimination algorithm.	Understand	The learner to recall the concept of inductive bias and candidate elimination algorithm then should describe how inductive bias is present in this algorithm.	CO5
10	Explain the limitations of version space learned by candidate elimination algorithm.	Understand	The learner to mention version space in candidate elimination algorithm and the drawbacks present in its hypothesis.	CO1
11	Describe the final version space of Enjoy Sport task obtained from candidate elimination algorithm with a neat diagram.	Understand	The learner to derive version space for enjoy sport task using candidate elimination algorithm.	CO12
12	Explain in detail issues in machine learning.	Understand	The learner to recall machine learning and the issues in it related to training experience and generalization of target function.	CO1
13	State the choices in learning the checkers learning program with the help of a diagram.	Remember	—-	CO2
14	Explain the steps in designing a learning system.	Understand	The learner to explain the five important steps that are to be followed when developing a machine learning model.	CO2
15	State the representation of target function of the checkers learning program and explain each term in it.	Understand	The learner should have an idea of target function in over to mathematically represent it for the checkers learning problem.	CO2

16	Explain LMS weight update rule in adjusting weights.	Understand	The learner should possess the knowledge about function approximation, in this process the way in which weights are adjusted.	CO3
17	Describe the final design of the checkers learning system with a proper diagram.	Understand	The learner should know the Software development process of machine learning algorithms.	CO2
18	Compare Find-S and Candidate Elimination Algorithms.	Analyze	The learner to recall both these algorithms and their applicability and drawbacks.	CO5
19	Explain the steps in Candidate Elimination Algorithm.	Understand	The learner to recall the steps in candidate elimination algorithm in order to properly obtain the version space.	CO12
20	State the rule for estimating training values for checkers learning program during function approximation.	Apply	The learner to recall the function approximation step in designing a learning problem and mention the rule of function approximation for a checkers problem.	CO2
PART C-SHORT ANSWER QUESTIONS				
1	Explain General-to-Specific Ordering of Hypotheses with an example.	Understand	The learner first should have an idea of hypothesis and then decides the ordering of hypothesis.	CO4
2	Define hypothesis in machine learning.	Remember	—-	CO4
3	State the general notation of hypothesis in machine learning with positive example and negative example.	Remember	—-	CO4
4	Explain the use of Find-S algorithm and which hypothesis is considered in this algorithm?	Understand	The learner should know find s algorithm, then its use and the hypothesis considered are explained.	CO2
5	Define inductive learning in machine learning.	Remember	—-	CO1
6	Define machine learning according to Tom Mitchell.	Remember	—-	CO1

7	Explain task, experience and performance in checkers learning problem.	Understand	The learner should know how to well pose a machine learning problem to explain task, experience and performance.	CO2
8	Mention any four domains where machine learning applications are useful.	Remember	—-	CO1
9	Define a well posed learning problem.	Remember	—-	CO2
10	Explain the importance of Machine Learning.	Understand	The learner should understand the difficulties in traditional techniques in order to find the importance of machine learning in the problem domain.	CO1
11	List a fewpopular examples of machine learning.	Remember	—-	CO1
12	Draw the structure of learning problem.	Remember	—-	CO2
13	Distinguish traditional and machine learning program.	Understand	The learner to define traditional and machine learning program in terms of input, processing and output.	CO1
14	Compare predictive and descriptive learning task.	Analysis	The learner to define predictive and descriptive tasks and how they are varied.	
15	State positive and negative example in training data set?	Remember	—-	CO1
16	List the steps in designing a learning system.	Remember	—-	CO2
17	Statethe perspective of machine learning.	Remember	—-	CO1
18	Define version space in machine learning.	Remember	—-	CO1
19	Explain when you can say that the hypothesis is consistent?	Understand	The learner to define how hypothesis is obtained and when it becomes consistent.	CO4

<table>
<tr><td>20</td><td>Describe general boundary and specific boundary with respect to hypothesis space and training data.</td><td>Understand</td><td>The learner to define general and specific hypothesis in the predefined hypothesis space.</td><td>CO4</td></tr>
<tr><td colspan="5">MODULE II</td></tr>
<tr><td colspan="5">DECISION TREE LEARNING</td></tr>
<tr><td colspan="5">PART-A PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS</td></tr>
<tr><td>1</td><td>For example, suppose S is a collection of training-example days described by attributes including Wind, which can have the values Weak or Strong. As before, assume S is a collection containing 14 examples, [9+, 5-]. Of these 14 examples, suppose 6 of the positive and 2 of the negative examples have Wind = Weak, andthe remainder have Wind = Strong. Calculate information gain due to sorting the original 14 Examples by the attribute Wind.</td><td>Apply</td><td>The learner to recall the information gain measure.</td><td>CO4</td></tr>
<tr><td>2</td><td>Calculate the entropy of each attribute for the given dataset.
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<tr><th>Where</th><th>When</th><th>Fred Starts</th><th>Joe offense</th><th>Joe defense</th><th>Opp C</th><th>OutCome</th></tr>
<tr><td>Home</td><td>7pm</td><td>Yes</td><td>Center</td><td>Forward</td><td>Tall</td><td>Won</td></tr>
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<tr><td>3</td><td>Find the attribute that is best suited for the root node for the given dataset.
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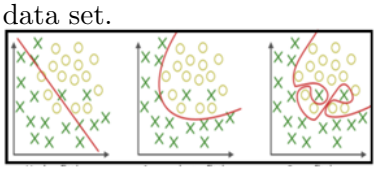
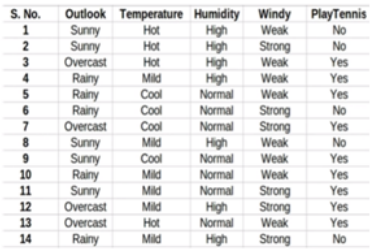
<tr><td>6</td><td>What do you infer from the below diagram of a training data set.
  </td><td>Analyze</td><td>The learner to relate the concepts of overfitting and underfitting in terms of training data.</td><td>CO5</td></tr>
<tr><td>7</td><td>Explain how high bias and low variance contribute to underfitting.</td><td>Understand</td><td>The learner to figure out the relation between bias and variance.</td><td>CO5</td></tr>
</table>

8	Explain how low bias and high variance contribute to overfitting.	Understand	The learner to figure out the relation between bias and variance.	CO5
9	Derive with a class dataset with marks, overall participation and discipline attributes a best hypothesis using decision tree learning.	Apply	The learner to recall the process of decision tree construction.	CO4
10	Construct the decision tree for the given data set by considering information gain at each level. 	Apply	The learner to recall the process of decision tree construction.	CO4

S. No.	Outlook	Temperature	Humidity	Windy	PlayTennis
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3	Overcast	Hot	High	Weak	Yes
4	Rainy	Mild	High	Weak	Yes
5	Rainy	Cool	Normal	Weak	Yes
6	Rainy	Cool	Normal	Strong	No
7	Overcast	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rainy	Mild	Normal	Weak	Yes
11	Sunny	Mild	Normal	Strong	Yes
12	Overcast	Mild	High	Strong	Yes
13	Overcast	Hot	Normal	Weak	Yes
14	Rainy	Mild	High	Strong	No

PART B-LONG ANSWER QUESTIONS				
1	Explain underfitting with the help of appropriate diagram and how is it related to bias and variance?	Understand	The learner to recall the concepts of bias and variance and their role in obtaining hypothesis of poor accuracy.	CO5
2	Demonstrate overfitting with the help of appropriate diagram and how is it related to bias and variance?	Understand	The learner to recall the concepts of bias and variance and their role in obtaining hypothesis of poor accuracy.	CO5
3	Define local maximum, global maximum, flat local maximum and current state regions in a state space diagram.	Remember	—-	CO1
4	Explain hill climbing search strategy.	Understand	The learner to recall the search strategies and explain the simplest algorithm among them.	CO4
5	List in detail capabilities and limitations of ID3 algorithm.	Remember	—-	CO5

6	Explain hypothesis space search in decision tree learning.	Understand	The learner to explain how the best hypothesis is inferred from a hypothesis space.	CO4
7	List the steps in ID3 algorithm with proper explanation.	Remember	—-	CO4
8	Mention the appropriate problems for decision tree learning.	Remember	—-	CO5
9	Demonstrate decision tree representation with the help of a diagram.	Remember	—-	CO12
10	State the terminating conditions of decision tree learning algorithm.	Remember	—-	CO4
11	Which type of inference is incorporated in decision tree learning model? Justify your answer.	Analyze	The learner to recall difference inferences and to mention the proper inference that suits in decision tree learning.	CO4
12	List the different issues in decision tree learning technique?	Remember	—-	CO5
13	Explain incorporating continuous valued attributes in Decision tree learning with an example.	Understand	The learner to address the issues related to decision tree learning.	CO5
14	Describe the need to convert the decision tree to rules before pruning?	Understand	The learner to identify the need to change decision trees to rules in terms of processing.	CO5
15	Explain with an example rule antecedent and rule consequent in rule post pruning.	Understand	The learner to relate precondition and post condition in context of rule post pruning.	CO5
16	Explain different formulae for attribute selection measure instead of information gain attribute for handling attributes with differing costs in decision trees.	Understand	The learner to recall all the attribute selection measures for handling issue related to cost.	CO4

17	Describe the method of handling missing attribute value in decision tree learning using probability.	Understand	The learner to handle the issues in decision tree learning approach.	CO5
18	Explain alternative measures for selecting attributes other than information gain.	Understand	The learner to recall all the attribute selection measures for handling issues.	CO4
19	State noise in the training data. Mention the issues related to it.	Remember	—-	CO5
20	a) Demonstrate the relationship between size of the tree and overfitting.	Analyze	The learner to identify how the accuracy of the model is affected with increase in number of nodes.	CO4
PART C-SHORT ANSWER QUESTIONS				
1	Describe the decision tree learning method?	Remember	—-	CO4
2	Define hypothesis space for decision tree learning.	Remember	—-	CO4
3	Explain the inductive bias considered for decision tree learning method.	Understand	The learner to recall inductive bias and how is it incorporated in the learning process using decision trees.	CO4
4	Explain the improvement of readability in decision tree learning method.	Understand	The learner to recall the different ways in which decision trees are represented for easy understanding.	CO5
5	Mention some applications where decision tree learning is effectively applied.	Remember	—-	CO12
6	Explain the measure used to identify the best attribute for classification?	Understand	The learner to recall the different ways in which best attribute at a particular node is selected.	CO5
7	Define entropy and its use in decision tree learning?	Remember	—-	CO4
8	Explain the significance of the hypothesis search strategy used in ID3 algorithm.	Understand	The learner to recall the ID3 algorithm and the measures used to find the best attribute in order to derive the hypothesis.	CO4

9	Define heuristic search and its role in decision tree learning?	Remember	—-	CO4
10	State underfitting in machine learning.	Remember	—-	CO5
11	State overfitting in machine learning.	Remember	—-	CO5
12	Describe the purpose of validation set in machine learning?	Understand	The learner to recall the different types of datasets used during developing a machine learning model.	CO1
13	Mention the two classes into which the different approaches to avoid overfitting in decision trees are grouped.	Remember	—-	CO5
14	Explain the drawback of reduced error pruning?	Understand	The learner to relate overfitting to pruning a decision tree.	CO4
15	Describe rule post pruning method in decision tree learning?	Understand	The learner to state different methods to avoid overfitting.	CO4
16	Define SplitInformation measure with its formula.	Remember	—-	CO4
17	Mention the different ways in which missing attribute values can be handled in decision tree learning.	Remember	—-	CO5
18	Recallinductive bias in decision tree learning with an example.	Remember	—-	CO5
19	Explain the need of decision tree pruning.	Understand	The learner to recall the problem of overfitting and the ways to overcome it.	CO4
20	Distinguish between training set and test set.	Analyze	The learner to mention the different types of data set in terms of size, applicability and specifications.	CO1

MODULE III				
ARTIFICIAL NEURAL NETWORKS				
PART-A PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Demonstrate a neural network representation for self driving vehicle with a neat representation of the architecture.	Apply	The learner to recall ANN architecture.	CO8
2	Derive XOR boolean function implementation using a perceptron with a neat diagram.	Apply	The learner to recall the perceptronfunctionality.	CO8
3	Illustrate the visual representation of the hypothesis space in the gradient descent algorithm. Explain how optimal hypothesis is obtained from the diagram.	Apply	The learner to represent the error surface in terms of weights used...	CO7
4	Derive the back propagation rule for both hidden and output unit weights.	Analyze	The learner to know the concept in weight update rules.	CO8
5	Explain adding momentum in back propagation algorithm and relate it to a real time example.	Understand	The learner to recall momentum concept and relate it to updating weights.	CO8
CIE II				
6	Demonstrate to test a hypotheses h whose error D(h) is known to be in the range between 0.2 and 0.6.What is the minimum number of examples you must collect to assure that the width of the two-sided 95% confidence interval will be smaller than 0.1?	Apply	The learner to recall sample error and true error.	CO3

7	Supposehypotheses h commits r = 10 errors over a sample of n=65 independently drawn examples. What is the 95% one-sided interval (i.e., what is the upper bound U such that error D(h)≤5 U with 95% confidence)?	Apply	The learner to recall sample error, true error and confidence interval for one-sided interval.	CO3
8	Supposeyou test a hypotheses h and find that it commits r=300 errors on a sample s of n=1000 randomly drawn test examples. What is the standard deviation in errors(h)?	Apply	The learner to recall basics of sampling theory.	CO3
9	A telecom company has developed a classifier for detecting whether a cell-phone networkbase station is faulty or not. (a) Evaluate the classifier on a test set. Here is the confusion matrix. (In the table, Fmeans faulty and NF not faulty.) Compute the accuracy of the classifier. Predicted: F, NF Truth: F → 10, 5; NF → 20, 965 (b) What is the accuracy of a majority-class baseline? (The class not faulty is the mostcommon in the training set.) Would you say that the classifier is more useful than the majority-class baseline? Explain why or why not.	Analyze	The learner to recall how to find out accuracy and precision based on hypotheses.	CO5

10	Suppose hypotheses h commits r = 12 errors over a sample of n=67 independently drawn examples. i) What is the variance and standard deviation for number of true error rate errorD(h). ii) What is the 90% confidence interval (two-sided) for thetrue error rate?	Apply	The learner to recall sample error, true error and confidence interval for two-sided interval.	CO3
PART-B LONG ANSWER QUESTIONS				
1	Describe the significance of Artificial Neural Network in Machine Learning.	Understand	The learner to recall the concept ANN and how it is used to implement machine learning models.	CO8
2	Explain the representational power of the perceptron.	Understand	The learner should know the linearly separable and unseparable datasets.	CO6
3	Derive AND boolean function implementation using a perceptron.	Apply	The learner to recall the perceptron functionality.	CO6
4	Derive OR boolean function implementation using a perceptron.	Apply	The learner to recall the perceptron functionality.	CO6
5	Describe perceptron learning rule of solving a learning problem.	Understand	The learner to know the various learning mechanisms available.	CO6
6	Explain gradient descent rule of solving a learning problem.	Understand	The learner to know the various learning mechanisms available.	CO7
7	Derive NOT boolean function implementation using a perceptron.	Apply	The learner to recall the perceptron functionality.	CO6
8	Explain the drawback of perceptron and the way to overcome it.	Understand	The learner to define alternative building units of ANN.	CO6
9	Mention the characteristics of the problems appropriate for ANN representation.	Remember	—-	CO8
10	Describe the boolean function in disjunctive formal form with a suitable example.	Remember	—-	CO5

CIE II				
11	What are the steps involved in hypotheses testing?	Remember	—-	CO4
12	Write a Procedure to estimate the difference in error between two learning methods LA and LB.	Remember	—-	CO4
13	Suppose a computer program for recognizing dogs in photographs identifies eight dogs in a picture containing 12 dogs and some cats. Of the eight dogs identified, five actually are dogs while the rest are cats. Compute the precision and recall of the computer program.	Apply	The learner to recall the values of confidence matrix and find TP, FP and FN to find precision and recall.	CO4
14	Find 95% confidence interval for hypothesis h that observed to have 10 miss-classifications over a sample of 100 instances.	Apply	This would require the learner to recall the values of confidence interval.	CO3
15	Assume the following: A database contains 80 records on a particular topic of which 55 are relevant to a certain investigation. A search was conducted on that topic and 50 records were retrieved. Of the 50 records retrieved, 40 were relevant. Construct the confusion matrix for the search and calculate 1. Precision 2. Recall 3. Accuracy 4. Error rate 5. Sensitivity 6. Specificity 7. F-measure scores for the search.	Apply	The learner to recall the values of confidence matrix and find the required scores of search.	CO4
16	Define confusion matrix with suitable example	Remember	—-	CO4

17	How can we interpret the "learning of a concept" as "searching a concept"?	Understand	The learner to recall how learned concept using a learning algorithm is used for searching a concept in hypotheses.	CO4
18	Explain Binomial Distribution with an example.	Remember	—-	CO3
19	Explain most general hypotheses and most specific hypotheses in the context of a classification problem.	Understand	The learner relates the hypotheses related to most general or specific hypotheses depending on requirement.	CO4
20	Explain the terms i) Type I and Type II errors ii) Null Hypotheses and Alternate hypotheses	Understand	The learner to differentiate the terms like Type I and II errors and Null and Alternate hypotheses.	CO4
PART C-SHORT ANSWER QUESTIONS				
1	Explain Sigmoid function and its role in the ANN.	Understand	The learner to recall the effect of sinusoidal activation function.	CO6
2	Describe the structure of Artificial Neural Network.	Understand	The learner to represent the units and their interconnection among them.	CO8
3	List out some of the applications of ANN.	Remember	—-	CO8
4	Define Perceptron. State the output function.	Remember	—-	CO6
5	Explain the way thresholding is implemented in a perceptron.	Understand	The learner to recall the effect of step activation function.	CO6
6	Describe perceptron in terms of vectors.	Understand	The learner to mention the vector representation form of output function.	CO6
7	Explain the space of candidate hypotheses considered in perceptron learning.	Understand	The learner to define the hypothesis obtained.	CO4
8	Describe the significance of hyperplanes in machine learning.	Understand	The learner to know classification of data points.	CO1
9	Mention different methods of perceptron learning.	Remember	—-	CO6

10	Mention the steps in gradient descent algorithm for training linear units.	Remember	—-	CO7
CIE II				
11	Write short notes on estimating hypotheses accuracy	Understand	The learner to recall the concepts of their role in obtaining hypothesis accuracy.	CO4
12	What do you mean by conjunction and disjunction of constraints while evaluating hypotheses?	Understand	Relate constraints on training data obtains different hypotheses	CO4
13	What is Central Limit Theorem?	Remember	—-	CO3
14	What does it mean by a hypothesis that is consistent with training data versus hypothesis that satisfies a certain instance?	Analyze	The learner to recall the concepts to make hypotheses consistent	CO4
15	Explain the two key difficulties that arise while estimating the Accuracy of Hypothesis.	Remember	—-	CO4
16	Define hypotheses space	Understand	Relate how the hypotheses space obtained used for predicting.	CO4
17	What is binomial distribution	Remember	—-	CO3
18	Define the following terms 1. Sample error 2. True error	Understand	The learner to know the difference between the errors raised on sample and at the time of prediction.	CO7
19	What is confusion matrix?	Remember	—-	CO5
20	Define the following terms i) Mean ii) Variance iii) Standard Deviation	Remember	—-	CO3
MODULE IV				
BAYESIAN LEARNING				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Give a distribution for P(h) and P(D/h) under which Find G is guaranteed to output a MAP hypothesis.	Understand	The learner to recall about MAP hypothesis and find G.	CO9

2	Consider a medical diagnosis problem in which there are two alternative hypotheses: 1. That the patient has a particular form of cancer (+) and 2. That the patient does not (-). A patient takes a lab test and the result comes back positive. The test returns a correct positive result in only 98% of the cases in which the disease is actually present, and a correct negative result in only 97% of the cases in which the disease is not present. Furthermore, .008 of the entire population have this cancer. Determine whether the patient has Cancer or not using MAP hypothesis.	Apply	The learner to recall about MAP hypothesis and determine the value for given example.	CO9
3	Give a distribution for P(h) and P(D/h) under which Find G is not guaranteed to output a MAP hypothesis.	Understand	The learner to recall about MAP hypothesis.	CO9
4	How do we calculate frequency and likelihood tables for a given dataset in the "Naïve Bayes" algorithm	Understand	The learner to recall about text using naïve bayes theorem.	CO9
5	Write down the expression for the quantity to be minimized according to the minimum description length principle.	Understand	The learner to recall about text usingminimum description length principle.	CO9
6	Give a distribution for P(h) and P(D/h) under which Find G is guaranteed to output a ML hypothesis but not a MAP hypothesis.	Analyze	The learner to recall about MAP find G using ML hypothesis.	CO9

7	Is it possible to construct a set of training data such that a consistent hypothesis exists, but MDL chooses a less consistent hypothesis? If so, give such a training set. If not, explain why not.	Understand	The learner to recall about text using find G using MDL hypothesis.	CO4
8	Give probability distributions for P(h) and P(D/h) such that the above MDL algorithm outputs MAP hypotheses.	Analyze	The learner to recall about text using, find G using MAP hypothesis.	CO4
9	Let XX be a continuous random variable with the following PDF: Find the MAP estimate of X given Y=3. $f_X(x) = \begin{cases} 2\tilde{x} \text{ if } 0 \le x \le 1 \\ 0 \quad otherwise \end{cases}$ Also, suppose that $Y\|X = x \sim Geometric(x)$	Apply	The learner to recall about how to use MAP hypothesis.	CO9
10	A man is known to speak truth 2 out of 3 times. He throws a die and reports that the number obtained is a four. Find the probability that the number obtained is actually a four by using bayes theorem.	Apply	The learner to recall about text using bayes theorem.	CO9
PART B-LONG ANSWER QUESTIONS				
1	ExplainBayestheorem? How it is useful.	Understand	The learner to recall about Bayes theorem and its uses.	CO3
2	Compare L1 and L2 regularization?	Understand	The learner to recall both L1 and L2 regularization and compare them.	CO9
3	ExplainBayesian belief network and conditional independence with example.	Understand	The learner toneed to explain Bayesian belief network with example.	CO9
4	What is the difference between probability and likelihood?	Remember	—-	CO3

5	Explain prior probability likelihood and marginal likelihood in context of Naïve Bayes algorithm?	Understand	The learner torecall probability likelihood and marginal likelihood in context of Naïve Bayesalgorithm.	CO9
6	ExplainBayesianbelief network? Where are they used?	Understand	The learner recalls about Bayesianbelief network and its uses.	CO9
7	Describe about prior probability likelihood in NaiveBayes algorithm	Understand	The learner torecallprior probability likelihood in Naïve Bayes algorithm.	CO9
8	How do you classify text using Bayes Theorem?	Remember	—-	CO9
9	Explain the general cause of overfitting and underfitting? What steps will you take to avoid overfitting and underfitting?	Understand	The learner to recall about overfitting and underfitting.	CO5
10	Describe the average squared difference between classifier predicted output and actual output	Understand	The learner to recall about classifier predicted output and actual output.	CO9
11	Explain probability of a hypothesis before the presentation of evidence	Understand	The learner to recall about probability of hypothesis.	CO4
12	What are the uses of Bayes classifier	Remember	—-	CO9
13	Explain hypothesis with example	Understand	The learner to relate hypothesis for the given example.	CO4
14	What are the advantages of naïve bayes classifier	Remember	—-	CO9
15	ExplainBayesian belief network and conditional independence with example.	Understand	The learner to recall about Bayesian network and conditional independence.	CO9
16	Explain the concept of EM Algorithm.	Remember	—-	CO9
17	Discuss what are gaussian mixtures.	Understand	The learner to recall about gaussian mixtures.	CO9
18	What is optimal classifier	Remember	—-	CO9
19	Explain about different classifiers	Understand	The learner to recall about different classifiers.	CO9

20	How do you classify text using Bayes theorem	Understand	The learner to recall Bayes theorem and know how to classify using it.	CO9
PART C- SHORT ANSWER QUESTIONS				
1	Explain naïve Bayes classifier algorithm?	Remember	—-	CO9
2	What is the need of learning?	Understand	The learner to recall about need of Learning.	CO1
3	Define Bayesian Belief nets and their uses?	Understand	The learner to recall about Bayesian belief networks.	CO9
4	Define (i) Prior Probability (ii) Conditional Probability (iii) Posterior Probability	Remember	—-	CO3
5	Explain conditional Independence?	Understand	The learner to recall about conditional independence.	CO9
6	Describe the concept of MDL?	Understand	The learner to state about concept of MDL.	CO9
7	Discuss maximum likelihood and least square error hypothesis?	Understand	The learner to recall about maximum likelihood and least square error hypothesis.	CO3
8	Describe maximum likelihood hypothesis for predicting probabilities?	Understand	The learner to recall about maximum likelihood and least square error hypothesis.	CO3
9	Explain naïve Bayes classifier with an example?	Understand	The learner to recall about Naïve Bayes classifier and explain with example.	CO9
10	Describe the concept of MDL?	Remember	—-	CO9
11	Explain brute force Bayes concept learning?	Understand	The learner to recall about brute force Bayes concept learning.	CO9
12	Why is naive Bayes so naïve?	Remember	—-	CO9
13	Define Bayesian theorem? What is the relevance and features of Bayesian theorem? Explain the practical difficulties of Bayesian theorem.	Remember	—-	CO3

14	Explain the gradient search to maximize likelihood in a neural network?	Understand	The learner needs to know how to use gradient search to maximize likelihood.	CO7
15	Explain the concept of EM Algorithm with example?	Understand	The learner needs to explain about concept of EM algorithm.	CO9
16	What are the advantages of Naive Bayes?	Remember	—-	CO9
17	Explain the concept of EM algorithm?	Remember	—-	CO9
18	Compare conditional probability and joint probability?	Understand	The learner to recall both these algorithms and their applicability and drawbacks.	CO3
19	How does naïve bayes classifier works?	Understand	The learner to recall about working functionality of Naïve Bayes classifier	CO9
20	Explain bayes errors?	Understand	The learner to recall about Bayes errors and understand.	CO9
MODULE V				
INSTANCE BASED AND REINFORMENT LEARNING				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Explain the Q function and Q learning algorithm assuming deterministic rewards and actions with example.	Understand	The learner to explain deterministic Q learning algorithm based on rewards and actions.	CO11
2	Explain the K – nearest neighbor algorithm for approximating a discrete – valued function f : Hn→ V with pseudo code.	Understand	The learner to explain k-nn classification learning algorithm based on discrete inputs.	CO10
3	Compare unsupervised learning and reinforcement learning with examples.	Analyze	The learner to recall the different types of learning and compare with examples.	CO1
4	Develop a Q learning task for recommendation system of an online shopping website. What will be the environment of the system? Write the cost function and value function for the system.	Apply	The learner to recall the Q learning task for online shopping website.	CO12

5	Identify the suitable learning method for training a robotic arm and explain it.	Analyze	The learner to recall learning methods and identify suitable learning method for training a robotic arm.	CO12
6	Consider playing Tic-Tac-Toa against an opponent who plays randomly. In particular, assume the opponent chooses with uniform probability any open space, unless there is a forced moved (in which case it makes the obvious correct move). (a) Formulate the problem of learning an optimalTic-Tac-Toa strategy in this case as a Q-learning task. (b) What are the states, transitions, and rewards in this non-deterministic Markov decision process?	Analyze	The learner to recall tic-tac-toe game and identify states, transitions and rewards in MDP.	CO12
7	How does Q function become able to learn with and without complete knowledge of reward function and state transition function.	Understand	The learner to relate Q function learning with and without complete Knowledge of reward function and state transition function.	CO11
8	How does setting a Reinforcement Learning problem require an understanding of the following parameters of the problem? (a) Delayed reward (b) Exploring unknown or exploiting already learned states and actions. (c) Number of old states should be considered to decide action	Understand	The learner should understand parameters needed for reinforcement learning.	CO11

9	Consider playing Tic-Tac-Toa against an opponent who plays randomly. In particular, assume the opponent chooses with uniform probability any open space, unless there is a forced moved (in which case it makes the obvious correct move). (a) Outline Will your program succeed if the opponent plays optimally rather than randomly.	Understand	The learner to recall tic-tac-to a game and analyze will your game succeed if the opponent plays optimally rather than randomly.	CO11
10	Identify the suitable learning method for applications given below and explain how the learning method is used. i) Videos Surveillance ii) Predictions while Commuting iii) Industry automation	Apply	The learner to recall learning methods and identify suitable learning method for the applications.	CO12
PART B-LONG ANSWER QUESTIONS				
1	Explain the Q function and Q Learning Algorithm.	Understand	The learner to recall Q function and know how it is used in Q learning algorithm.	CO11
2	Describe K-nearest Neighbor learning Algorithm for continues (real) valued target function.	Understand	The learner to learn using k-nn algorithm on the real valued data for classification problems.	CO10
3	What are different aspects of the environment that points towards reinforcement learning?	Remember	—-	CO11
4	Explain Locally Weighted Linear Regression.	Understand	The learner to learn using locally weighted linear regression.	CO10
5	Explain about distance-weighted nearest neighbor algorithm.	Understand	The learner to learn the refinement to the k-nn algorithm by giving weights.	CO10

6	Discuss the major drawbacks of K-nearest Neighbor learning Algorithm and how it can be corrected.	Understand	The learner to identify the drawbacks of k-nn algorithm.	CO10
7	Explain difference between lazy learning and eager learning.	Understand	The learner to memorize the differences between lazy learning and eager learning.	CO1
8	Recall Q function and algorithm for Q learning, how does it relate to dynamic programming?	Analyze	The learner to relate Q learning to dynamic programming.	CO11
9	What is reinforcement learning and explain reinforcement learning problem with neat diagram.	Understand	The learner todesign the aspects and describe the learning problem using RL method.	CO11
10	Explain how an agent can take action to move from one state to other state with the help of rewards.	Understand	The learner to explain how agent will move from one step to other with the help of rewards.	CO11
11	Choose Q learning in deterministic environment...	Remember	—-	CO11
12	Explain reinforcement learning in detail along with the various elements involved in forming the concept.	Understand	The learner to understand various elements involved in reinforcement learning.	CO11
13	Explain Convergence of Q learning for deterministic Markov decision process theorem with proof.	Understand	The learner to recall convergence theorem and use it in Q learning.	CO11
14	Explain how reinforcement learning problem differs from other function approximation.	Understand	The learner to relate how reinforcement learning differs from other learning. convergence theorem and use it in Q learning.	CO11
15	Explain CADET System using Case based reasoning.	Understand	The learner to recall Case based reasoning how we can use in CADET System	CO11
16	Interpret the role of radial basis function in separatingnonlinear patterns.	Understand	The learner to recall how we can we use radial basis function for nonlinear patterns.	CO11

17	Explain about Q learning in non deterministic environment.	Understand	The learner to recall Q learning and to know how to use in non deterministic environment.	CO11
18	Whatis instance based learning? Explain key features and disadvantages of these methods.	Remember	—-	CO1
19	Explain the k-nearest neighbor algorithm for appropriate in a discrete-valued function.	Understand	The learner to recall k-nn algorithm behavior for discrete inputs.	CO10
20	Explain the behavior of an agent in a Markov decision process (MDP).	Understand	The learner to understand agent behavior in markov decision process.	CO11
PART C-SHORT ANSWER QUESTIONS				
1	What is instance based learning	Remember	—-	CO11
2	Explain instance based learning methods.	Understand	The learner should identify instance based learning methods.	CO11
3	Explain convergence theorem of Q learning for non deterministic Markov decision process (MDP).	Understand	The learner to recall convergence theorem and use it for MDP.	CO3
4	What is Reinforcement Learning?	Remember	—-	CO11
5	Analyze aboutK-nearest Neighbor learning Algorithm and give reason under which category of Machine learning algorithm it comes?	Analyze	The learner should relate K-NN algorithm to any one of category of ML.	CO10
6	Remarks on Lazy and Eager Learning.	Understand	The learner should understand the drawbacks of lazy and eager learning methods.	CO1
7	Explain properties of case-based reasoning system.	Understand	The learner to relate properties to case-based reasoning system.	CO12
8	What is radial basis function.	Remember	—-	CO12

9	Write reinforcement learning problem characteristics.	Understand	The learner to recall the usage reinforcement learning for different problems.	CO11
10	Define radial basis function network.	Remember	—-	CO10
11	What are lazy learning methods?	Remember	—-	CO10
12	What is temporal difference learning?	Remember	—-	CO1
13	Explain Convergence in Q learning.	Understand	The learner to use convergence theorem in Q learning.	CO11
14	Define the following terms with respect to K - Nearest Neighbor Learning: 1. Regression 2. Residual 3. Kernel Function	Remember	—-	CO10
15	What is Q function?	Remember	—-	CO11
16	Explain 3 key properties of instance based methods	Understand	The learner should understand the properties of instance based methods.	CO10
17	What is Bellman's equation and why we use it.	Remember	—-	CO11
18	Describe the elements used in reinforcement learning?	Understand	The learner to identify the elements used in reinforcement learning.	CO11
19	Explain about offline systems and online systems.	Understand	The learner should analyze the characteristics related to offline and online systems.	CO12
20	Show how partially observed data used in reinforcement learning?	Understand	The learner to know how to use reinforcement learning on partially observed data.	CO11

Course Coordinator: **HOD CSE**
Dr. C Shantaiah, Associate Professor