SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

V SEMESTER

CS3563 - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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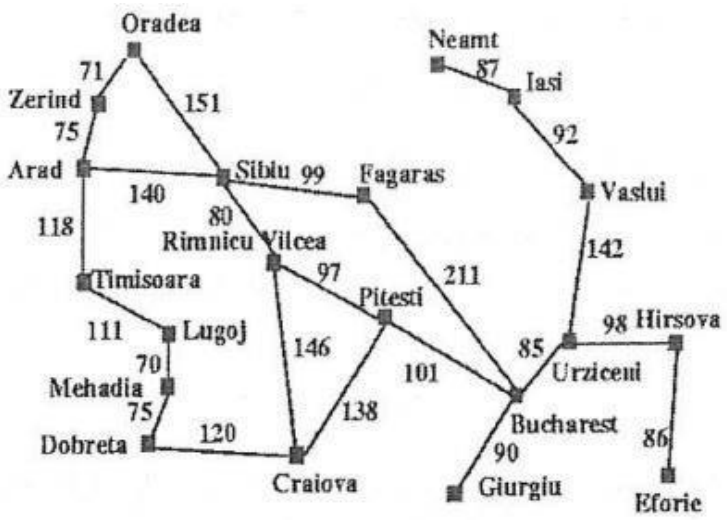
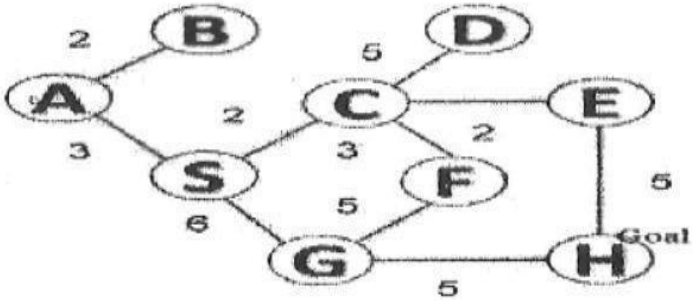
UNIT I - PROBLEM SOLVING			
Introduction to AI - AI Applications - Problem solving agents - Problem spaces and searches -Blind search strategies; Breadth first - Depth first -Heuristic search techniques Hill climbing - Best first -A* algorithm AO* algorithm - game trees - Minimax algorithm - Game playing - Alpha beta pruning.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define artificial intelligence and write its applications.	BTL 1	Remembering
2.	Differentiate uniformed and informed search.	BTL 2	Understanding
3.	What is meant by Turing test?	BTL 1	Remembering
4.	List four approaches that are followed in AI.	BTL 1	Remembering
5.	Give the structure of agent in an environment.	BTL 1	Remembering
6.	List the different types of agents.	BTL 1	Remembering
7.	Differentiate Simple hill climbing and Simulated annealing.	BTL 2	Understanding
8.	Mention the area where AI can be used.	BTL 1	Remembering
9.	Summarize the major components of AI.	BTL 2	Understanding
10.	List the qualities of an artificially intelligent agent.	BTL 1	Remembering
11.	What are the capabilities, computer should possess to pass Turing test?	BTL 2	Understanding
12.	Give the two basic types of search strategies.	BTL 2	Understanding
13.	What are the factors that a rational agent should depend on at any given time?	BTL 1	Remembering
14.	How will you evaluate A* search?	BTL 2	Understanding
15.	Why heuristic search techniques are considered to be powerful than the traditional search techniques?	BTL 2	Understanding
16.	What are the need for heuristic function?	BTL 1	Remembering
17.	Give reason when hill climbing often gets stuck.	BTL 2	Understanding
18.	What are the PEAS Characteristics for automated Bill Paying system?	BTL 1	Remembering
19.	How would you demonstrate that alpha–beta pruning outperforms the minimax search algorithm?	BTL 2	Understanding
20.	What inference can you draw about how minimax can be extended to a game of chance?	BTL 1	Remembering
21.	Differentiate A* and AO* algorithm with example.	BTL 2	Understanding
22.	How will you apply Blind search strategies? Summarize any two.	BTL 2	Understanding
23.	Give in brief about problem space and search strategies.	BTL 2	Understanding
24.	What are the partial game tree for the game of tic-tac-toe?	BTL 1	Remembering

PART - B				
1.	Explain in details about the four approaches that are followed in AI.	(16)	BTL 4	Analyzing
2.	Summarize the various characteristics of AI that contributed the ideas, viewpoints and techniques to different applications.	(16)	BTL 4	Analyzing

3.	Consider the following 8-Puzzle problem where we have a start state and a goal state. Our task is to slide the tiles of the current / start state and place it in order followed in the goal state. There can be four moves either left, right, up or down. There can be several ways to convert the current / start state to the goal state, solve the following puzzle. Explain procedure. Initial State 1 2 3 8 4 7 6 5 Goal State 2 8 1 4 3 7 6 5	(16)	BTL 3	Applying
4.	(i) What is an Intelligent agent? Explain the terms percept, percept sequence, agent function, and agent program using the vacuum cleaner example.	(8)	BTL 5	Evaluating
	(ii) List out the various applications of Artificial Intelligence and explain their use in various domains.	(8)		
5.	(i) Explain in detail about Turing Test Approach and Cognitive Modeling Approach.	(8)	BTL 4	Analyzing
	(ii) Infer the effect of “Laws of thought” approach and “Rational agent” approach.	(8)		
6.	Explain in detail about the structure of different intelligent agents.	(16)	BTL 5	Evaluating
7.	Discuss A* and AO* algorithm and the various observations about algorithm briefly?	(16)	BTL 5	Evaluating
8.	Outline A* Algorithm. Trace the algorithm to find the shortest route from Lugoj to Bucharest using the straight-line distance heuristic. Show the sequence of nodes traversed by the algorithm. The straight lines distance is given below	(16)	BTL 3	Applying



Town	Air Dist.	Town	Air Dist.
Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Dobreta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
Lasi	226	Vaslui	199
Lugoj	244	Zerind	374

9.	(i) Demonstrate the AO* algorithm with a suitable example.	(10)	BTL 4	Analyzing
	(ii) State the limitations in the algorithm.	(6)		
10.	Perform BFS, DFS, and Depth Limit Search and Uniform Cost Search strategies on the following graph and explain them. 	(16)	BTL6	Creating
11.	Develop an algorithm to implement alpha–beta pruning with an example.	(16)	BTL 3	Applying
12.	(i) Analyze the Best First Search algorithm with suitable example.	(8)	BTL 4	Analyzing
	(ii) Point out the importance of Hill climbing algorithm with an example.	(8)		

13.	Consider the given problem. Formulate the operator involved in it. Consider the water jug problem: You are given two jugs, a 4-gallon one and 3-gallon one. Neither has any measuring marker on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water from the 4-gallon jug? Explicit Assumptions: A jug can be filled from the pump, water can be poured out of a jug on to the ground, water can be poured from one jug to another and that there are no other measuring devices available.	(16)	BTL 5	Evaluating
14.	Describe the PEAS representation for an automated taxi driver, an ATM system, and a medical diagnosis system. Explain each component in the context of the agents.	(16)	BTL 4	Analyzing
15.	Assess in detail the various Heuristic Search strategies available with necessary examples.	(16)	BTL 5	Evaluating
16.	Apply the steps involved in search through problem space for 8 Queens problem and explain in detail.	(16)	BTL 3	Applying
17.	Discuss the min-max algorithm in game playing theory with tic-tac-toe example.	(16)	BTL 4	Analyzing

UNIT II - KNOWLEDGE REPRESENTATION AND REASONING

Introduction to Knowledge representation -Techniques- Prepositional logic, First order logic- uncertain knowledge review of probability - Baye's Probabilistic inferences -Symbolic reasoning under uncertainty- Statistical reasoning - Fuzzy reasoning - Temporal reasoning- Non monotonic reasoning.

PART - A

Q.No	Questions	BT Level	Competence
1.	What is knowledge representation in AI? List two challenges in Knowledge representation?	BTL 1	Remembering
2.	What is probabilistic reasoning?	BTL 1	Remembering
3.	What is propositional logic? Determine the drawbacks of using Propositional logic to represent the knowledge base.	BTL 1	Remembering
4.	Define Probability and Conditional probability.	BTL 2	Understanding
5.	Differentiate procedural knowledge and declarative knowledge.	BTL 2	Understanding
6.	Name the issues involved in knowledge representation.	BTL 1	Remembering
7.	What is Bayes' Theorem? Write its formula?	BTL 1	Remembering
8.	Distinguish between propositional versus first order predicate logic.	BTL 2	Understanding
9.	How will you represent a coin toss using probability to model Uncertainty?	BTL 2	Understanding
10.	Define the role of probability in handling uncertain knowledge?	BTL 1	Remembering
11.	Convert the Sentence "All Children likes sweets" in to FOL.	BTL 2	Understanding
12.	What is statistical reasoning in AI?	BTL 1	Remembering
13.	List the types of knowledge.	BTL 1	Remembering

14.	Infer about Non monotonic reasoning with example. Provide an example of non-monotonic reasoning in a real-world scenario, like changing Beliefs about weather forecasts?	BTL 2	Understanding
15.	Infer about uncertainty, what is uncertain knowledge in the context of AI?	BTL 2	Understanding
16.	What is the role of probability in handling uncertain knowledge?	BTL 1	Remembering
17.	Define symbolic reasoning in AI.	BTL 1	Remembering
18.	List the steps to convert first order logic sentence to normal form?	BTL 1	Remembering
19.	What is temporal reasoning in AI? Explain the use of temporal reasoning in scheduling and planning?	BTL 1	Remembering
20.	Compare propositional logic with FOL.	BTL 2	Understanding
21.	Express the issues that arise while using knowledge representation in Artificial Intelligence.	BTL 2	Understanding
22.	What is fuzzy reasoning? Explain how fuzzy reasoning differs from Traditional Boolean logic?	BTL 1	Remembering
23.	What is the logic used in reasoning with uncertain information?	BTL 1	Remembering
24.	How fuzzy reasoning differs from traditional Boolean logic?	BTL 2	Understanding

PART – B				
1.	Show the various problems that are represented in the knowledge.	(16)	BTL 3	Applying
2.	With the help of examples, summarize the various rules used in Knowledge representation.	(16)	BTL 5	Evaluating
3.	(i) Define Temporal reasoning? Explain how temporal reasoning helps in scheduling and planning tasks	(8)	BTL 5	Evaluating
	(ii) What is Non monotonic reasoning? Explain with example.	(8)		
4.	Write down the predicate logic for the following Sentences. Marcus was a man; Marcus was a Pompeian; All Pompeian's were roman; Caser was a ruler.	(16)	BTL 3	Applying
5.	(i)Examine Symbolic reasoning under uncertainty,	(8)	BTL 5	Evaluating
	(ii) Explain Statistical reasoning with example.	(8)		
6.	What is meant by First Order Logic? Explain the syntax and semantics of first order logic with suitable examples.	(16)	BTL 4	Analyzing
7.	Explain Conjunctive Normal Form for First order Logic for the following problem and Prove West is criminal using First order logic. "The law says that it is a crime for an American to sell weapons to hostile nations. The country Nono**,** an enemy has some missiles, and all of its missiles were sold to it by Colonel West, who is American".	(16)	BTL 4	Analyzing
8.	Illustrate Bayesian network. How can you use Bayesian inference and explain the components of Bayes' Theorem with examples?	(16)	BTL 3	Applying
9.	Consider the following sentences: John likes all kinds of food; Apples are food; Chicken is food; Anything anyone eats and isn't killed by is food; Bill eats peanuts and still is alive; Sue eats everything Bill eats.		BTL 5	Evaluating
	(i) Translate these sentences into formulas in predicate logic.	(8)		

	(ii) Convert the formulas of part an into clause form.	(8)		
10.	Brief about (i) Propositional Logic	(8)	BTL 5	Evaluating
	(ii) Predicate Logic	(8)		
11.	What is symbolic reasoning? Explain its role in handling uncertainty in AI? Discuss the advantages of symbolic reasoning over statistical methods in certain AI applications?	(16)	BTL 4	Analyzing
12.	Formulate the following sentences to predicate logic ● All birds fly ● Every man respects his parent. ● Some boys play cricket. ● Not all students like both Mathematics and Science. Only one student failed in Mathematics**.**	(16)	BTL6	Creating
13.	Marie's marriage is tomorrow. In recent years, each year it has rained only 5 days. The weatherman has predicted rain for tomorrow. When it actually rains, the weatherman correctly forecasts rain 90% of the time. When it doesn't rain, the weatherman incorrectly forecasts rain 10% of the time. The question: Analyze the probability that it will rain on the day of Marie's wedding using Baye's theorem.	(16)	BTL 4	Analyzing
14.	Analyze the different reasoning system as to how reasoning is done under uncertain conditions?	(16)	BTL 4	Analyzing
15.	Demonstrate in detail about reasoning with Fuzzy sets quoting some examples?	(16)	BTL 3	Applying
16.	Summarize the various issues faced while representing Knowledge in Artificial Intelligence.	(16)	BTL 5	Evaluating
17.	What is fuzzy reasoning? Explain its significance in AI. Describe how fuzzy reasoning handles imprecise or vague data compared to classical logic?	(16)	BTL 4	Analyzing

UNIT 3 SUPERVISED LEARNING

Introduction to machine learning - Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function - Probabilistic discriminative model - Logistic regression, Probabilistic generative model -Naive Bayes, Maximum margin classifier - Support vector machine, Decision Tree, Random forests.

PART A

Q.No	Questions	BT Level	Competence
1.	What is Machine Learning?	BTL 2	Understanding
2.	How can over fitting be avoided?	BTL 2	Understanding

3.	Outline the difference between supervised learning and unsupervised learning.	BTL 1	Remembering
4.	What is a random forest?	BTL 1	Remembering
5.	Mention the difference between Data Mining and Machine learning?	BTL 2	Understanding
6.	Brief what is 'Overfitting' in Machine learning?	BTL 2	Understanding
7.	What are the five popular algorithms of Machine Learning?	BTL 1	Remembering
8.	Give the different Algorithm techniques in Machine Learning.	BTL 2	Understanding
9.	What are the three stages to build the hypotheses or model in machine learning?	BTL 1	Remembering
10.	State the standard approach to supervised learning.	BTL 1	Remembering
11.	What is 'Training set' and 'Test set'?	BTL 2	Understanding
12.	Give the difference between artificial learning and machine learning?	BTL 2	Understanding
13.	Give the advantages of Naive Bayes.	BTL 2	Understanding

14.	What is a Linear Regression?	BTL 2	Understanding
15.	State the objective of the Least Squares method in linear regression?	BTL 1	Remembering
16.	Give the disadvantages of the linear regression model.	BTL 2	Understanding
17.	State the difference between classification and regression.	BTL 2	Understanding
18.	Show what is the key idea behind logistic regression in classification tasks?	BTL 3	Applying
19.	Give the difference between stochastic gradient descent (SGD) and gradient descent (GD)?	BTL 2	Understanding
20.	What are the different types of least squares?	BTL 2	Understanding
21.	List the difference between least squares regression and multiple regression?	BTL 1	Remembering
22.	What are types of classification models?	BTL 1	Remembering
23.	State the main assumption behind Naive Bayes classification.	BTL 1	Remembering
24.	Define the concept of margin in a Support Vector Machine.	BTL 1	Remembering
PART B			
1.	Illustrate with a suitable example and explain knowledge extraction in detail. (16)	BTL 3	Applying
2.	Explain the principal of the gradient descent algorithm. Accompany (16)	BTL 4	Analyzing

	your explanation with a diagram			
3.	Elaborate on logistics regression with an example. Explain the process of computing coefficients.	(16)	BTL 4	Analyzing
4.	What is a classification tree? Illustrate the steps to construct a classification tree. List and explain about the different procedures used.	(16)	BTL 3	Applying
5.	Explain Naive Bayes Classifier with an Example.	(16)	BTL 4	Analyzing
6.	Discuss the working of the Naive Bayes classifier with an example	(16)	BTL 4	Analyzing
7.	Describe the concept of gradient descent with suitable example.	(16)	BTL 4	Analyzing
8.	(i) Explain the principle of the gradient descent algorithm. Accompany your explanation with a diagram. (ii) Explain the use of all the terms and constants that you introduce and comment on the range of values that they can take.	(8) (8)	BTL 4	Analyzing
9.	Explain the following (i) Linear regression (ii) Logistic Regression	(8) (8)	BTL 4	Analyzing
10.	Compare and contrast discriminative and generative models with examples.	(16)	BTL 5	Evaluating
11.	Illustrate Logistic Regression as a Probabilistic Discriminative Model and explain in detail	(16)	BTL 3	Applying
12.	Explain how Decision Trees make predictions.	(16)	BTL 4	Analyzing
13.	Describe the general procedure of random forest algorithm	(16)	BTL 5	Evaluating
14.	Explain Decision Tree Classification with an example.	(16)	BTL 4	Analyzing
15.	Explain SVM Algorithm in Detail with an example.	(16)	BTL 5	Evaluating
16.	Show when and why you would use random forests vs SVM?	(16)	BTL 3	Applying
17.	Explain Support Vector Machine (SVM) as a maximum margin classifier.	(16)	BTL 4	Analyzing

UNIT 4 ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.			
PART A			
Q.No	**Questions**	**BTL LEVEL**	**Competence**
1.	State what is bagging and boosting in ensemble learning?	BTL 2	Understanding
2.	Write the three types of ensemble learning.	BTL 1	Remembering
3.	How Expectation maximization is used in Gaussian mixture models?	BTL 2	Understanding
4.	Define ensemble learning.	BTL 1	Remembering
5.	State the significance of Gaussian mixture model?	BTL 2	Understanding
6.	What is stacking in ensemble learning?	BTL 2	Understanding
7.	Give the main goal of ensemble learning.	BTL 2	Understanding
8.	Differentiate between bagging and boosting.	BTL 2	Understanding
9.	What is a Gaussian Mixture Model (GMM)?	BTL 2	Understanding
10.	What is voting in model combination schemes?	BTL 2	Understanding
11.	What is a voting classifier?	BTL 1	Remembering
12.	State what type of classifiers are used in weighted voting method?	BTL 2	Understanding
13.	Give the basic idea behind the K-Nearest Neighbors (KNN) algorithm?	BTL 2	Understanding
14.	What is difference between K means and Gaussian mixture?	BTL 1	Remembering
15.	What is k-means unsupervised learning?	BTL 1	Remembering
16.	Give the difference between K-means and KNN?	BTL 2	Understanding
17.	Give the examples of unsupervised learning?	BTL 2	Understanding
18.	What is the principle of maximum likelihood?	BTL 1	Remembering
19.	How do you implement expectation maximization algorithm?	BTL 2	Understanding
20.	What is expectation maximization algorithm used for?	BTL 1	Remembering
21.	Why is the smoothing parameter h need to be optimal?	BTL 2	Understanding
22.	What is the role of centroids in the K-means algorithm?	BTL 1	Remembering

23.	State one major limitation of K-means clustering.		BTL 2	Understanding
24.	What is the purpose of the Expectation-Maximization (EM) algorithm in GMM?		BTL 1	Remembering
	PART B			
1.	Explain various learning techniques involved in unsupervised learning.	(16)	BTL 4	Analyzing
2.	Analyze the applications of clustering and identify advantages and disadvantages of clustering algorithms.	(16)	BTL 3	Applying
3.	(i) What is bagging and boosting? Give Example. (ii) Outline the steps in the Ada Boost algorithm with an example.	(8) (8)	BTL 3	Applying

4.	Illustrate in detail the different ensemble learning techniques.	(16)	BTL 3	Applying
5.	Explain in detail about combining multiple classifiers by voting	(16)	BTL 4	Analyzing
6.	Assume an image has pixel size 240 x 180.Elaborate how K means clustering can be used to achieve lossy data compression of that image.	(16)	BTL 4	Analyzing
7.	Explain about EM algorithm.	(16)	BTL 4	Analyzing
8.	List non-parametric techniques and Explain K-nearest neighbor estimation.	(16)	BTL 5	Evaluating
9.	List the applications of clustering and identify advantages and disadvantages of clustering algorithm.	(16)	BTL 5	Evaluating
10.	(i) Explain the concepts of clustering approaches. (ii) How it differ from classification	(10) (6)	BTL 4	Analyzing
11.	What is Gaussian process? And explain in detail of Gaussian parameter estimates with suitable examples.	(16)	BTL 5	Evaluating
12.	Explain briefly about unsupervised learning structure?	(16)	BTL 4	Analyzing
13.	Explain details about KNN algorithm?	(16)	BTL 4	Analyzing
14.	Explain in detail about k-means algorithm?	(16)	BTL 4	Analyzing
15.	Explain the various ensemble learning techniques?	(16)	BTL 4	Analyzing
16.	Explain in detail about Gaussian mixture models and expectation maximization?	(16)	BTL 4	Analyzing
17.	Elaborate on the steps in expectation-maximization algorithm.	(16)	BTL 5	Evaluating

UNIT 5 NEURAL NETWORKS			
Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization - stochastic gradient descent, error backpropagation, from shallow networks to deep networks -Unit saturation (aka the vanishing gradient problem) - ReLU, hyper parameter tuning, batch normalization, regularization, dropout.			
PART A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	What is perceptron and its types?	BTL 2	Understanding
2.	What is stochastic gradient descent and why is it used in the training of neural networks?	BTL 2	Understanding
3.	Why is ReLU better than softmax? Give the equation for both	BTL 2	Understanding
4.	Draw the architecture of multilayer perceptron	BTL 2	Understanding
5.	Name any two activation functions	BTL 1	Remembering
6.	Which activation function is used in multilayer perceptron?	BTL 1	Remembering
7.	What are the activation functions of MLP?	BTL 2	Understanding
8.	Does MLP have activation function?	BTL 1	Remembering
9.	Give the difference between a perceptron and a MLP?	BTL 2	Understanding
10.	What are the types of activation function?	BTL 2	Understanding
11.	Brief MLP and how does it work?	BTL 2	Understanding
12.	Why do you require Multilayer Perceptron?	BTL 2	Understanding
13.	Give the advantages of Multilayer Perceptron?	BTL 2	Understanding
14.	What do you mean by activation function?	BTL 2	Understanding
15.	How many layers are there in perceptron?	BTL 1	Remembering
16.	What is the role of an activation function in a neural network?	BTL 1	Remembering
17.	State the main idea behind the backpropagation algorithm?	BTL 2	Understanding
18.	State one key limitation of the Perceptron model.	BTL 2	Understanding
19.	What the vanishing gradient problem?	BTL 2	Understanding
20.	How do you solve the vanishing gradient problem within a deep neural network?	BTL 1	Remembering

21.	How is stochastic gradient descent used as an optimization technique?	BTL 1	Remembering
22.	What are the three main types of gradient descent algorithm?	BTL 1	Remembering
23.	What are the disadvantages of stochastic gradient descent?	BTL 1	Remembering
24.	What is the problem with ReLU?	BTL 1	Remembering

PART B				
1.	Draw the architecture of a single layer perceptron (SLP) and explain its operation. Mention its advantages and disadvantages.	(16)	BTL 5	Evaluating
2.	How do you tune hyper parameters for better neural network performance? Explain in detail.	(16)	BTL 3	Applying
3.	(i) Explain the steps in the back propagation learning algorithm. (ii) What is the importance of it in designing neural networks?	(10) (6)	BTL 4	Analyzing
4.	Explain a deep feed forward network with a neat sketch.	(16)	BTL 4	Analyzing
5.	Explain in detail about gradient descent optimization?	(16)	BTL 4	Analyzing
6.	Explain detail about activation functions?	(16)	BTL 4	Analyzing
7.	Explain in detail the back propagation algorithm in neural network	(16)	BTL 5	Evaluating
8.	Explain about ReLu, Hyper parameter tuning, Normalization, Regularization, Dropout?	(16)	BTL 4	Analyzing
9.	Explain in detail about Perceptron and its types?	(16)	BTL 4	Analyzing
10.	Difference between a Shallow Net & Deep Learning Net.	(16)	BTL 2	Understanding
11.	How do you tune hyper parameters for better neural network performance? Explain in detail.	(16)	BTL 3	Applying
12.	Illustrate the factors that affect the performance of multilayer feed-forward neural network.	(16)	BTL 3	Applying
13.	Develop a Back propagation algorithm for Multilayer Feed forward neural network consisting of one input layer, one hidden layer and output layer from first principles.	(16)	BTL 5	Evaluating
14.	Illustrate with flowchart the error back-propagation training algorithm.	(16)	BTL 3	Applying
15.	Describe back propagation and features of back propagation.	(16)	BTL 5	Evaluating
16.	Explain the stochastic optimization methods for weight determination.	(16)	BTL 4	Analyzing

17.	(i) Draw the architecture of a Multilayer perceptron (MLP) and explain its operation. (ii) Mention its advantages and disadvantages.	(12) (4)	BTL 3	Applying