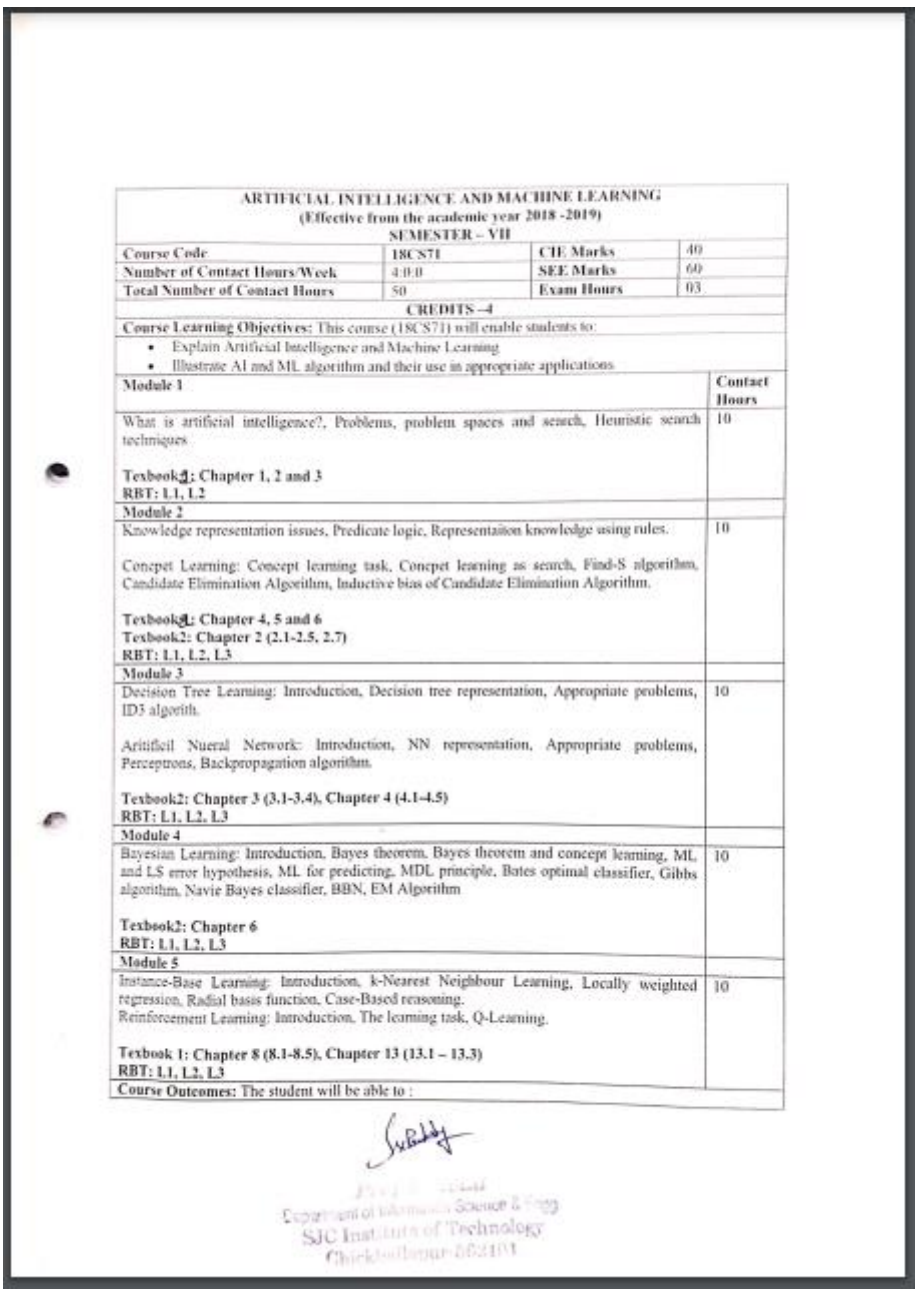
8. COURSE FILE- SAMPLE

Contents in course file

1. Course details
2. Course plan
3. Course execution
4. Attainment calculation
5. Action proposed

VTU Syllabus for subject Artificial Intelligence and Machine Learning (18CS71)



ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(Effective from the academic year 2018 -2019)
SEMESTER – VII

Course Code	**18CS71**	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03

CREDITS –4

Course Learning Objectives: This course (18CS71) will enable students to:

- Explain Artificial Intelligence and Machine Learning
- Illustrate AI and ML algorithm and their use in appropriate applications

Module 1	**Contact Hours**
What is artificial intelligence?, Problems, problem spaces and search, Heuristic search techniques **Texbook1: Chapter 1, 2 and 3** **RBT: L1, L2**	10
Module 2	
Knowledge representation issues, Predicate logic, Representation knowledge using rules. Concpet Learning: Concept learning task, Concpet learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm. **Texbook1: Chapter 4, 5 and 6** **Texbook2: Chapter 2 (2.1-2.5, 2.7)** **RBT: L1, L2, L3**	10
Module 3	
Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3 algorith. Artificil Nueral Network: Introduction, NN representation, Appropriate problems, Perceptrons, Backpropagation algorithm. **Texbook2: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.5)** **RBT: L1, L2, L3**	10
Module 4	
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Navie Bayes classifier, BBN, EM Algorithm **Texbook2: Chapter 6** **RBT: L1, L2, L3**	10
Module 5	
Instance-Base Learning: Introduction, k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function, Case-Based reasoning. Reinforcement Learning: Introduction, The learning task, Q-Learning. **Texbook 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3)** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

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• Appraise the theory of Artificial intelligence and Machine Learning. • Illustrate the working of AI and ML Algorithms. • Demonstrate the applications of AI and ML.
Question Paper Pattern:
• The question paper will have ten questions. • Each full Question consisting of 20 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.
Textbooks:
1. Tom M Mitchell,**"Machine Lerning"**,1st Edition, McGraw Hill Education, 2017. 2. Elaine Rich, Kevin K and S B Nair, **"Artificial Inteligence"**, 3rd Edition, McGraw Hill Education, 2017.
Reference Books:
1. Saroj Kaushik, Artificial Intelligence, Cengage learning 2. Stuart Rusell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition 3. AurÉlienGÉron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017. 4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics. 5. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press 6. Srinivasa K G and Shreedhar, " Artificial Intelligence and Machine Learning", Cengage

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Question Bank

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QUESTION BANK

SUBJECT TITLE	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
SUBJECT TYPE	CORE		
SUBJECT CODE	18CS71		
ACADEMIC YEAR	2021-2022	BATCH	2018-2022
SCHEME	2018		
SEMESTER	VII		
FACULTY NAME and DESIGNATION	CHANDRA SHEKHAR J M-Assistant Professor		

Module -1			
Q. No.	*Questions*	*Bloom's LL*	*COs*
1	Describe how the branch and bound technique could be used to find the shortest solution to a water jug problem.	L2	CO1
2	For each of the following problem types try to describe a good Heuristic function.	L2	CO1
3	Give an example of a problem for which breadth first search would work better than Depth first search. Give an example of a problem for which Depth first search would work better than Breadth first search.	L2	CO1
4	Try to construct an algorithm for solving blocks world problems.	L2	CO1
5	Formalize the Graceful Decay of Admissibility Corollary and prove that it is true of the A* Algorithm.	L2	CO1
6	Trace the constraint satisfaction procedure solving the following cryptarithmetic problem:	L2	CO1

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	CROSS +ROADS --------- DANGER		
7	Consider trying to solve the 8-puzzle using hill climbing. Can you find a heuristic function that make this work? Make Sure that it works on the following example: Start: 1 2 3 / 8 5 6 / 4 7 _ ; Goal: 1 2 3 / 4 5 6 / 7 8 _		
8	What is AI Technique? Explain Tic-Tac-Toe Problem using AI Technique.		
9	Define the heuristic search. Discuss benefits and short comings.		
10	Discuss any four from the following heuristic search techniques. Explain the algorithm with the help of an example. a. Hil Climbing: Steepest Ascent. b. Best First Search: The A Algorithms. c. Problem Reduction: The AO Algorithms. d. Constraints Satisfaction. e. Generate and Test. f. Means – End – Analysis.		
11	Explain AO* algorithm with an example.		

Module -2			
Q. No.	*Questions*	*Bloom's LL*	*COs*
1	Discuss various approaches and issues in knowledge representation. Also discuss various Problems in representing knowledge.		
2	Write unification algorithm and explain resolution in predicate logic.		
3	Represent the following statements in predicate logic: i) Marcus tried to assassinate Caesar. ii) All Pompeian's were Roman. iii) All Romans were either loyal to Caesar or hated him. iv) Everyone is loyal to someone. v) People only try to assassinate rulers they are not loyal to.		

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4	Define Concept and Concept Learning. With example explain how the Concept Learning task determines the Hypothesis for given target concept.		
5	Discuss Concept learning as search with respect to General to specific ordering of hypothesis.		
6	Describe Find S Algorithm. What are the properties and complaints of Find S.		
7	Illustrate Find S Algorithm over EnjoySport concept. Training instances given below.		

Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

8	Define Consistent Hypothesis and Version Space. With example explain Version Space and Representation of version Space.		
9	Describe List the Eliminate Algorithm.		
10	Explain the candidate elimination algorithm.		
11	Trace Candidate-Elimination algorithm on the following data.		

a)

Origin	Manufacturer	Color	Decade	Type	Example Type
Japan	Honda	Blue	1980	Economy	Positive
Japan	Toyota	Green	1970	Sports	Negative
Japan	Toyota	Blue	1990	Economy	Positive
USA	Chrysler	Red	1980	Economy	Negative
Japan	Honda	White	1980	Economy	Positive

b)

Origin	Manufacturer	Color	Decade	Type	Example Type
Japan	Honda	Blue	1980	Economy	Positive
Japan	Toyota	Green	1970	Sports	Negative
Japan	Toyota	Blue	1990	Economy	Positive
USA	Chrysler	Red	1980	Economy	Negative
Japan	Honda	White	1980	Economy	Positive
Japan	Toyota	Green	1980	Economy	Positive
Japan	Honda	Red	1990	Economy	Negative

13	Explain the inductive biased hypothesis space, unbiased learner and the futility of Bias Free Learning. Describe the three types of learner.	L3	CO2

Module -3			
Q.	Questions	Bloom's	COs

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No.		LL	
1	Explain the following with examples: a. Decision Tree, b. Decision Tree Learning c. Decision Tree Representation.	L2	
2	What are the characteristics of the problems suited for decision tree learning.	L3	
3	Describe the ID3 algorithm for decision tree learning with example.	L3	
4	Consider the following set of training examples. a. What is the entropy of this collection of training example with respect to the target function classification? b. What is the information gain of A2 relative to these training examples?	L4	
5	Discuss Inductive Bias in Decision Tree Learning. Differentiate between two types of biases. Why prefer Short Hypotheses?	L2	
6	What are issues in decision tree learning? Explain briefly How are they overcome? a. Discuss the following issues in detail: a. Avoiding overfitting in Decision Trees b. Incorporating Continuous valued attributes c. Handling Training Examples with Missing attribute values. d. Handling Attributes with Different costs.	L2	
7	What are the types of problems in which Artificial Neural Network can be applied.	L2	
8	Derive the Backpropagation rule considering the training rule for Output Unit weights and Training Rule for Hidden Unit weights	L2	
9	Explain how to learn Multilayer Networks using Backpropagation Algorithm.	L2	
10	Briefly explain the following with respect to Backpropagation a) Convergence and Local Minima of MLP	L2	

Instance	Classification	A1	A2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

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	b) Representational Power of Feedforward Networks c) Generalization, Overfitting, and Stopping Criterion		
11	Derive the Gradient Descent Rule.	L2	CO2

Module -4			
Q. No.	Questions	Bloom's LL	COs
1	Define (i) Prior Probability (ii) Conditional Probability (iii) Posterior Probability	L2	CO2
2	Define Bayesian theorem? What is the relevance and features of Bayesian theorem? Explain the practical difficulties of Bayesian theorem.	L2	CO2
3	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.	L4	CO2
4	Define MAP hypothesis. Derive the relation for hMAP using Bayesian theorem.	L2	CO2
5	Discuss Maximum Likelihood and Least Square Error Hypothesis..	L2	CO2
6	Describe Maximum Likelihood Hypothesis for predicting probabilities.	L2	CO2
7	Explain Bayesian belief network and conditional independence with example.	L2	CO2
8	Explain the concept of EM Algorithm. Discuss what are Gaussian Mixtures.	L2	CO2
9	What are Bayesian Belief nets? Where are they used?	L2	CO2
10	Explain Naïve Bayes Classifier with an Example.	L2	CO2

Module -5			
Q.	Questions	Bloom's	COs

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SJCIT Question Bank

No.		LL	
1	Explain the two key difficulties that arise while estimating the Accuracy of Hypothesis.	L2	CO2
2	Define the following terms a. Sample error b. True error c. Random Variable d. Expected value e. Variance f. standard Deviation	L2	CO2
3	What are instance based learning? Explain key features and disadvantages of these methods.	L2	CO2
4	Explain the K – nearest neighbor algorithm for approximating a discrete – valued function with pseudo code.	L2	CO2
5	Describe K-nearest Neighbor learning Algorithm for continues (real) valued target function.	L2	CO2
6	Define the following terms with respect to K - Nearest Neighbor Learning : i) Regression ii) Residual iii) Kernel Function.	L2	CO2
7	Explain Locally Weighted Linear Regression.	L2	CO2
8	Explain CADET System using Case based reasoning.	L2	CO2
9	What is Reinforcement Learning and explain Reinforcement learning problem with neat diagram.	L2	CO2
10	Explain the Q function and Q Learning Algorithm assuming deterministic rewards and actions with example.	L2	CO2

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Assignment

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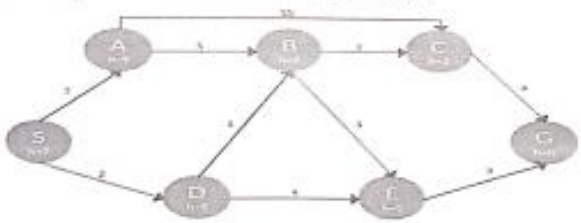
ASSIGNMENT

SUBJECT TITLE	~~Data Mining and Data Warehousing~~ ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
SUBJECT TYPE	~~ELECTIVE~~ CORE		
SUBJECT CODE	~~18CS643~~ 18CS71		
ACADEMIC YEAR	~~2020-21~~	BATCH	~~2018-2022~~
SCHEME	2018 Scheme		
SEMESTER	VII		
FACULTY NAME and DESIGNATION	Chandra Shekhar J M Assistant Professor		

Module -1

Q. No.	*Questions*	*Bloom's LL*	*COs*
1	Certification Course Related to Subject	L3	CO1-CO5
2	Find the path to reach from S to G using A* search. 	L3	CO1
3	Find the path from S to G using greedy search. The heuristic values h of each node below the name of the node.	L3	CO1

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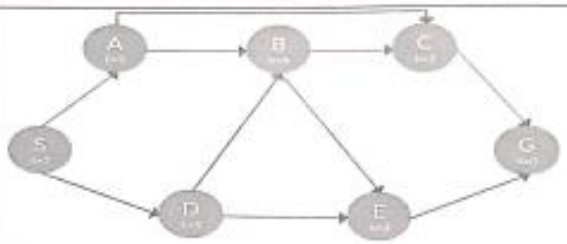
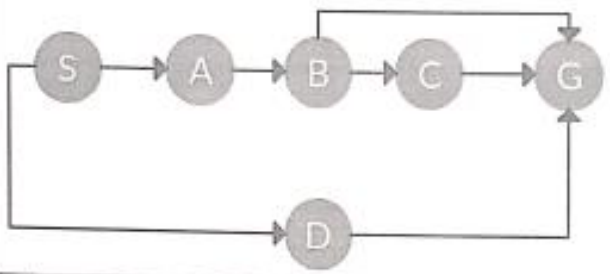
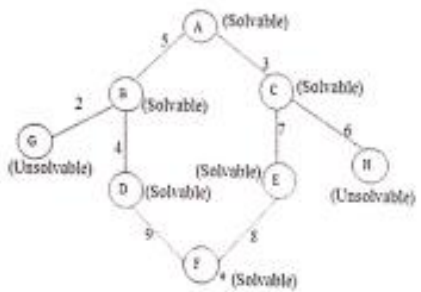
			
4	Which solution would DFS find to move from node S to node G if run on the graph below? 	L4&L5	CO1
5	Implement the AO* Algorithm for the given problem.  Figure	L4&L5	CO1

Module -2			
Q. No.	Questions	Blooms LL	COs
1	Certification Course Related to Subject	L3	CO1-CO5
2	Illustrate Find S Algorithm over Enjoy-Sport concept. Training instances given below.	L3	CO2

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Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

3	Consider the "Japanese Economy Car" concept and instance given below, identify the hypothesis using candidate elimination algorithm.	L3	CO2

Origin	Manufacturer	Color	Decade	Type	Target Value
Japan	Honda	Blue	1980	Economy	Positive
Japan	Toyota	Green	1970	Sports	Negative
Japan	Toyota	Blue	1990	Economy	Positive
USA	Chryler	Red	1980	Economy	Negative
Japan	Honda	White	1980	Economy	Positive

4	Consider the concept and instance given below, identify the hypothesis using candidate elimination algorithm.	L4&L5	CO2

Size	Color	Shape	Class
Big	Red	Circle	No
Small	Red	Triangle	No
Small	Red	Circle	Yes
Big	Blue	Circle	No
Small	Blue	Circle	Yes

5	Represent the following statements in predicate logic: i) Marcus tried to assassinate Caesar. ii) All Pompeian's were Roman. iii) All Romans were either loyal to Caesar or hated him. iv) Everyone is loyal to someone. v) People only try to assassinate rulers they are not loyal to.	L4&L5	CO2

Module -3

Q. No.	Questions	Bloom's LL	COs
1	Certification Course Related to Subject	L3	CO1-CO5
2	Give Decision trees for the following set of training examples	L3	CO3

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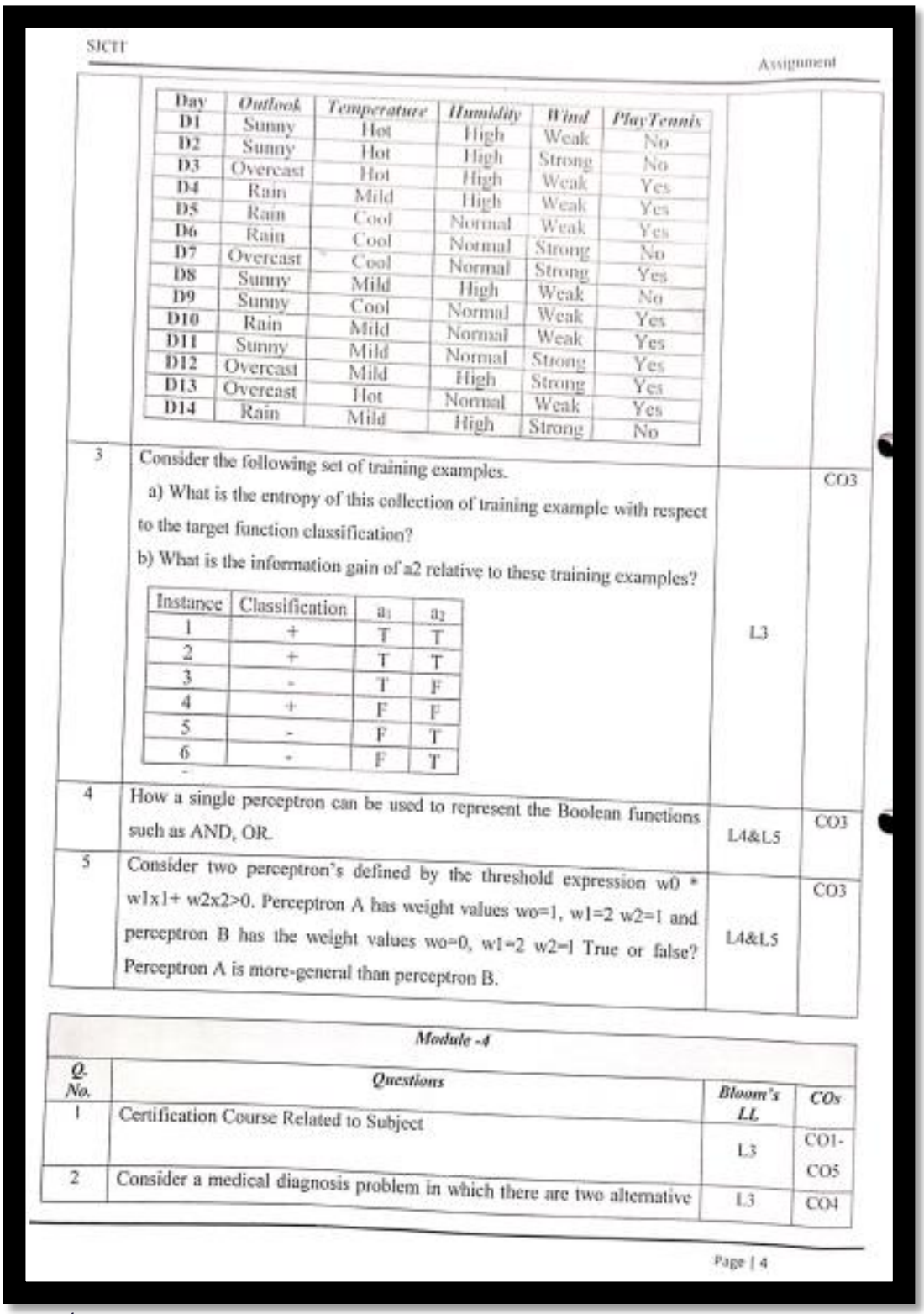

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Assignment

Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

3	Consider the following set of training examples. a) What is the entropy of this collection of training example with respect to the target function classification? b) What is the information gain of a2 relative to these training examples?	L3	CO3
4	How a single perceptron can be used to represent the Boolean functions such as AND, OR.	L4&L5	CO3
5	Consider two perceptron's defined by the threshold expression w0 * w1x1+ w2x2>0. Perceptron A has weight values wo=1, w1=2 w2=1 and perceptron B has the weight values wo=0, w1=2 w2=1 True or false? Perceptron A is more-general than perceptron B.	L4&L5	CO3

Instance	Classification	a_1	a_2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

Module -4

Q. No.	Questions	Bloom's LL	COs
1	Certification Course Related to Subject	L3	CO1-CO5
2	Consider a medical diagnosis problem in which there are two alternative	L3	CO4

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	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		
3	Apply Naive Bayes classifier for PlayTennis concept learning problem to classify the following novel instance < Outlook: sunny, Temperature: cool, Humidity: high, Wind: strong >	L3	CO3
4		L4&L5	CO3
5		L4&L5	CO3

Module -5			
Q. No.	*Questions*	*Bloom's LL*	*COs*
1	Certification Course Related to Subject	L3	CO1-CO3
2	Suppose that the data mining task is to cluster points (with (x, y) representing location) into three clusters, where the points are A1(2,10),A2(2,5),A3(8,4),B1(5,8),B2(7,5),B3(6,4),C1(1,2),C2(4,9). The distance function is Euclidean distance. Suppose initially we assign A1, B1, and C1 as the center of each cluster, respectively. Use the k-means algorithm to show only (a) The three cluster centers after the first round of execution. (b) The final three clusters.	L3	CO2
3	Both k-means and k-medoids algorithms can perform effective clustering. (a) Illustrate the strength and weakness of k-means in comparison with k-medoids. (b) Illustrate the strength and weakness of these schemes in comparison with a hierar chical clustering scheme (e.g., AGNES).	L3	CO5
4	Human eyes are fast and effective at judging the quality of clustering methods for 2-D data. Can you design a data visualization method that may help humans visualize data clusters and judge the clustering quality	L4&L5	CO5

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	for 3-D data? What about for even higher-dimensional data?		
5	Suppose that you are to allocate a number of automatic teller machines (ATMs) in a given region so as to satisfy a number of constraints. Households or workplaces may be clustered so that typically one ATM is assigned per cluster. The clustering, however, may be constrained by two factors: (1) obstacle objects (i.e., there are bridges, rivers, and highways that can affect ATM accessibility), and (2) additional user-specified constraints such as that each ATM should serve at least 10,000 households. How can a clustering algorithm such as k-means be modified for quality clustering under both constraints?	L4&L5	CO5

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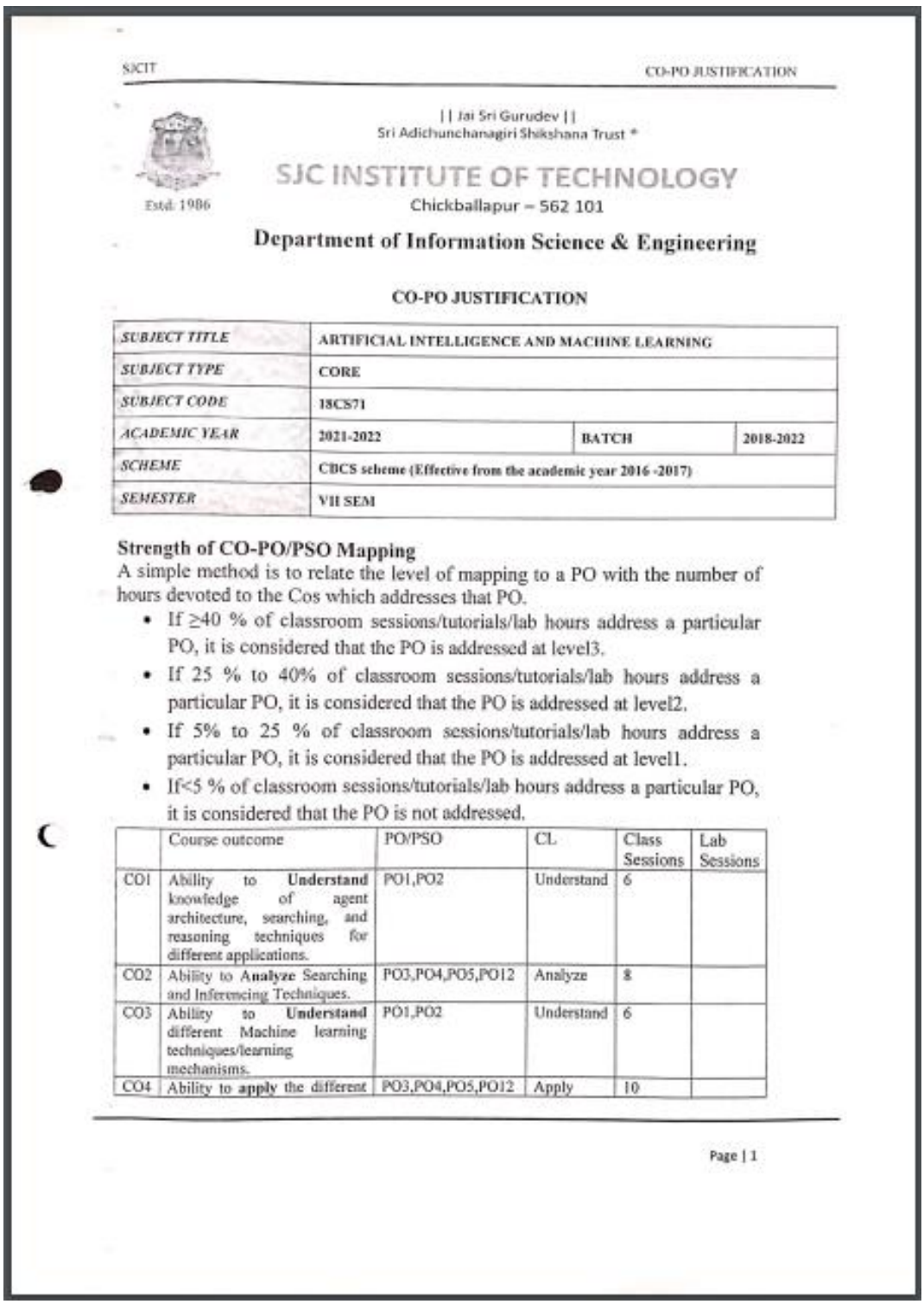
Co-PO Justification for the Course Outcomes



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CO-PO JUSTIFICATION

SUBJECT TITLE	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
SUBJECT TYPE	CORE		
SUBJECT CODE	18CS71		
ACADEMIC YEAR	2021-2022	BATCH	2018-2022
SCHEME	CBCS scheme (Effective from the academic year 2016 -2017)		
SEMESTER	VII SEM		

Strength of CO-PO/PSO Mapping

A simple method is to relate the level of mapping to a PO with the number of hours devoted to the Cos which addresses that PO.

- If ≥40 % of classroom sessions/tutorials/lab hours address a particular PO, it is considered that the PO is addressed at level3.
- If 25 % to 40% of classroom sessions/tutorials/lab hours address a particular PO, it is considered that the PO is addressed at level2.
- If 5% to 25 % of classroom sessions/tutorials/lab hours address a particular PO, it is considered that the PO is addressed at level1.
- If<5 % of classroom sessions/tutorials/lab hours address a particular PO, it is considered that the PO is not addressed.

	Course outcome	PO/PSO	CL	Class Sessions	Lab Sessions
CO1	Ability to **Understand** knowledge of agent architecture, searching, and reasoning techniques for different applications.	PO1,PO2	Understand	6	
CO2	Ability to **Analyze** Searching and Inferencing Techniques.	PO3,PO4,PO5,PO12	Analyze	8	
CO3	Ability to **Understand** different Machine learning techniques/learning mechanisms.	PO1,PO2	Understand	6	
CO4	Ability to **apply** the different	PO3,PO4,PO5,PO12	Apply	10	

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CO-PO JUSTIFICATION

	learning algorithms.				
CO5	Ability to **analyze** the learning techniques for a given dataset.	PO3,PO4,PO5,PO12	Analyze	10	
CO6	Ability to **design** a model using machine learning to solve a problem.	,PO3,PO4,PO5,PO12	Create	10	

PO/PSO ADDRESSED BY CO'S

PO/PSO	CO'S	Total Number of sessions
PO1	CO1, CO3	6+6=12
PO2	CO1, CO3	6+6=12
PO3	CO2, CO4, CO5, CO6	8+10+10+10=38
PO4	CO2, CO4, CO5, CO6	8+10+10+10=38
PO5	CO2, CO4, CO5, CO6	8+10+10+10=38
PO12	CO2, CO4, CO5, CO6	8+10+10+10=38
PSO1	CO1, CO2, CO3, CO4, CO5, CO6	6+6+8+10+10+10=50
PSO2	CO2, CO4, CO5, CO6	8+10+10+10=38

Course-PO/PSO Mapping Strength

Number of Sessions Devoted	PO/PSO	MAPPING STRENGTH
12 OF 50 (24%)	PO1	1
12 OF 50 (24%)	PO2	1
38 OF 50(76%)	PO3	3
38 OF 50(76%)	PO4	3
38 OF 50(76%)	PO5	3
38 OF 50(76%)	PO12	3
50 OF 50(100%)	PSO1	3
38 OF 50(76%)	PSO2	3

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1											3	
CO2	1	1											3	3
CO3			3	3	3							3	3	
CO4			3	3	3							3	3	3
CO5			3	3	3							3	3	3
CO6			3	3	3							3	3	3

Signature of Faculty

Signature of HOD

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Lesson Plan

SJCIT Lesson Plan

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Sri Adichunchanagiri Shikshana Trust ®

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Estd: 1986

Department of Information Science and Engineering

LESSON PLAN

SUBJECT TITLE	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
SUBJECT TYPE	CORE		
SUBJECT CODE	18CS71		
ACADEMIC YEAR	2021-2022	BATCH	2018-2022
SCHEME	CBCS scheme (Effective from the academic year 2016 -2017)		
SEMESTER & SECTION	VII SEM		
IA MARKS	40	*EXAM MARKS*	60
NUMBER OF LECTURE HOURS/WEEK	4	*TOTAL NUMBER OF LECTURE HOURS*	50
FACULTY NAME	CHANDRA SHEKHAR J M	*NO. OF TIMES HANDLED*	2
COURSE LEARNING OBJECTIVES: This course will enable students to			
1. Explain Artificial Intelligence and Machine Learning.			
2. Illustrate AI and ML algorithm and their use in appropriate applications.			

Course Outcomes: At the end of this course, students are able to:	
CO1	Ability to **apply** knowledge of agent architecture, searching and reasoning techniques for different applications.
CO2	Ability to **analyze** Searching and Inferencing Techniques.
CO3	Ability to **design** a reasoning system for a given requirement.
CO4	Ability to **apply** the different learning algorithms.
CO5	Ability to **analyze** the learning techniques for given dataset.
CO6	Ability to **design** a model using machine learning to solve a problem.

CO-PO MATRIX

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												3	
CO2		1											3	
CO3			2										3	2
CO4	3												3	
CO5		1											3	
CO6			3										3	2

Note: Justification of CO-PO mapping

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DELIVERY PLAN WITH DETAILS

MODULE – 1

Lecture #	Topic	Mode of Delivery (Pls Tick √)				Date of Delivery	COs Covered
		1	2	3	4		
1	What is artificial intelligence? AI Problems, Assumptions		√			04/10	CO1
2	What is an AI Technique? The level of the model		√			05/10	CO1
3	Criteria for success, General References	√				07/10	CO1
4	Problems, problem spaces and search: Defining the problem as a state space search	√				8/10 11/10	CO1
5	Production systems and problem characteristics		√			12/10	CO1
6	Production system characteristics, Issues in the design of Search programs		√			13/10 01/10	CO1
7	Heuristic search techniques: Generate and test	√				20/10	CO2
8	Hill climbing search, Best first search	√				21/10	CO2
9	Problem reduction and constraint Satisfaction	√				25/10	CO2
10	Mean ends analysis	√				27/10	CO2

Textbook : and chapter Textbook 1: Chapter 1, 2 and 3

Signatures	Faculty:	#HOURS	Allotted	Taken
	HoD:		10	10
Remarks	Executed as per plan.			

MODULE – 2

Lecture #	Topic	Mode of Delivery (Pls Tick √)				Date of Delivery	COs Covered
		1	2	3	4		
11	Knowledge representation issues: Representations and mappings		√			26/10, 27/10	CO3
12	Approaches to knowledge representation, Issues in knowledge representation		√			28/10 29/10	CO3
13	Representing simple facts in logic, Representing instance and ISA relationships. Computable Functions.	√	√			29/10 03/11	CO3
14	Resolution and natural deduction		√			04/11-08/11	CO3
15	Representing knowledge using rules: procedural vs declarative knowledge, Logic programming	√	√			09/11 to 11/11	CO3
16	Forward vs backward Reasoning Matching control knowledge	√	√			11/11	CO3
17	Concept learning task, Concept learning as search Find-S algorithm	√	√			25/11	CO4
18	Version space		√			15/11, 16/11	CO4

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19	Candidate Elimination algorithm	√	√			16/11	CO4
20	Inductive Bias		√			17/11	CO4

Textbook : and chapter:Textbook 1: Chapter 4, 5 and 6 Texbook2: Chapter 2 (2.1-2.5, 2.7)

Signatures	**Faculty:**	**#HOURS**	**Allotted**	**Taken**
	HoD:		10	16
Remarks	Executed as per plan			

MODULE – 3

Lecture #	Topic	Mode of Delivery (Pls Tick √)				Date of Delivery	COs Covered
		1	2	3	4		
21	Decision tree representation		√			18/11	CO4
22	Appropriate problems for decision tree learning		√			19/11	CO5
23	Basic decision tree learning algorithm(ID3 ALGORITHM)	√	√			19/11	CO5
24	Basic decision tree learning algorithm EXAMPLES	√				22/11	CO5
25	Issues in decision tree learning		√			24/11	CO4
26	Artificial Neural Networks Introduction		√			25/11	CO4
27	Neural Network representation	√	√			29/11	CO5
28	Appropriate problems Perceptron's	√	√			30/11	CO5
29	Backpropagation algorithm	√				06/12	CO6
30	Backpropagation algorithm example	√				06/12	CO5

Textbook : and chapter :Texbook2: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.5)

Signatures	**Faculty:**	**#HOURS**	**Allotted**	**Taken**
	HoD:		10	10
Remarks	Executed as per plan			

MODULE – 4

Lecture #	Topic	Mode of Delivery (Pls Tick √)				Date of Delivery	COs Covered
		1	2	3	4		
31	Bayesian Learning: Introduction Bayes theorem	√				07/12	CO5
32	Bayes theorem and concept learning	√				09/12	CO5
33	ML and LS error hypothesis ML for predicting probabilities	√	√			10/12	CO5
34	MDL principle		√			13/12	CO5
35	Bates optimal classifier with examples	√	√			14/12	CO5
36	Gibbs algorithm with examples.	√	√			15/12	CO5
37	Naive Bayes classifier	√				22/12	CO6
38	Naive Bayes classifier examples	√	√			30/12	CO6

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39	Bayesian belief networks		√			31/12	CO6
40	EM algorithm examples	√	√			02/01	CO6

Textbook: and chapter :Textbook2: Chapter 6

Signatures	**Faculty:**	**#HOURS**	**Allotted**	**Taken**
	HoD:		10	10
Remarks	Executed as per plan			

MODULE – 5

Lecture #	Topic	Mode of Delivery (Pls Tick √) 1	2	3	4	Date of Delivery	COs Covered
41	Instance Based Learning: Introduction		√			03/01	CO5
42	k-nearest neighbour learning	√	√			04/01	CO6
43	Locallyweighted regression		√			05/01	CO6
44	Radial basis function	√	√			06/01	CO5
45	cased-based reasoning		√			10/01	CO5
46	Working Examples	√	√			11/01	CO6
47	Reinforcement Learning: Introduction		√			12/01	CO5
48	Reinforcement Learning: Learning Task		√			13/01	CO5
49	Reinforcement Learning: Q Learning	√	√			18/01	CO6
50	Reinforcement Learning: Q Function	√	√			19/01	CO6

Textbook : and chapter :Textbook 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3)

Signatures	**Faculty:**	**#HOURS**	**Allotted**	**Taken**
	HoD:		10	07
Remarks	Syllabus completed as per plan			

Text Books:

1.Elaine Rich, Kevin K and S B Nair, "Artificial Intelligence", 3rdEdition, McGraw Hill Education, 2017.

2.Tom M Mitchell,"Machine Learning", 1st Edition, McGraw Hill Education, 2017.

Reference Books:

1.Saroj Kaushik, Artificial Intelligence, Cengage learning

2. Stuart Rusell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition

3. AurÉlienGÉron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017.

4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd

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edition, springer series in statistics.

5. EthemAlpaydın, Introduction to machine learning, second edition, MIT press 6. Srinivasa K G and Shreedhar, " Artificial Intelligence and Machine Learning", Cengage

(Note: Mode of Delivery 1 Black Board 2 PPT 3 Video 4 Demo/Hands on)

INTERNAL/ASSIGNMENT/QUIZ SCHEDULE

TEST and QUIZ		COs and Portions Covered		ASSIGNMENT	
Test# and Quiz#	DATE	CO	Modules	Assignment#	DATE
T1 & Q1	03/12/21	CO1, CO2	1, 2	A1	14/06/21
T2 & Q2	28/12/21	CO3, CO4	1, 2	A2	15/07/21
T3 & Q3	20/01/22	CO5, CO6	2	A3	05/08/21

SUMMARY

Signatures With Date	Faculty:	Total #HOURS	Allotted	Taken
	HoD: 29/1/22		50	55
Remarks	Executed as per plan			

ENCLOSURES

1. Syllabus
2. CO Attainment
3. Gap Analysis
4. Special lectures/talks arranged if any

Feedback by PAC

Completed syllabus as per plan

Faculty | Course coordinator | PAC | HOD

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Tutorial 1

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Estd: 1986

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Department of Information Science & Engineering

Tutorial-1

SUBJECT TITLE	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
SUBJECT TYPE	CORE		
SUBJECT CODE	18CS71		
ACADEMIC YEAR	2021-2022	BATCH	2018-2022
SCHEME	2018		
SEMESTER	VII 'A'		
FACULTY NAME and DESIGNATION	CHANDRA SHEKHAR J M-Assistant Professor		

1. Discuss any four from the following heuristic search techniques. Explain the algorithm with the help of an example.
   i. Best First Search
   ii. Simple Hill Climbing
   iii. A* algorithm
   iv. AO* algorithm
   v. Simulated Annealing
   vi. Mean End Analysis
2. What is AI Technique? Explain Tic-Tac-Toe Problem using AI Technique.
3. Solve water jug problem using production rule System.
4. Explain problem Characteristics with respect to heuristic search.
5. Define Artificial Intelligence. Classify the task domains of Artificial Intelligence.
6. Explain the components and categories of production systems. List the requirement of good control strategies.
7. Consider trying to solve the 8-puzzle using hill climbing. Can you find a heuristic function that make this work? Make Sure that it works on the following example:

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Start		
1	2	3
8	5	6
4	7	

Goal		
1	2	3
4	5	6
7	8	

8. Explain Depth first Search algorithm With an example.
9. Discuss the approaches of Knowledge Representation.
10. Explain forward and backward Reasoning with examples.
11. Discuss the issues associated with knowledge representation.
12. Define CNF. Give an algorithm to convert the predicate logic into CNF.
13. Define Resolution. Explain the stages involved in Resolution Process.
14. Consider the following statements:
    a. Ranjith likes all kinds of food.
    b. Apples are food
    c. Anything anyone eats and isn't killed by food.
    d. Pavithra eats peanuts and is still alive.
    e. Sukesh eats every thing that Pavithra eats.
        i. Translate all the statements into formulas in predicate logic.
        ii. Covert Formulas from previous step into clause form.
        iii. Prove that John likes peanuts using Resolution.
15. Consider the following statements:
    a. Liquid CO_2, H_2SO_4, DDT, Caffeine and Ethylene Glycol are hazardous for health.
    b. If X contains something that is hazardous for health then X is also hazardous.
    c. Coke contains all the items in fact-1 above.
        i. Translate all the statements into formulas in predicate logic.
        ii. Covert Formulas from previous step into clause form.
        iii. Prove that Drinking Coke is not good for health using Resolution.
16. Trace the constraint satisfaction procedure solving the following cryptarithmetic problem:

SEND	GO	CROSS
+MORE	+TO	+ROADS
MONEY	OUT	DANGER

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Test Question Paper 1

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Internal Test Question paper format- CBCS Scheme

Name of the staff's: Chandra Shekhar J M

Date:02/12/2021 Signature

Reviewer's Signature:

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Department of Information Science and Engineering
Test : 1
Semester:VII Section:B
Subject Name & Code: Artificial Intelligence & Machine Learning (18CS71)

Duration: 90 minutes Max Marks: 50

SLNo		Marks	CO	Level
1.	Define Artificial Intelligence. Classify the task domains of Artificial Intelligence.	10	CO1	L2
	OR			
2.	Explain the components and categories of production systems. List the requirement of good control strategies.	10	CO1	L2
3.	Consider trying to solve the 8-puzzle using hill climbing. Can you find a heuristic function that make this work? Make Sure that it works on the following example: Start: 1 2 3 / 8 5 6 / 4 7 _ ; Goal: 1 2 3 / 4 5 6 / 7 8 _	10	CO1	L4
	OR			
4.	Solve water jug problem using production rule System.	10	CO1	L4
5.	Explain forward and backward Reasoning with examples.	10	CO1	L4
	OR			
6.	Discuss the issues associated with knowledge representation.	10	CO1	L3
7.	Define CNF. Give an algorithm to convert the predicate logic into CNF.	10	CO2	L4
	OR			
8.	Define Resolution. Explain the stages involved in Resolution Process.	10	CO2	L4
9.	Consider the following statements: a. Ranjith likes all kinds of food. b. Apples are food c. Anything anyone eats and isn't killed by food. d. Pavithra eats peanuts and is still alive. e. Sukesh eats every thing that Pavithra eats. i. Translate all the statements into formulas in predicate logic.	10	CO3	L3

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	ii. Covert Formulas from previous step into clause form. iii. Prove that John likes peanuts using Resolution.			
	OR			
10	Consider the following statements: a. Liquid CO_2, H_2SO_4, DDT, Caffeine and Ethylene Glycol are hazardous for health. b. If X contains something that is hazardous for health then X is also hazardous. c. Coke contains all the items in fact-1 above. i. Translate all the statements into formulas in predicate logic. ii. Covert Formulas from previous step into clause form. iii. Prove that Drinking Coke is not good for health using Resolution.	10	CO3	L3

Course Outcome No.	Course Outcomes
C401.1	Ability to **apply** knowledge of agent architecture, searching and reasoning techniques for different applications.
C401.2	Ability to **analyze** Searching and Inferencing Techniques.
C401.3	Ability to **design** a reasoning system for a given requirement.
C401.4	Ability to **apply** the different learning algorithms.
C401.5	Ability to **analyze** the learning techniques for given dataset.
C401.6	Ability to **design** a model using machine learning to solve a problem.

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Scheme 0f Valuation

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DEPARTMENT : Information Science & Engineering

TEST-I Scheme & Solutions

Sem : 7th B sec **Subject Title:** Artificial Intelligence & machine learning [18CS71]

Question Number	Solution	Marks Allocated
1.	Definition of artificial intelligence mundane Tasks: Perception, Vision, Speech, Natural language understanding, Generation Formal Tasks: Games, Chess, checkers, Geometry, logic, proving Expert Tasks: - Engineering - Design - Analysis - medical analysis - Advanced Task	3m 4x2 = 8m 10m
2.	Components of production system - Set of rules - knowledge base / Database - control strategy - Rule applier. control strategy requirement - It should cause motion - It should be a systematic category of production system - monotonic - non monotonic - partially commutative - Commutative production system	5m 5m 10m

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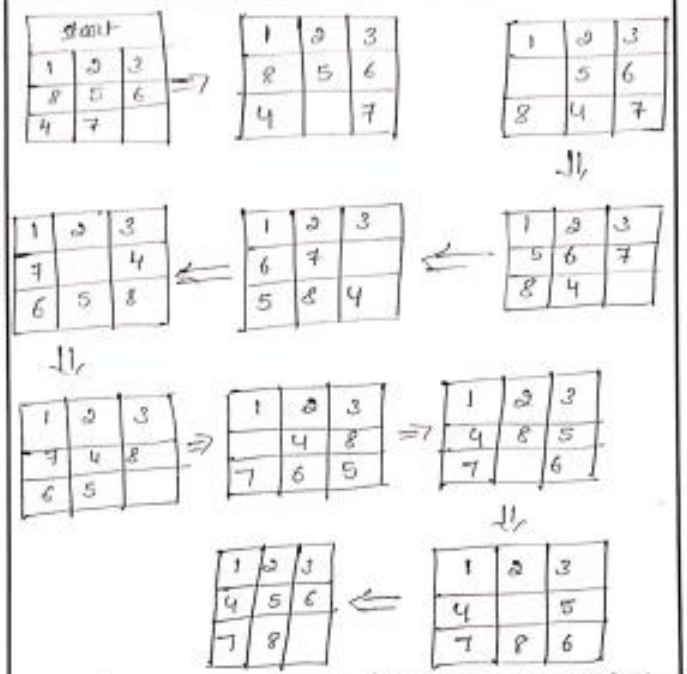
Question Number	Solution	Marks Allocated
3.	 Explanation & simple full climbing process	8m
4.	x : 0, 1, 2, 3 or 4 y : 0, 1, 2 or 3 x : number of litres of water in 4 litre jug y : number of litres of water in 3 litre jug. production Rules Sl.no — current state — next state 1. (x,4) if x<4 — (4,0) 2. (x,4) if 4<3 — (0,3) 3. (x,4) x>0 — (x,y-d)	8m 10m -9m- -6m-

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Question Number	Solution	Marks Allocated
	4. (x,y) if $y \geq 0$ (x-0, y) 5. (x,y) if $x \geq 0$ (x+y, 0) 6. (x,y) if $y \geq 0$ (0, x+y) 7. (x,y) if $x+y \geq 4$ $y \geq 0$ (x, y-(4-x)) 8. (x,y) if $x+y \geq 3$ $y \geq 0$ (x-(3-y)) 9. (x,y) if $x+y \leq 4$ $y \geq 0$ (0, y) 10. (x,y) if $x+y < 2$ $y \geq 0$ (x, 0) 11 (0,2) (2,0) 12 (2,4) (2,4)	3m 10m
5.	Solution: forward Chaining inference strategy that starts with initial state and attempts to reach up to goal state. inference Engine Rule1, Rule2, Rule3, Rule4 — Knowledge base case fact ⟷ user case fact working memory. Backward Chaining:- inference strategy that attempts to prove a hypothesis by gathering supporting information	5m

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Question Number	Solution	Marks Allocated
	Algorithm: - Eliminate all implication ($\rightarrow$) and rewrite - move negation ($\rightarrow$) inwardly and rewrite - Rename variably as standardize variables - Eliminate existential instantiation quantifier by elimination - Drop universal quantifier - Distribute conjunction $\wedge$ over disjunction	8m / 10m
8.	Resolution is a single inference rule which can efficiently operate on the conjunctive normal form or clausal form. Steps for resolution - conversion of facts into first order logic - conversion of FOL statements into CNF - negate the statement which needs to prove	2m 3x4=8m / 10m

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Question Number	Solution	Marks Allocated
9.	(proof by contradiction) - Draw resolution graph (unification) Step 1: Conversion facts into FOL $\forall x$: Food (x) $\rightarrow$ Likes (Ranjitha, x) Food (Apple) $\wedge$ Food (Vegetable) $\forall x \forall y$: Eats (x, y) $\wedge \neg$ killed (x) $\rightarrow$ Food(y) Eats (pavithra, peanuts) $\wedge$ Alive (pavithra) $\forall x$: Eats (pavithra, x) $\rightarrow$ Eats (Rakesh, x) $\forall x$: $\neg$killed (x) $\rightarrow$ Alive (x) $\forall x$: Alive (x) $\rightarrow \neg$ killed (x) Likes (Ranjitha, peanuts) Step 2: Conversion FOL into CNF $\forall x$: $\neg$Food (x) V Likes (Ranjitha, x) Food (apple) $\wedge$ Food (Vegetable) $\forall x \forall y$: $\neg$ Eats (x, y) V killed (x) V Food (y) Eats (pavithra, peanuts) $\wedge$ Alive (pavithra) $\forall x$: $\neg$ Eats (pavithra) V Eats (Sowjanya) $\forall x$: killed (x) V $\neg$ Alive (x) $\forall x$: $\neg$ Alive (x) V $\neg$ killed (x) Likes (Ranjitha, peanuts) Step 3: $\neg$ Likes (Ranjitha, peanuts)	Each step am am x 5 = 10m

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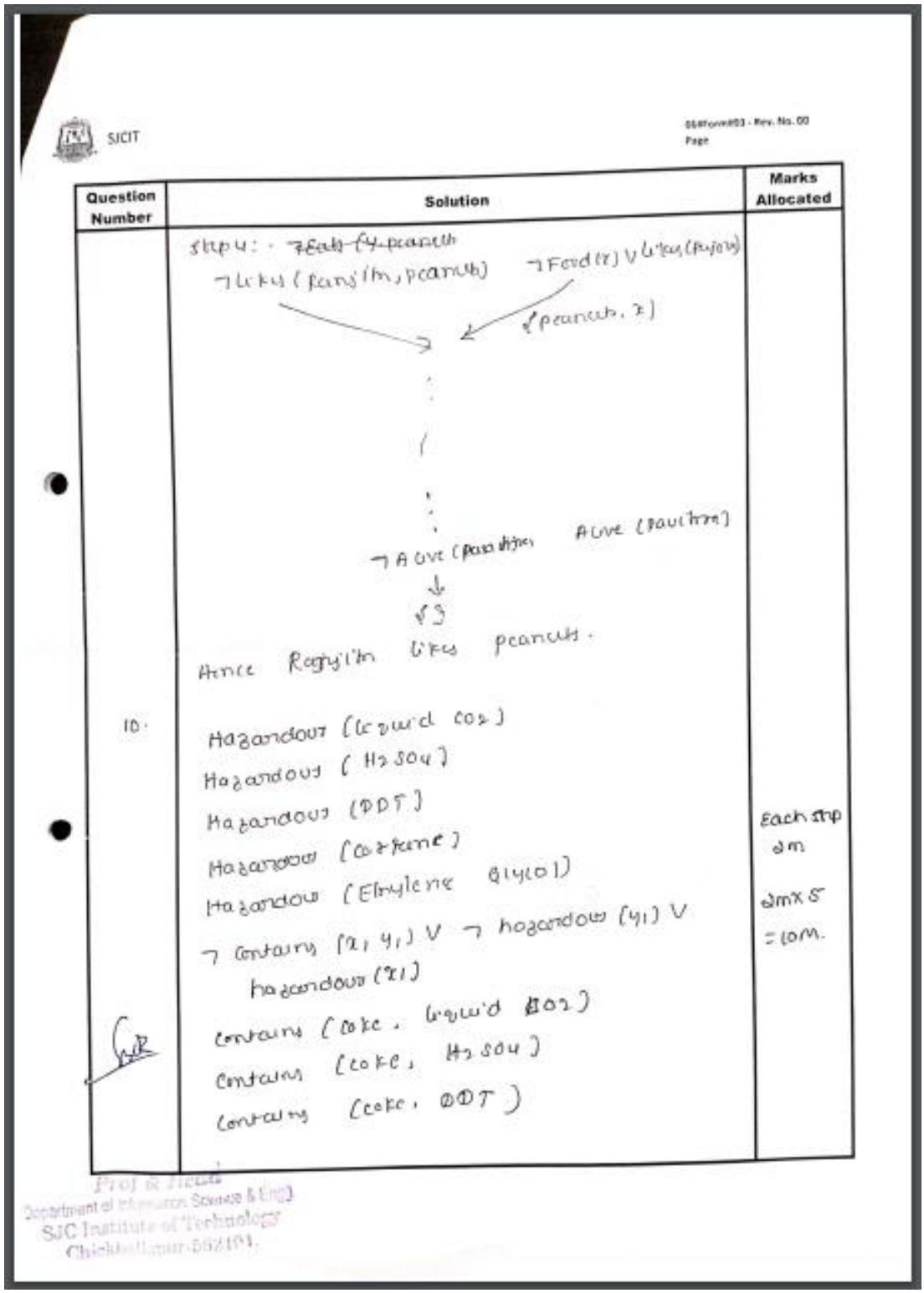

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Question Number	Solution	Marks Allocated
10.	Step 4: ~~Feed fly peanuts~~ $\neg$ Likes (Ravi, peanuts) $\neg$ Feed(x) $\vee$ Likes(Ravi, x) (peanuts, x) $\neg$ Alive (Ravi, time) Alive (Ravi, time) Hence Ravi likes peanuts. Hazardous (Liquid CO_2) Hazardous (H_2SO_4) Hazardous (DDT) Hazardous (Caffeine) Hazardous (Ethylene Glycol) $\neg$ Contains (x, y) $\vee$ $\neg$ hazardous (y) $\vee$ hazardous (x) Contains (Coke, Liquid CO_2) Contains (Coke, H_2SO_4) Contains (Coke, DDT)	Each step 2m 2m x 5 = 10m.

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Question Number	Solution	Marks Allocated
	contains (coke, caffeine) contains (coke, Ethylene glycol) ¬hazardous (x1) V ¬ good for health (x2) good for health (coke) step3:- ¬ good for heath (coke) step4:- Draw resolution graph + generate {} set Hence good for health (coke) = FALSE ¬ good for health (coke) = TRUE Therefore ¬ good for health hence drinking coke is not good for health	

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Tutorial 2

SJCIT Tutorial-2

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Tutorial-II

SUBJECT TITLE	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
SUBJECT TYPE	CORE		
SUBJECT CODE	18CS71		
ACADEMIC YEAR	2021-2022	BATCH	2018-2022
SCHEME	2018		
SEMESTER	VII 'A'		
FACULTY NAME and DESIGNATION	CHANDRA SHEKHAR J M-Assistant Professor		

1. Explain concept learning with an example.
2. Apply candidate elimination algorithm and obtain the version space considering the training example given below,

Eyes	Nose	Head	Fcolor	Hair	Smile
Round	Triangle	Round	Purple	Yes	Yes
Square	Square	Square	Green	Yes	No
Square	Triangle	Round	Yellow	Yes	Yes
Round	Triangle	Round	Green	No	No
Square	Square	Round	Yellow	Yes	Yes

3. Explain the concept of inductive bias.
4. Explain the concept of decision tree learning. Discuss necessary measures required to select the attribute for building a decision tree using ID3 algorithm.
5. Explain the following with respect to decision tree learning:
   a. Incorporating continuous valued attributes.
   b. Alternative measures for selecting attributes.
   c. Handling training examples with missing attribute values.
6. Construct the decision tree using ID3 algorithm considering the following training examples.

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Weekend	Weather	Parental availability	Wealthy	Decision class
H1	Sunny	Yes	Rich	Cinema
H2	Sunny	No	Rich	Tennis
H3	Windy	Yes	Rich	Cinema
H4	Rainy	Yes	Poor	Cinema
H5	Rainy	No	Rich	Home
H6	Rainy	Yes	Poor	Cinema
H7	Windy	No	Poor	Cinema
H8	Windy	No	Rich	Shopping
H9	Windy	Yes	Rich	Cinema
H10	Sunny	No	Rich	Tennis

7. Discuss the issues of avoiding overfitting of data, and handling attributes with different costs.
8. Discuss the application of neural network which is used to steer an autonomous vehicle.
9. Write a gradient descent algorithm to train a linear unit along with the derivation.
10. Discuss the issues of convergence, local minima and Generalization, overfitting and stopping criterion.
11. Discuss the appropriate problems suitable for neural network learning.
12. Define perceptron and discuss its training rule.
13. Show the derivation of back propagation training rule for output unit weights.

Note:
1. The students who are not able to score more than 30 marks out of 50 need to write the answers for the above questions as an assignment.
2. The students who are planning to absent for the test need to write the answers for the above questions 2 times as an assignment.

Signature of Faculty

Signature of HOD

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Test Question Paper 2

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Ref:Form#02 b - Rev. No. 02
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Internal Test Question paper format- CBCS Scheme

Name of the staff/s: Chandra Shekhar J M

Date:27/12/2021 Signature:

Reviewer's Signature:

S.J.C. Institute of Technology
Department of Information Science and Engineering
Semester:VII Test : II Section:B
Subject Name & Code: Artificial Intelligence & Machine Learning (18CS71)

Duration: 90 minutes Max Marks: 50

Sl. No		M	CO	Level
1.	Explain concept learning with an example.	10	CO4	L2
	OR			
2.	Explain the concept of decision tree learning. Discuss necessary measures required to select the attribute for building a decision tree using ID3 algorithm.	10	CO4	L2
3.	Apply candidate elimination algorithm and obtain the version space considering the training example given below.	10	CO5	L4

Eyes	Nose	Head	Fcolor	Hair	Smile
Round	Triangle	Round	Purple	Yes	Yes
Square	Square	Square	Green	Yes	No
Square	Triangle	Round	Yellow	Yes	Yes
Round	Triangle	Round	Green	No	No
Square	Square	Round	Yellow	Yes	Yes

	OR				
4.	Construct the decision tree using ID3 algorithm considering the following training examples.	10	CO5	L4	

Weekend	Weather	Parental availability	Wealthy	Decision class
H1	Sunny	Yes	Rich	Cinema
H2	Sunny	No	Rich	Tennis
H3	Windy	Yes	Rich	Cinema
H4	Rainy	Yes	Poor	Cinema
H5	Rainy	No	Rich	Home
H6	Rainy	Yes	Poor	Cinema
H7	Windy	No	Poor	Cinema
H8	Windy	No	Rich	Shopping
H9	Windy	Yes	Rich	Cinema
H10	Sunny	No	Rich	Tennis

5.	Discuss the issues of avoiding overfitting of data, and handling attributes with different costs.	10	CO4	L2
	OR			
6.	Discuss the application of neural network which is used to steer an autonomous vehicle.	10	CO4	L2
7.	Discuss the issues of convergence, local minima and Generalization, overfitting and stopping criterion.	10	CO4	L2
	OR			

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8.	Discuss the appropriate problems suitable for neural network learning.	10	CO4	L2
9.	Define perceptron and discuss the perceptron training rule and Delta rule.	10	CO4	L3
	OR			
10.	Show the derivation of backpropagation training rule for output unit weights.	10	CO4	L3

Co No.	Course Outcomes
C401.1	Ability to **apply** knowledge of agent architecture, searching and reasoning techniques for different applications.
C401.2	Ability to **analyze** Searching and Inferencing Techniques.
C401.3	Ability to **design** a reasoning system for a given requirement.
C401.4	Ability to **apply** the different learning algorithms.
C401.5	Ability to **analyze** the learning techniques for given dataset.
C401.6	Ability to **design** a model using machine learning to solve a problem.

MCQ : 01

Sl.No		M	CO	L
1.	Which of the following is not type of learning. a. Semi supervised Learning c. Reinforcement Learning b. Supervised Learning d. Unsupervised Learning	1	CO4	L2
2.	Machine Learning is a branch of a. AI b. Java c. C Programming d. C++	1	CO4	L2
3.	The entropy of a given dataset is Zero. This statement implies what. a. Further Splitting is required c. no further splitting is required b. Need Further information to decide d. None of the above.	1	CO4	L2
4.	How do you choose the root node while constructing a decision tree. a. An attribute having high entropy c. an attribute having largest GAIN b. An attribute having high entropy & GAIN d. None of the above	1	CO4	L2
5.	In a decision tree leaf node represents. a. One of the class label c. one of the complete observations b. One of the attributes d. None of the above	1	CO4	L2
6.	How do you handle missing or corrupted data in a dataset a. Drop missing rows and columns c. replace missing values with mean/median b. Assigning a unique to missing values d. All of the above.	1	CO4	L2
7.	Backpropagation can be defined as a. It is the another name given to the curvy function in the perceptron b. It is the transmission of errors back through the network to adjust the inputs. c. It is the transmission of error back through the network to allow weights to be adjusted so that the network can learn. d. None of the above.	1	CO4	L2
8.	In artificial neural network , interconnected processing elements are termed as a. Weights b. Axon c. Nodes or Neurons d. soma	1	CO4	L2
9.	Each connection link in ANN is linked with _____ that contains statics about the input signal. a. Neurons b. Activation Function c. Weights d. Bias		CO4	L2
10.	Automated vehicle is an application of. a. Unsupervised learning b. Supervised learning c.Reinforcement Learning b. Active Learning	1	CO4	L2

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Scheme of Valuation

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DEPARTMENT : Information Science & Engineering

TEST-II Scheme & Solutions

Sem : VII B Subject Title: Artificial Intelligence & machine learning [18CS71]

Question Number	Solution	Marks Allocated
1.	Concept learning The Goal is to find the hypothesis that best fits training example Example Sky Temp humidity wind water Forecast play sport Sunny warm normal strong warm same yes Sunny warm high strong warm same yes Rainy cold high strong warm change no Sunny warm high strong cool change yes target concept Days on which my friend Raju enjoy's his favourite sports. general hypothesis Specific hypothesis	5M 5M 10M
2.	Decision tree representation Outlook Sunny Overcast Rain Humidity yes wind High Normal Strong Weak No Yes No Yes Internal node test an attribute Each branch corresponds to attribute value each leaf node assigns a classification	5M

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Question Number	Solution	Marks Allocated
2.	Entropy(S) = $-P_{\oplus}\log_2 P_{\oplus} - P_{\ominus}\log_2 P_{\ominus}$ Gain(S,A) = Entropy(S) $- \sum_{v \in values(A)} \frac{|S_v|}{|S|}$ Entropy(S_v) Eyes Nose Head Feelings hairs Smile Round Triangle Round Purple Yes Yes Square Square Square Green Yes No Square Triangle Round Yellow Yes Yes Round Triangle Round Green No No Square Square Round Yellow Yes Yes S_0: (0, 0, 0, 0, 0) S_1: (Round, Triangle, Round, Purple, Yes) S_2: (Round, Triangle, Round, Purple, Yes) S_3: (?, Triangle, Round, ?, Yes) S_4: (?, Triangle, Round, ?, Yes) S_5: (? ? Round, ?, Yes) S_6: (? ? Round ? Yes) S_4: (Square, Triangle ? ? ?) (?, Triangle, Square, ? ?) (? Triangle ? Purple ?) (? Triangle ? ? Yes) S_3: (? Triangle ? ? ?) (? ? Round ? ?) S_2: (Round ? ? ? ?) (? Triangle ? ? ?) (?? Round ??) (??)	5M 10 M 5x2 = 10M

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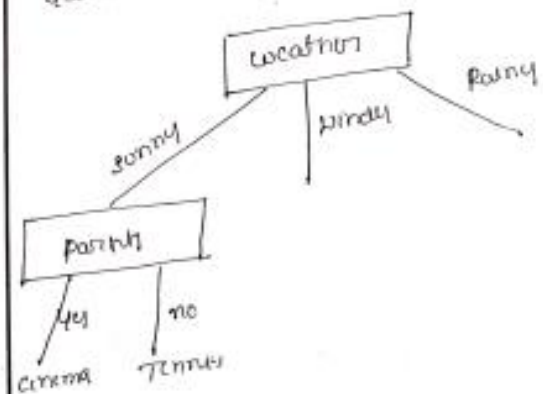
Question Number	Solution	Marks Allocated
4.	Entropy $= -P_C \log_4 P_C - P_T \log_4 P_T - P_H \log_4 P_H - P_S \log_4 P_S$ $= -6/10 \log_4 6/10 - 3/10 \log_4 3/10 - 1/10 \log_4 1/10 - 1/10 \log_4 1/10$ $= 0.221 + 0.232 + 0.166 + 0.166$ $= 0.785$ Gain (weather) = Sunny : 3 [1 2 0 0] = 0 windy : 4 [3 0 0 1] = 0 Rainy : 3 [2 0 1 0] = 0 Gain (weather) = 0.785 Gain (P.A) = yes = 5 [5 0 0 0] = 0 no = 5 [1 2 1 1] Gain (parents) = 0.61 Gain (money) = 0.28.16  	8M 8M 10M

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Question Number	Solution	Marks Allocated
5.	Overfitting Given a hypothesis space H a hypothesis $h \in H$ is said to overfit the training data if there exists some alternative $h' \in H$ Reasons for overfitting - noise in data - number of training examples too small How to avoid - stop the tree grow earlier - allow overfitting and then post-prune the tree Attributes with different costs - prefer cheap ones if possible - use costly ones only if good gain - Introduce cost term in selection measure - no guarantee in finding optimum but gives towards cheapest. applications - robot driving - medical diagnosis	5M 10M
6.	Diagram ALVINN Input :- 30×32 grid of pixel intensities obtained from a forward pointed camera mounted on the vehicle output :- Direction in which the vehicle is steered.	5M 5M 10M

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Question Number	Solution	Marks Allocated
7.	Part perception entry - convergence to global minima is not guaranteed. - common heuristic to attempt to alleviate the problem of local minima include • Add a momentum term to weight update rule. • Train multiple networks using the same data but initialize each network with different random weights • Use a larger choice of to continue learning until the error E on the training examples falls below some predetermined threshold. • This is a poor strategy because back propagation is susceptible to overfitting the training example at the cost of decreasing generalization accuracy overall unseen examples	5x2 = 10m
8.	- instances are represented as many attribute value pairs - Target function output may be discrete valued or vector valued - Training example may contain errors	3x5 = 10m

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Question Number	Solution	Marks Allocated
	- long training times are acceptable - fast evaluation of the learned target function may be required. - ability of humans to understand the learned target function is not important.	
9.	perceptron training Rule Determine a weight vector $\vec{w}$ that causes the perceptron to produce the correct output for each training example $w_i = w_i + \Delta w_i$ where $\Delta w_i = \eta (t - o) x_i$ t = target output o = perceptron output η = learning rate	5M
	Delta Rule. The error function for what is known as gradient descent learning which involves the modification of weights along the most direct path in weight-	

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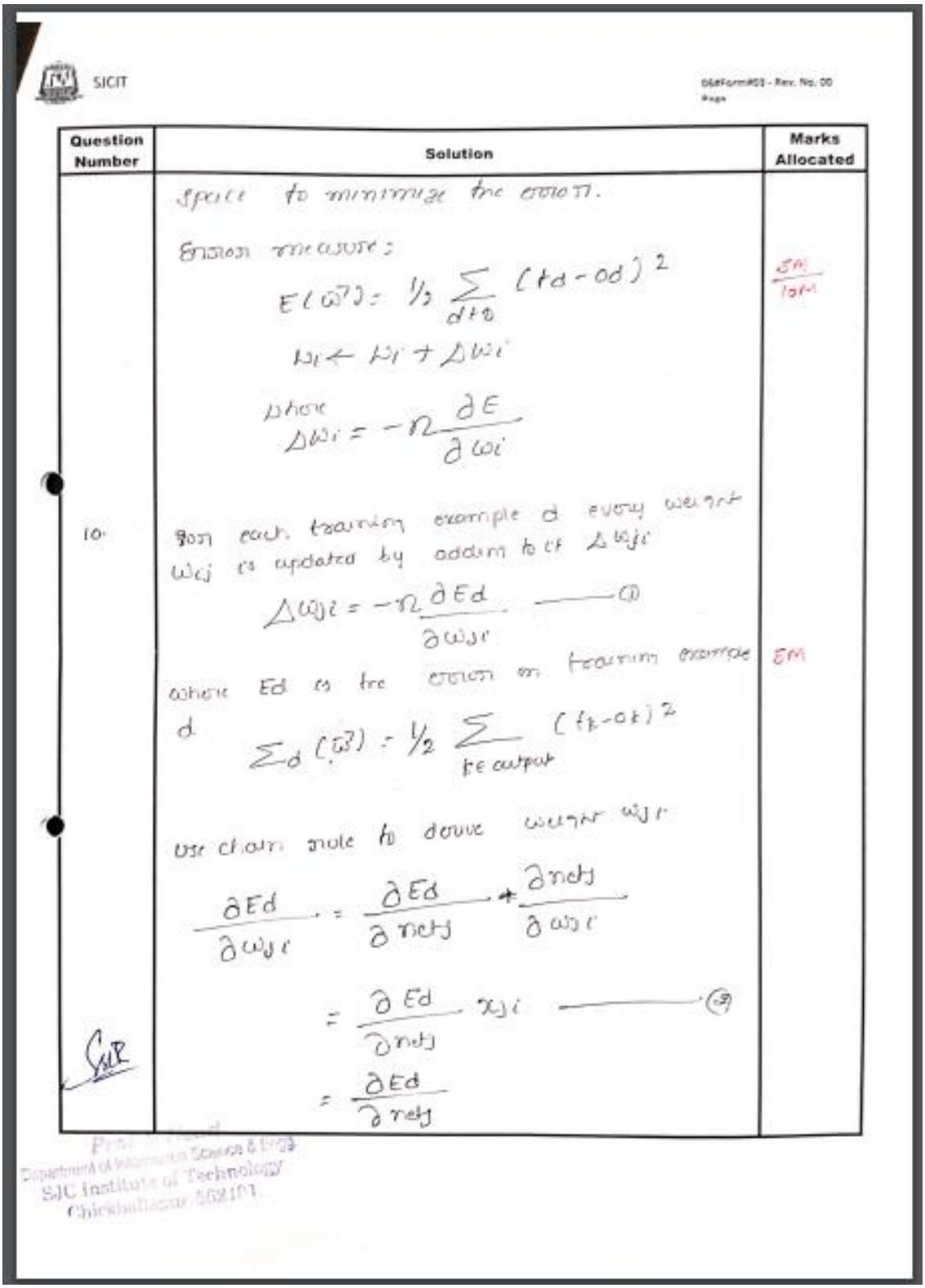

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Question Number	Solution	Marks Allocated
10.	space to minimize the error fn. Error measure: $E(\vec{w}) = \frac{1}{2} \sum_{d \in D} (t_d - o_d)^2$ $w_i \leftarrow w_i + \Delta w_i$ where $\Delta w_i = -\eta \frac{\partial E}{\partial w_i}$ for each training example d every weight w_{ij} is updated by adding to it Δw_{ji} $\Delta w_{ji} = -\eta \frac{\partial E_d}{\partial w_{ji}}$ ——— (1) where E_d is the error on training example d $E_d(\vec{w}) = \frac{1}{2} \sum_{k \in \text{output}} (t_k - o_k)^2$ use chain rule to derive weight w_{ji} $\frac{\partial E_d}{\partial w_{ji}} = \frac{\partial E_d}{\partial net_j} * \frac{\partial net_j}{\partial w_{ji}}$ $= \frac{\partial E_d}{\partial net_j} x_{ji}$ ——— (3) $= \frac{\partial E_d}{\partial net_j}$	5M 10M 5M

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Question Number	Solution	Marks Allocated
	$\frac{\partial E_d}{\partial net_j} = \frac{\partial E_d}{\partial o_j} \frac{\partial o_j}{\partial net_j}$ $\frac{\partial E_d}{\partial o_j} = \frac{\partial}{\partial o_j} \frac{1}{2} \sum_{k \in outputs} (t_k - o_k)^2$ $\frac{\partial E_d}{\partial o_j} = \frac{\partial}{\partial o_j} \frac{1}{2} (t_j - o_j)^2$ $= \frac{1}{2} 2 (t_j - o_j) \frac{\partial (t_j - o_j)}{\partial o_j}$ $\frac{\partial E_d}{\partial o_j} = -(t_j - o_j)$ 28-12-2021.	5M 10M

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Test Question Paper 3

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Internal Test Question paper format- CBCS Scheme

me of the staff's: Chandra Shekhar J M & Abdul Khadeer A

te: 19/01/2022 Signature

Reviewer's Signature:

S.J.C. Institute of Technology
Department of Information Science and Engineering
Semester: VII Test : III Section: A & B
Subject Name & Code: Artificial Intelligence & Machine Learning (18CS71)

ation: 90 minutes Max Marks: 50

	M	CO	Level
For the transactions shown in the table to compute the following. i) Entropy of the collection of transactions records of the table with respect to classification. ii) what are the information gain of a1 and a2 relative to the transaction table.	10	CO5	L5

Instance	1	2	3	4	5	6	7	8	9
a1	T	T	T	F	F	F	F	T	F
a2	T	T	F	F	T	T	F	F	T
Target Class	+	+	-	+	-	-	-	+	-

OR

Consider a football game between two rival teams: Team0 and Team1. Suppose Team0 wins 95% of the time and Team1 wins the remaining matches. Among the games won by Team0, only 30% of them come from playing Team1's football ground. on the other hand, 75% of the victories for Team1 are obtained while playing at home. If Team1 is to host the next match between the two teams, which team will likely emerge as the winner?	10	CO5	L5

Apply Naive Bayes classifier for Play Tennis concept learning problem to classify the following novel instance < Outlook: Sunny, Temperature: cool, Humidity: high, Wind: strong >

Day	Outlook	Temperature	Humidity	Wind	Play Tennis
1	Sunny	Hot	High	Weak	No
2	Sunny	Hot	High	Strong	No
3	Overcast	Hot	High	Weak	Yes
4	Rain	Mild	High	Weak	Yes
5	Rain	Cool	Normal	Weak	Yes
6	Rain	Cool	Normal	Strong	No
7	Overcast	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rain	Mild	Normal	Weak	Yes
11	Sunny	Mild	Normal	Strong	Yes
12	Overcast	Mild	High	Strong	Yes
13	Overcast	Hot	Normal	Weak	Yes
14	Rain	Mild	High	Strong	No

OR

Give a decision tree to represent the Boolean functions i) A && A → B ii) A ∨ [B && A && C] iii) A XOR B iv) [A && B] ∨ [C && D]	10	CO5	L5

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Explain Maximum Likelihood Hypothesis for predicting probabilities.	10	CO6	L3
OR			
Explain the K – nearest neighbor algorithm for approximating a discrete-valued function with pseudo-code.	10	CO6	L3
Explain CADET System using Case based reasoning.	10	CO6	L3
OR			
Explain the Q function and Q Learning Algorithm assuming deterministic rewards and actions with example.	10	CO6	L3
Write Bayes theorem. What is the relationship between Bayes theorem and the problem of concept learning?	10	CO6	L3
OR			
Discuss the method of comparing two algorithms. Justify with paired to tests method.	10	CO6	L3

No.	Course Outcomes
1.1	Ability to **apply** knowledge of agent architecture, searching, and reasoning techniques for different applications.
1.2	Ability to **analyze** Searching and Inferencing Techniques.
1.3	Ability to **design** a reasoning system for a given requirement.
1.4	Ability to **apply** the different learning algorithms.
1.5	Ability to **analyze** the learning techniques for a given dataset.
1.6	Ability to **design** a model using machine learning to solve a problem.

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Scheme of Valuation

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DEPARTMENT : Information Science & Engineering

TEST-III Scheme & Solutions

Sem : VII Subject Title: Artificial intelligence & machine learning - 18CS71

Question Number	Solution	Marks Allocated
1.	instance 1 2 3 4 5 6 7 8 9 a_1 T T T F F F F T F a_2 T T F F T T F F T Target class + + − + − − − + − a) Entropy(S) = $-P_{\oplus}\log_2 P_{\oplus} - P_{\ominus}\log_2 P_{\ominus}$ Gain(S, A) = Entropy(S) − $\sum_{v \in values(A)} \frac{\|S_v\|}{\|S\|}$ Entropy(S_v) i) Here there are 9 instances out of which * 4 are positive instances * 5 are negative instances Entropy(4+, 5−) = $-(4/9)\log_2(4/9) - 5/9 \log_2 5/9$ = 0.9910 ii) Root attribute a_1 a_1 + − T 3 1 F 1 4 Entropy of a_1 is $\frac{\|S_v\|}{\|S\|}$ Entropy(S_v) $= 4/9\left[-3/4\log_2 3/4 - 1/4\log_2 1/4\right] + \frac{5}{9}\left[-1/5\log_2 1/5 - 4/5\log_2 4/5\right]$ = 0.3605 + 0.4010 = 0.7615	3M 4M

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Question Number	Solution	Marks Allocated
	Gain(S, a_1) = 0.9710 - 0.7615 = 0.2295 For attribute a_2 a_2 + − T 2 3 F 0 2 = 5/9 [- 2/5 log 2/5 - 3/5 log 3/5] + 4/9 [ ] = 0.6374 + 0.444 = 0.9838 Gain(S, a_2) = 0.9710 - 0.9838 = 0.0072//	4m 10 m
2.	probability that team 0 wins is P(y_0) = 0.95 probability that team 1 wins is P(y_1) = 1 - P(y_0) = 1 - 0.95 = 0.05	2M
	probability that team 1 hosted the match if it had won is P(x_1 / y_1) = 0.75	3M
	probability of team 1 hosted the match won by team 0 is P(x_1 / y_0) = 0.30	
	The problem can be solved by computing P(y_1 / x_1) using Bayes Theorem $P(y_1 / x_1) = \frac{P(x_1 / y_1) * P(y_1)}{P(x_1)}$	3M

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Question Number	Solution	Marks Allocated
	$= \frac{P(X_1/Y_1) * P(Y_1)}{P(X_1/Y_1) * P(Y_1) + P(X_1/Y_0) P(Y_0)}$	2M
	$= \frac{0.75 * 0.05}{(0.75 * 0.05) + (0.02 * 0.95)}$	
	$P(Y_1/X_1) = 0.1162$	
	$P(Y_0/X_1) = 1 - P(Y_1/X_1) = 1 - 0.1162$	
	$= 0.8838$	2M
	$P(Y_1/X_1) < P(Y_0/X_1)$	10M
	Team 0 has a better probability & commy from team 1	
	team → denoted by Y	
	host → denoted by X	
	team 0 → denoted by 0	
	team 1 → denoted by 1	
3.	Tom play tennis yes	
	$P(yes) = P(\text{sunny}/yes) * P(\text{cool}/yes) * P(\text{high}/yes) * P(\text{strong wind}/yes) * P(yes)$	
	$= 2/5 * 3/4 * 3/4 * 3/6 * 9/14$	3M
	$= 0.4 * 0.75 * 0.428 * 0.5 * 0.6428$	
	$= 0.04126$	

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Question Number	Solution	Marks Allocated
	$P(no) = P(sunny/no) * P(mild/no) * P(humid/no) * P(strong/no) * P(no)$ $= \frac{3}{5} * \frac{1}{4} * \frac{4}{5} * \frac{3}{5} * \frac{5}{14}$ $= 0.6 * 0.25 * 0.57 * 0.6 * 0.357$ $= 0.0153$ $P(yes) > P(no)$ play tennis is possible → yes.	5m 10m
4.	(i) A ⇔ ¬B	5m
	(ii) A ∨ [B ↔ C]	4m
	(iii) A XOR B	

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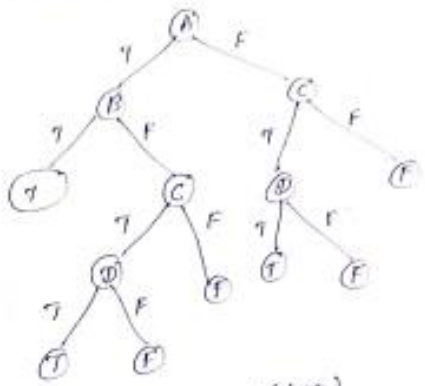
Question Number	Solution	Marks Allocated
	(a) [A ∧ ¬ B] ∨ [C ∧ ¬ D]	
		4M
5.	$h_{map} = \underset{h \in H}{\operatorname{argmax}}\ P(h/D)$	5M
	By using normal distribution $f(x/m) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$	3M
	$h_{map} = \underset{h \in H}{\operatorname{argmax}} \prod_{i=1}^{m} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(d_i - h(x_i))^2}{2\sigma^2}}$	
	using logarithmic function	
	$= \underset{h \in H}{\operatorname{argmax}} \sum_{i=1}^{m} \ln \frac{1}{\sqrt{2\pi\sigma^2}} - \frac{1}{2\sigma^2}(d_i - h(x_i))^2$	4M
	$= \underset{h \in H}{\operatorname{argmax}} \sum_{i=1}^{m} -\frac{1}{2\sigma^2}(d_i - h(x_i))^2$	
	$= \underset{h \in H}{\operatorname{argmin}} \sum_{i=1}^{m} \frac{1}{2\sigma^2}(d_i - h(x_i))^2$	

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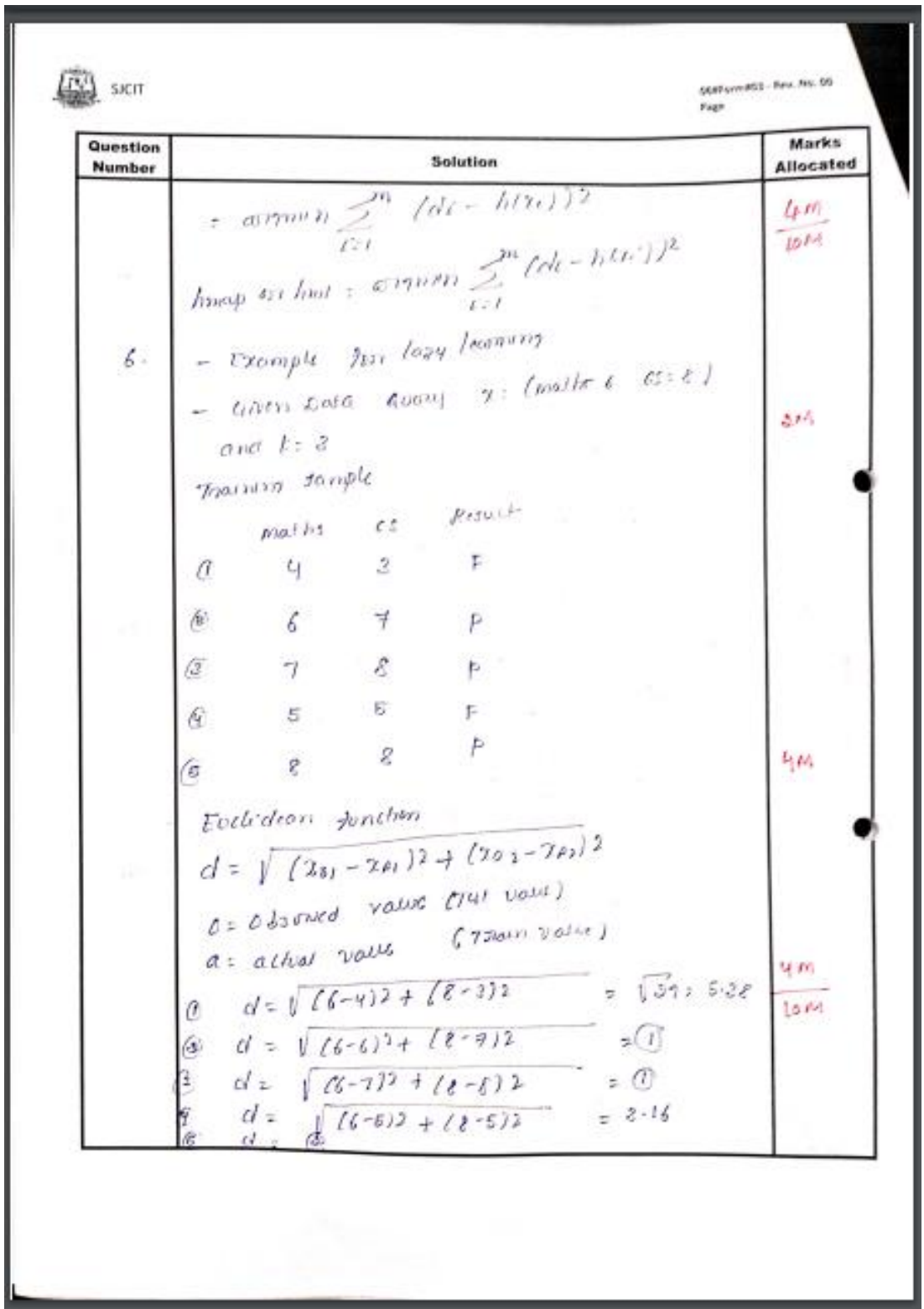

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Question Number	Solution	Marks Allocated
6.	= argmin $\sum_{i=1}^{m} (d_i - h(x_i))^2$ linear regression : argmin $\sum_{i=1}^{m} (d_i - h(x_i))^2$ - Example for lazy learning - Given data query x_q (maths & CS : 8) and k : 3 Training sample maths CS Result ① 4 3 F ② 6 7 P ③ 7 8 P ④ 5 5 F ⑤ 8 8 P Euclidean function $d = \sqrt{(x_{B1} - x_{A1})^2 + (x_{B2} - x_{A2})^2}$ O : Observed value (Test value) a : actual value (Train value) ① $d = \sqrt{(6-4)^2 + (8-3)^2} = \sqrt{29} = 5.38$ ② $d = \sqrt{(6-6)^2 + (8-7)^2} = 1$ ③ $d = \sqrt{(6-7)^2 + (8-8)^2} = 1$ ④ $d = \sqrt{(6-5)^2 + (8-5)^2} = 3.16$ ⑤ d =	4M 10M 6M 4M 4M 10M

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SJC Institute of Technology
Chickballapur-562101

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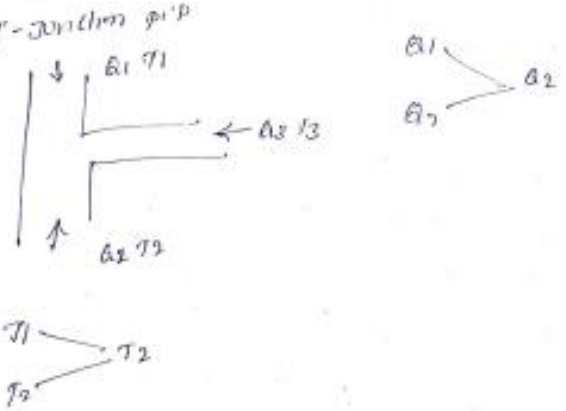
Question Number	Solution	Marks Allocated
7.	a. 2. 4 valves are pass 3 pass a day'l Test sample belongs to pass CASE based Reasoning has 2 components – Similarity function / Adjustment & mistakes – approximation – symbolic presentation Example vacuum water tap T-junction pipe  	5M 5M 10M
8.	Q function $Q^{\pi}(S_t, a_t) = E\left(R_{t+1} + R_{t+2} \cdots + \partial^{n} R_{t+n} / S_{t+1}\right)$ R = Reward ∂ = discount factor	5M

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Question Number	Solution	Marks Allocated
9.	Bayesian algorithm. Actions state steps followed ① exploration :- explore all possible states ② expectation :- Best possible solution is identified. $p(h\|D) = \frac{p(D\|h) \cdot p(h)}{p(D)}$ —①	5M 10M 2M
	assumptions ① training data is noise free ② Any hypothesis is more probable than any other $p(h) = \frac{1}{\|H\|}$ for all h in H $p(D\|h) = \begin{cases} 1 & \text{if } d_i = h(x_i) \text{ for each } x_i \text{ in } D \\ 0 & \text{otherwise} \end{cases}$ case i: hypothesis is inconsistent $p(h\|D) = \frac{0 \times p(h)}{p(D)} = 0$	2M 3M

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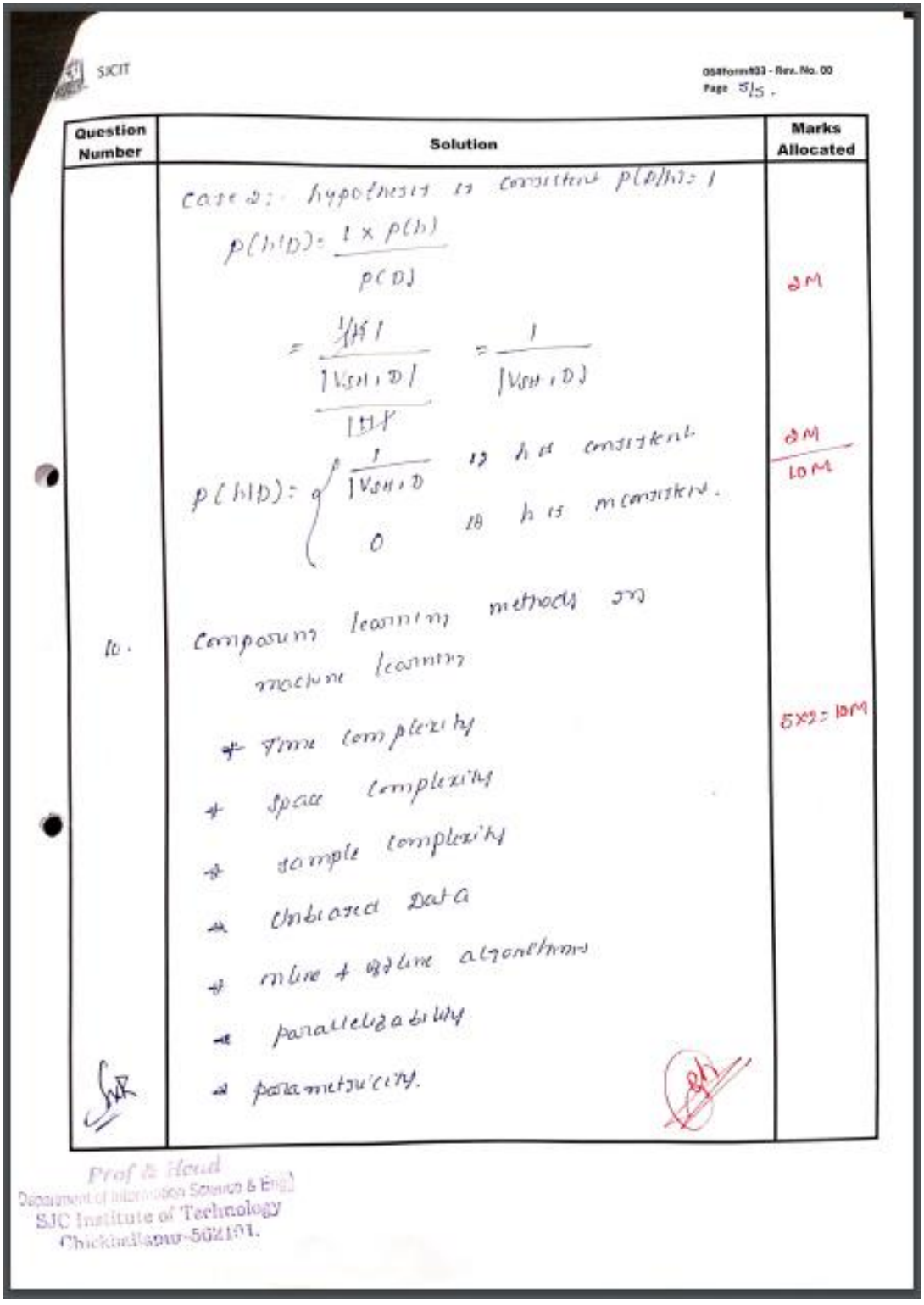

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Question Number	Solution	Marks Allocated
	Case 2:- hypothesis is consistent $P(D/h) = 1$	
	$P(h/D) = \frac{1 \times P(h)}{P(D)}$	2M
	$= \frac{\frac{1}{|H|}}{\frac{|VS_{H,D}|}{|H|}} = \frac{1}{|VS_{H,D}|}$	
	$P(h/D) = \begin{cases} \frac{1}{|VS_{H,D}|} & \text{if } h \text{ is consistent} \\ 0 & \text{if } h \text{ is inconsistent.} \end{cases}$	3M / 10M
10.	Comparison learning methods in machine learning	
	* Time complexity	5×2 = 10M
	* Space complexity	
	* Sample complexity	
	* Unbiased Data	
	* Online & offline algorithms	
	* parallelizability	
	* parametricity.	

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Final IA Marks

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|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust ®

Estd: 1986

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Department of Information Science & Engineering

7B ISE AI&ML-18CS71 Attendance & Marks

Sl. No	USN	STUDENT NAMES	% ATT	IA-1	IA-2	IA-3	Internal Assessment (Out of 30.0)	Other Assessment (Out of 10.0)	Total
1.	1SJ17IS075	Shamanth	75	40.0	38.0	46.0	25	8	33.0
2.	1SJ18IS064	Modem Tharun Kumar	95	40.0	35.0	46.0	24	10	34.0
3.	1SJ18IS065	Nama Manasa	93	32.0	45.0	40.0	23	9	32.0
4.	1SJ18IS066	Navyashree L	100	43.0	46.0	42.0	26	10	36.0
5.	1SJ18IS067	Neharika L	75	35.0	33.0	38.0	21	9	30.0
6.	1SJ18IS068	Nikhil R	75	43.0	40.0	42.0	25	9	34.0
7.	1SJ18IS069	Nikhitha D H	88	44.0	44.0	44.0	26	9	35.0
8.	1SJ18IS071	Nithya D M	81	48.0	50.0	50.0	30	10	40.0
9.	1SJ18IS072	Nithyashree V N	91	45.0	48.0	46.0	28	8	36.0
10.	1SJ18IS073	Pavan Kumar N	75	41.0	41.0	43.0	25	9	34.0
11.	1SJ18IS074	Pavan M N	80	41.0	42.0	42.0	25	9	34.0
12.	1SJ18IS075	Poorvikanagesh B N	95	50.0	50.0	44.0	29	10	39.0
13.	1SJ18IS076	Pottayial Manikanta	75	28.0	22.0	42.0	18	9	27.0
14.	1SJ18IS077	Prajwal M B	75	50.0	48.0	50.0	30	10	40.0
15.	1SJ18IS079	Preethi G R	88	44.0	45.0	46.0	27	9	36.0
16.	1SJ18IS080	Prerana S	82	40.0	45.0	46.0	26	10	36.0
17.	1SJ18IS081	Priyanka A	91	46.0	44.0	50.0	28	9	37.0
18.	1SJ18IS082	R P Pavitra	91	47.0	50.0	49.0	29	10	39.0
19.	1SJ18IS083	Rachana G S	89	49.0	40.0	46.0	27	10	37.0
20.	1SJ18IS084	Rachana P	89	45.0	42.0	35.0	24	9	33.0
21.	1SJ18IS085	RAKSHITH N J	75	39.0	42.0	44.0	25	8	33.0
22.	1SJ18IS086	RAKSHITHA N R	75	28.0	43.0	46.0	23	9	32.0
23.	1SJ18IS087	Ramyashree M G	98	48.0	48.0	50.0	29	9	38.0
24.	1SJ18IS088	Ranjitha M	89	40.0	37.0	47.0	25	10	35.0
25.	1SJ18IS089	REVANTH REDDY R	75	26.0	34.0	42.0	20	8	28.0
26.	1SJ18IS090	Rohan K U	75	40.0	40.0	46.0	25	9	34.0

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27.	1SJ18IS091	SAHANA H S	86	45.0	40.0	50.0	27	8	35.0
28.	1SJ18IS093	Sandhya G	75	44.0	50.0	44.0	28	9	37.0
29.	1SJ18IS095	Santhosh T M	75	48.0	48.0	50.0	29	10	39.0
30.	1SJ18IS096	Shaik Amaan	75	40.0	40.0	45.0	25	9	34.0
31.	1SJ18IS097	Sharath K N	78	44.0	43.0	46.0	27	9	36.0
32.	1SJ18IS098	Shashank N	75	40.0	41.0	46.0	25	9	34.0
33.	1SJ18I:099	Shirisha B V	84	46.0	48.0	50.0	29	9	38.0
34.	1SJ18IS100	Shreasta M S	93	48.0	48.0	46.0	28	9	37.0
35.	1SJ18IS101	Shreeraksha A	89	48.0	46.0	48.0	28	10	38.0
36.	1SJ18IS102	SHREESHA N	75	40.0	34.0	40.0	23	8	31.0
37.	1SJ18IS104	Shubha Gurudev	100	38.0	38.0	46.0	24	9	33.0
38.	1SJ18IS105	Shwetha G D	84	44.0	47.0	50.0	28	9	37.0
39.	1SJ18IS106	Sireesha N S	89	50.0	45.0	48.0	29	10	39.0
40.	1SJ18IS107	Smruthi R Paladhi	79	44.0	45.0	48.0	27	10	37.0
41.	1SJ18IS108	Sneha C R	82	50.0	46.0	50.0	29	10	39.0
42.	1SJ18IS109	Subramanya K	75	42.0	38.0	35.0	23	9	32.0
43.	1SJ18IS110	Sukesh V N	91	50.0	50.0	50.0	30	10	40.0
44.	1SJ18IS111	Suma G V	96	50.0	48.0	50.0	30	10	40.0
45.	1SJ18I:112	SUMITH M	75	38.0	39.0	28.0	21	8	29.0
46.	1SJ18IS113	Supriya B C	93	42.0	45.0	50.0	27	9	36.0
47.	1SJ18IS114	Tejas S V	81	40.0	42.0	50.0	26	10	36.0
48.	1SJ18IS115	Tejaswini K N	98	50.0	50.0	50.0	30	10	40.0
49.	1SJ18IS116	Thanuja K	96	46.0	44.0	50.0	28	9	37.0
50.	1SJ18IS117	Thanuja R	91	48.0	43.0	50.0	28	9	37.0
51.	1SJ18IS119	Vani N	77	37.0	45.0	50.0	26	9	35.0
52.	1SJ18IS120	Vanishree C S	86	30.0	46.0	48.0	25	10	35.0
53.	1SJ18IS121	Vanusha K M	96	50.0	45.0	50.0	29	10	39.0
54.	1SJ18IS122	Vathsala K R	88	47.0	50.0	50.0	29	10	39.0
55.	1SJ18IS123	Vidyashree V N	75	45.0	44.0	42.0	26	9	35.0
56.	1SJ18I:124	Vishwas R	75	39.0	37.0	50.0	25	10	35.0
57.	1SJ18IS125	Yashashwitha R	79	46.0	46.0	42.0	27	9	36.0

Signature of Subject teacher

HOD
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Department of Information Science & Engg
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S J C Institute of Technology

CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2021-2022 (Even Semester)

(Affiliated to Visvesvaraya Technological University, Belagavi & Approved by AICTE, New Delhi) P. B No. 20, B. B. Road, Chickballapur – 562101. Karnataka
Phone: 08156 – 263181/82/83/84 Mobile: 9880373629/9901653915 Email: principal@sjcit.ac.in www.sjcit.ac.in
Accredited by NAAC, NBA, Gold rated by QS – I Gauge Certified

Week No.	Month	Week Days							No of Working Days	EVENTS
		Mon	Tue	Wed	Thu	Fri	Sat	Sun		
1.	MAR/APRIL	28	29	30	31	1	2	3	5	28th HOD's / IC Meeting, April 1st Staff Council Meeting, April 2nd Chandramana Ugadi,
2.	APRIL	4	5	6	7	8	9	10	6	4th – Registration and commencement of VI ,VIII Sem B E & IV sem M.Tech, 4th HOD's / IC Meeting, 10th Sri Ramanavami
3.	APRIL	11	12	13	14	15	16	17	4	April 11th HOD's / IC Meeting, 14th Dr. B R Ambedkar Jayanthi / Sri Maharveer Jayanthi, 15th Good Friday
4.	APRIL	18	19	20	21	22	23	24	6	18th HOD's / IC Meeting, 23rd – Functional Committee Meeting
5.	APRIL/MAY	25	26	27	28	29	30	1	6	11th HOD's / IC Meeting, 25th SEED Activity, 1st May Day
6.	MAY	2	3	4	5	6	7	8	5	2nd HOD's / IC Meeting, 3rd Ramzan, May 5th to 7th – Tutorial I, 11th – Announcement of Attendance CIE – I
7.	MAY	9	10	11	12	13	14	15	6	9th HOD's / IC Meeting, May 12th, 13th, 14th / Continuous Internal Evaluation I (for VI / VIII) semester
8.	MAY	16	17	18	19	20	21	22	6	16th HOD's / IC Meeting, May 20th – CIE-I Progress Report Dispatch, May 21st – Class Teachers and Proctors meeting
9.	MAY	23	24	25	26	27	28	29	5	23rd HOD's / IC Meeting, 25th – Course wise Mid Feedback, 27th SEED Activity
10.	MAY/JUNE	30	31	1	2	3	4	5	6	30th HOD's / IC Meeting June 2nd to 4th – Tutorial II
11.	JUNE	6	7	8	9	10	11	12	6	6th HOD's / IC Meeting 8th – Announcement of Attendance CIE – II 9th, 10th, 11th / Continuous Internal Evaluation II (for VI / VIII) semester
12.	JUNE	13	14	15	16	17	18	19	6	13th HOD's / IC Meeting, 17th – CIE-II Progress Report Dispatch, June 18th – Class Teachers and Proctors meeting
13.	JUNE	20	21	22	23	24	25	26	5	20th HOD's / IC Meeting, 24th SEED Activity
14.	JUNE/JULY	27	28	29	30	1	2	3	6	27th HOD's / IC Meeting, June 30th to July 2nd – Tutorial III, July 2nd - Announcement of Attendance CIE - III
15.	JULY	4	5	6	7	8	9	10	6	4th HOD's / IC Meeting, 6th, 8th, 9th / Continuous Internal Evaluation III (for VI / VIII) semester, 8th – IQAC Meeting, 10th Bakrid
16.	JULY	11	12	13	14	15	16	17	6	11th HOD's / IC Meeting, 13th CIE-III Progress Report Dispatch, 14th – Class Teachers & Mentors meeting, 14th Course Wise Feedback, Course End Survey and Program Exit Survey
17.	JULY	18	19	20	21	22	23	24	6	18th HOD's / IC Meeting, Last Working Day of Even Semester, 19th July 2022
18.	JULY	25	26	27	28	29	30	31	6	25th HOD's / IC Meeting
19.	AUG	1	2	3	4	5	6	7	6	1st HOD's / IC Meeting
20.	AUG	8	9	10	11	12	13	14	5	8th HOD's / IC Meeting, 9th Moharram Last Day
21.	AUG	15	16	17	18	19	20	21	5	15th Independence Day
22.	AUG	22	23	24	25	26	27	28	6	22nd HOD's / IC Meeting, 22nd to 26th - Internal Quality Audit
23.	AUG/SEPT	29	30	31	1	2	3	4	5	29th HOD's / IC Meeting 31st Vinayaka Chadhurthi
24.	SEPT	5	6	7	8	9	10	11	6	5th HOD's / IC Meeting
25.	SEPT	12	13	14	15	16	17	18	6	12th HOD's / IC Meeting
26.	SEPT	19	20	21	22	23	24	25	6	19th HOD's / IC Meeting, 23rd SEED Activity, 25th Mahalaya Amavasye

4TH April – Commencement of VI & VIII Semester BE, IV Sem M Tech

VISION
Preparing Competent Engineering and Management Professional to Serve the Society

MISSION
- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Dr. R. Ranganatha
HOD MED

21/03/2022
Dr. B. N. Shobha
Chief Coordinator
SJCIT-IQAC

Dr. G. T Raju
Principal

S J C INSTITUTE OF TECHNOLOGY – DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Calendar of Events of Even Semester B.E 2020-21

Week No	SUN	MON	TUE	WED	THUR	FRI	SAT
W 01	APR 18	APR 19	APR 20	APR 21	APR 22	APR 23	APR 24
W 02	APR 25	APR 26	APR 27	APR 28	APR 29	APR 30	MAY 01
W 03	MAY 02	MAY 03	MAY 04 Webinar – Cross Platform Mobile Application Development – GNS Tech	MAY 05	MAY 06 Webinar-Industrial Skill Development & Internship Program – Tequed Labs	MAY 07	MAY 08
W 04	MAY 09	MAY 10	MAY 11	MAY 12	MAY 13	MAY 14	MAY 15
W 05	MAY 16	MAY 17	MAY 18	MAY 19	MAY 20	MAY 21	MAY 22
W 06	MAY 23	MAY 24 Online Boot Camp - NAIN	MAY 25	MAY 26	MAY 27	MAY 28 Test 1 – Online Mode	MAY 29
W 07	MAY 30	MAY 31	JUN 01	JUN 02	JUN 03	JUN 04 Mid Sem Student Feedback	JUN 05
W 08	JUN 06	JUN 07	JUN 08	JUN 09	JUN 10	JUN 11	JUN 12
W 09	JUN 13	JUN 14	JUN 15	JUN 16	JUN 17	JUN 18	JUN 19
W 10	JUN 20	JUN 21	JUN 22	JUN 23	JUN 24	JUN 25	JUN 26
W 11	JUN 27	JUN 28 Mock LIC Documentation Verification	JUN 29 Test 2 – Online Mode	JUN 30	JUL 01	JUL 02	JUL 03
W 12	JUL 04	JUL 05	JUL 06	JUL 07	JUL 08	JUL 09	JUL 10
W 13	JUL 11	JUL 12	JUL 13 Project Work Ph	JUL 14	JUL 15	JUL 16	JUL 17 Webinar – Seeding Domine Knowledge in Academia – Manoj Kumar Lal
W 14	JUL 18	JUL 19	JUL 20	JUL 21	JUL 22	JUL 23	JUL 24
W 15	JUL 25	JUL 26	JUL 27	JUL 28	JUL 29	JUL 30	JUL 31
W 16	AUG 01	AUG 02	AUG 03	AUG 04	AUG 05	AUG 06 Test 3 – Online Mode	AUG 07
W 17	AUG 08	AUG 09 Project Report Submission Farewell function for Final Year Students	AUG 10	AUG 11	AUG 12	AUG 13	AUG 14

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IA Time Table

Sample Time table for the Department of Computer Science and Engineering for the academic year 2019-20 (odd sem) are as follows

S.J.C.I.T

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S.J.C INSTITUTE OF TECHNOLOGY, CHICKBALLAPUR
Department of Information Science & Engineering

DATE: 09-09-2019

Circular

It is here by informing to all the students of ISE, the First internals has been scheduled from **12-09-2019 to 14-09-2019** for **3rd and 5th semester.**

Time Table

DAY	TIME	III SEM	V SEM
Thursday 12-09-2019	09:30AM to 11:00AM	MAT -3	AT&C
	1.30PM to 3:00PM	CO	MEM
Friday 13-09-2019	09:30AM to 11:00AM	DMS	AJAVA
	1.30PM to 3:00PM	ADE	DBMS
Saturday 14-09-2019	09:30AM to 11:00AM	DSC	CN
	1.30PM to 3:00PM	SE	AI/.NET

Signature of co-ordinators

Signature of HOD
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S.J.C.I.T

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S.J.C INSTITUTE OF TECHNOLOGY, CHICKBALLAPUR
Department of Information Science & Engineering

DATE: 14-10-2019

Circular

It is here by informing to all the students of ISE, the Second internals has been scheduled from **17-10-2019 to 19-10-2019** for **3rd, 5th and 7th semester.**

Time Table

DAY	TIME	III SEM	V SEM	VII SEM
Thursday 17-10-2019	09:30AM to 11:00AM	MAT -3	AT&C	SA
	1.30PM to 3:00PM	CO	MEM	ML
Friday 18-10-2019	09:30AM to 11:00AM	DMS	AJAVA	SAN
	1.30PM to 3:00PM	SE	DBMS	--
Saturday 19-10-2019	09:30AM to 11:00AM	DSC	CN	WTA
	1.30PM to 3:00PM	ADE	AI/.NET	INS

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Signature of co-ordinators

Signature of HOD 14/10/19
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VII 'A'

VII 'B' ISE

S.J.C.I.T

S.J.C INSTITUTE OF TECHNOLOGY, CHICKBALLAPUR
Department of Information Science & Engineering

DATE: 21-11-2019

Circular

It is here by informing to all the students of ISE, the Third internals has been scheduled from **25-11-2019 to 30-11-2019** for **3rd, 5th and 7th semester.**

Time Table

DAY	TIME	III SEM	V SEM	VII SEM
Monday 25-11-2019	09:30AM to 12:30AM	MAT -3 (18MAT31)	MEM (17CS51)	WTA (15CS71)
Tuesday 26-11-2019	09:30AM to 12:30AM	SE (18CS35)	CN (17CS52)	SA (15IS72)
Wednesday 27-11-2019	09:30AM to 12:30AM	DSC (18CS32)	DBMS (17CS53)	ML (15CS73)
Thursday 28-11-2019	09:30AM to 12:30AM	ADE (18CS33)	AT&C (17CS54)	INS (15CS743)
Friday 29-11-2019	09:30AM to 12:30AM	CO (18CS34)	AJAVA (17CS553)	SAN (15CS754)
Saturday 30-11-2019	09:30AM to 12:30AM	DMS (18CS36)	AI/.NET (17CS562/564)	--

Signature of co-ordinators

Signature of HOD

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IA QUESTION PAPER / ASSESSMENT/SCHEME

Sample Internal assessment question paper, the assessment sheet and scheme of evaluation for the course Data Structures and Applications, course code: 18CS32.

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Internal Test Question paper format- CBCS Scheme

Name of the staff/s: Bhanumathi S

Date:14/09/2019 Signature:

Reviewer's Signature: 14/9/19

NOTE: Only the following information's to be given to the students.

S.J.C. Institute of Technology

Department:Information Science & Engineering

Test : I

Semester:III Section:A

Subject Name & Code: Data Structures and Applications & 18CS32

Instructions

Duration: 110 minutes **Max Marks: 50**

Answer the following questions selecting one question from each part

Sl. No		Marks	CO	Levels
1.	a. Define Data structures. Classify the data structures.	5	CO1	L2
	b. Explain dynamic memory allocation functions in C.	5	CO1	L2
	OR			
2.	a. Distinguish between structures and unions.	5	CO1	L2
	a. Explain with example i) insertion ii) deletion into array	5	CO1	L2
3.	Write a program to implement a stack using dynamic array whose initial capacity is 1 and array doubling is used to increase the stack's capacity(that is dynamically reallocate twice the memory) whenever an element is added to a full stack. Illustrate the operations –push, pop and display.	10	CO3	L3
	OR			
4.	Write an algorithm to evaluate a postfix expression .Solve the following postfix expressions. **abc+*de/- where a=5,b=6,c=2,d=12,e=4**	10	CO3	L3
5.	Write an algorithm to convert infix to a postfix expression. Apply the algorithm to convert the given infix expression to postfix. **(((a / b)-c) + (d * e)) - (a * c).**	10	CO6	L3
	OR			
6.	a. Using recursion write an algorithm for tower of Hanoi.	4	CO6	L3

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	b. Write an algorithm for Ackermann function. Solve A(1,2) using Ackermann function	6	CO6	L3
7	a. Write a C program to concatenate Fname and Lname of a person without using library function.	6	CO2	L1
	b. Express the sparse matrix using triples and give the transpose of a given sparse matrix. $a = \begin{bmatrix} 15 & 0 & 0 & 22 & 0 & -15 \\ 0 & 11 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & -6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 & 0 & 0 \end{bmatrix}$	4	CO2	L2
	OR			
8	a. What do you mean by pattern matching? Let P and T be strings with lengths R and S respectively and are stored as arrays with one character per element. Write a pattern matching algorithm that finds index P in T.	6	CO2	L1
	b. Define polynomial.Consider two polynomials, $A(x) = 4x^{15}+3x^4+5$ and $B(x) = x^4+10^{x2}+1$. Indicate diagrammatically how these two polynomials can be stored in a 1-D array. Also give its C representation.	4	CO2	L2
9	Describe the functions in C to add two polynomials.	10	CO2	L2
	OR			
10	a. Explain about representation of arrays in memory.	5	CO2	L2
	b. List and explain three types of structures used to store the strings.	5	CO2	L2

Note:
1. **The Choice question should satisfy same COs and levels.**

Course Outcomes: At the end of this course, students are able to:	
CO1	Demonstrate and classify various data structures and their primitive operations.
CO2	Apply the concepts of arrays and strings in sorting and pattern matching applications.
CO3	Implement the operations of linear data structures like stacks, queues and linked lists.
CO4	Demonstrate primitive operations on different types of trees and their applications.
CO5	Summarize the concepts of graphs, traversal techniques, hashing and file handling.
CO6	Design and develop solutions to solve various computing problems by choosing appropriate data structures.

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DEPARTMENT : INFORMATION SCIENCE & ENGINEERING

Scheme & Solutions

Test-I

Semester: III Subject Title: Data Structures & Applications Subject Code: 18CS32

Question Number	Solution	Marks Allocated
1 a	The study of how efficiently different types of data are collected and stored in the memory, how efficiently the data is organized in the memory, how efficiently the data can be retrieved and manipulated and the possible ways in which different data items are logically related is called data structures.	1 M
	Data structures Primitive — Non-primitive Non-primitive → Linear, Non linear	2 M
	Primitive - Manipulated directly by machine instructions. Eg - int, float, char, double etc Non primitive - cannot be manipulated directly by machine instructions	
	Linear - Elements are stored in sequential order. Eg - Arrays, Stacks, queues	2 M
	Non Linear - Elements are not stored in linear order. Eg - Trees, graphs, files.	
		5 M

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Subject Title: Data Structures & Applications Subject Code: 18CS32

Question Number	Solution	Marks Allocated

b.	i) malloc (size) - Allows the program to allocate a block of memory space as and when required and the exact amount needed during execution.
	ptr = (data-type *) malloc (size);
	ii) calloc (n, size) - Used to allocate multiple blocks of memory.
	ptr = (data-type *) calloc (n, size);
	iii) realloc (ptr, size) - The size of the allocated memory can be changed.
	ptr = (data-type *) realloc (ptr, size);
	iv) free (ptr) - Used to de-allocate the allocated block of memory.
	free (ptr);
	ptr = NULL;
		1¼ x 4 = 5 M

2.a.		1x5 = 5

Structure	Union
1. keyword is struct	1. keyword is union
2. The size of structure is greater than or equal to the sum of sizes of its members.	2. Size of union is equal to the size of largest member.
3. Altering the value of a member does not affect other members.	3. Altering the value of any member will alter other member values.
4. The address of each member will be in ascending order.	4. The address is same for all the members of the union.
5. Individual members can be accessed at any time.	5. Only one member can be accessed at a time.

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Subject Title: Data Structures & Applications Subject Code: 18CS32

Question Number	Solution	Marks Allocated
2. b.	**Insertion** 1) Check for valid position a: 50 40 20 90 (0 1 2 3 4 5 6 7 8), n = 4, pos if (pos > n || pos < 0) Invalid position.	
	2) Make a room for inserting element a: 50 40 20 90 (0 1 2 3 4 5 6 7 8), n = 4, pos	2½ M
	3) Insert the element a: 50 60 40 20 90 (0 1 2 3 4 5 6 7 8)	
	4) Update the number of elements n = n+1.	
	Deletion 1) Elements are present (Invalid position) a: 50 40 20 90 (0 1 2 3 4 5 6 7 8), n = 4, pos if (pos >= n || pos < 0 || n == 0) Invalid position	2½ M
	2) Display the item to be deleted a: 50 40 20 90 (0 1 2 3 4 5 6 7 8), n = 4, pos	

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Subject Title: Data Structures & Applications Subject Code: 18CS32

Question Number	Solution	Marks Allocated
	3. Remove the item from the array a: 50 20 90 (0 1 2 3 4 5 6) 4. Update the number of elements in array n = n-1.	
3.	#include <stdio.h> #include <stdlib.h> int SIZE = 1; void push(int item, int *top, int *s) { if (*top == SIZE - 1) { printf ("Stack full, update size"); SIZE ++; s = (int *) realloc (s, SIZE * sizeof(int)); }	3 M

	*top = *top + 1;
	s[*top] = item;
	}
	int pop(int *top, int *s)
	{ int item;
	if (*top == -1) return 0;
	item = s[(*top) - -];
	return item;
	}
		2 M

	void display (int top, int *s) { int i; if (top == -1)	2 M

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Subject Title: Data Structures & Applications **Subject Code:** 18CS32

Question Number	Solution	Marks Allocated

```
    { printf("Stack empty");
      return;
    }
    for(i=0; i<=top; i++)
    { printf("%d\n", S[i]);
    }
}
Void main()
{ int item, choice, top=-1, *a;
  a = (int *) malloc(sizeof(int));
  for(;;)
  { printf("1. push 2. pop 3. display 4. Exit");
    scanf("%d", &choice);
    switch(choice)
    { case 1: printf("Enter item");
              scanf("%d", &item);
              push(item, &top, a);
              break;
      case 2: item = pop(&top, a);
              if(item == -1)
                printf("Stack empty");
              else
                printf("Item = %d", item);
              break;
      case 3: display(top, a);
              break;
      default: exit(0);
    }
  }
}
```

3 M

10 M

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Subject Title: Data Structures & Applications **Subject Code:** 18CS32

Question Number	Solution	Marks Allocated

4.

```
while end of input is not reached do
{
  symbol = nextchar()
  if (symbol is an operand)
    push(symbol, top, s);
  else
    op2 = pop(top, s);
    op1 = pop(top, s);
    res = op1 op op2;
    push(res, top, s);
  end if
}
```

4 M

Postfix expression	Symbol	op2	op1	result	Stack contents
562 + * 124 / -	5				5
62 + * 124 / -	6				5 6
2 + * 124 / -	2				5 6 2
+ * 124 / -	+	2	6	6+2=8	5 8
* 124 / -	*	8	5	5*8=40	40
124 / -	12				40 12
4 / -	4				40 12 4
/ -	/	4	12	12/4=3	40 3
-	-	3	40	40-3=37	37

The result after evaluating the postfix expression is 37

6M

10 M

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Subject Title: Data Structures & Applications **Subject Code:** 18CS32

Question Number	Solution	Marks Allocated

5.

```
Algorithm infix-postfix
  top = -1;
  S[++top] = '#';
  j = 0;
  for each symbol in infix expression
  { while(F(s[top]) > G(symbol))
      postfix[j++] = s[top--];
    if(F(s[top]) != G(symbol))
      S[++top] = symbol;
    else top--;
  }
(((a/b) - c) + (d*e)) - (a*c)
```

3 M

Stack	s[top]	Symb	F(s[top])>G(sym)	postfix
#	#	(	-1 < 9 push(	
#(	(	(	0 < 9 push(	
#((	(	(	0 < 9 push(	
#(((	(	a	0 < 7 push a	
#(((a	a	/	8 > 3 pop a	a
#(((	(		0 < 3 push /	
#(((/	/	b	4 < 7 push b	
#(((/b	b	-	8 > 1 pop b	a b
#(((/	/		4 > 1 pop /	ab/
#((	(		0 < 1 push -	
#((-	-	c	2 < 7 push c	

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Subject Title: Data Structures & Applications **Subject Code:** 18CS32

Question Number	Solution	Marks Allocated

#(((-c	c	)	8 > 0	pop c ab/c
#(((-	-	*	2 > 0	pop - ab/c-
#(((	(	)	0 = 0	
#((	(	)	0 = 0	
#(	(	)	0 = 0	
#	#	+	-1 < 1	push +
#+	+	(	2 < 9	push (
#+(	(	d	0 < 7	push d
#+(d	d	*	8 > 3	pop d ab/c-d
#+(	(	*	0 < 3	push *
#+(*	*	e	4 < 7	push e
#+(*e	e	)	8 > 0	pop e ab/e-de
#+(*	*		4 > 0	pop * ab/c-de*
#+(	(		0 = 0	
#+	+	)	2 > 0	pop + ab/c-de*+
#	#		-1 < 0	push)
#)	)	-		

7M

ab/c-de*+ae*-

10 M

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Question Number	Solution	Marks Allocated

6 a.	Algorithm tower (n, s, t, d)
	{
	if (n == 0) return;
	tower (n-1, s, d, t);
	move n^{th} disc from s to d.
	tower (n-1, t, s, d);
	}
		4 M

b.	Algorithm A(m, n)
	{
	if (m == 0) return n+1;
	if (n == 0) return A(m-1, 1);
	return A(m-1, A(m, n-1));
	}
	A(1,2) = A(0, A(1,1))
	= A(0, A(0, A(1,0)))
	= A(0, A(0, A(0,1)))
	= A(0, A(0,2))
	= A(0,3)
	A(1,2) = 4
		4 M
		2 M

7. a.	#include <stdio.h>
	Void my_strcat (char Fname[], char Lname[])
	{ int i, j;
	i = 0;
	while (Fname[i] != '\0') i++;
	j = 0;
		4M

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Question Number	Solution	Marks Allocated

	while (Lname[j] != '\0')
	{
	Fname[i++] = Lname[j++];
	}
	Fname[i++] = '\0';
	}
	Void main()
	{
	char Fname[20], Lname[20];
	printf ("Enter first name");
	gets (Fname);
	printf ("Enter Last name");
	gets (Lname);
	my_strcat (Fname, Lname);
	printf ("Resultant String = %s", Fname);
	}
		2M

b.

	Transpose						
	row	col	val	row	col	val	
a[0]	6	6	8	6	6	8	b[0]
a[1]	0	0	15	0	0	15	b[1]
a[2]	0	3	22	0	4	91	b[2]
a[3]	0	5	-15	1	1	11	b[3]
a[4]	1	1	11	2	1	3	b[4]
a[5]	1	2	3	2	5	28	b[5]
a[6]	2	3	-6	3	0	22	b[6]
a[7]	4	0	91	3	2	-6	b[7]
a[8]	5	2	28	5	0	-15	b[8]

2M

2M

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Question Number	Solution	Marks Allocated

8.a	The process of searching for a pattern string in a given text string is called pattern matching.
	Algorithm Str_cmpi (P, T, i)
	{ int j, r;
	j = 0;
	r = Strlen(P);
	while (j < r && P[j] == t[i+j]) j++;
	if (j == r) return 1;
	return -1;
	}
	Algorithm pattern_match (P, T)
	{
	int i, r, S, flag;
	r = Strlen (P);
	S = Strlen (T);
	for (i = 0; i <= S-r; i++)
	{
	flag = Str_cmpi (P, T, i);
	if (flag == 1) return i;
	}
	return -1;
	}
		1M
		2 M
		3 M

8.b	A polynomial is a mathematical expression consisting of sum of terms where each term is made up of a coefficient multiplied by a variable raised to a power.	1M

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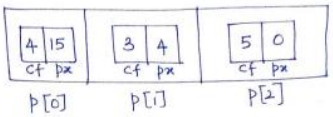
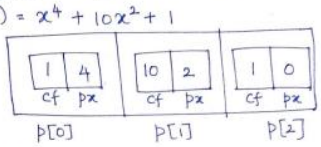
Question Number	Solution	Marks Allocated
	$A(x) = 4x^{15} + 3x^4 + 5$	
		1 M
	$B(x) = x^4 + 10x^2 + 1$	
		1 M
	typedef struct { int cf; int px; } POLY;	1 M

9.	int search (int px1, POLY p2[], int n)
	{ int j, px2;
	for (j=0; j<n; j++)
	{ px2 = p2[j].px;
	if (px1 == px2) return j;
	}
	return -1;
	}
		2M

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Question Number	Solution	Marks Allocated

```
int add_poly (POLY p1[], int m, POLY p2[],
              int n, POLY p3[])
{ int i, k, cf1, px1, pos, sum;
  k=0;
  for(i=0; i<m; i++)
  {
    cf1 = p1[i].cf;
    px1 = p1[i].px;
    pos = search(px1, p2, n);
    if(pos>0)
    {
      sum = cf1 + p2[pos].cf;
      p3[k].cf = sum;
      p2[pos].cf = -999;
    }
    else
      p3[k].cf = cf1;
    p3[k].px = px1;
    k++;
  }
  k = copy_poly(p3, k, p2, n);
  return k;
}
int copy_poly (POLY p3[], int k, POLY p2[], int n)
{ int j;
  for(j=0; j<n; j++)
  { if(p2[j].cf != -999)
    {
      p3[k].cf = p2[j].cf;
      p3[k].px = p2[j].px;
      k++;
    }
  }
  return k;
}
```

6M

2 M

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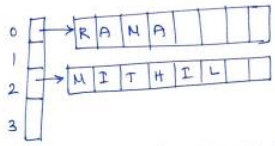
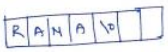
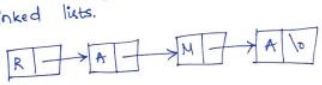
Question Number	Solution	Marks Allocated
10.b	a) Fixed length Storage Structure All the records have same length and same size.  b) Variable length storage structure The storage structure for a string can expand or shrink to accomodate any size of data.  c) Linked Storage Structure The strings are represented using linked lists.  	1 M 1 M 1 M example 2M 5 M

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Assignment

Assignment detail of the course Data Structures and Applications, course code: 18CS32.

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Department: Information Science & Engineering
Semester: III Section: A
Subject Name & Code: Data Structures and Applications & 18CS32
Assignment 1

Q.No		CO	Level
1	Explain string handling functions in C.	CO1	L2
2	Describe how you could model a maze, where 0 represents open paths and 1 represents barriers. What moves are permitted in the matrix model? Provide an example maze together with its allowable moves and table of moves.	CO1	L2
3	Explain dynamic memory allocation functions in C	CO1	L2
4	Define recursion. What are the properties of recursive procedure? Write recursive procedures for i) Tower of Hanoi ii) Factorial of a number.	CO3	L1
5	Convert the following infix expressions to postfix form. i) A+((B*C-D/E^F)*G)*11 ii) ((6+(3-2)*4)^5+7) iii) ABC*D iv) (a+ b) * d + e / (f +a* d) + c v) ((a/(b- c + d))* (e - a)* c)	CO3	L3
6	Write a program to implement a stack using dynamic array whose initial capacity is 1 and array doubling is used to increase the stack's capacity(that is dynamically reallocate twice the memory) whenever an element is added to a full stack. Implement the operations –push, pop and display.	CO4	L3
7	Differentiate between structures and unions	CO1	L2
8	Write an algorithm to evaluate a postfix expression .Evaluate the following postfix expressions i) **abc+*de/- where a=5,b=6,c=2,d=12,e=4** **ii) a b/c - de*+ a c * where a= 6, b = 3, c = l, d = 2, e = 4.**	CO3	L3
9	Explain about representation of arrays in memory.	CO1	L2
10	Discuss pattern matching algorithm	CO1	L2

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S.J.C. Institute of Technology
Department: Information Science & Engineering
Semester: III Section: A
Subject Name & Code: Data Structures and Applications & 18CS32
Assignment II

Q.No		CO	Level
1	Implement Addq and Deleteq function for the circular queue using dynamic arrays.	CO3	L3
2	Illustrate with examples how to insert a node at the beginning, insert a node at intermediate position, and delete a node with a given value.	CO3	L3
3	Illustrate with example the following operations on a doubly linked list. i) Inserting a node at the beginning ii) Inserting at the intermediate position iii) Deleting a node with a given value iv) Search a key element	CO3	L3
4	Explain the following with suitable example i) Circular linked list ii) Doubly linked list	CO3	L2
5	Give the node structure to create a singly linked list of integers and write functions to perform the following. i) Create a list ii) Assume the list contains 3 nodes with data 10, 20, 30. Insert a node with data 40 at the end of the list. iii) Insert a node with data 50 between the nodes having data values 10 and 20. iv) Display the singly linked list.	CO3	L1
6	Explain how a linked list can be used as stack and queue.	CO1	L2
7	What is linked list? Explain the types of linked list with diagram	CO1	L2
8	Define queues. Write QINSERT and QDELETE procedures for queues using arrays	CO1	L1
9	What is a doubly linked list? Write a C program to perform following operations on doubly linked list i) insert a node ii) delete a node	CO4	L1
10	List any two differences between doubly linked lists and singly linked lists	CO1	L1

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S.J.C. Institute of Technology
Department: Information Science & Engineering
Semester: III Section: A
Subject Name & Code: Data Structures and Applications & 18CS32
Assignment III

Q.No		CO	Level
1	Briefly explain basic operations that can be performed on the file. Briefly summarize different file organization technique	CO2	L2
2	Explain threaded binary tree construction for **85,95,100,25,36,45,48**	CO1	L2
3	Describe an algorithm for insertion sort and radix sort.	CO1	L2
4	Define binary trees. Explain the following with an example: i) Complete BT ii) Almost Complete BT iii)skewed binary tree iv) Depth of a tree	CO1	L2
5	Write a function to insert an element into the ordered binary search tree(duplicates not allowed). Construct BST for the following: **22, 28, 20, 25, 22, 15, 18, 10, 14.** Perform all tree traversals for the constructed binary search tree.	CO3	L3
6	Construct a binary tree from the given preorder and inorder sequence: Preorder: **A B D G C E H I F** In order: **D G B A H E I C F** .And also write a c function for Preorder, Postorder and Inorder tree traversals	CO3	L3
7	What is collision? What are the methods to resolve collision? Explain linear probing (open addressing) and chaining to handle collision with an example.	CO1	L2
8	Describe an algorithm for DFS and BFS	CO1	L2
9	Write a C program to implement dequeue using doubly linked list.	CO4	L1
10	Write a C function to count number of elements present in a singly linked list	CO4	L1

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IA TABULATION / RESULT ABSTRACT

Internal Assessment Marks of all three IA, Assignment and the semester end Exam and the result abstract of the course Data Structures and Applications, course code: 18CS32.

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S J C Institute of Technology

Department of Information Science and Engineering

Subject: Data Structures and Applications (18CS32) Semester: III A

Final IA Marks

Sl.No	USN	Name of the Student	IA1 (50)	Improvement Test 1(50)	IA2 (50)	Improvement Test II(50)	IA3 (50)	Average (30)	MCQ (4)	Assignment (6)	Final IA Marks(40)
1.	1SJ20IS001	A R SAI KIRAN	22		23		32	15	4	6	25
2.	1SJ20IS002	ANANYA C	26	50	32		46	26	4	6	36
3.	1SJ20IS003	ANNASAGARAM LASYA PRIYA	33		17		34	17	4	6	27
4.	1SJ20IS004	ANUSHA K	25	47	31		50	26	4	6	36
5.	1SJ20IS005	ARADABANDA SREENIVAS KUMAR	30		18		25	15	4	6	25
6.	1SJ20IS006	ARUNKUMAR R	28	47	39		44	26	4	6	36
7.	1SJ20IS007	ASHAY KUMAR	27	40	39		50	26	4	6	36
8.	1SJ20IS008	AVINASH C	28	42	43		44	26	4	6	36
9.	1SJ20IS009	BALAM YASWANTH REDDY	23	34	36		44	23	4	6	33
10.	1SJ20IS010	BALIJA SRUTHI	29		28		27	17	4	6	27
11.	1SJ20IS011	BANGARU VINAY KUMAR	18	27	5	20	25	14	4	6	24
12.	1SJ20IS012	BASAVARAJ S BIRADAR	10	29	20	30	32	18	4	6	28
13.	1SJ20IS013	BHARATHI N	25	32	24		29	17	4	6	27
14.	1SJ20IS014	BHAVANA B	26	49	26	27	39	23	4	6	33
15.	1SJ20IS015	BHUVAN GOWDA K M	29	45	32		43	24	4	6	34
16.	1SJ20IS016	BHUVAN S	26		33		40	20	4	6	30
17.	1SJ20IS017	BOGA BHUVAN KUMAR	13	34	9	29	21	17	4	6	27
18.	1SJ20IS018	CHANDANA B N	26	38	36		41	21	4	6	31
19.	1SJ20IS019	CHETHAN KUMAR N	22	48	50		50	30	4	6	40
20.	1SJ20IS020	CHETHANA D P	23	41	33		35	22	4	6	32
21.	1SJ20IS021	CHINMAYI C	33	49	42		45	27	4	6	37
22.	1SJ20IS022	CHITRA SHREE N	32	41	35	28	48	25	4	6	35
23.	1SJ20IS023	D P SAI MANOHAR	20	42	34		42	24	4	6	34
24.	1SJ20IS024	DARSHAN D	2	16	15	26	8	10	4	6	20
25.	1SJ20IS025	DARSHAN T P	26	36	30		37	21	4	6	31
26.	1SJ20IS026	DEEKSHITHA RAM	25	50	29	27	42	24	4	6	34
27.	1SJ20IS027	DEEPAK B K	14	16	32		25	15	4	6	25
28.	1SJ20IS029	G SHIVARAME GOWDA	18	49	30		42	24	4	6	34
29.	1SJ20IS030	GAJENDRA B R	25	38	33		38	22	4	6	32
30.	1SJ20IS031	GAJENDRA V	25	42	46		50	28	4	6	38

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31	1SJ20IS032	GANASUDHA G K	24	38	27		45	22	4	6	32
32	1SJ20IS033	GANTOLLA PAVAN SAI	40		50		45	27	4	6	37
33	1SJ20IS034	GHORUDE HARIOM MADHAVRAO	25	35	20	13	8	13	4	6	23
34	1SJ20IS035	GOWTHAMI K	27		46		41	23	4	6	33
35	1SJ20IS036	HARSHAPRIYA S R	25	33	22	40	37	22	4	6	32
36	1SJ20IS037	J M KEERTHANA	29	40	35		49	25	4	6	35
37	1SJ20IS038	K T TANUJA	37		44		42	25	4	6	35
38	1SJ20IS039	KAMAL C D	22		41		27	18	4	6	28
39	1SJ20IS040	KAMSALI MALLIKARJUNACHARI	19	27	AB	26	20	15	2	6	23
40	1SJ20IS041	KAVANA M	31		42		42	23	4	6	33
41	1SJ20IS042	KEERTHANA A C	27	49	36		43	26	4	6	36
42	1SJ20IS043	KEERTHANA S	26	35	47		46	26	4	6	36
43	1SJ20IS044	KISHOR A	16								
44	1SJ20IS046	KUSHAL M	31	42	28	46	45	27	4	6	37
45	1SJ20IS047	LAVANYA T	38	46	47		50	29	4	6	39
46	1SJ20IS048	LIKITH GOWDA K M	25	31	23		27	16	4	6	26
47	1SJ20IS049	M KARTHIK	20	32	17	10	33	16	4	6	26
48	1SJ20IS050	MADHU SHREE K V	25	43	47		45	27	4	6	37
49	1SJ20IS051	MADHUSUDHAN B	21	47	47		46	28	4	6	38
50	1SJ20IS052	MADHUSUDHAN S M									
51	1SJ20IS053	MANJU M K	20	34	24		35	19	4	6	29
52	1SJ20IS054	MANOJ A	20	32	8	17	29	16	4	6	26
53	1SJ20IS055	MANOJ D B	19		37		46	20	4	6	30
54	1SJ20IS057	MEDHINI T R	AB	43	20		27	18	4	6	28
55	1SJ20IS058	MEENAKSHI L N	16	40	23	38	46	25	4	6	35
56	1SJ20IS059	MEGAVATHI K	36		49		50	27	4	6	37
57	1SJ20IS060	MOHAMMED MUSTAFA A	25	46	32		47	25	4	6	35
58	1SJ20IS061	MOHAMMED SAHEB I	20	18	AB	22	35	15	4	6	25
59	1SJ20IS062	MURALI C	31		32		44	21	4	6	31
60	1SJ20IS063	NAYANA N	29	50	29	50	50	30	4	6	40

Signature of Staff

Signature of HOD
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RESULT ABSTRACT

Period : From 01-10-2021 To 13-04-2022

DATA	Course Title & Code			
	BDA	DSA		
No. of Students Appeared	57	60		
Absentees	–	–		
First Class with Distinctions	36	21		
First Class	14	14		
Second Class	7	11		
Pass	57	52		
Fail	–	08		
% of Pass	100	86.67		

After revaluation - 90%

Sign. of the Staff

Sign. of the HOD

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