



Sri Indu

College of Engineering & Technology

UGC Autonomous Institution

Recognized under 2(f) & 12(B) of UGC Act 1956,
NAAC, Approved by AICTE &
Permanently Affiliated to JNTUH



NAAC
NATIONAL ASSESSMENT AND
ACCREDITATION COUNCIL



HANDOUT

MACHINE LEARNING

III Year I Semester

DEPARTMENT OF COMPUTER SCIENCE &
ENGINEERING (AI & ML)

ACADEMIC YEAR 2025-2026



SRIINDUCOLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

(Permanently Affiliated to JNTUH, Approved by AICTE, New Delhi and Accredited by NBA, NAAC) Sheriguda Village, Ibrahimpatnam Mandal, RangaReddy Dist.-501 510

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI & ML)

HANDOUT-INDEX

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SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

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Sheriguda Village, Ibrahimpatnam Mandal, RangaReddyDist.-501510

VISION OF THE INSTITUTE

To be a premier institution in engineering & technology and management for competency, values and social consciousness.

MISSION OF THE INSTITUTE

IM₁: Provide high quality academic programs, training activities and research facilities.

IM₂: Promote continuous industry-institute interaction aimed at promoting employability, entrepreneurship, leadership and research aptitude among stakeholders.

IM₃: Contribute to the economic and technological development of the region, state and nation.

VISION OF THE DEPARTMENT

To be a technologically adaptive centre for computing by grooming the students as top-notch professionals.

MISSION OF THE DEPARTMENT

The Department has following Missions:

DM₁: To offer quality education in computing.

DM₂: To provide an environment that enables overall development of all the stakeholders.

DM₃: To impart training on emerging technologies

DM₄: To encourage participation of stakeholders in Research and Development.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

PEO₁: Acquire the proficiency necessary to solve the Cyber security problems and be job ready.

PEO₂: Apply cutting-edge solutions within a professional, legal and ethical framework and will operate effectively in multidisciplinary teams.

PEO₃: Self-learning to keep the knowledge and skills up to date and to remain up-to-date of the latest developments in cyber security.

PEO₄: Adhere to ethical practices in professional, societal and strong inception for lifelong learning.

Program Outcomes (POs)

PO1	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning: Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program specific Outcomes (PSOs)

PSO1	Diagnose the systems reliability in risk and threat environments.
PSO2	Design and enforce computing-based solutions according to the cyber security requirements.
PSO3	Identify professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

COURSE OUTCOMES(CO's)

Academic Year: 2025-26

Class: III YEAR - I SEM.

Course Name: MACHINE LEARNING (R22CSM3112)

At the end of the course, the student will be able to

Course Outcomes (COs)	
C312.1	Understand the concepts of computational intelligence like machine learning.
C312.2	Understand the Neural Networks and its usage in machine learning applications.
C312.3	Ability to get the skill to apply machine learning techniques to address the real time problems in different areas.
C312.4	To understand computational learning theory.
C312.5	Understand the concepts of genetics algorithms and reinforcement learning.
C312.6	Understand the concepts of analytical learning and inductive learning

COURSE ARTICULATION MATRIX

CO	PO													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C312.1	3	3	2	3	1	-	-	-	-	1	2	2	1	2
C312.2	2	2	2	3	2	-	-	-	-	1	2	1	1	2
C312.3	3	3	2	2	2	-	-	-	1	1	2	2	1	2
C312.4	2	2	2	3	3	-	-	-	1	2	1	2	2	1
C312.5	2	3	2	2	2	-	-	-	1	1	1	1	1	1
C312.6	2	2	2	2	1					1	2	1	1	1
C312	1.6	1.6	2.0	2.0	-	-	-	-	-	1.1	1.6	2.8	2.8	1.5

3: High 2. Medium 1.Low

ACADEMIC CALENDAR



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
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Sheriguda (V), Ibrahimpatnam, R.R. Dist, Hyderabad - 501 510

D4

ANNEXURE -II

BR-22

Lr.No.SICET/AUTO/DAE/III B.Tech Academic Calendar/29/2025

B.TECH III-YEAR I-SEM & II-SEM ACADEMIC CALENDAR **(FOR ACADEMIC YEAR : 2025-26)**

Academic Calendar for B.Tech – IIIrd Year Students (2023 - 24 Batch), BR-22 Regulation.

I – Semester

S.No.	EVENT	PERIOD	DURATION
1.	Commencement of class work.	14.07.2025 (Monday)	
2.	1 st Spell of Instructions for covering First Two and a half Units.	14.07.2025 – 13.09.2025	9 Weeks
3.	CRT Classes	15.09.2025 – 07.10.2025	2 Weeks 2 Days
4.	I Mid Term Examinations.	08.10.2025 – 10.10.2025	3 Days
5.	Submission of I Mid Term Examination Marks.	16.10.2025	
6.	2 nd Spell of Instructions for Remaining Two and a half Units.	13.10.2025 – 13.12.2025	9 Weeks
7.	II Mid Term Examinations.	15.12.2025 – 17.12.2025	3 Days
8.	Preparation Holidays and Practical Examinations	18.12.2025 – 27.12.2025	1 Week
9.	Submission of II Mid Term Examination Marks.	23.12.2025	
10.	I Semester End Examinations.	29.12.2025 – 10.01.2026	2 Weeks
Commencement of Class-Work for III B.Tech - II Semester 19.01.2026			

Note: No of Working/instructional days : 90

II – Semester

S.No.	EVENT	PERIOD	DURATION
1.	Commencement of class work.	19.01.2026 (Monday)	
2.	1 st Spell of Instructions for covering First Two and a half Units.	19.01.2026 – 14.03.2026	8 Weeks
3.	I Mid Term Examinations.	16.03.2026 – 18.03.2026	3 Days
4.	Submission of I Mid Term Examination Marks.	24.03.2026	
5.	2 nd Spell of Instructions for Remaining Two and a half Units.	20.03.2026 – 09.05.2026	7 Weeks
6.	Continuation of remaining 2 nd Spell of Instructions	25.05.2026 – 10.06.2026	2 Weeks
7.	II Mid Term Examinations.	11.06.2026 – 13.06.2026	3 Days
8.	Preparation Holidays and Project Evaluation.	15.06.2026 – 20.06.2026	1 Week
9.	Submission of II Mid Term Examination Marks.	18.06.2026	
10.	II Semester End Examinations	22.06.2026 – 04.07.2026	2 Weeks

Note: No of Working/instructional days : 93

ACE

CE

DIRECTOR

PRINCIPAL

Controller of Examination
Sri Indu College of Engineering & Technology
(An Autonomous Institution Under UGC)
Sheriguda (V), Ibrahimpatnam, R.R. Dist-501510

DIRECTOR
Sri Indu College of Engineering & Technology
(An Autonomous Institution Under UGC)
Sheriguda (V), Ibrahimpatnam, R.R. Dist-501510

PRINCIPAL
Sri Indu College of Engineering & Technology
(An Autonomous Institution Under UGC)
Sheriguda (V), Ibrahimpatnam, R.R. Dist-501510

Sign:

Dr. M.V.S.S. Giridhar
Prof. of CEA; JNTUH Nominee

Sign:

Dr. T. Venu Gopal
Prof. of CSE; JNTUH Nominee

Sign:

Dr. D. Ramesh
Prof. of CSE; JNTUH Nominee

(Copy to DAP&E and Copy to all the Dept. Heads)

DEPARTMENT CALENDAR

SRI INDU COLLEGE OF ENGINEERING AND TECHNOLOGY(AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(AI&ML) DEPARTMENT CALENDAR – 2025-2026(SEMESTER-I)

SUNDAY					SEPTEMBER					DECEMBER		
MONDAY		JULY		1	IV-I MID I EXAMS					1	IV-I END EXAMS	
TUESDAY	1	DEPARTMENT MEETING FOR IV-I & III-I 2025-2026		2	IV-I MID I EXAMS	OCTOBER				2	IV-I END EXAMS	
WEDNESDAY	2			3	IV-I MID I EXAMS	1	III-I CRT CLASSES			3	IV-I END EXAMS	
THURSDAY	3		AUGUST	4	IV-I SPELL 2 CLASSES	2	GANDHI JAYANTI & DASHARAJA			4	IV-I END EXAMS 1	
FRIDAY	4		II-I SPELL 1 CLASSES COMMENCEMENT	5		3	III-I CRT CLASSES	NOVEMBER		5	IV-I END EXAMS 2	
SATURDAY	5		DEPARTMENT MEETING	6		4	III-I CRT CLASSES	1	WOKSHOP UNDER AI CLUB	6	IV-I END EXAMS 3	
SUNDAY	6			7		5		2		7		4
MONDAY	7	IV-I SPELL 1 CLASSES COMMENCEMENT		8		6	III-I CRT CLASSES	3		8	IV-I END EXAMS	5
TUESDAY	8			9		7	III-I CRT CLASSES	4		9	IV-I END EXAMS	6
WEDNESDAY	9			10	IV-I MID I EXAMS SUBMISSION	8	III-I MID I EXAMS & II-I MID I EXAMS	5		10	IV-I END EXAMS	7
THURSDAY	10			11		9	III-I MID I EXAMS & II-I MID I EXAMS	6		11	IV-I END EXAMS	8
FRIDAY	11			12	DEPARTMENT MEETING REVIEW ON IV-I SLOW LEARNERS	10	III-I MID I EXAMS & II-I MID I EXAMS	7		12	IV-I END EXAMS	9
SATURDAY	12	AI CLUB MEETING	WOKSHOP UNDER AI CLUB	13	AI CLUB MEETING	11		8		13	IV-I END EXAMS	10
SUNDAY	13			14		12		9		14		11
MONDAY	14	III-I SPELL 1 CLASSES COMMENCEMENT		15	III-I CRT CLASSES	13	II-I & III-I SPELL 2 CLASSES	10		15	II-I & III-I MID II EXAMS	12
TUESDAY	15			16	III-I CRT CLASSES	14		11		16	II-I & III-I MID II EXAMS	13
WEDNESDAY	16			17	III-I CRT CLASSES	15		12		17	II-I & III-I MID II EXAMS	14
THURSDAY	17			18	III-I CRT CLASSES	16	II-I & III-I MID I E MARKS SUBMISSION	13		18	II-I & III-I PREPARATION & PRACTICAL EXAMS	15
FRIDAY	18		15 INDEPENDENCE DAY	19	III-I CRT CLASSES	17	DEPARTMENT MEETING REVIEW ON III-IB, II-I SLOW LEARNERS	14		19	II-I & III-I PREPARATION & PRACTICAL EXAMS	16
SATURDAY	19			20	III-I CRT CLASSES	18	AI CLUB MEETING	15		20	II-I & III-I PREPARATION & PRACTICAL EXAMS	17
SUNDAY	20			21	SATHUKAMMA	19		16		21		18
MONDAY	21	BONALI HOLIDAY		22	III-I CRT CLASSES	20	DIWALI	17		22	II-I & III-I PREPARATION & PRACTICAL EXAMS	19
TUESDAY	22			23	III-I CRT CLASSES	21		18		23	II-I & III-I MID II MARKS SUBMISSION III-I PREPARATION & PRACTICAL EXAMS	20

WEDNESDAY	23		20		24	III-I CRT CLASSESS	22		19	IV-I MID II EXAMS	24	II-I & III-I PREPARATION & PRACTICAL EXAMS	21
THURSDAY	24		21		25	III-I CRT CLASSESS	23		20	IV-I MID II EXAMS	25	CHRISTMAS DAY	22
FRIDAY	25		22		26	III-I CRT CLASSESS	24		21	IV-I MID II EXAMS	26	II-I & III-I PREPARATION & PRACTICAL EXAMS	23
SATURDAY	26		23		27	GANESH CHATURTHI	25	DEPARTMENT MEETING	22	AI CLUB MEETING	27	II-I & III-I PREPARATION & PRACTICAL EXAMS	24
SUNDAY	27		24		28		26		23		28		25
MONDAY	28	DEPARTMENT MEETING FOR II YR 2025-2026	25		29	III-I CRT CLASSESS	27		24	IV-I PREPARATION & PRACTICAL EXAMS	29	II-I & III-I END EXAMS	26
TUESDAY	29		26		30	III-I CRT CLASSESS	28		25	IV-I PREPARATION & PRACTICAL EXAMS	30	II-I & III-I END EXAMS	27
WEDNESDAY	30		27				29		26	IV-I PREPARATION & PRACTICAL EXAMS	31	II-I & III-I END EXAMS	28
THURSDAY	31		28				30		27	IV-I PREPARATION & PRACTICAL EXAMS			29
FRIDAY			29				31		28	IV-I PREPARATION & PRACTICAL EXAMS			30
SATURDAY			30	AI CLUB MEETING		WOKSHOP UNDER AI LUB			29	IV-I PREPARATION & PRACTICAL EXAMS			31
SUNDAY			31						30				

MACHINE LEARNING

SYLLABUS

BR22 – B.TECH. – CSE(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

B.Tech. - III Year – I Semester

L	T	P	C
3	0	0	3

(R22CSM3112) MACHINE LEARNING

Course Objectives

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

Course Outcomes

- Understand the concepts of computational intelligence like machine learning.
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas.
- Understand the Neural Networks and its usage in machine learning application.

UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning.

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance-Based Learning- Introduction, k -nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT- IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary,

learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning – Introduction, the learning task, Q -learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOK:

1. Machine Learning – Tom M. Mitchell, - MGH.

REFERENCE BOOK:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

	SRI INDU COLLEGE OF ENGG & TECHNOLOGY QUESTION BANK (Regulation: BR22) Department of CSE (AI&ML)			Prepared on 09-07-2025	
	Sub. Code & Title		(R22CSM3112) MACHINE LEARNING		
	Academic Year:2025-26		Year/Sem. III/I		Academic Year:2025-26
	Faculty Name & Designation		Dr. E. RAVI, ASSOC.PROFESSOR Dr. M. NARESH, ASSOC.PROFESSOR		

Unit / Item No.	Topic(s)	Book Reference	Page(s)		Teaching Methodology	Proposed No. of Periods	Actual Date of Handled	CO/BT
			From	To				
	UNIT-I							
I	ML Introduction					19		
1.1	Introduction	T1	1	1	Black board	1		CO1/L2
1.2	Well-posed learning problems	T1	2	3	Black board	1		CO1/L1
1.3	Designing a learning system	T1	4	6	Black board	2		CO1/L2
1.5	Perspectives and issues in machine learning	T1	7	7	Black board	1		CO1/L2
1.6	Concept learning task,	T1	8	9	Black board	1		CO1/L1
1.7	Concept learning as search	T1	10	11	Black board	1		CO1/L2
1.8	finding a maximally specific hypothesis	T1	12	14	Black board	1		CO1/L1
1.9	Version spaces and the Candidate elimination algorithm,	T1	15	17	Black board	1		CO1/L3
1.10	Remarks on version spaces and Candidate elimination,	T1	18	20	Black board	2		CO1/L4
1.11	Inductive bias.	T1	21	21	Black board	1		CO1/L1
1.12	Introduction to Decision tree representation	T1	22	23	Black board	1		CO1/L2
1.13	Appropriate problems for decision tree learning,	T1	24	24	Black board	1		CO1/L2
1.14	the basic decision tree learning algorithm,	T1	25	25	Black board	1		CO1/L1
1.15	hypothesis space search in decision tree learning,	T1	26	28	Black board	1		CO1/L2
1.16	Inductive bias in decision tree learning	T1	29	31	Black board	1		CO1/L1
1.17	Issues in decision tree learning.	T1	31	33	Black board	1		CO1/L3
	Review	Signature of the HOD / Coordinator						
Unit / Item No.	Topic(s)	Book Reference	Page(s)		Teaching Methodology	Proposed No. of Periods	Actual Date of Handled	CO/BT
UNIT-II								
II	Artificial Neural Networks-1, 2 Evaluation Hypotheses					13		

2.1	Introduction,	T1	35	35	Black board	1		CO1/L1
2.2	neural network representation	T1	36	37	Black board	1		CO2/L2
2.3	appropriate problems for neural network learning,	T1	37	39	Blackboard	1		CO2/L1
2.4	perceptions,	T1	39	41	Blackboard	1		CO2/L1
2.5	multilayer networks and the back-propagation algorithm.	T1	41	41	Blackboard	1		CO2/L1
2.6	Remarks on the Back-Propagation algorithm	T1	42	44	Black board	1		CO2/L3
2.7	An illustrative example: face recognition	T1	44	45	Black board	1		CO2/L1
2.8	advanced topics in artificial neural networks	T1	45	46	Black board	1		CO2/L2
2.9	Motivation, estimation hypothesis accuracy	T1	47	51	Black board	1		CO2/L1
2.10	basics of sampling theory	T1	52	57	Black board	1		CO2/L3
2.11	a general approach for deriving confidence intervals	T1	57	61	Black board	1		CO2/L1
2.12	difference in error of two hypotheses	T1	61	62	Black board	1		CO2/L2
2.13	comparing learning algorithms.	T1	62	63	Black board	1		CO2/L1
	Review	Signature of the HOD/Coordinator						
UNIT-III								
III	Bayesian Learning					14		
3.1	Introduction to Bayes theorem and concept learning	T1	70	71	Blackboard	1		CO3/L3
3.2	Maximum Likelihood and least squared error hypotheses	T1	71	71	Presentation	1		CO3/L3
3.3	maximum likelihood hypotheses for predicting probabilities,	T1	72	73	Black board	1		CO3/L1
3.4	minimum description length principle,	T1	73	74	Black board	1		CO3/L1
3.5	Bayes optimal classifier	T1	74	75	Black board	1		CO3/L3
3.6	Gibs algorithm		75	76	Black board	1		CO3/L1
3.7	Naïve Bayes classifier, an example: learning to classify text	T1	77	78	Black board	1		CO3/L2
3.8	Bayesian belief networks,	T1	79	81	Presentation	1		CO3/L3
3.9	the EM algorithm	T1	82	84	Presentation	1		CO3/L1
3.10	Introduction, probably learning an approximately correct hypothesis	T1	85	87	Black board	1		CO3/L2
3.11	sample complexity for finite hypothesis space	T1	88	90	Black board	1		CO3/L2
3.12	sample complexity for infinite hypothesis spaces	T1	91	93	Black board	1		CO3/L4
3.13	the mistake bound model of learning.	T1	93	94	Black board	1		CO3/L1
3.14	Introduction, k-nearest neighbour algorithm	T1	95	99	Black board	1		CO4/L3
3.15	locally weighted regression,	T1	100	101	Black board	1		CO3/L2
3.16	radial basis functions and case-based reasoning	T1	102	102	Black board	1		CO3/L3

3.17	remarks on lazy and eager learning	T1	103	105	Black board	1		CO3/L2
	Review	Signature of the HOD/Coordinator						
UNIT-IV								
IV	Genetic Algorithms					20		
4.1	Motivation, Genetic algorithms an illustrative example	T1	106	107	Black board	1		CO4/L2
4.2	hypothesis space search	T1	108	110	Black board	1		CO4/L2
4.3	genetic programming	T1	112	113	Black board	1		CO4/L5
4.4	models of evolution and learning	T1	114	116	Black board	1		CO4/L1
4.5	parallelizing genetic algorithms.	T1	117	121	Black board	1		CO4/L2
4.6	Introduction, sequential covering algorithms	T1	121	124	Black board	1		CO4/L2
4.7	Learning rule sets: summary	T1	125	127	Black board	1		CO4/L2
4,8	learning First-Order rules	T1	128	131	Black board	1		CO4/L5
4,9	learning sets of First-Order rules:	T1	132	135	Black board	1		CO4/L1
410	FOIL	T1	138	141	Black board	1		CO4/L2
4.11	Induction as inverted deduction	T1	143	147	Black board	1		CO5/L2
4.12	inverting resolution.	T1	151	157	Black board	1		CO4/L2
4.13	Introduction, the learning task	T1	161	167	Black board	1		CO5/L5
4.14	Q-learning,	T1	168	174	Black board	2		CO5/L1
4.15	non-deterministic,	T1	174	178	Black board	1		CO5/L2
4.16	rewards and actions,	T1	179	180	Black board	1		CO5/L2
4.17	temporal difference learning	T1	181	185	Black board	1		CO5/L2
4.18	generalizing from examples	T1	189	192	Black board	1		CO5/L5
4.19	relationship to dynamic programming.	T1	193	195	Black board	1		CO5/L1
	Review	Signature of the HOD/Coordinator						
UNIT-V								
v	Analytical Learning-1					07		
5.1	Introduction, learning with perfect domain theories: PROLOG-EBG	T1	196	198	Seminar	1		CO6/L2
5.2	remarks on explanation-based learning,	T1	201	206	Black board	1		CO6/L2
5.3	explanation-based learning of search control knowledge	T1	208	210	Black board	1		CO6/L5
5.4	Using prior knowledge to alter the search objective	T1	210	217	Black board	1		CO6/L1
5.5	using prior knowledge to augment search operators.	T1	218	221	Seminar	1		CO6/L2

5.6	Motivation, inductive-analytical approaches to learning,	T1	223	226	Black board	1		CO6/L3
5.7	using prior knowledge to initialize the hypothesis	T1	227	230	Black board	1		CO6/L1
	Review	Signature of the HOD / Coordinator						

	SRI INDU COLLEGE OF ENGG & TECHNOLOGY QUESTION BANK (Regulation: BR22) Department of CSE (AI&ML)			Prepared on 09-07-2025
	Sub. Code & Title		(R22CSM3112) MACHINE LEARNING	
	Academic Year:2025-26		Year/Sem.	Academic Year:2025-26
	Faculty Name & Designation		Dr. E. RAVI, ASSOC.PROFESSOR Dr. M. NARESH, ASSOC.PROFESSOR	

QUESTION BANK WITH BLOOMS TAXONOMY LEVEL (BTL)

(1. Remembering 2. Understanding 3. Applying 4. Analyzing 5. Evaluating 6. Creating)

UNIT-1 : INTRODUCTION			
	Multiple choice Questions	BT Level	Course Outcome
1C-1	What is Machine learning? a) The selective acquisition of knowledge through the use of computer programs b) The selective acquisition of knowledge through the use of manual programs c) The autonomous acquisition of knowledge through the use of computer programs d) The autonomous acquisition of knowledge through the use of manual programs	I	CO1
1C-2	_____ is the approach of basic algorithm for decision tree induction. A) Greedy b) Top Down c) Procedural d) Step by Step	I	CO1
1C-3	Which of the following is not a supervised machine learning algorithm? a) K-means b) Naïve Bayes c) SVM for classification problems d) Decision tree	I	CO1
1C-4	Well posed learning problems are A) Checkers game B) Handwriting recognition learning problem C) Robo driving learning problem D) All the above	I	CO1
1C-5	Which algorithm is best suited for a binary classification problem? a) K-nearest Neighbors b) Decision Trees c) Random Forest d) Linear Regression	I	CO1
1C-6	What is one of the drawbacks of the Find-S algorithm? a) Computation cost is high b) Time-ineffective c) All correct hypotheses are not output. d) Most specific accurate hypothesis is not output	I	CO1

1C-6	Decision tree uses the inductive learning machine learning approach. A) False B) True	I	CO1
1C-7	What elements describe the Candidate-Elimination algorithm? a) depends on the dataset b) just a set of candidate hypotheses c) just a set of instances d) set of instances, set of candidate hypotheses	I	CO1
1C-8	What is the goal of concept learning? a) To minimize cross-validation set error b) To maximize test set accuracy c) To find a hypothesis that is most suitable for training instances To identify all possible predictors	I	CO1
1C-9	For a dataset with 4 attributes, which is the most general hypothesis? a) (Sunny, Warm, Strong, Humid) b) (Sunny, ?, ?, ?) c) (?, ?, ?, ?) d) ($\emptyset$, $\emptyset$, $\emptyset$, $\emptyset$)	I	CO1
1C-10	What is present in the version space of the Find-S algorithm in the beginning? a) Set of all hypotheses H b) Both maximally general and maximally specific hypotheses c) Maximally general hypothesis d) Maximally specific hypothesis	I	CO1
1C-11	What is one of the assumption of the Find-S algorithm? a) No assumptions are made b) The most specific hypothesis is also the most general hypothesis c) All training data are correct (there is no noise) d) Overfitting does not occur	I	CO1
1C-12	How does the hypothesis change gradually? a) Specific to Specific b) Specific to General c) General to Specific d) General to General	I	CO1
1C-14	Which of the following statements is not true about the ID3 algorithm? a) It is used to generate a decision tree from a dataset b) It begins with the original set S as the root node c) On each iteration of the algorithm, it iterates through every unused attribute of the set S and calculates the entropy or the information gain of that attribute d) Finally it selects the attribute which has the largest entropy value	I	CO1
1C-15	Which of the following statements is not true about Information Gain? a) It is a gain measure that is used in the ID3 algorithms b) It is the difference between the entropy of the label before and after the split c) It is based on the decrease in entropy after a data-set is split on an attribute d) Constructing a decision tree is all about finding attribute that returns the lowest information gain	I	CO1

	FILL IN THE BLANKS	BT Level	Course Outcome
1F- 1	_____ algorithm is best suited for a binary classification problem	I	CO1
1F-2	_____ is a generative model used in machine learning	I	CO1
1F-3	Candidate-Elimination algorithm can be described by _____	I	CO1
1F-4	version space represented by _____	I	CO1
1F-5	S = <sunny, warm, high, same>. Training data = <sunny, warm, normal, same> => Yes (positive example). How will S be represented after encountering this training data -----	I	CO1
1F-6	version space of the Find-S algorithm in the beginning by _____	I	CO1
1F-7	What is one of the advantages of the Find-S algorithm _____	I	CO1
1F-8	one of the drawbacks of the Find-S algorithm _____	I	CO1
1F-9	Which algorithm accommodates all the maximally specific hypotheses _____	I	CO1
1F-10	Decision trees are a type of _____ learning	I	CO1
1F-11	Well posed learning problem if it has three traits _____.	I	CO1
1F-12	Algorithm for version space _____.	I	CO1
1F-13	Each leaf node represents the _____	I	CO1
1F-14	_____ is Consistent hypothesis .	I	CO1
1F-15			
1M-1	Match the following 1. Machine learning A. Minimize errors in predictions 2. Supervised learning B. The predicted category of an input 3. Unsupervised learning C. Technique for teaching computers to learn from data 4. Backup and Recovery D. K-Means Clustering	I	CO1
1M -2	1) Cross Validation A. Precision focuses on false positives 2) Regularization B. recall focuses on false negatives 3) Precision C. Testing a model's generalization ability 4) Recall D. To decrease model complexity	I	CO1
1M -3	1) Find-S algorithm A. Positive Example inconsistent with the hypothesis is encountered 2) Hypothesis B. Computation cost is high 3) Find-S algorithm drawbacks C. Maximally specific hypothesis 4) Hypothesis in FIND S D. Specific to General	I	CO1

1M -4	1) Well posed learning 2) Decision Tree 3) Training Example 4) Version Space	A. Candidate elimination algorithm B. Checker’s game C. Information Gain D. Target attribute	I	CO1																																																																																										
1M -5	1) ID3 2) P+ 3) Entrophy 4) Occam’s Razor	A. Prefer the simplest hypothesis that fits the data B. Searches a complete hypothesis space C. Proportion of positive examples D. Information gain	I	CO1																																																																																										
	5-MARKSQUESTIONS		BT Level	Course Outcome																																																																																										
1D-1.	Define Machine Learning. Explain with examples why machine learning is important.		II	CO1																																																																																										
1D-2.	Describe the following problems with respect to Tasks, Performance and Experience: A. A Checkers learning problem B. Handwritten recognition learning problem C. A Robot driving learning problem		II	CO1																																																																																										
1D-3.	Apply FIND-S algorithm and explain with example given below <table><tr><th>Examp l e</th><th>Sky</th><th>AirTemp</th><th>Humidity</th><th>Wind</th><th>Water</th><th>Forecast</th><th>Enjoy Sport</th></tr><tr><td>1</td><td>Sunny</td><td>Warm</td><td>Normal</td><td>Strong</td><td>Warm</td><td>Same</td><td>Yes</td></tr><tr><td>2</td><td>Sunny</td><td>Warm</td><td>High</td><td>Strong</td><td>Warm</td><td>Same</td><td>Yes</td></tr><tr><td>3</td><td>Rainy</td><td>Cold</td><td>High</td><td>Strong</td><td>Warm</td><td>Change</td><td>No</td></tr><tr><td>4</td><td>Sunny</td><td>Warm</td><td>High</td><td>Strong</td><td>Cool</td><td>Change</td><td>Yes</td></tr></table>		Examp l e	Sky	AirTemp	Humidity	Wind	Water	Forecast	Enjoy Sport	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	III	CO1																																																		
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3	Rainy	Cold	High	Strong	Warm	Change	No																																																																																							
4	Sunny	Warm	High	Strong	Cool	Change	Yes																																																																																							
1D-4.	Determine the version space for the above mentioned training examples using candidate elimination algorithm.		V	CO1																																																																																										
1D-5.	Explain in detail the Inductive Bias of Candidate Elimination algorithm		II	CO1																																																																																										
1D-6.	Construct the Decision tree for the following set of training examples <table><tr><th>Day</th><th>Outlook</th><th>Temper ature</th><th>Humidit y</th><th>Wind</th><th>Play Tennis</th></tr><tr><td>D1</td><td>Sunny</td><td>Hot</td><td>High</td><td>Weak</td><td>No</td></tr><tr><td>D2</td><td>Sunny</td><td>Hot</td><td>High</td><td>Strong</td><td>No</td></tr><tr><td>D3</td><td>Overcast</td><td>Hot</td><td>High</td><td>Weak</td><td>Yes</td></tr><tr><td>D4</td><td>Rain</td><td>Mild</td><td>High</td><td>Weak</td><td>Yes</td></tr><tr><td>D5</td><td>Rain</td><td>Cool</td><td>Normal</td><td>Weak</td><td>Yes</td></tr><tr><td>D6</td><td>Rain</td><td>Cool</td><td>Normal</td><td>Strong</td><td>No</td></tr><tr><td>D7</td><td>Overcast</td><td>Cool</td><td>Normal</td><td>Strong</td><td>Yes</td></tr><tr><td>D8</td><td>Sunny</td><td>Mild</td><td>High</td><td>Weak</td><td>No</td></tr><tr><td>D9</td><td>Sunny</td><td>Cool</td><td>Normal</td><td>Weak</td><td>Yes</td></tr><tr><td>D10</td><td>Rain</td><td>Mild</td><td>Normal</td><td>Weak</td><td>Yes</td></tr><tr><td>D11</td><td>Sunny</td><td>Mild</td><td>Normal</td><td>Strong</td><td>Yes</td></tr><tr><td>D12</td><td>Overcast</td><td>Mild</td><td>High</td><td>Strong</td><td>Yes</td></tr><tr><td>D13</td><td>Overcast</td><td>Hot</td><td>Normal</td><td>Weak</td><td>Yes</td></tr><tr><td>D14</td><td>Rain</td><td>Mild</td><td>High</td><td>Strong</td><td>No</td></tr></table>		Day	Outlook	Temper ature	Humidit y	Wind	Play Tennis	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	III	CO1
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1D-7.	Discuss Consistent Hypothesis and Version Space.				II	CO1	
1D-8	Discuss Inductive Bias in Decision Tree Learning and explain the Restriction Biases, Preference Biases.				VI	CO1	
1D-9	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 training examples?				II	CO1	
	Instance	Classification	a1	a2			
	1	+	T	T			
	2	+	T	T			
	3	-	T	F			
	4	+	F	F			
	5	-	F	T			
	6	-	F	T			
1D-10	Identify the entropy, information gain and draw the decision trees for the following set of training example.				III	CO1	
	Gender	Car ownership	Travel cost	Income Level			Transportation (Class)
	Male	0	Cheap	Low			Bus
	Male	1	Cheap	Medium			Bus
	Female	1	Cheap	Medium			Train
	Female	0	Cheap	Low			Bus
	Male	1	Cheap	Medium			Bus
	Male	0	Standard	Medium			Train
	Female	1	Standard	Medium			Train
	Female	1	Expensive	High			Car
	Male	2	Expensive	Medium			Car
	Female	2	Expensive	High			Car
1D-11	List and Interpret the issues in decision tree learning in detail.				II	CO1	
1D-12	Explain basic decision tree algorithm with example?				II	CO1	
UNIT-II							
	Multiple choice Questions				BT Level	Course Outcome	

2C-1	What is perceptron? a) a single layer feed-forward neural network with pre-processing b) an auto-associative neural network c) a double layer auto-associative neural network d) a neural network that contains feedback	I	CO2
2C-2	What is an Artificial Neural Network (ANN)? a) A computational model inspired by the human brain b) A machine learning algorithm used for image processing c) A statistical analysis technique for data clustering d) A programming language for neural network implementation	I	CO2
2C-3	What is the basic building block of an Artificial Neural Network? a) Neuron b) Activation function c) Gradient descent d) Loss function	I	CO2
2C-4	Which of the following activation functions is commonly used in ANNs? a) ReLU (Rectified Linear Unit) b) Sigmoid c) Tanh (Hyperbolic Tangent) d) All of the above	I	CO2
2C-5	What is the function of the input layer in an ANN? a) It receives input data and passes it to the hidden layers b) It performs mathematical computations on the input data c) It stores the trained weights and biases of the network d) None of the above	I	CO2
2C-6	Which layer of an ANN is responsible for making predictions or producing the final output? a) Input layer b) Hidden layer c) Output layer d) All layers contribute equally	I	CO2
2C-7	What is the purpose of the back propagation algorithm in ANN training? a) To update the weights and biases based on the prediction error b) To initialize the weights and biases of the network c) To determine the number of hidden layers and neurons d) None of the above	I	CO2
2C-8	What is the purpose of the forward pass in ANN training? a) To compute the predicted output based on the current weights and biases b) To adjust the weights and biases using gradient descent c) To identify misclassified samples and update the model d) None of the above	I	CO2

2C-9	What is the primary goal of training an ANN? a) To minimize the prediction error on the training data b) To maximize the number of neurons in the hidden layers c) To achieve 100% accuracy on the test data d) None of the above	I	CO2
2C-10	Which of the following is a common optimization algorithm used in ANN training? a) Gradient Descent b) Stochastic Gradient Descent (SGD) c) Adam d) All of the above	I	CO2
2C-11	Which type of ANN architecture is commonly used for image classification tasks? a) Convolutional Neural Network (CNN) b) Recurrent Neural Network (RNN) c) Radial Basis Function Network (RBFN) d) Multilayer Perceptron (MLP)	I	CO2
2C-12	What is the purpose of weight initialization in ANN training? a) To set the initial values of the weights and biases in the network b) To adjust the learning rate during training c) To compute the gradient of the loss function d) None of the above	I	CO2
2C-13	Which activation function is commonly used in the output layer for binary classification in ANN's? a) Sigmoid b) ReLU (Rectified Linear Unit) c) Tanh (Hyperbolic Tangent) d) Softmax	I	CO2
2C-14	What is the purpose of the bias term in an ANN? a) To provide a threshold for neuron activation b) To add an additional feature to the input data c) To prevent over-fitting by adjusting the learning rate d) None of the above	I	CO2
2C-15	What is full form of ANN's? a) Artificial Neural Node b) AI Neural Networks c) Artificial Neural Networks d) Artificial Neural number	I	CO2
Fill in the blanks			
2F-1	ANN is the collection of artificial _____	I	CO2
2F-2	In ANN, Neurons interconnected among multiple network layers are referred to as _____	I	CO2
2F-3	The complexity of ANN is dependent upon -----	I	CO2
2F-4	Weighted sums in ANNs are referred to as -----	I	CO2

2F-5	Weighted sums are passed via activation functions and -----is produced	I	CO2
2F-6	Ultimate results are produced in ANN at -----	I	CO2
2F-7	Input applied in ANN passed on to layers hidden to produce outcome is referred to as -----	I	CO2
2F-8	Computational power in ANNs is determined by -----	I	CO2
2F-9	ANN involves large processors operating in -----	I	CO2
2F-10	ANNs are -----	I	CO2
2F-11	Facial recognitions & computer vision technologies use -----	I	CO2
2F-12	Processing nodes outcome is saved in -----variant of ANN	I	CO2
2F-13	Text-to-speech conversion uses -----	I	CO2
2F-14	Image recognition is possible by using -----	I	CO2
2F-15	ANNs are utilized for Dynamic modelling and its identification -----	I	CO2

Match the following

2M-1	1) Interconnected units 2) Input layer 3) Hidden layer 4) Output layer	A) Representing predictions or classifications B) Nuerons C) Recieves th einput data D) Perform intermediate computations and transformations	I	CO2
2M-2	1) Artificial neural netwroks 2) ReLU activation function 3)Back propagation 4) Output layer	A) Collection of interconnected nodes or Nuerons B)Recieves th einput data C) An optimization algorithm for training neural networks D) Perform intermediate computations and transformations	I	CO2
2M-3	1) Null hypothesis 2) Alternative hypothesis 3) Type I Error 4) Type II Error	A) A statement of an effect or a difference B) A statement of no effect or no difference C) Failing to reject the null hypothesis when it is false D) Rejecting the null hypothesis when it is true.	I	CO2

5-MARKSQUESTIONS

2D-1.	Elaborate multilayer networks and back propagation algorithm with an example.	VI	CO2
2D-2.	Consider two perceptron defined by the threshold expression $w_0 + w_1x_1 + w_2x_2 > 0$. Perceptron A has weight values $w_0=1, w_1=2, w_2=1$ And perceptron B has the weight values $w_0=0, w_1=2, w_2=1$ True or false? Perceptron A is more general than perceptron B.	II	CO2
2D-3.	Write a note on (i) Perceptron Training Rule (ii) Gradient Descent and Delta Rule.	II	CO2

2D-4.	How a single perceptron can be used to represent the Boolean functions such as AND& OR? Justify		CO2
2D-5.	Design a two-input perceptron that implements the Boolean function $A \wedge \neg B$. Design a two-layer network of perceptron's that implements A XOR B	VI	CO2
2D-6.	Evaluate the practical design choices involved in applying backpropagation algorithm in learning task of face recognition system.	V	CO2
2D-7	What are the remarks of Back Propagation Algorithm? Illustrate in detail.	III	CO2
2D-8	Discuss in detail about representation of Neural Networks.	VI	CO2
2D-9	Discuss how a multi-layer network learns using a gradient descent algorithm	VI	CO2
2D-10	Distinguish between single layer and multilayer neural networks.	III	CO2
2D-11	Present the Back propagation algorithm for feed forward networks and explain each step in it	II	CO2
2D-12	Explain multilayer neural networks using back propagation with an example.	II	CO2
2D-13	What is Artificial Neural Network? Explain appropriate problems for Neural Network Learning with its characteristics.	II	CO2

UNIT-III			
	Multiple choice Questions	BT Level	Course Outcome
3C-1	What is the fundamental principle behind Bayesian algorithms? a. Minimizing error b. Maximizing accuracy c. Incorporating prior knowledge d. Optimizing computational complexity	I	CO3
3C-2	Which Bayesian algorithm is commonly used for classification tasks? a. Naive Bayes b. Bayesian Networks c. Bayesian Linear Regression d. Bayesian Optimization	I	CO3
3C-3	Which assumption does the Naive Bayes algorithm make regarding the features? a. They are conditionally dependent b. They are conditionally independent c. They are normally distributed d. They are uniformly distributed	I	CO3

3C-4	Which Bayesian algorithm is commonly used for modelling dependencies among variables? a. Naive Bayes b. Bayesian Networks c. Bayesian Linear Regression d. Bayesian Optimization	I	CO3
3C-5	K-Nearest Neighbours (KNN) is classified as what type of machine learning algorithm? a) Instance-based learning b) Parametric learning c) Non-parametric learning d) Model-based learning	I	CO3
3C-6	k-nearest neighbour (k-NN) is a type of ____ method. a) Reinforcement learning b) Unsupervised learning c) Instance-based learning d) Lazy learning	I	CO3
3C-7	Which of the following is a disadvantage of lazy learning? a) Difficulty to maintain b) Not fit for simultaneous application to multiple problems c) Not suitable for complex and incomplete problem domains d) Difficult to handle excessively noise data	I	CO4
3C-8	Choose the instance-based learner. A) Eager Learner B) Lazy Learner C) Both (A) and (B) D) None of the Above	I	CO4
3C-9	How many terms are required for building a bayes model? a) 1 b) 2 c) 3 d) 4	I	CO4
3C-10	Where does the bayes rule can be used? A)Solving queries B)Increasing complexity C) Decreasing complexity D) Answering probabilistic query	I	CO4
3C-11	How the bayesian network can be used to answer any query? A)Full distribution B)Joint distribution C)Partial distribution D) All of the mentione	I	CO4

3C-12	How the entries in the full joint probability distribution can be calculated? A. Using variables B. Using information C. Both Using variables & information D. None of the mentioned	I	CO4
3C-13	In the context of instance-based learning, what is an episodic memory? A) A memory of specific instances in the training data B) A memory of the general patterns in the training data C) A memory of the similarity measures used during training D) A memory of the classification rules learned during training	I	CO4
3C-14	Which of the following is an example of Instance-Based Learning? A) K-Nearest Neighbors B) Naïve Bayes C) Neural Networks D) Decision Trees	I	CO4
3C-15	What is the primary limitation of KNN? A) High computational cost for large datasets B) Cannot classify non-linear data C) Requires labeled training data D) Does not work with real-world problems	I	CO-4
	Fill in the Blanks	BT Level	Course Outcom
3F-1	Bayes' theorem calculates the probability of a hypothesis given _____.	I	CO 3
3F-2	The Gibbs Algorithm selects hypotheses based on their _____ probability.	I	CO 3
3F-3	Naïve Bayes assumes that features are _____ of each other.	I	CO 3
3F-4	The EM Algorithm is often used for training _____ models.	I	CO 3
3F-5	Instance-based learning stores training examples and delays learning until a _____ is needed.	I	CO-4
3F-6	K-Nearest Neighbors finds the closest _____ to classify new data points.	I	CO-4
3F-7	Case-Based Reasoning solves new problems by referring to _____ cases.	I	CO-4
3F-8	Locally Weighted Regression assigns higher importance to _____ training points.	I	CO-4
3F-9	The Minimum Description Length principle balances model complexity and _____.	I	CO-4
3F-10	Naïve Bayes Algorithm is a _____ learning algorithm.	I	CO-3
3F-11	In the context of instance-based learning, what does the term `nan` refer to -----	I	CO-4

3F-12	_____parameter of the K-Nearest Neighbors algorithm determines the number of neighbors to consider when classifying a new point	I	CO-4
3F-13	Kind of data representation is commonly used in instance-based learning methods like K-Nearest Neighbors -----	I	CO-4

5- MARKSQUESTION S			
3 D-1	A) Explain the features of Bayesian learning methods. B) Discuss the relationship between the maximum likelihood hypothesis and the least squared error hypothesis.	III	CO-3
3 D-2	Illustrate Naïve Bayes Classifier of Bayesian learning.	II	CO-3
3 D-3	Describe the Naive Bayesian method of classification. What assumptions does this method make about the ribues and the classification? Give an example where this assumption is to justify.		CO-3
3 D-4	Explain Gibbs algorithm with an example.	II	CO-3
3 D-5	State Bayes theorem. Illustrate Bayes theorem with an example.	II	CO-3
3 D-6	a) Discuss about Bayesian belief networks. b) Explain about Bayes theorem.	III	CO-3
3 D-7	a) Explain Gibbs algorithm with an example. b) State and explain the Minimum Description Length Principle.	II	CO-3
3 D- 8	Describe briefly about k-nearest neighbour algorithm.	II	CO-4
3 D-9	Compare and contrast Lazy and Eager Learning.	IV	CO-4
3 D-10	Explain Weighted-Majority algorithm.	II	CO-4
3 D-11	a) Write the differences between Eager Learning and Lazy Learning approaches. b) State Bayes theorem. Illustrate Bayes theorem with an example.	II	CO-4
3 D-12	Explain the Mistake Bound for the Halving Algorithm.	II	CO-4
3 D-13	Elaborate the Locally Weighted Linear Regression.	VI	CO-4

UNIT-IV			
	Multiple choice Questions	BT Level	Course Outcome
4C-1	What is the primary inspiration for Genetic Algorithms? a) Neural networks b) Evolution and natural selection c) Decision trees d) Bayesian networks	I	CO5
4C-2	Which component of a genetic algorithm is responsible for maintaining diversity in the population? a) Selection b) Crossover c) Mutation d) Fitness function	I	CO5
4C-3	How does a fitness function influence the genetic algorithm? a) It assigns random values to solutions b) It determines which individuals survive and reproduce c) It removes weak solutions immediately d) It generates new individuals through mutation	I	CO5
4C-4	What is the main purpose of crossover in a genetic algorithm? a) To increase population size b) To create new offspring by combining genetic material from parents c) To remove low-fitness individuals d) To introduce random mutations	I	CO5
4C-5	Which of the following approaches can parallelize genetic algorithms efficiently? a) Using an island model b) Reducing the population size c) Removing the crossover operation d) Avoiding mutation	I	CO5
4C-6	You are given a hypothesis space in a genetic algorithm. How would you optimize the search? a) Increase mutation probability to 100% b) Use a fitness function that rewards diversity and performance c) Always select the best individuals d) Use only a single generation	I	CO5
4C-7	How does genetic programming differ from standard genetic algorithms? a) Genetic programming evolves programs as solutions b) Genetic algorithms work only with binary chromosomes c) Genetic programming requires labeled data d) Genetic algorithms do not use mutation	I	CO5
4C-8	What is the main limitation of hypothesis space search in genetic algorithms? a) It always converges to a global optimum b) It can get stuck in local optima c) It does not require a fitness function d) It never explores new solutions	I	CO5
4C-9	Which of the following statements best describes the trade-off in genetic algorithms? a) High mutation rates always lead to better results b) Exploration and exploitation must be balanced c) Crossover is always more important than mutation d) Larger populations always result in faster convergence	I	CO5

4C-10	When should genetic algorithms be preferred over traditional optimization methods? a) When the problem has a smooth, differentiable function b) When the search space is large and complex c) When exact solutions are required d) When deterministic results are needed	I	CO5
4C-11	You are designing a reinforcement learning agent for a dynamic environment. How would you ensure it adapts to changes? a) Keep the learning rate constant b) Use a dynamic exploration-exploitation strategy c) Remove rewards from the system d) Reduce the number of possible actions	I	CO5
4C-12	What is the key idea behind Q-learning in reinforcement learning? a) To compute the shortest path in a graph b) To learn the optimal action-value function c) To perform supervised learning d) To minimize entropy	I	CO5
4C-13	How does temporal difference learning differ from traditional reinforcement learning methods? a) It updates values based on future rewards before the episode ends b) It requires a complete model of the environment c) It only works for deterministic environments d) It cannot be applied to continuous state spaces	I	CO5
4C-14	Which of the following techniques would best improve the efficiency of a sequential covering algorithm in rule learning? a) Increasing the number of rules randomly b) Using pruning strategies to remove redundant rules c) Ignoring negative examples d) Reducing the dataset size	I	CO5
4C-15	How would you modify a standard reinforcement learning algorithm to handle multiple agents interacting in a competitive environment? a) Use independent Q-learning for each agent b) Eliminate exploration entirely c) Reduce the state space d) Use only positive rewards	I	CO-5
	Fill in the Blanks	BT Level	Course Outcome
4F-1	Genetic algorithms are inspired by the process of _____.	I	CO 5
4F-2	The three main genetic operators in Genetic Algorithms are selection, _____, and mutation.	I	CO 5
4F-3	In a genetic algorithm, the _____ function determines how well an individual solution performs in solving the problem.	I	CO 5
4F-4	The purpose of mutation in Genetic Algorithms is to introduce _____ into the population to prevent premature convergence.	I	CO 5
4F-5	The _____ model is a parallelization technique in genetic algorithms where multiple subpopulations evolve independently and occasionally exchange individuals.	I	CO-5
4F-6	In reinforcement learning, the process of updating values based on estimated future rewards is called _____ learning.	I	CO-5

4F-7	The primary challenge in hypothesis space search using Genetic Algorithms is avoiding _____, where the algorithm gets stuck in a suboptimal solution.	I	CO-5
4F-8	Genetic programming differs from genetic algorithms because it evolves _____ instead of fixed-length chromosomes.	I	CO-5
4F-9	The balance between exploration and exploitation in reinforcement learning is often managed using a parameter called _____.	I	CO-5
4F-10	A major drawback of sequential covering algorithms is that they tend to generate overly _____ rule sets if not properly pruned.	I	CO-5
4F-11	To improve Q-learning in environments with large state spaces, we can use function approximation techniques such as _____ networks.	I	CO-5
4F-12	The FOIL algorithm is used for learning _____ rules in machine learning.	I	CO-5
4F-13	Inverting resolution is a technique used in learning sets of rules, where the goal is to derive a _____ representation of the knowledge.	I	CO-5
4F-14	In reinforcement learning, the method that estimates the value of taking an action in a given state without requiring a model of the environment is called _____.	I	CO-5
4F-15	A researcher wants to improve genetic algorithms by introducing a hybrid approach that combines evolution with gradient-based optimization. This technique is known as _____.	I	CO-5

5-MARKS QUESTIONS			
4 D-1	Define a Genetic Algorithm (GA) and list its key components.	II	CO-5
4 D-2	What is hypothesis space search , and how is it applied in Genetic Algorithms?	II	CO-5
4 D-3	Explain how the fitness function influences the evolution process in Genetic Algorithms.	II	CO-5
4 D-4	How does genetic programming differ from standard genetic algorithms? Provide an example of its application.	II	CO-5
4 D-5	Describe the Island Model for parallelizing Genetic Algorithms and explain its advantages.	III	CO-5
4 D-6	How can mutation and crossover rates be adjusted to improve the performance of a Genetic Algorithm?	III	CO-5
4 D-7	Compare and contrast sequential covering algorithms and FOIL (First Order Inductive Learner) in rule learning.	IV	CO-5
4 D-8	Discuss the trade-off between exploration and exploitation in reinforcement learning. How does this impact learning efficiency?	IV	CO-5
4 D-9	Evaluate the advantages and disadvantages of Q-learning compared to Temporal Difference Learning.	V	CO-5
4 D-10	Discuss the effectiveness of inverting resolution in rule learning. Under what conditions does it work best?	V	CO-5

4 D-11	Design a hybrid learning algorithm that combines Genetic Algorithms and Reinforcement Learning. Explain how they complement each other.	VI	CO-5
4 D-12	Propose an improvement to parallelizing Genetic Algorithms using a new communication strategy between subpopulations.	VI	CO-5
4 D-13	Explain how models of evolution and learning relate to reinforcement learning strategies.	II	CO-5
4 D-14	Given a non-deterministic environment, how can a reinforcement learning agent adapt its policy effectively?	III	CO-5
4 D-15	Critically analyze the role of generalization in reinforcement learning and suggest methods to improve it.	V	CO-5

Match the following

		BT Level	CO
4M-1	A. Selection 1. Introduces diversity into the population B. Crossover 2. Evaluates individuals based on problem-solving ability C. Mutation 3. Creates offspring by combining genetic material D. Fitness Function 4. Chooses individuals for reproduction	I	CO5
4M-2	A. Hypothesis Space 1. Technique to learn rules from examples B. Sequential Covering 2. The set of all possible solutions in machine learning C. FOIL Algorithm 3. Learns first-order rules using induction D. Inverting Resolution 4. Used to infer logical representations of knowledge	I	CO5
4M-3	A. Q-Learning 1. Balances exploration and exploitation using a probability value B. Temporal Difference Learning 2. Learns the optimal action-value function C. Epsilon-Greedy Policy 3. Updates value estimates based on future rewards D. Dynamic Programming 4. Requires a complete model of the environment	I	CO5
4M-4	A. Island Model 1. Uses a single, large evolving population B. Steady-State Model 2. Maintains subpopulations that occasionally exchange individuals C. Generational Model 3. Replaces only a few individuals per iteration D. Elitism 4. Ensures the best solutions are carried over to the next generation	I	CO5
4M-5	A. Exploration-Exploitation Dilemma 1. Using function approximation methods B. Large State Space 2. Using deep reinforcement learning C. Non-Deterministic Rewards 3. Using probability-based action selection D. Slow Convergence 4. Applying experience replay and prioritized sampling	I	CO5

UNIT-V			
	Multiple choice Questions	BT Level	Course Outcome
5C-1	What is the primary goal of Analytical Learning ? A) Learning from labeled examples B) Using prior knowledge to improve learning efficiency C) Randomly exploring the hypothesis space D) Avoiding the use of domain knowledge	I	CO6
5C-2	Explanation-Based Learning (EBL) primarily relies on which of the following? A) Statistical generalization B) Perfect domain theories C) Random search strategies D) Neural networks	I	CO6
5C-3	What is the role of PROLOG-EBG in explanation-based learning? A) To generate new rules from prior experience B) To classify images based on neural networks C) To perform unsupervised learning D) To replace all domain knowledge with examples	I	CO6
5C-4	How does search control knowledge benefit learning systems? A) By increasing randomness in search B) By making the search process more efficient C) By eliminating all search efforts D) By avoiding the use of hypotheses	I	CO6
5C-5	If an agent modifies search operators using prior knowledge , what is it trying to achieve? A) Reduce computational complexity B) Increase randomness in learning C) Make learning independent of domain knowledge D) Avoid using hypotheses	I	CO6
5C-6	In inductive learning, hypotheses are typically generated based on: A) Prior domain knowledge B) Statistical patterns in data C) Random rule selection D) Fixed pre-defined rules	I	CO6
5C-7	Which of the following best differentiates inductive and analytical learning ? A) Inductive learning depends on prior knowledge, while analytical learning does not B) Analytical learning relies on perfect domain theories, whereas inductive learning does not C) Inductive learning is deterministic, while analytical learning is probabilistic D) Inductive learning always produces more accurate results	I	CO6
5C-8	In explanation-based learning, when is a learned rule generalized ? A) When it fits all available data points B) When it is consistent with prior domain knowledge C) When it minimizes computational cost D) When it eliminates all examples	I	CO6
5C-9	What is a major limitation of explanation-based learning (EBL) ? A) It requires a perfect domain theory B) It cannot generalize beyond training data C) It is too slow for real-world applications D) It does not rely on prior knowledge	I	CO6

5C-10	Which of the following best describes a weakness of inductive learning compared to analytical learning? A) Inductive learning always requires labeled examples B) Inductive learning never leads to correct results C) Inductive learning cannot handle large datasets D) Inductive learning requires a perfect domain theory	I	CO6
5C-11	A researcher is designing a hybrid learning model combining inductive and analytical learning. What should be the primary goal of this approach? A) Reduce dependency on labeled training data B) Increase randomness in learning C) Remove prior knowledge from learning D) Avoid generating hypotheses	I	CO6
5C-12	To optimize inductive-analytical learning , a system should: A) Learn purely from data without prior knowledge B) Use prior knowledge to initialize the hypothesis space C) Ignore previous domain knowledge D) Avoid generalizing learned rules	I	CO6
5C-13	How does explanation-based learning (EBL) help in search optimization? A) By reducing the number of hypotheses considered B) By increasing the complexity of search C) By ignoring domain theories D) By randomly selecting solutions	I	CO6
5C-14	In a robot navigation system , using prior knowledge to adjust search objectives can help in: A) Finding optimal paths faster B) Avoiding all obstacles C) Eliminating the need for reinforcement learning D) Preventing generalization	I	CO6
5C-15	Why might combining inductive and analytical learning lead to better learning models? A) It improves generalization and reduces reliance on labeled data B) It eliminates the need for search algorithms C) It prevents the need for hypothesis testing D) It avoids using prior knowledge	I	CO6
5C-15	What need to be satisfied in inductive logic programming? a) Constraint b) Entailment constraint c) Both Constraint & Entailment constraint d) None of the mentioned Fill in the Blanks	I	CO6
5F-1	Explanation-Based Learning (EBL) requires a _____ domain theory to correctly generalize knowledge.	I	CO6
5F-2	In PROLOG-EBG , learning occurs by explaining training examples and then extracting _____ from those explanations.	I	CO6
5F-3	In EBL, a learned rule is considered useful if it leads to a _____ search space for future problem-solving.	I	CO6
5F-4	Search control knowledge is used in EBL to improve the efficiency of _____	I	CO6
5F-5	When using prior knowledge to alter the search objective, the goal is to improve _____ and reduce unnecessary computation	I	CO6
5F-6	In analytical learning, modifying search operators using prior knowledge helps the system to avoid _____ solutions.	I	CO6

5F-7	A key difference between inductive and analytical learning is that inductive learning depends on _____, whereas analytical learning relies on prior domain knowledge.	I	CO6
5F-8	Inductive learning is more suitable when a perfect domain theory is _____ or unavailable.	I	CO6
5F-9	A major limitation of explanation-based learning (EBL) is that it depends heavily on the _____ of its domain knowledge.	I	CO6
5F-10	A drawback of using prior knowledge to initialize a hypothesis is the risk of _____, where the system becomes too dependent on existing knowledge.	I	CO6
5F-11	A hybrid learning approach combining inductive and analytical learning can reduce the need for _____ examples while improving generalization.	I	CO6
5F-12	One way to improve inductive-analytical learning is by dynamically updating _____ to refine future learning.	I	CO6
5F-13	Explanation-based learning (EBL) generalizes specific instances by identifying their _____ structure.	I	CO6
5F-14	In a robot navigation system , using analytical learning can optimize path selection by leveraging _____ about the environment.	I	CO6
5F-15	The advantage of combining inductive and analytical learning is that it allows for both data-driven learning and _____ refinement using prior knowledge.	I	CO6

5-MARKS QUESTIONS

5 D-1	What is Explanation-Based Learning (EBL) ? Define its key characteristics.	II	CO6
5 D-2	Discuss the role of PROLOG-EBG in analytical learning?	II	CO6
5 D-3	Explain how perfect domain theories are essential in Explanation-Based Learning (EBL).	II	CO6
5 D-4	Describe the process of Explanation-Based Learning with an example.	II	CO6
5 D-5	How does search control knowledge improve the efficiency of learning in an AI system?	III	CO6
5 D-6	Provide an example of how prior knowledge can be used to modify search objectives in analytical learning.	III	CO6
5 D-7	Compare and contrast inductive learning and analytical learning, highlighting their advantages and limitations.	IV	CO6
5 D-8	Why is it necessary to alter search operators using prior knowledge in analytical learning?	IV	CO6
5 D-9	What are the limitations of Explanation-Based Learning (EBL)? Discuss possible ways to overcome them.	V	CO6
5 D-10	In what scenarios would inductive learning be more effective than analytical learning? Provide justifications	V	CO6
5 D-11	Design a hybrid Inductive-Analytical learning system that utilizes the benefits of both approaches. Explain its working.	VI	CO6
5 D-12	How can prior knowledge be used to initialize a hypothesis in a combination of inductive and analytical learning? Provide an example.	VI	CO6
5 D-13	Explain how Explanation-Based Learning of search control knowledge helps in problem-solving.	II	CO6
5 D-14	Suppose you are designing an AI system for medical diagnosis. How could analytical learning improve its decision-making ability?	III	CO6
5 D-15	Evaluate the effectiveness of using prior knowledge in machine learning. What trade-offs are involved?	V	CO6

Match the following

			BT Level	CO
5M-1	PROLOG-EBG Learning method that generalizes from specific instances using prior domain theories. Search Control Knowledge A logic-based implementation of Explanation-Based Generalization. Inductive Learning Knowledge that helps guide and optimize search efficiency in learning systems. Hypothesis Initialization Using prior knowledge to define an initial hypothesis in machine learning.		I	CO6
5M-2	Inductive Learning Learns from large datasets and detects patterns. Analytical Learning Uses prior knowledge to improve learning efficiency. Altering Search Objective Modifies learning goals using prior knowledge. Augmenting Search Operators Changes search strategies to enhance problem-solving.		I	CO6
5M-3	Self-Driving Car Navigation Explanation-Based Learning (EBL) Spam Email Classification Inductive Learning Logical Theorem Proving PROLOG-EBG Chess AI Strategy Improvement Search Control Knowledge		I	CO6
5M-4	Uses domain knowledge to improve efficiency. Analytical Learning Reduces the number of training examples needed. Hybrid Learning Helps guide learning by improving search control. Explanation-Based Learning Enhances the effectiveness of learning from experience. Using Prior Knowledge		I	CO6
5M-5	Computationally expensive with large datasets. Explanation-Based Learning (EBL) Can suffer from bias in prior knowledge. Inductive Learning May be difficult to integrate different approaches. Hybrid Learning Requires extensive labeled data for good performance. Inductive Learning		I	CO6

MACHINE LEARNING ASSIGNMENT - 1

SET 1

1. Define Machine Learning. Explain with Examples why machine learning is important.
2. Write candidate elimination algorithm and illustrate with example
3. How a single layer perceptron can be used to represent the Boolean functions such as AND & OR? Justify.
4. What are the remarks of Back Propagation Algorithm? Illustrate in detail.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 2

1. Explain the steps in designing a learning system in detail.
2. What are the key properties and complaints of FIND-S algorithm? Explain in Detail
3. Evaluate the practical design choices involved in applying back propagation algorithm in learning task of face recognition system.
4. Discuss how a multi-layer network learns using a gradient descent algorithm.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 3

1. Describe the following problems with respect to Tasks, Performance and Experience:
 - a. A Checkers learning problem
 - b. A Hand written recognition learning problem
 - c. A Robot driving learning problem
2. Define Concept learning and discuss with example.
3. Elaborate multi layer networks and back propagation algorithm with an example.
4. Consider two perceptron defined by the threshold expression $w_0 + w_1x_1 + w_2x_2 > 0$. Perceptron A has weight values $w_0=1, w_1=2, w_2=1$ And perceptron B has the weight values $w_0=0, w_1=2, w_2=1$ True or false? Perceptron A is more-general than perceptron B.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 4

1. Define Consistent Hypothesis and Version Space. Give examples
2. What is well-posed learning problems. Explain with examples?
3. Write a note on (i) Perceptron Training Rule (ii) Gradient Descent and Delta Rule

4. How a single perceptron can be used to represent the Boolean functions such as AND& OR? Justify
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 5

1. Explain machine learning, applications and features of machine learning?
2. Explain in detail the Inductive Bias of Candidate Elimination algorithm.
3. Design a two-input perceptron that implements the Boolean function $A \wedge \neg B$. Design a two-layer network of perceptrons that implements $A \text{ XOR } B$
4. Evaluate the practical design choices involved in applying backpropagation algorithm in learning task of face recognition system.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 6

1. Write the final version space for the below mentioned training examples using candidate elimination algorithm.

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

- 4
2. Explain the steps in designing a learning system in detail.
3. What are the remarks of Back Propagation Algorithm? Illustrate in detail.
4. Discuss in detail about representation of Neural Networks.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 7

1. Discuss Inductive Bias in Decision Tree Learning and explain the Restriction Biases, Preference Biases.
2. 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 a_2 relative to these training examples?

Instance	Classification	a1	a2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

3. Discuss how a multi-layer network learns using a gradient descent algorithm.
4. Distinguish between single layer and multilayer neural networks.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 8

1. Explain decision tree with an example training data.
2. Discuss Inductive Bias in Decision Tree Learning and explain the Restriction Biases , Preference Biases.
3. Present the Back propagation algorithm for feed forward networks and explain each step in it.
4. What is Artificial Neural Network? Explain appropriate problem for Neural Network Learning with its characteristics.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 9

1. List and Interpret the issues in decision tree learning in detail.
2. What is well-posed learning problems . Explain with examples?
3. Explain multilayer neural networks using back propagation with an example.
4. Consider two perceptron defined by the threshold expression $w_0 + w_1x_1 + w_2x_2 > 0$.
Perceptron A has weight values $w_0=1, w_1=2, w_2=1$ And perceptron B has the weight values $w_0=0, w_1=2, w_2=1$ True or false? Perceptron A is more-general than perceptron B.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 10

1. Define Machine Learning. Explain with Examples why machine learning is important.
2. Write candidate elimination algorithm and illustrate with example.

3. Write a note on (i) Perceptron Training Rule (ii) Gradient Descent and Delta Rule.
4. Evaluate the practical design choices involved in applying backpropagation algorithm in learning task of face recognition system.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 11

1. Explain machine learning, applications and features of machine learning?
2. Explain in detail the Inductive Bias of Candidate Elimination algorithm.
3. Distinguish between single layer and multilayer neural networks.
4. Explain multilayer neural networks using back propagation with an example.
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 12

1. Write the final version space for the below mentioned training examples using candidate - elimination algorithm.

Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	Enjoy Sport
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

2. Explain decision tree with an example training data.
3. What is Artificial Neural Network? Explain appropriate problem for Neural Network Learning with its characteristics.
4. How a single perceptron can be used to represent the Boolean functions such as AND & OR? Justify
5. State Bayes theorem. Illustrate Bayes theorem with an example.

SET 13

1. Discuss Inductive Bias in Decision Tree Learning and explain the Restriction Biases, Preference Biases.
2. 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?

Instance	Classification	a1	a2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

3. Design a two-input perceptron that implements the Boolean function $A \wedge B$.
4. Design a two-layer network of perceptron's that implements $A \text{ XOR } B$.
5. Discuss in detail about representation of Neural Networks.

SET 14

1. Define Consistent Hypothesis and Version Space. Give examples
2. What is well-posed learning problems. Explain with examples?
3. Elaborate multi layer networks and back propagation algorithm with an example
4. Write a note on (i) Perceptron Training Rule (ii) Gradient Descent and Delta Rule
5. State Bayes theorem. Illustrate Bayes theorem with an example.

ASSIGNMENT QUESTIONS

Question no.	Question	Marks	RBT Level	COs
Batch 1				
1	Explain Gibbs algorithm with an example.	5	L2	CO3
2	Define a Genetic Algorithm (GA) and list its key components.	5	L1	CO4
3	Given a non-deterministic environment, how can a reinforcement learning agent adapt its policy effectively?	5	L3	CO4
4	Explain how Explanation-Based Learning of search control Knowledge helps in problem-solving.	5	L2	CO5
5	What are the limitations of Explanation-Based Learning (EBL)? Discuss possible ways to overcome them.	5	L5	CO5
Batch 2				
1.	State Bayes theorem. Illustrate Bayes theorem with an example	5	L2	CO3
2.	What is hypothesis space search , and how is it applied in Genetic Algorithms?	5	L1	CO4
3	Critically analyze the role of generalization in reinforcement learning and suggest methods to improve it.	5	L5	CO4
4	Compare and contrast inductive learning and analytical learning, highlighting their advantages and limitations.	5	L4	CO5
5	Suppose you are designing an AI system for medical diagnosis. How could analytical learning improve its decision-making ability?	5	L3	CO5
Batch 3				
1.	a) Discuss about Bayesian belief networks. b) Explain about Bayes theorem	5	L3	CO3
2.	Explain how the fitness function influences the evolution process in Genetic Algorithms.	5	L1	CO4
3	Discuss the trade-off between exploration and exploitation in reinforcement learning. How does this impact learning efficiency?	5	L4	CO4
4	How can prior Knowledge be used to initialize a hypothesis in a combination of inductive and analytical learning? Provide an example.	5	L6	CO5
5	Explain how perfect domain theories are essential in Explanation-Based Learning (EBL).	5	L2	CO5
Batch 4				
1.	a) Explain Gibbs algorithm with an example. b) State and explain the Minimum Description Length Principle.	5	L2	CO3
2.	How does genetic programming differ from standard genetic algorithms? Provide an example of its application.	5	L2	CO4
3	Discuss the effectiveness of inverting resolution in rule learning. Under what conditions does it work best?	5	L5	CO4
4	What is the role of PROLOG-EBG in analytical learning?	5	L1	CO5
5	Design a hybrid Inductive-Analytical learning system that utilizes the benefits of both approaches. Explain its working.	5	L6	CO5

Batch 5				
1.	Describe briefly about L-nearest neighbour algorithm	5	L1	CO3
2.	Describe the Island Model for parallelizing Genetic Algorithms and explain its advantages.	5	L3	CO4
3	Propose an improvement to parallelizing Genetic Algorithms using a new communication strategy between subpopulations.	5	L6	CO4
4	Describe the process of Explanation-Based Learning with an example.	5	L2	CO5
5	In what scenarios would inductive learning be more effective than analytical learning? Provide justifications	5	L5	CO5
Batch 6				
1.	Compare and contrast Lazy and Eager Learning.	5	L4	CO3
2.	How can mutation and crossover rates be adjusted to improve the performance of a Genetic Algorithm?	5	L3	CO4
3	How does genetic programming differ from standard genetic algorithms? Provide an example of its application.	5	L2	CO4
4	What are the limitations of Explanation-Based Learning (EBL)? Discuss possible ways to overcome them.	5	L5	CO5
5	Design a hybrid Inductive-Analytical learning system that utilizes the benefits of both approaches. Explain its working.	5	L6	CO5
Batch 7				
1.	Explain Weighted-Majority algorithm.	5	L2	CO3
2.	Compare and contrast sequential covering algorithms and FOIL (First Order Inductive Learner) in rule learning.	5	L4	CO4
3	Propose an improvement to parallelizing Genetic Algorithms using a new communication strategy between subpopulations.	5	L6	CO4
4	What is the role of PROLOG-EBG in analytical learning?	5	L1	CO5
5	Why is it necessary to alter search operators using prior Knowledge in analytical learning?	5	L4	CO5
Batch 8				
1.	a) Write the differences between Eager Learning and Lazy Learning approaches. b) State Bayes theorem. Illustrate Bayes theorem with an example.	5	L2	CO3
2.	Discuss the trade-off between exploration and exploitation in reinforcement learning. How does this impact learning efficiency?	5	L4	CO4
3	Evaluate the advantages and disadvantages of Q-learning compared to Temporal Difference Learning.	5	L5	CO4
4	Provide an example of how prior Knowledge can be used to modify search objectives in analytical learning.	5	L3	CO5
5	How can prior Knowledge be used to initialize a hypothesis in a combination of inductive and analytical learning? Provide an example.	5	L6	CO5
Batch 9				
1.	Explain the Mistake Bound for the Halving Algorithm.	5	L2	CO3
2.	Evaluate the advantages and disadvantages of Q-learning compared to Temporal Difference Learning.	5	L5	CO4
3		5		CO4
4	Compare and contrast sequential covering algorithms and FOIL (First Order Inductive Learner) in rule learning.	5	L4	CO5
5	Suppose you are designing an AI system for medical diagnosis. How	5	L3	CO5

	could analytical learning improve its decision-making ability?			
Batch 10				
1.	Elaborate the Locally Weighted Linear Regression.	5	L6	CO3
2.	Discuss the effectiveness of inverting resolution in rule learning. Under what conditions does it work best?	5	L5	CO4
3	Explain how models of evolution and learning relate to reinforcement learning strategies.	5	L2	CO4
4	How does search control Knowledge improve the efficiency of learning in an AI system?	5	L3	CO5
5	Compare and contrast inductive learning and analytical learning, highlighting their advantages and limitations.	5	L4	CO5
Batch 11				
1.	Explain Gibbs algorithm with an example.	5	L2	CO3
2.	Design a hybrid learning algorithm that combines Genetic Algorithms and Reinforcement Learning. Explain how they complement each other.	5	L6	CO4
3	Discuss the trade-off between exploration and exploitation in reinforcement learning. How does this impact learning efficiency?	5	L4	CO4
4.	Describe the process of Explanation-Based Learning with an example.	5	L2	CO5
5.	Suppose you are designing an AI system for medical diagnosis. How could analytical learning improve its decision-making ability?	5	L3	CO5
Batch 12				
1.	State Bayes theorem. Illustrate Bayes theorem with an example.	5	L2	CO3
2.	Propose an improvement to parallelizing Genetic Algorithms using a new communication strategy between subpopulations.	5	L6	CO4
3	Critically analyze the role of generalization in reinforcement learning and suggest methods to improve it.	5	L5	CO4
4	Explain how perfect domain theories are essential in Explanation-Based Learning (EBL).	5	L2	CO5
5	Why is it necessary to alter search operators using prior Knowledge in analytical learning?	5	L4	CO5
Batch 13				
1.	Describe briefly about L-nearest neighbour algorithm.	5	L1	CO3
2.	Explain how models of evolution and learning relate to reinforcement learning strategies.	5	L2	CO4
3.	Propose an improvement to parallelizing Genetic Algorithms using a new communication strategy between subpopulations.	5	L4	CO4
4.	What is the role of PROLOG-EBG in analytical learning?	5	L1	CO5
5.	Suppose you are designing an AI system for medical diagnosis. How could analytical learning improve its decision-making ability?	5	L3	CO5
Batch 14				
1.	Compare and contrast Lazy and Eager Learning.	5	L4	CO3
2.	How can mutation and crossover rates be adjusted to improve the performance of a Genetic Algorithm?	5	L3	CO4
3.	Explain how models of evolution and learning relate to reinforcement learning strategies.	5	L2	CO4
4.	What is Explanation-Based Learning (EBL)? Define its key characteristics.	5	L1	CO5
5.	Design a hybrid Inductive-Analytical learning system that utilizes the benefits of both approaches. Explain its working.	5	L6	CO5

BR-18

Write Your Ht.No. D4
QC997

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi) - Recognized under 2(f) and 12(B) of UGC Act 1956

III B.Tech. II Semester (SUPPLEMENTARY) End Examinations, Feb/Mar - 2023.

27/02/2023

(R18CSE3201) MACHINE LEARNING

Day- 1 (AN)

Duration: 3 Hrs

(For CSE and IT)

Maximum Marks: 70M

Blooms Taxonomy : (I-Remembering, II-Understanding, III-Applying, IV-Analyzing, V-Evaluating and VI-Creating)

Course Outcomes : CO

SECTION-A

Answer ALL the following questions.

1. Define well-posed learning problems.
2. Define Neural networks and throw light on its representation.
3. Estimate sample complexity for infinite Hypothesis space.
4. Introduce about inverting resolution analytical learning.
5. Define about Temporal Difference Learning.

(5Qx 4M = 20M)

II	CO1
II	CO2
V	CO3
I	CO4
II	CO5

SECTION-B

Answer FIVE questions choosing at least one from each unit.

(5Qx10M = 50M)

6. Apply Version spaces and the candidate elimination algorithm with a suitable instance of values.

III CO1

OR

7. Design a learning system with suitable example which uses Machine Learning Concepts.

III CO1

UNIT-II

8. What is perceptron? Estimate Multilayer networks and the back propagation algorithm for a suitable neural network.

V CO2

OR

9. Estimate back propagation algorithm for face recognition application.

V CO2

UNIT-III

10. Explain about k-Nearest Neighbour Learning for a suitable example.

II CO3

OR

11. Outline the remarks on Lazy and Eager Learning Genetic algorithm and motivation of Genetic Algorithm.

II CO3

UNIT-IV

12. Outline the EBG remarks on Explanation-Based Learning.

II CO4

OR

13. State and first order rules and explain all first order rules in detail.

II CO4

UNIT-V

14. Explain analytical approaches to learning, usage of prior knowledge to alter the search objective.

II CO5

OR

15. Outline the usage of Dynamic programming for solving Machine Learning based applications.

II CO5



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III B.Tech. II Semester (For CSE,IT,DS and AI & ML)

(R20CSE2101)MACHINE LEARNING

MODEL PAPER-1

Duration: 3 Hrs

Maximum Marks: 70M

Blooms Taxonomy : (L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating and L6-Creating)

Course Outcomes : CO

PART-A

(5QX4M=20Marks)

S.NO	QUESTIONS	MARKS	COURSE OUT COME	BT LEVEL
1	Discuss applications of ML?	4	CO1	2
2	Discuss Inductive Bias in Decision Tree Learning	4	CO2	1
3	What are Consistent Learners?	4	CO4	1
4	Write Learning First-Order Rules?	4	CO5	1
5	Discuss Reinforcement Learning	4	CO6	4

PART-B**(5QX10M=20Marks)****UNIT-I**

6. Write FIND-S algorithm and explain with example 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

OR

7. Explain in detail the Inductive Bias of Candidate Elimination algorithm.

UNIT-II

8. Explain the followings w.r.t Back Propagation algorithm

- Convergence and Local Minima
- Representational Power of Feedforward Networks
- Hypothesis Space Search and Inductive Bias
- Hidden Layer Representations
- Generalization, Overfitting, and Stopping Criterion

OR9. Consider two perceptrons defined by the threshold expression $w_0 + w_1x_1 + w_2x_2 > 0$. Perceptron A has weight values $w_0 = 1, w_1 = 2, w_2 = 1$ and perceptron B has the weight values $w_0 = 0, w_1 = 2, w_2 = 1$

True or false? Perceptron A is more-general than perceptron B.

UNIT-III

10. What is genetic algorithm? How to parallelizing genetic algorithms

OR11. Define is Maximum a Posteriori (MAP) Maximum Likelihood (ML) Hypothesis. Derive the relation for h_{MAP} and h_{ML} using Bayesian theorem.**UNIT-IV**

12. Write the First Order Inductive Learning Algorithm? With example

OR

13. Discuss in detail about Explanation Based Learning

UNIT-V

14. Discuss the EBNN Algorithm

OR

15. Implement the Neural Net Equivalent to Domain Theory

10**CO3,C
O1****2,3****10****CO2****2,1****10****CO4****5,2****10****CO5****2****10****CO6****2**



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III B.Tech. II Semester(For CSE,IT,DS and AI&ML) (R20CSE2101)MACHINE LEARNING ALGORITHM

MODEL PAPER-2

Duration: 3 Hrs

Maximum Marks: 70M

Blooms Taxonomy : (L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating and L6-Creating)

Course Outcomes : CO

PART-A

(5QX4M=20Marks)

S.NO	QUESTIONS	MARKS	COURSE OUT COME	BTLEVEL
1	Write the steps in designing a learning systems in detail.	4	CO1	1
2	Give Decision trees to represent the Boolean Functions: a) $A \&\& \sim B$ b) $A \vee [B \&\& C]$ c) $A \text{ XOR } B$ d) $[A \&\& B] \vee [C \&\& D]$	4	CO2	2
3	Explain the practical difficulties of Bayesian theorem.	4	CO4	1
4	Explain about Sequential covering algorithm	4	CO5	1
5	Define Domain Theory?	4	CO6	1

PART-B**(5QX10M=20Marks)****UNIT-1**

6. Describe the following problems with respect to Tasks, Performance and Experience:

10**CO1****5,2**

a. A Checkers learning problem

b. A Handwritten recognition learning problem

C .A Robot driving learning problem

OR

7. Write the final version space for the below mentioned training examples using candidate elimination algorithm

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

UNIT-II

8. Explain the followings w.r.t Back Propagation algorithm (10)

10**CO2****2**

- Convergence and Local Minima
- Representational Power of Feed forward Networks
- Hypothesis Space Search and Inductive Bias
- Hidden Layer Representations
- Generalization, Over fitting, and Stopping Criterion

OR

9. Give Decision trees for the following set of training examples

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

UNIT-III

10. Suppose hypothesis h commits $r = 10$ errors over a sample of $n = 65$ independently drawn examples.

- What is the variance and standard deviation for number of true error rate $\text{error}_D(h)$?
- What is the 90% confidence interval (two-sided) for the true error rate?
- What is the 95% one-sided interval (i.e., what is the upper bound U such that $\text{error}_D(h) \leq U$ with 95% confidence)?

What is the 90% one-sided interval?

α	0.100	0.050	0.025	0.001
$1 - \alpha$	0.900	0.950	0.975	0.999
$z_{1-\alpha}$	1.28	1.64	1.96	3.09

OR

11. Define is Maximum a Posteriori (MAP) Maximum Likelihood (ML) Hypothesis. Derive the relation for hMAP and hML using Bayesian theorem. (10)

10

CO4

2,6

UNIT-IV

12. Write the Sequential Covering Algorithm? With example.

OR

13. Discuss about PROGOL?

10

CO5

2

UNIT-V

14. Discuss about Hypothesis Space Search. Demonstrate the Using Prior Knowledge to Initialize the Hypothesis

OR

15. What is the Motivation? Explain Motivation Inductive-Analytical Approaches to learning

10

CO6

2