Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY,BANGALORE

CONTINUOUS INTERNAL ASSESSMENT

Academic Year 2018-19

COURSE PLAN

Academic Year 2018-19

Program:	B E – Computer Science & Engineering
Semester :	7
Course Code:	15CS73
Course Title:	Machine Learning
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	Nagarathna C

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Note : Remove “Table of Content” before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	EC
Semester:	7	Academic Year:	2018
Course Title:	Machine Learning	Course Code:	15Cs73
Credit / L-T-P:	4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	55	SEE Marks:	80 Marks
CIA Marks:	15	Assignment	1 / Module
Course Plan Author:	Nagarathna C	Sign ..	Dt:
Checked By:		Sign ..	Dt:
CO Targets	CIA Target : ..... %	SEE Target:	..... %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	*Introduction: Well posed learning problems, Designing a Learning system, Perspective* and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.	11	Classification of Machine Language, Category Learning.	Analyze L4
2	Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.	11	Statistics on Objects, Predictive Modeling	Apply L3
3	Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.	11	Weightage of Neural Network, Errors on Object	Evaluate L5
4	Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.	11	Predicting of objects, Estimating accuracy on Hypothesis.	Analyze L4
5	Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning.	11	Used to find the Dependencies	Evaluate L5
-	**Total**	**55**	-	-

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2, 3, 4, 5	Tom M. Mitchell, Machine Learning, McGraw Hill Education India Edition 2013		In Lib / In Dept
1	Microwave Devices and circuits- Liao, Pearson Education.		In Lib/ In dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1	Ethem Alpaydın Introduction to Machine Learning MIT press second edition	?	Not Available
2	Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning springer series in statistics 2nd edition	?	Not Available
		?	In lib
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			
C10			
	Lab :		
D	**Software Tools for Design**	**-**	**-**
E	**Recent Developments for Research**	**-**	**-**
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1			
?			

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	15CS		1. Knowledge on JAVA	4		L3
3	15cs664	phython	2. Knowledge on Python	6		L3
3			3. Knowledge on Statistics / Probability		Plan Gap Course	L3
5			4. Knowledge on Artificial Intelligence	5		L3
-			5. Knowledge on Deep Learning		Plan Gap Course	L3
-						

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1				
	-	-		
-				

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	15CS73.1	classify the Artificial Intelligence problem's for Machine Leaning	5	Classification of Machine Language.	Learning / class discussion	Q & A (Oral)	L4
1	15CS73.2	Analyze the Category learning using candidate algorithm	6	Category Learning.	Learning / class discussion	Q & A (Oral)	L4
2	15CS73.3	Apply the fundamentals of statistics based on the Decision Tree Learning	5	Statistics on Objects	Learning / class discussion	Employ Problem Set	L3
2	15CS73.4	Apply the data set on hypothesis space using Inductive bias modeling	6	Predictive Modeling	Learning / class discussion	Employ Problem Set	L3
3	15CS73.5	Analyze the candidate neuron's in Neural networks using power of perceptrons	5	Weightage of Neural Network	Learning / class discussion	Test (Take Home)	L4

3	15CS73.6	Analyze the gradient in Artificial Neural Network using Backpropagation algorithm	5	Errors on Objects	Learning / class discussion	Test (Take Home)	L4
4	15CS73.7	Analyze the data sets on Bayes theorem	6	Predicting of objects.	Learning / class discussion	Test (Take Home)	L5
4	15CS73.8	Analyze the bayes belief network using EM Algorithm	5	Estimating accuracy on Hypothesis .	Learning / class discussion	Test (Take Home)	L4
5	15CS73.9	Evaluate the Artificial Nural Network based on the Learning algorithm	6	Used to find the Dependencies	Case Study	Small group discussion	L5
5							
-	**-**	**Total**	**55**	**-**	**-**	**-**	**L2-L5**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Virtual Personal Assistants, Email Spam and Malware Filtering	CO1	L4
2	include directed graphs and Graphical modeling	CO2	L4
3	Used in Data mining	CO3	L3
4		CO4	L3
5	Character recognition	CO5	L4
6	Speech Recognition	CO6	L4
7	Medical science: Like predicting a particular disease based on the symptoms and physical condition	CO7	L4
8	Document Classification, Information Retrieval	CO8	L4
9	Image Processing Evaluation based on particular disease	CO9	L5
5	Helical-Circularly polarized radio waves for satellite communication, Parabolic-direct the radio waves in radio telescopes, Yagi-Uda-high directivity for log distance communication, Log-Periodic-Wide bandwidth UHF terrestrial TV	CO10	L2

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Modules	Mapping	Mapping Level	Justification for each CO-PO pair	Level

-	CO	PO	-	'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'	-
				Knowledge of various machine learning approaches involves solving complex engineering problems	L2
				Principles of mathematics and engineering sciences are used in various aspects of machine learning approaches	L3
				Using the knowledge of supervised learning concepts, we can design and develop solutions for complex engineering problems	L3
				Supervised learning and VC dimension concepts can be used to design and conduct experiments to provide valid conclusions	L3
				Expertise developed, which will enable the student to become a productive member of a design team	L3
				The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge	L3
				Comparative study of different dimensionality reduction techniques involves solving complex engineering problems	L3
				Principles of mathematics and engineering sciences are used in various aspects of dimensionality reduction techniques.	L3
				Knowledge of dimensionality reduction techniques can be used to design and develop solutions for complex engineering problems	L3
				Dimensionality reduction techniques knowledge can be used to design and conduct experiments to provide valid conclusions	L3
				Expertise developed, which will enable the student to become a productive member of a design team	L3
				The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge	L3
				Knowledge of theoretical foundations of decision trees involves solving complex engineering problems	L3
				Principles of mathematics and engineering sciences are used intheoretical foundations of decision treesto identify best split and Bayesian classifier to label data points.	L3
				Knowledge of theoretical foundations of decision trees to identify best split can be used to design and develop solutions for complex engineering problems	L3
				Theoretical foundations of decision treesto identify best split and Bayesian classifier to label data points.knowledge can be used to design and conduct experiments to provide valid conclusions	L3
				Knowledge of theoretical foundations of decision trees to identify best split and Bayesian classifier to label data points. will help understand issues and societal problems related to cybercrimes and computer hacking3	L3
				Expertise developed, which will enable the student to become a productive member of a design team	L3
				The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge	L3
				Knowledge of classifier models applications helps in solving complex engineering problems	L3
				Principles of mathematics and engineering sciences are used in various aspects of classifier models	L3
				Knowledge of classifier models can be used to design and develop solutions for complex engineering problems	L3
				Various classifier models knowledge can be used to design and conduct experiments to provide valid conclusions	L3
				Expertise developed, which will enable the student to become a productive member of a design team	L3
				The student will become aware of the need for lifelong learning and the continued upgrading of technical knowledge	L3
				Study of HMM involves solving complex engineering problems	L3
				Study of HMM involves principles of mathematics and engineering	L3
				Sequence emission probability evaluation knowledge can be used to	L3

				design and develop solutions for complex engineering problems	
				State sequence identification and sequence emission probabilityevaluation skills can be used to design and conduct experiments to provide valid conclusions	L3
				Knowledge of clustering algorithms involves solving complex engineering problems	L3
				Design of clustering algorithms involves principles of mathematics and engineering	L3
				Clustering algorithms can be used to design and develop solutions for complex engineering problems	L3
				Clustering algorithms knowledge can be used to conduct experiments in real life problems to provide valid conclusions	L3

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	15CS73.1	classify the Artificial Intelligence problem's for Machine Leaning	3	3	3	1					1			2				L4
1	15CS73.2	Analyze the Category learning using candidate algorithm	3	3	3	1					1			1				L4
2	15CS73.3	Apply the fundamentals of statistics based on the Decision Tree Learning	3	3	3	1					1			1				L3
2	15CS73.4	Apply the data set on hypothesis space using Inductive bias modeling	3	3	3	1					1			2				L3
3	15CS73.5	Analyze the candidate neuron's in Nural networks using power of perceptrons	3	3	3	1					1			2				L4
3	15CS73.6	Analyze the gradient in Artificial Nural Network using Backpropagation algorithm	3	3	3	1					1			1				L5
4	15CS73.7	Analyze the data sets on Bayes theorem	3	3	3	1					1			1				L4
4	15CS73.8	Analyze the bayes belief network using EM Algorithm	3	3	3	2					1			2				L4
5	15CS73.9	Evaluate the Artificial Nural Network based on the Learning algorithm	3	3	3	3					1			2				L5
-	**CS501PC**	**Average attainment (1, 2, or 3)**	**3**	**3**	**3**	**2**					1			**2**				**L4**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	Knowledge on Statistics	Extra classes	6th Aug to 11th Aug	Prof. Veerabhadra	

	and Probability		2019	Swamy, Dept. of Mathematics	
2	Knowledge on Deep Learning				
3					
4					
5					

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Modules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1						
1						
2						
2						
3						
3						
4						
4						
5						
5						

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	*Introduction*	11	2	-	-	1	-	2	CO1, CO2	L4

2	Decision Tree Learning	11	2	-	-	1	-	2	CO3, CO4	L3
3	Artificial Neural Networks	11	-	2	-	1	-	2	CO5, CO6	L5
4	Bayesian Learning	12	-	2	-	1	-	2	CO7, C08	L4
5	Evaluating Hypothesis	12	-	-	4	1	-	2	CO9	L5
-	**Total**	**57**	**4**	**4**	**4**	**5**	**-**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	15	CO1, CO2, CO3, CO4	L4.L3
3, 4	CIA Exam – 2	15	CO5, CO6, CO7, C08	L4
5	CIA Exam – 3	15	CO9	L5
1, 2	Assignment - 1	05	CO1, CO2, CO3, CO4	L4.L3
3, 4	Assignment - 2	05	CO5, CO6, CO7, C08	L4
5	Assignment - 3	05	CO9	L5
	Final CIA Marks	**20**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	*Introduction*	Appr Time:	11 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	classify the Artificial Intelligence problem's for Machine Leaning	CO1	L4
2	Analyze the Category learning using candidate algorithm	CO2	L4
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Well posed learning problems	CO1	L2
2	Designing a Learning system	CO1	L4
3	Perspective and Issues in Machine Learning	CO1	L2
4	Concept learning task	CO1	L3
5	Concept learning as search	CO1	L3
6	Concept learning as search	CO2	L2
7	Find-S algorithm	CO2	L2
8	Version space	CO2	L2
9	Candidate Elimination algorithm	CO2	L2
10	Inductive Bias.	CO2	L2
11	Inductive Bias.	CO2	L3
c	**Application Areas**	**CO**	**Level**
1	Virtual Personal Assistants, Email Spam and Malware Filtering	CO1	L4
2	include directed graphs and Graphical modeling	CO2	L4
d	**Review Questions**	-	-
1	*Show the significance of Machine learning by taking different problem statements*	CO1	L2
2	*Explain the different constraints and problems in designing the Learning system*	CO1	L2
3	*List the Issues in Machine Learning*	CO2	L1
4	*Explain the notations that are used in Concept learning.*	CO2	L2
5	*Apply the concept of General to Specific ordering to Hypothesis*	CO2	L3
6	*Analyze whether FIND-S algorithm can be used for Hypothesis.*	CO2	L4
7	*Analyze the compact Representation for version space from the Representation*	CO2	L4
8	*Illustrate the example for Candidate Elimination algorithm*	CO2	L3
9	*Differentiate between unbiased and biased Hypothesis.*	CO2	L2
e	**Experiences**	-	-
1			
2			
3			
4			
5			

Module – 2

Title:	Decision Tree Learning	Appr Time:	11 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Apply the data set on hypothesis space using Inductive bias modeling	CO3	L4
2	Analyze the candidate neuron's in Nural networks using power of perceptrons	CO3	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
12	Decision tree representation	CO3	L2
13	Appropriate problems for decision tree learning	CO3	L3
14	Basic decision tree learning algorithm, , Attribute Classifier , Examples	CO3	L3
15	Basic decision tree learning algorithm Measures, Illustrative Examples	CO3	L4
16	hypothesis space search in decision tree learning Tree Representation	CO3	L3
17	hypothesis space search in decision tree learning Examples	CO3	L3
18	*Inductive bias in decision tree learning Approximate , Restriction*	CO4	L3
19	*Inductive bias in decision tree learning why*	CO4	L3
20	*Issues in decision tree learning Avoiding Overfiting , Reduced Error*	CO4	L3
21	*Issues in decision tree learning Rules Post Pruning Alternative Measures*	CO4	L3
22	*Different Attributes*	CO4	L2
c	**Application Areas**	**CO**	**Level**
1	Used in Data mining	CO3	L3
2		CO4	L3
d	**Review Questions**	-	-
10	Explain the Representation that is used to build the Decision Tree, with an example.	CO3	L2
11	Analyze the problems for the decision tree and its learning.	CO3	L4
12	Discuss the Basic decision tree learning algorithm, with its Attribute	CO3	L2
13	Illustrate Basic decision tree learning algorithm Measures with Examples	CO3	L3
14	Discuss the Representation used in tree in decision tree learning used for hypothesis space search	CO3	L2
15	Analyze the hypothesis space search in decision tree learning Examples	CO3	L4
16	*Explain the Restriction in Inductive bias of decision tree learning with Approximate*	CO4	L2
17	Explain the Representation that is used to build the Decision Tree, with an example.	CO4	l2
18	Analyze the problems for the decision tree and its learning.	CO4	L4
19	*Classify Issues in decision tree learning Rules Post Pruning Alternative Measures*	CO4	L4
20	*Explain the Different Attributes*	CO4	L2
21	*Figure out the Issues in decision tree learning Avoiding Overfiting with reduced error*	CO4	L4
e	**Experiences**	-	-
1			
2			

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	15CS73	Sem:	7	Marks:	30	Time:	75 minutes		
Course:	Machine Learning								
-	**-**	**Note: Answer any 3 questions, each carry equal marks.**					**Marks**	**CO**	**Level**
1	a	*What are the important objectives of Machine Learning? Discuss important examples of Machine Learning*					6	CO1	L1
	b	*Explain the different constraints and problems in designing the Learning system*					7	CO1	L2
	c	*List the Issues in Machine Learning*					2	CO1	L1
2	a	*Analyze whether FIND-S algorithm can be used for Hypothesis.*					8	CO2	L4
	b	*Analyze the compact Representation for version space from the Representation*					7	CO2	L4
3	a	Explain the Representation that is used to build the Decision Tree, with an example.					8	CO3	L2
	b	Analyze the problems for the decision tree and its learning.					7	CO3	L4
4	a	*How to apply the concepts of Inductive bias in decision tree learning*					7	CO4	L3
	b	*Figure out the Issues in decision tree learning Avoiding Overfiting with reduced error*					8	CO4	L4

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions									
Crs Code:	15CS73	Sem:	7	Marks:	5	Time:	90 – 120 minutes		
Course:	Machine Learning								
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.									
SNo	**USN**	**Assignment Description**					**Marks**	**CO**	**Level**
1		*Show the significance of Machine learning by taking different problem statements*					5	CO1	L2
2		*Explain the different constraints and problems in designing the Learning system*					5	CO1	L2
3		*List the Issues in Machine Learning*						CO2	L1
4		*Explain the notations that are used in Concept learning.*					5	CO2	L2
5		*Apply the concept of General to Specific ordering to Hypothesis*					5	CO2	L3
6		*Analyze whether FIND-S algorithm can be used for Hypothesis.*					5	CO2	L4
7		*Analyze the compact Representation for version space from the Representation*					5	CO2	L4
8		*Illustrate the example for Candidate Elimination algorithm*					5	CO2	L3
9		*Differentiate between unbiased and biased Hypothesis.*					5	CO2	L2
10		Explain the Representation that is used to build the Decision Tree, with an example.					5	CO3	L2
11		Analyze the problems for the decision tree and its learning.					5	CO3	L4
12		Discuss the Basic decision tree learning algorithm, with its Attribute					5	CO3	L2
13		Illustrate Basic decision tree learning algorithm Measures with Examples					5	CO3	L3
14		Discuss the Representation used in tree in decision tree learning used for hypothesis space search					5	CO3	L2
15		Analyze the hypothesis space search in decision tree learning Examples					5	CO3	L4
16		*Explain the Restriction in Inductive bias of decision tree learning with Approximate*					5	CO4	L2

17		Explain the Representation that is used to build the Decision Tree, with an example.	5	CO4	l2
18		Analyze the problems for the decision tree and its learning.	5	CO4	L4
19		*Classify Issues in decision tree learning Rules Post Pruning Alternative Measures*	5	CO4	L4
20		*Explain the Different Attributes*	5	CO4	L2
21		*Figure out the Issues in decision tree learning Avoiding Overfiting with reduced error*	5	CO4	L4

D2. TEACHING PLAN - 2

Module – 3

Title:	Artificial Neural Networks	Appr Time:	11 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Analyze the candidate neuron's in Nural networks using power of perceptrons	CO5	L4
2	Analyze the gradient in Artificial Nural Network using Backpropagation algorithm	CO6	L5
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
23	*Artificial Neural Networks Introduction what is NN and its attributes*	CO5	L2
24	*Introduction contd.. Biological Motivation*	CO5	L3
25	*Neural Network representation*	CO5	L3
26	*Appropriate problems 1*	CO5	L4
27	*Appropriate problems 2*	CO5	L4
28	*Perceptrons represaentation power of perceptrons and the training Rule*	CO5	L4
29	*PerceptronsGradiant Descent and the Delta Rule, Visualizing the HYPOTHESIS Space*	CO6	L5
30	*Derivation of the Gradient Descent Rule Stochastic approximation to Gradient Descent*	CO6	L4
31	*Backpropagation algorithm differentiable threshold Unit and its representation*	CO6	L4
32	*Backpropagation algorithm explanation*	CO6	L4
33	Examples of Backpropagation algorithm	CO6	L4
c	**Application Areas**	**CO**	**Level**
1	Character recognition	CO5	L3
2	Speech Recognition	CO6	L4
d	**Review Questions**	-	-
22	*Explain NN and its attributes*	CO5	L2
22	Explain the problems that arise in Neural Network and its representation	CO5	L2
23	Consider a multilayer feed forward neural network. Enumerate and explain steps in back propagation algorithm use to train network.	CO5	L4
24	What is linear separability issue?	CO5	L2
25	What is the role of hidden layer?	CO5	L2
26	How is Multilayer is trained using Bank propagation?	CO5	L4
27	How to estimate difference in error between two hypotheses using error D(h) and error S(h)?	CO6	L5
28	What is Multilayer perception?	CO5	L2
29	*Explain the Backpropagation algorithm and conclude why it is not likely to be trapped in local minima*	CO6	L4
30	Demonstrate the steps involved in Back propagation algorithm?	CO6	L3
31	Why a Multilayer neural network is required?	CO6	L4
e	**Experiences**	-	-
1			

2			
3			
4			
5			

Module – 4

Title:	Divide and Conquer	Appr Time:	11 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Analyze the data sets on Bayes theorem	CO7	L4
2	Analyze the bayes belief network using EM Algorithm	CO8	L4
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
34	Bayesian Learning Introduction	CO7	L2
35	Bayes theorem	CO7	L2
36	Bayes theorem and concept learning	CO7	L3
37	ML and LS error hypothesis	CO7	L4
38	ML for predicting probabilities	CO7	L4
3.9	MDL principle	CO7	L4
40	Naive Bayes classifier	CO8	L4
41	Bayesian belief networks- classifier Example , Estimating Probabilities	CO8	L4
42	Bayesian belief networks Conditional Independence , Representation , Inference ,	CO8	L4
43	Bayesian belief networksLearning , Gradient	CO8	L4
44	EM Algorithm – Estimating Means of k Gaussians	CO8	L4
45	Derivation of k Means Algorithm	CO8	L4
c	**Application Areas**	**CO**	**Level**
1	Medical science: Like predicting a particular disease based on the symptoms and physical condition	CO7	L4
2	Document Classification, Information Retrieval	CO8	L4
d	**Review Questions**		
32	Explain Bayes theorem	CO7	L2
33	Demonstrate how Machine Learning is used for predicting probabilities	CO7	L3
34	What is Brute Force MAP hypothesis learner?	CO7	L2
35	How Brute Force MAP hypothesis related to Concept Learning? What is the Minimum Description Length (MDL) Principle	CO7	L4
36	Explain how naïve bays algorithm is useful for learning and classifying text.	CO7	L4
37	Explain the procedure to estimate difference in error between two learning methods. Consider a learned hypothesis h, for some Boolean concept. When h is tested on a set of 100 examples it classifies 83 correctly what is the standard deviation and 95% confidence interval for the true error rate for error D(h)?	CO8	L5
38	Explain Bayesian belief network and conditional independence with example	CO8	L3
39	How is Naïve Bayes algorithm useful for learning and classifying text?	CO8	L4
40	What are Bayesian Belief nets? Where are they used? Can it solve all types of problems?	CO8	L3
41	Describe in brief EM Algorithm	CO8	L2
42	Briefly Explain PAC Hypothesis	CO8	L2
e	**Experiences**	-	-
1			
2			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	15CS73	Sem:	7	Marks:	30	Time:	75 minutes		
Course:	Machine Learning								
-	**-**	**Note: Answer any 2 questions, each carry equal marks.**					**Marks**	**CO**	**Level**
1	a	*Explain NN and its attributes*					05	CO5	L2
	b	Explain the problems that arise in Neural Network and its representation					05	CO5	L2
	c	What is Multilayer perception?					05	CO5	L2
2	a	What is linear separability issue? And What is the role of hidden layer?					07	CO5	L2,L2
	b	Consider a multilayer feed forward neural network. Enumerate and explain steps in back propagation algorithm use to train network.					08	CO5	L4
3	a	Explain Bayes theorem					5	CO7	L2
	b	Demonstrate how Machine Learning is used for predicting probabilities					5	CO7	L3
	c	What is Brute Force MAP hypothesis learner?					5	CO7	L2
4	a	Explain the procedure to estimate difference in error between two learning methods. Consider a learned hypothesis h, for some Boolean concept. When h is tested on a set of 100 examples it classifies 83 correctly what is the standard deviation and 95% confidence interval for the true error rate for error D(h)?					9	CO8	L5
	b	What are Bayesian Belief nets? Where are they used? Can it solve all types of problems?					6	CO8	L3

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions									
Crs Code:	15CS73	Sem:	7	Marks:	5 / 10	Time:	90 – 120 minutes		
Course:	Machine Learning								
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.									
SNo	**USN**	**Assignment Description**					**Marks**	**CO**	**Level**
1		*Explain NN and its attributes*					5	CO5	L2
2		Explain the problems that arise in Neural Network and its representation					5	CO5	L2
3		Consider a multilayer feed forward neural network. Enumerate and explain steps in back propagation algorithm use to train network.					5	CO5	L4
4		What is linear separability issue?					5	CO5	L2
5		What is the role of hidden layer?					5	CO5	L2
6		How is Multilayer is trained using Bank propagation?					5	CO5	L4
7		How to estimate difference in error between two hypotheses using error D(h) and error S(h)?					5	CO6	L5
8		What is Multilayer perception?					5	CO5	L2
9		*Explain the Backpropagation algorithm and conclude why it is not likely to be trapped in local minima*					5	CO6	L4
10		Demonstrate the steps involved in Back propagation algorithm?					5	CO6	L3
11		Why a Multilayer neural network is required?					5	CO6	L4
12		Explain Bayes theorem					5	CO7	L2
13		Demonstrate how Machine Learning is used for predicting probabilities					5	CO7	L3
14		What is Brute Force MAP hypothesis learner?					5	CO7	L2
15		How Brute Force MAP hypothesis related to Concept Learning? What is the Minimum Description Length (MDL) Principle					5	CO7	L4

16		Explain how naïve bays algorithm is useful for learning and classifying text.	5	CO7	L4
17		Explain the procedure to estimate difference in error between two learning methods. Consider a learned hypothesis h, for some Boolean concept. When h is tested on a set of 100 examples it classifies 83 correctly what is the standard deviation and 95% confidence interval for the true error rate for error D(h)?	5	CO8	L5
18		Explain Bayesian belief network and conditional independence with example	5	CO8	L3
19		How is Naïve Bayes algorithm useful for learning and classifying text?	5	CO8	L4
20		What are Bayesian Belief nets? Where are they used? Can it solve all types of problems?	5	CO8	L3
21		Describe in brief EM Algorithm	5	CO8	L2
22		Briefly Explain PAC Hypothesis	5	CO8	L2

D3. TEACHING PLAN - 3

Module – 5

Title:	Divide and Conquer	Appr Time:	11 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Evaluate the Artificial Nural Network based on the Learning algorithm	CO9	L5
2			
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
46	Motivation, Estimating hypothesis accuracy,	CO9	L4
47	Basics of sampling theorem, General approach for deriving confidence intervals	CO9	L4
48	Difference in error of two hypothesis	CO9	L5
49	Comparing learning algorithms	CO9	L2
50	Instance Based Learning Introduction	CO9	L5
51	k-nearest neighbor learning, locally weighted regression	CO9	L5
52	radial basis function,	CO9	L5
53	cased-based reasoning	CO9	L5
54	Reinforcement Learning Introduction,	CO9	L6
55	Learning Task	CO9	L6
	Q Learning	CO9	L6
	Q Learning	CO9	L6
c	**Application Areas**	**CO**	**Level**
1	Image Processing Evaluation based on particular disease	CO9	L6
2			
d	**Review Questions**	-	-
46	Describe k-nearest neighbor algorithm. Why is it called instance based learning?	CO9	L3

47	Describe these terms in brief PAC Hypothesis	CO9	L3
48	Describe these terms in brief Mistake bound model of learning	CO9	L3
49	Describe in brief Lazy and eager learning	CO9	L3
50	Explain salient features of a Genetic Algorithm. Describe basic genetic algorithm using all the necessary steps of fitness function evaluation	CO9	L2,L3
51	Describe in brief Crossover & mutation	CO9	L3
52	Describe k-nearest neighbor algorithm. Why is it called instance based learning?	CO9	L3
53	Describe the method of learning using Locally weighted linear regression	CO9	L3
54	Describe k-nearest neighbor learning algorithm for continuous valued target functions. Discuss one major drawback of this algorithm and how is can be corrected	CO9	L3
55	Write the FOIL algorithm for learning rule sets and explain the purpose of outer loop and the function of the inner loop	CO9	L4
56	What is reinforcement learning	CO9	L2
57	Explain the Q function and Q learning algorithm	CO9	L3
58	Compare inductive learning and analytical learning	CO9	L5
e	**Experiences**	-	-
1			
2			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	15CS73	Sem:	7	Marks:	30	Time:	75 minutes
Course:	Machine Learning						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Describe k-nearest neighbor algorithm. Why is it called instance based learning?	05	CO9	L3
	b	Describe these terms in brief PAC Hypothesis	05	CO9	L3
	c	Describe these terms in brief Mistake bound model of learning	05	CO9	L3
2	a	Explain salient features of a Genetic Algorithm. Describe basic genetic algorithm using all the necessary steps of fitness function evaluation	10	CO9	L2,L3
	b	Describe in brief Crossover & mutation	05	CO9	L3
3	a	Describe k-nearest neighbor learning algorithm for continuous valued target functions. Discuss one major drawback of this algorithm and how is can be corrected	08	CO9	L3
	b	Write the FOIL algorithm for learning rule sets and explain the purpose of outer loop and the function of the inner loop	07	CO9	L3
4	a	Explain the Q function and Q learning algorithm	08	CO9	L3
	b	Compare inductive learning and analytical learning	07	CO9	L5
	c				

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15CS73	Sem:	7	Marks:	5	Time:	90 – 120 minutes
Course:	Machine Learning						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	**USN**	**Assignment Description**	**Marks**	**CO**	**Level**
1		Describe k-nearest neighbor algorithm. Why is it called	5	CO9	L3

		instance based learning?			
2		Describe these terms in brief PAC Hypothesis	5	CO9	L3
3		Describe these terms in brief Mistake bound model of learning	5	CO9	L3
4		Describe in brief Lazy and eager learning	5	CO9	L3
5		Explain salient features of a Genetic Algorithm. Describe basic genetic algorithm using all the necessary steps of fitness function evaluation	5	CO9	L2,L3
6		Describe in brief Crossover & mutation	5	CO9	L3
7		Describe k-nearest neighbor algorithm. Why is it called instance based learning?	5	CO9	L3
8		Describe the method of learning using Locally weighted linear regression	5	CO9	L3
9		Describe k-nearest neighbor learning algorithm for continuous valued target functions. Discuss one major drawback of this algorithm and how is can be corrected	5	CO9	L3
10		Write the FOIL algorithm for learning rule sets and explain the purpose of outer loop and the function of the inner loop	5	CO9	L4
11		What is reinforcement learning	5	CO9	L2
12		Explain the Q function and Q learning algorithm	5	CO9	L3
13		Compare inductive learning and analytical learning	5	CO9	L5

F. EXAM PREPARATION

1. University Model Question Paper

Course:	Machine Learning					Month / Year	Dec /2018	
Crs Code:	15CS73	Sem:	7	Marks:	80	Time:	180 minutes	
-	**Note**	Answer all FIVE full questions. All questions carry equal marks.				**Marks**	**CO**	**Level**
1	a	*What are the important objectives of Machine Learning? Discuss important examples of Machine Learning*				6	co1	L1
	b	*Explain the different constraints and problems in designing the Learning system*				8	co1	L2
	c	*List the Issues in Machine Learning*				2	co1	L1
		or						
2	a	*Analyze whether FIND-S algorithm can be used for Hypothesis.*				8	CO2	L4
	b	*Analyze the compact Representation for version space from the Representation*				8	CO2	L4
3	a	Explain the Representation that is used to build the Decision Tree, with an example.				8	CO3	L2
	b	Analyze the problems for the decision tree and its learning.				8	CO3	L4
		or						
4	a	*How to apply the concepts of Inductive bias in decision tree learning*				8	CO4	L3
	b	*Figure out the Issues in decision tree learning Avoiding Overfiting with reduced error*				8	CO4	L4
5	a	*Explain NN and its attributes*				05	CO5	L2
	b	Explain the problems that arise in Neural Network and its representation				06	CO5	L2
	c	What is Multilayer perception?				05	CO5	L2
		or						
6	a	What is linear separability issue? And What is the role of hidden layer?				08	CO5	L2,L2
-	b	Consider a multilayer feed forward neural network. Enumerate and explain steps in back propagation algorithm use to train network.				08	CO5	L4
7	a	Explain Bayes theorem				5	CO7	L2
	b	Demonstrate how Machine Learning is used for predicting probabilities				6	CO7	L3
	c	What is Brute Force MAP hypothesis learner?				5	CO7	L2
		or						

8	a	Explain the procedure to estimate difference in error between two learning methods. Consider a learned hypothesis h, for some Boolean concept. When h is tested on a set of 100 examples it classifies 83 correctly what is the standard deviation and 95% confidence interval for the true error rate for error D(h)?	10	CO8	L5
	b	What are Bayesian Belief nets? Where are they used? Can it solve all types of problems?	6	CO8	L3
9	a	Describe k-nearest neighbor algorithm. Why is it called instance based learning?	06	CO9	L3
	b	Describe these terms in brief PAC Hypothesis	05	CO9	L3
	c	Describe these terms in brief Mistake bound model of learning	05	CO9	L3
		or			
10	a	Explain salient features of a Genetic Algorithm. Describe basic genetic algorithm using all the necessary steps of fitness function evaluation	10	CO9	L2,L3
	b	Describe in brief Crossover & mutation	06	CO9	L3
	d	Analyze precisely the computing time and space requirements of this new version of Prim's algorithm using adjacency lists.			

2. SEE Important Questions

Course:	MICROWAVE AND ANTENNAS					Month / Year	May /2018	
Crs Code:	15EC71	Sem:	7	Marks:	80	Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.				-	-	
Module	Qno.	Important Question				**Marks**	**CO**	**Year**

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Module-#	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning	Assessment Methods to Measure Learning
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1	*Introduction: Well posed learning problems, Designing a Learning system, Perspective* and Issues in Machine Learning.	5	- L2 - L4	L4	- -	- Lecture - -	- Slip Test - -
1	Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.	6	- L2 - L4	L4	- -	- Lecture - Tutorial -	- Assignment - -
2	Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm	5	- L2 - L3	L3	- -	- Lecture -	- Assignment -
2	hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.	6	- L3	L3	- -	- Lecture -	- Slip Test -
3	Artificial Neural Networks: Introduction, Neural Network representation	5	- L2 - L4	L4	- -	- Lecture -	- Slip Test -
3	Appropriate problems, Perceptrons, Backpropagation algorithm.	6	- L2 - L4	L4	- -	- Lecture - Tutorial -	- Assignment - -
4	Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning	5	- L3 - L5	L5	- -	- Lecture - Tutorial -	- Assignment - -
4	ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm	6	- L2 - L4	L4	- -	- Lecture - Tutorial -	- Assignment - -
5	Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning.	11	- L5	L5	- -	- Lecture - -	- Assignment - -

2. Concepts and Outcomes:

Table 1: Concept to Outcome – Example Course

Module-#	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning or outcome)	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome **Student Should be able to ...**
A	I	J	K	L	M	N
1	- -	- -	Classification of Machine Language.	-Choose the learning techniques	-Analyze -Machine Language	classify the Artificial Intelligence problem's for Machine Leaning
1	- -	- -	Category Learning.	-examine the concept learning	-Analyze - Candidate Algorithm	Analyze the Category learning using candidate algorithm
2	- -	- -	Statistics on Objects	Identify the characteristics of decision tree and solve problems associated with	-Apply - statistics -decision tree	Apply the fundamentals of statistics based on the Decision Tree Learning
2	- -	- -	Predictive Modeling	-Apply different data sets on inductive bias mdeling	-Apply -data set - inductive bias modeling	Apply the data set on hypothesis space using Inductive bias modeling
3	- -	- -	Weightage of Neural Network	Apply effectively neural networks for appropriate applications	-Analyze -candidate neuron's -neural networks	Analyze the candidate neuron's in Neural networks using power of perceptrons
3	- -	- -	Errors on Objects	-Analyze the different errors on objects using back propogation	-Analyze -backpropagation algorithm	Analyze the gradient in Artificial Nural Network using Backpropagation algorithm
4	- -	- -	Predicting of objects.	Apply Bayesian techniques for different data sets	- examine bayes theorem	Analyze the data sets on Bayes theorem
4	- -	- -	Estimating accuracy on Hypothesis.	- derive effectively learning rules using EM alogirthm	-analyze EM algorithm	Analyze the bayes belief network using EM Algorithm
5	- -	- -	Used to find the Dependencies	Evaluate hypothesis and investigate instant based learning and reinforced learning	-Evaluate - Neural networks -Learning algorithm	Evaluate the Artificial Neural Network based on the Learning algorithm