NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech Computer Science and Engineering**		
Course Title	**Machine Learning**		
Course Code	**CSPE21**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**CSPC25**		
Session	**January 2019**	**Section (if, applicable)**	**A/B**
Name of Faculty	**Mr. Aravindh A**	**Department**	**CSE**
Email	**aravindha@nitt.edu**	**Telephone No.**	**-**
Name of Course Coordinator(s) (if, applicable)			
E-mail		**Telephone No.**	
Course Type	**Elective course (PE)**		

Syllabus (approved in Senate)

Unit – I

Basic Concepts, Introduction to Machine Learning, Applications of ML, Design Perspective and Issues in ML, Supervised, Unsupervised, Semi-supervised learning with applications and issues, A Formal Learning Model, The Runtime of Learning.

Unit – II

Model (or hypothesis) representation, decision boundary, cost function, gradient descent, regularization, Diagnostic: debugging a learning algorithm, evaluating a hypothesis (Model selection), training/validating/testing procedures, diagnosing bias versus variance and vice versa, regularization and bias/variance, learning curves, Accuracy and Error measures: classifier accuracy measures, predictor error measure, evaluating the accuracy of a classifier or predictor, Confusion metric, precision, recall, tradeoff between both, accuracy.

Unit – III

Decision Tree : representation, hypothesis, issues in Decision Tree Learning, Pruning, Rule extraction from Tree, Learning rules from Data, Probabilistic classifier: Bayes rule, Maximum Likelihood Estimation, case study, Support Vector Machine, Nearest Neighbor.

Unit – IV

Clustering: Unsupervised learning technique, Similarity and Distance Measures, k-means and k-medoids algorithm, optimization objective, random initialization, choosing value of k, EM algorithm Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, Graphical Models, Combining Multiple Learners.

Unit –V

Reinforcement Learning: Elements of Reinforcement Learning, Model-Based Learning, Temporal Difference Learning, Generalization, Design and Analysis of Machine Learning Experiments

Text Books

1. Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press, 2014

Reference books

1. Ethem Alpaydin, Introduction to Machine Learning, PHI, 2005
2. H. Witten and E. Frank, Data Mining: Practical Machine Learning Tools and Techniques Morgan Kaufmann, 2000
3. Tom Mitchell, Machine Learning, McGraw-Hill, 1997

COURSE OBJECTIVES

- To understand the basic building blocks and general principles that allow one to design machine learning algorithms
- To become familiar with specific, widely used machine learning algorithms
- To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance

COURSE OUTCOMES (CO)

- Ability to implement and apply machine learning algorithms to real-world applications
- Ability to identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems
- Ability to understand how to perform evaluation of learning algorithms and model selection.

Course Outcome (CO)	Aligned programme Outcome
Ability to implement and apply machine learning algorithms to real-world applications	1, 5, 6
Ability to identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems	1, 3, 4, 5
Ability to understand how to perform evaluation of learning algorithms and model selection	1, 3, 4, 5

COURSE PLAN – PART II

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week	Topic	Mode of Delivery
1.	1 Week	Unit 1 : Basic Concepts, Introduction to Machine Learning, Applications of ML	Chalk and Talk

2.	II Week	Design Perspective and issues in ML, Supervised Unsupervised, Semi-Supervised learning	Chalk and Talk
3.	III Week	Formal Learning Model, The Runtime of Learning	Chalk and Talk
4.	IV Week	Unit 2 : Model (or hypothesis) representation, decision boundary, cost function, gradient descent, regularization	Chalk and Talk
5.	V Week	Debugging a learning algorithm, evaluating a hypothesis (Model selection), Diagnostic, Bias/ Variance methods, trade off, bias/variance learning curves	Chalk and Talk
6.	VI Week	Accuracy measure, precision, recall, confusion matrix, trade-off, TF/IDF	Chalk and Talk
7.	VII Week	Unit 3 : Decision Tree : representation, hypothesis, Pruning, Rule extraction from Tree	Chalk and Talk
8.	VIII Week	Probabilistic classifier: Bayes rule, Maximum Likelihood Estimation, Support Vector Machine, Nearest Neighbor	Chalk and Talk
9.	IX Week	Unit 4 : Clustering: Unsupervised learning technique, Similarity and Distance Measures, K-means and K-medoids algorithm	Chalk and Talk
10.	X Week	Problems in K-means clustering, variations of K-means clustering, Fuzzy C/K means	Chalk and Talk
11.	XI Week	EM algorithm, Bayesian Networks, Graphical Model - Markov and Hidden Markov models, Combining Multiple Learners	Chalk and Talk
12.	XII Week	Unit 5 : Reinforcement Learning, Model Based Learning, Temporal Difference Learning	Chalk and Talk
13.	XIII Week	Generalization, Design and Analysis of Machine Learning Experiments	Chalk and Talk
14.	XIV Week	Introduction to Deep Learning Techniques	Chalk and Talk
COURSE ASSESSMENT METHODS-THEORY (shall range from 4 to 6)			

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Cycle Test-1	3rd week of Feb	1 hour	15%
2.	Cycle Test-2	1st week of April	1 hour	15%
3.	Group Project	2st week of April	Full Semester activity	20%
4.	Assignments	Periodically for units covered	Two	10%
CPA	Compensation Assessment	4th week of April	1 hour	20%
4.	Final Assessment	2nd week of May	3 hours	40%
TOTAL				**100%**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Students' feedback through class committee meetings.
2. Feedback questionnaire from students – from MIS at the end of the semester.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)
Mode of Correspondence through Phone and Email.

COMPENSATION ASSESSMENT POLICY
In case of emergency, the student should submit compensatory assignments on submission of appropriate documents as proof. Compensatory assessments would be framed according to the time frame available and the assessment task missed by the students.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmers.

ADDITIONAL INFORMATION

The students can get their doubts clarified at any time with their faculty member.

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____ 24/1/19