

# **Techno India NJR Institute of Technology**



## **Course File**

### **Machine Learning (6CS4- 02)**

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# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## Syllabus

III Year-VI Semester: B.Tech. Computer Science and Engineering

### 6CS4-02:Machine Learning

Credit: 3

Max. Marks: 150(IA:30, ETE:120)

3L+0T+0P

End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	01
2	<b>Supervised learning algorithm:</b> Introduction, types of learning, application, Supervised learning: Linear Regression Model, Naive Bayes classifier Decision Tree, K nearest neighbor, Logistic Regression, Support Vector Machine, Random forest algorithm	09
3	<b>Unsupervised learning algorithm:</b> Grouping unlabelled items using k-means clustering, Hierarchical Clustering, Probabilistic clustering, Association rule mining, Apriori Algorithm, f-p growth algorithm, Gaussian mixture model.	08
4	<b>Introduction to Statistical Learning Theory</b> , Feature extraction - Principal component analysis, Singular value decomposition. Feature selection - feature ranking and subset selection, filter, wrapper and embedded methods, Evaluating Machine Learning algorithms and Model Selection.	08
5	<b>Semi supervised learning, Reinforcement learning:</b> Markov decision process (MDP), Bellman equations, policy evaluation using Monte Carlo, Policy iteration and Value iteration, Q-Learning, State-Action-Reward-State-Action (SARSA), Model-based Reinforcement Learning.	08
6	<b>Recommended system</b> , Collaborative filtering, Content-based filtering Artificial neural network, Perceptron, Multilayer network, Backpropagation, Introduction to Deep learning.	08
	<b>Total</b>	<b>42</b>

## Course Overview

Machine Learning is the sub-field of Artificial Intelligence. It helps to build automated systems that can learn by themselves using data and experience. This helps the machines make data-directed choices. This is an introductory course in Machine Learning covering all popular machine learning algorithms in supervised learning, unsupervised learning, reinforcement learning, recommendation systems. This course also covers basics of statistical learning theory for feature extraction and feature selection. Last unit introduces the concepts of ANN with glimpses of Deep Learning.

This course will be very helpful for students who are planning for a career in the field of Data Science and Machine Learning. There is a huge demand for these skills in established companies as well as startups.

## Course Outcomes

CO. NO.	Cognitive Level	Course Outcome
1	Understand	Gain knowledge about basic concepts of various Machine Learning algorithms
2	Analyse	Identify machine learning techniques suitable for a given problem
3	Application	Apply various data pre-processing and dimensionality reduction techniques to prepare data for modelling purpose
4	Application	Solve the problems using various machine learning techniques
5	Create	Be able to design and implement various machine learning algorithms in a range of real-world applications.

## Course Outcome Mapping with Program Outcomes

Machine Learning Year of study: 2020-21															
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO36402.1	1	1	0	1	0	1	0	0	0	0	0	1	3	3	2
CO36402.2	1	2	1	1	1	1	0	0	0	0	0	1	3	3	2
CO36402.3	1	1	2	2	1	1	0	0	0	0	0	2	3	3	2
CO36402.4	1	1	1	2	1	1	0	0	0	0	0	3	3	3	2
CO36402.5	1	1	1	1	1	1	0	0	0	0	0	2	3	3	2
C36402 (AVG)	1.00	1.20	1.00	1.40	0.80	1.00	0.00	0.00	0.00	0.00	0.00	1.80	3.00	3.00	2.00

## Lecture Plan

Total No. of Lectures Planned: 42

Lecture No.	Unit Mapping	Topic
1	1	Introduction: Objective, scope and outcome of the course.
2	2	Supervised learning algorithm: Introduction, types of learning, application
3	2	Supervised learning algorithm: Introduction, types of learning, application
4	2	Linear Regression Model,
5	2	Naïve Bayes classifier
6	2	Decision Tree
7	2	Random forest algorithm
8	2	K nearest neighbour
9	2	Logistic Regression
10	2	Support Vector Machine
11	3	Unsupervised learning algorithm: Grouping unlabelled items using k-means clustering
12	3	Hierarchical Clustering, Probabilistic clustering
13	3	Association rule mining
14	3	Apriori Algorithm
15	3	Apriori Algorithm
16	3	f-p growth algorithm
17	3	f-p growth algorithm
18	3	Gaussian mixture model.
19	4	Introduction to Statistical Learning Theory
20	4	Feature extraction - Principal component analysis, Singular value decomposition.
21	4	Feature extraction - Principal component analysis, Singular value decomposition.
22	4	Feature selection – feature ranking and subset selection
23	4	Filter, wrapper and embedded methods
24	4	Filter, wrapper and embedded methods
25	4	Evaluating Machine Learning algorithms and Model Selection

26	4	Evaluating Machine Learning algorithms and Model Selection
27	5	Semi supervised learning, Reinforcement learning: Markov decision process (MDP)
28	5	Semi supervised learning, Reinforcement learning: Markov decision process (MDP)
29	5	Bellman equations
30	5	Policy evaluation using Monte Carlo
31	5	Policy iteration and Value iteration
32	5	Q-Learning, State-Action-Reward-State-Action (SARSA)
33	5	Q-Learning, State-Action-Reward-State-Action (SARSA)
34	5	Model-based Reinforcement Learning
35	6	Recommended system
36	6	Collaborative filtering
37	6	Content-based filtering
38	6	Artificial neural network, Perceptron,
39	6	Multilayer network, Backpropagation
40	6	Multilayer network, Backpropagation
41	6	Introduction to Deep learning
42	6	Introduction to Deep learning

### **Books / Online Resources**

A Course in Machine Learning by Hal Daumé III

Introduction to Probability and Statistics for Engineers and Scientists by Sheldon M. Ross

Machine Learning, on edX by Prof. John W. Paisley, Department of Electrical Engineering, Columbia University <https://www.edx.org/course/machine-learning>

NPTEL Course: Introduction to Machine Learning <https://nptel.ac.in/courses/106/105/106105152/>

### **Assessment Methodology**

1. Hands on exercises on various machine learning techniques and algorithms
3. Mid Term Subjective Paper
3. Final University Exam

## Teaching and Learning Resources

### Unit 1

Video Lectures:

Introductory Concepts

[https://www.youtube.com/watch?v=IjNwvrDC8fU&list=PLloZa6L2Dthh1B1m1xYLL\\_4IVcK\\_iaI2T](https://www.youtube.com/watch?v=IjNwvrDC8fU&list=PLloZa6L2Dthh1B1m1xYLL_4IVcK_iaI2T)

### Unit 2

Supervised Learning Algorithms

YouTube Playlist

<https://www.youtube.com/playlist?list=PLloZa6L2DthhoXRyHSXWS8WnH9iFIFPcc>

Lecture Notes

<https://drive.google.com/file/d/1beLEsPTP-XMOh9Ejt8OvFuYGGZ3qATyD4/view?usp=sharing>

[https://drive.google.com/file/d/1lL6m4e-UchuFHpvaVjf9Tc\\_zIVauAzGZ/view?usp=sharing](https://drive.google.com/file/d/1lL6m4e-UchuFHpvaVjf9Tc_zIVauAzGZ/view?usp=sharing)

[https://drive.google.com/file/d/1nK1VV4IbFF1fIP9zMh\\_PosUtP3mNuDeR/view?usp=sharing](https://drive.google.com/file/d/1nK1VV4IbFF1fIP9zMh_PosUtP3mNuDeR/view?usp=sharing)

### Unit 3

Unsupervised Learning Algorithms

YouTube Playlist

<https://www.youtube.com/playlist?list=PLloZa6L2DthjYtrJRuHTqI6V5XEUEioKV>

Lecture Notes

[https://drive.google.com/file/d/1Y\\_F3pR4CzThHb0SXuGvmnutffBBJaKeK/view?usp=sharing](https://drive.google.com/file/d/1Y_F3pR4CzThHb0SXuGvmnutffBBJaKeK/view?usp=sharing)

[https://drive.google.com/file/d/1hdArGnS5BwZDuGJKw5Krm1\\_kmYbXuEGn/view?usp=sharing](https://drive.google.com/file/d/1hdArGnS5BwZDuGJKw5Krm1_kmYbXuEGn/view?usp=sharing)

## **Unit 4**

Statistical Learning Theory

Lecture notes

[https://drive.google.com/file/d/12i\\_eqTWvWt0uISh2r6JnFCrnkgcNaH9I/view?usp=sharing](https://drive.google.com/file/d/12i_eqTWvWt0uISh2r6JnFCrnkgcNaH9I/view?usp=sharing)

## **Unit 5**

Reinforcement Learning

YouTube Playlist

<https://www.youtube.com/watch?v=-Afn1PBwMGc&list=PLloZa6L2Dthi-baGngFkImaq3jJEPQm6l>

Lecture Notes

[https://drive.google.com/file/d/19JOcQnIG5vmT5wgotNE5XxB-89o\\_H9Cg/view?usp=sharing](https://drive.google.com/file/d/19JOcQnIG5vmT5wgotNE5XxB-89o_H9Cg/view?usp=sharing)

## **Unit 6**

Recommendation Systems, Artificial Neural Networks, Deep Learning

YouTube Playlsts

[https://www.youtube.com/watch?v=YrL0WXAKT4w&list=PLloZa6L2Dthitwv73K8\\_S6agTi5DSEBJ0](https://www.youtube.com/watch?v=YrL0WXAKT4w&list=PLloZa6L2Dthitwv73K8_S6agTi5DSEBJ0)

<https://www.youtube.com/playlist?list=PLloZa6L2Dthnk2xlgCPrzXjIbsvyZ-r>

Lecture Notes

[https://drive.google.com/file/d/1Gm6ZxFUfcu9mz1zWSF5\\_S0595-wQeMkv/view?usp=sharing](https://drive.google.com/file/d/1Gm6ZxFUfcu9mz1zWSF5_S0595-wQeMkv/view?usp=sharing)

[https://drive.google.com/file/d/1e\\_7Kpi4yLIh9fdOXOxvBpk2Tf-jxBy-C/view?usp=sharing](https://drive.google.com/file/d/1e_7Kpi4yLIh9fdOXOxvBpk2Tf-jxBy-C/view?usp=sharing)

# **Lecture Notes (PPT Slides)**