GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,
EAST DELHI CAMPUS,
SURAJMAL VIHAR-110092

Paper code : ARM 206	L	T/P	C
Subject : Introduction to Machine Learning	4	0	4

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End Term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes:

CO1:	Ability of students to understand the basic concepts of Machine Learning and Data Science
CO2:	Ability of students to understand the types of Machine Learning
CO3:	Ability of students to understand the concept of support Vector Machine
CO4:	Ability of students to understand the basic concepts of Deep Networks and evaluating performance of ML algorithms

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	1	1	1	2
CO2	3	3	3	3	3	-	-	-	1	1	1	2
CO3	3	3	3	3	3	2	-	-	1	1	1	3
CO4	3	3	3	3	3	2	-	-	1	1	1	3

Unit I **[8]**

Introduction to Data Science concept : Data Science Terminology, process, data science toolkit, Types of data, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

Introduction to Machine Learning : Learning theory, Hypothesis and target class, Inductive bias and bias-variance tradeoff, Occam's razor, Limitations of inference machines, Approximation and estimation errors.

Unit II **[12]**

Supervised learning: Linear separability and decision regions, Linear discriminants, Bayes optimal classifier, Linear regression, Standard and stochastic gradient descent, Lasso and Ridge Regression, Logistic regression, Support Vector Machines, Perceptron, Back propagation, Artificial Neural

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Networks, Decision Tree Induction, Overfitting, Pruning of decision trees, Bagging and Boosting, Dimensionality reduction and Feature selection.

Unsupervised learning: Clustering, Mixture models, Expectation Maximization, Spectral Clustering, Non-parametric density estimation.

Unit III **[10]**

Support Vector Machines: Structural and empirical risk, Margin of a classifier, Support Vector Machines, Learning nonlinear hypothesis using kernel functions.

Unit IV **[10]**

Evaluation: Performance evaluation metrics, ROC Curves, Validation methods, Bias Variance decomposition, Model complexity.

Introduction to Deep Networks: Introduction to deep feedforward networks, convolutional neural networks, stacking, striding and pooling.

Text Books:

1. O'Neil, C., & Schutt, R. (2013). *Doing data science: Straight talk from the frontline.* " O'Reilly Media, Inc.".
2. Bishop, C. M., & Nasrabadi, N. M. (2006). *Pattern recognition and machine learning* (Vol. 4, No. 4, p. 738). New York: springer.
3. Duda, R. O., & Hart, P. E. (2006). *Pattern classification*. John Wiley & Sons.

Reference Books:

1. Bishop, C. M. (1995). *Neural networks for pattern recognition*. Oxford university press.
2. Alpaydin, E. (2014). *Introduction to machine learning*
3. Cielen, D., & Meysman, A. (2016). *Introducing data science: big data, machine learning, and more, using Python tools*. Simon and Schuster.

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