Birla Institute of Technology & Science, Pilani
Hyderabad Campus

**SECOND SEMESTER 2021-2022**

Course Handout Part II

Date : 17.01.2022

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

**Course No.** **:** BITS F464
**Course Title** **:** Machine Learning
**Instructor In Charge** **: Dr. Paresh Saxena**

## 1. Scope

Machine Learning is an exciting topic to learn to design machines that can learn from examples. This course provides a broad introduction to machine learning while emphasizing the role of probability and optimization in developing theoretical foundations, algorithms and methodologies for machine learning. The course covers the overview of several probability distributions relevant to understand the ML algorithms. Further, the course also covers linear models for regression and classification, neural networks, Kernel methods and mixture models. In addition to the theoretical concepts, the course will also provide several coding examples and exercises.

## 2. Objectives of the course

The objectives of the course are as follows:

- To understand a wide variety of learning algorithms.
- To understand how to evaluate models generated from data.
- To apply the algorithms to a real problem, optimize the models learned and understand the achievable expected accuracy by applying the models.

## 3. TEXT BOOK:

**T1. Christopher Bishop**: Pattern Recognition and Machine Learning, Springer, 1st ed. 2006.
**T2. Tom M. Mitchell:** Machine Learning, The McGraw-Hill International Edition, 1997.

## 4. Course Plan:

| Lecture No. | Learning objectives | Topics to be covered | Chapter in the Text Book |
|---|---|---|---|
| 1 – 3 | To introduce several relevant materials to understand ML algorithms | ML overview, Python and ML frameworks, Probability Theory, Probability Distributions. | Lecture Notes |
| 3 – 8 | To understand linear models for regression | Gradient Descent, Bias-Variance, Bayesian Regression, Bayesian Model Comparison. | T1 – Ch. 3 |
| 9–14 | To understand linear models for classification | Discriminant Functions, Probabilistic Generative and Discriminative Models, Bayesian Logistic Regression | T1 – Ch. 4 |
| 15-22 | To understand Neural networks | Feed-forward Network Functions, Network Training, Backpropagation, Regularization. | T1 – Ch.5 |
| 23-32 | To understand Kernel methods and Sparse Kernel Machines | Radial basis function networks, Gaussian processes, SVMs, Multiclass SVMs | T1 – Ch. 6 and 7 |
| 32-40 | To develop the understanding of Mixture models and combining models | K-means Clustering, Mixture Models, EM, Bagging, Boosting, Decision Trees. | T2 – Ch. 9 and Ch. 14 |

## 5. *Evaluation Scheme:*

| Component | Duration (Minutes) | Weightage | Date & Time | Nature of Component |
|---|---|---|---|---|
| Midsemester Test | 90 Mins | 35% | 15/03 9.00am to10.30am | Closed Book |
| Course Project (with final presentation/viva) | - | 25%<br>**(5% will be evaluated before the mid-sem)** | Details will be announced during the lecture sessions. | Open Book |
| Comprehensive Examination | 120 Mins | 40% | 17/05 FN | Closed Book |

***Note: 40% of the evaluation to be completed by midsem grading.***

***"For Comprehensive exam and Mid-semester Test, the mode (offline/online) and the duration are subject to changes as decided by the AUGSD/Timetable division in future."***

**6. CHAMBER CONSULTATION HOUR:** To be announced.
**7. Make-up:** The make-up policy will be in accordance with the AUGSD guidelines.
**8. NOTICES:** All notices pertaining to this course will be displayed on the CMS.
**9**. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**
**BITS F464**