Indian Institute of Technology Ropar

Department of Mathematics

1st Semester (AY: 2025-2026)

MA515: Foundations of Data Science

(4 Credits: 3-0-2-7-4)

Details of Course Coordinator:

Name: Dr. Arun Kumar

E-mail: arun.kumar@iitrpr.ac.in

Details of Teaching Assistants:

Ms. Priti **E-mail:** priti.21maz0007@iitrpr.ac.in

Ms. Meenu **E-mail:** meenu.22maz0005@iitrpr.ac.in

Mr. Shankha N. Chattopadhyay E-mail: shankha.21maz0008@iitrpr.ac.in

Class Timings:

Lectures: 2:00 - 2:50 PM (Wed, Thu, Fri at Auditorium)

Lab: 6 to 8 PM every Tuesday

Objectives of the course: Develop good understanding of the key concepts in data science. Gain hands-on experience with Python to apply the concepts to data. Understand the mathematical foundations of the key techniques in data science.

Textbooks:

1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer-Verlag New York, 2013.
2. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition, Springer-Verlag, 2009

Reference Book:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From the Frontline. O'Reilly, 2014
2. Charu Agarwal, Data Classification Algorithms and Applications, CRC Press, 2015

Course Content:

Overview of probability and statistics; statistical learning: definition, principles and different types of statistical learning, assessing model accuracy, bias-variance tradeoff; regression models: simple linear and multiple linear and non-linear; resampling methods: assessing model prediction quality, cross validation, bootstrap; model selection and regularization: dimensionality reduction, ridge and lasso; unsupervised learning: clustering approaches, K-means and hierarchical clustering; supervised learning: classification problem, classification using logistic regression, naive Bayes, classification with Support Vector Machines, neural networks

Marks Distributions:

The following marks distribution scheme will be followed:

Task	**% Marks**
Quiz/s	10%
Mid Term	30%
End Term	40%
Project	20%
Total	**100%**

Grading Scheme:

Institute rules will be followed for assigning the final grade for this course. The minimum pass marks for this course will be 30%.

Attendance:

Attendance is mandatory. Institute rules will be followed.