# FS 401: FINANCIAL ANALYTICS

**Course Objectives:**

- To give introduction of machine learning techniques to students
- To provide knowledge of Python programming

**Learning outcomes:**

- Students will learn basics of Machine learning
- Students will understand Python programming language.
- Students will be able to apply these techniques on financial data

**Course Contents:**

**Unit I** (4 weeks)

**Data Manipulation using Python**: Introduction to Python, IDE's (Jupyter, Spyder), custom environment settings, Data Structure: basic data types (numeric, string, float, date timestamp), aggregate functions, conditions (if-elif-else), looping (for, while), inbuilt functions for data conversion, writing user defined functions. Concepts of packages/libraries – important packages like NumPy, scikit-learn, scipy, sympy, math, Pandas, Matplotlib, etc. importing packages using pip, reading and writing data from/to different formats: Data frame, arrays, list of list, series, sets, dictionaries, plotting, functions, list comprehensions (index comprehension). Application of machine learning algorithm for solving problem in financial markets.

**References:**

Dive into PYTHON 3 by Mark Pilgrim : Chapters 1, 2, 4

Python Machine Learning by Sebastian Raschka: Chapter 3

**Unit II** (2 weeks)

**Machine learning**: Introduction, Definitions, Supervised, unsupervised, python libraries for machine learning, Sci-kit learn, Applications of Machine learning in Financial Technology (FinTech).

**References:**

Machine Learning by Tom M. Mitchell: Chapter 1, 2, 4

# FINANCIAL ANALYTICS

**Unit III**                                                                    **(2 weeks)**

**Regression**: Linear regression univariate and multivariate, nonlinear regression, over-fitting and regularization, logistic regression, Case studies based on regression techniques (using financial market data)

An Introduction to Statistical Learning by Gareth James: Chapter 3 and Chapter 4

**Unit IV**                                                                     **(3 weeks)**

**Classification:**  K Neighbors, K – means, decision Trees and SVM.

**Clustering:** Partial based clustering, hierarchical clustering, intensity based clustering, Neural Network: Single layer perceptron, multi-layer perceptron, back propagation algorithm applying neural network on financial market data

**References:**

Machine Learning by Tom M. Mitchell: Chapter 3, 4, 6, 8

**Practical:**

The entire syllabus is based on practical exercise i.e. learning through doing in computer lab on specified SW like Python and Matlab. The exam will also have 50% weightage for practical in the lab with evaluation through external expert.

**Text Books:**

1.  Dive into PYTHON 3 by Mark Pilgrim

2.  Machine Learning by Tom M. Mitchell

3.  An Introduction to Statistical Learning by Gareth James

**Additional Readings:**

1.  Step-by-Step Machine Learning with Python By Yuxi (Hayden) Liu

2.  Regression Analysis with Python By Luca Massaron, Alberto Boschetti

3.  Principles of  Soft Computing, by S. N. Deepa and S. N. Sivanandam

4.  Python Machine Learning by Sebastian Raschka

# FINANCIAL ANALYTICS

**Teaching Learning Process:**

Class room lecture, Practical Lab Session, Problem solving, Class presentation on the assigned topic by students individually or in group, Workshop

**Assessment Method**

1. Practical exam of 50% marks inclusive of internal evaluation (25%). Internal evaluation will have:

   a. Attendance 5% marks

   b. Two internal evaluations by the teacher with 10% marks each out of which one must be a class test and other may be another test or home assignment or presentation. Faculty may take more than two assignments and (or) tests but total will be only 20% marks.

2. End term University Exam of 50% marks

   **Key words:**

   Data Structure, Python, Machine learning, Neural Network, Regression