Course Code	Course Title	L	T	P	C
UCCA234E	R and Python for Finance	2	0	2	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To understand financial data analysis for decision making.
2. To gain understanding on the need and significance of R and Python for Finance.
3. To learn applications of finance domain specific libraries of R and Python.

Course Outcomes

Upon Successful completion of this course, the students will be able to:

1. Work with Financial datasets.
2. Understand linear regression concepts.
3. Develop basic understanding of R & Python.
4. Explore regression model building and testing using Python.
5. Carry out data analysis and visualization.
6. Use advanced machine learning models in Finance.

Module:1	Python and Finance	4 hours

Python- History of Python- Python Ecosystem- Technology in Finance- Rise of Real-Time Analytics- Finance and Python Syntax- Efficiency and Productivity Through Python- From Prototyping to Production- Python Deployment- Anaconda- Python-Spyder- Algorithmic Trading- Python for Algorithmic Trading- Machine and Deep Learning.

Module:2	Financial Data	4 hours

Reading Financial Data from Different Sources- Working with Open Data Sources- Retrieving Historical Structured Data- Retrieving Historical Unstructured Data- Storing Financial Data Efficiently- The process of algorithmic trading- Moving averages.

Module:3	Data Sets	4 hours

Technical analysis techniques- Crossovers- Pairs trading- Data Visualization- Two-Dimensional Plotting- One-Dimensional Data Set- Two-Dimensional Data Set- Other Plot Styles- Financial Plots- Financial Data- Regression Analysis.

Module:3	Linear Regression	4 hours

Supervised Learning Models: An Overview- Linear Regression- Ordinary Least Squares- Regularized Regression- Logistic Regression- K-Nearest Neighbors- Linear Discriminant Analysis- Classification and Regression Trees

Module:4	Evaluation Metrics	4 hours

Ensemble Models- ANN-Based Models- ANN using sklearn- Using ANNs for supervised learning in finance- Model Performance- Overfitting and Underfitting- Cross Validation- Evaluation Metrics- Unsupervised Learning: Dimensionality Reduction- Clustering Techniques- k-means Clustering

Module:5	Advanced Machine Learning Models in Finance	4 hours

Investigating advanced classifiers- Random Forest- Gradient Boosted Trees- XGBoost- Using stacking for improved performance- Investigating the feature

importance- Investigating different approaches to handling imbalanced data- Undersampling- Oversampling- SMOTE- Bayesian hyperparameter optimization.		
Module:6	**Financial Analytics and Development**	**4 hours**
Excel Integration- Basic Spreadsheet Interaction- Scripting Excel with Python- Object Orientation and Graphical User Interfaces- Object Orientation- Basics of Python Classes- Simple Short Rate Class- Cash Flow Series Class.		
Module:7	**Rapid Web Applications**	**4 hours**
Graphical User Interfaces- Short Rate Class with GUI- Updating of Values- Cash Flow Series Class with GUI- Web Integration- Web Basics- Web Plotting- Static Plots- Interactive Plots- Real-Time Plots- Rapid Web Applications- Web Services.		
Module:8	**Contemporary Issues**	**2 hours**
Guest Lecture from Industry and R & D Organizations		
Total Lecture hours		**30 hours**
Text Book(s)		
1.	Lookabaugh, B., Tatsat, H., Puri, S. (2020). Machine Learning and Data Science Blueprints for Finance. China: O'Reilly Media.	
2.	Hilpisch, Y. (2014). Python for Finance: Analyze Big Financial Data. United States: O'Reilly Media.	
3.	Hilpisch, Y. (2020). Python for Algorithmic Trading. United States: O'Reilly Media.	
4.	Fletcher, S., Gardner, C. (2010). Financial Modelling in Python. Germany: Wiley	
Reference Books		
1.	Naik, K. (2019). Hands-On Python for Finance: A Practical Guide to Implementing Financial Analysis Strategies Using Python. United Kingdom: Packt Publishing	
2.	Molin, S. (2019). Hands-On Data Analysis with Pandas: Efficiently Perform Data Collection, Wrangling, Analysis, and Visualization Using Python. United Kingdom: Packt Publishing.	
3.	Lewinson, E. (2020). Python for Finance Cookbook: Over 50 Recipes for Applying Modern Python Libraries to Financial Data A nalysis. United Kingdom: Packt Publishing.	
Lab Experiments		
Python Installation basics (int, float, complex, bool and string types).		4 hours
Python and Extract data using the Quandl API.		6 hours
Technical analysis techniques using cross over techniques.		4 hours
Linear Regression build –in functions.		4 hours
Binary classification in financial data.		6 hours
k-Nearest Neighbors (k-NN).		6 hours
Visualization using Matplotlib library.		4 hours
Mode of Evaluation: CAT, Quiz, Digital Assignments and FAT		
Recommended by Board of Studies	08.11.2023	
Approved by Academic Council	No.72. Date 30.11.2023	