Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed Syllabus (DJS23)

Of

Honors Degree Program in

Computational Finance

(Semester VI)

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme of Semester VI (DJS23) HONORS for Department of Computer Science and Engineering (Data Science)

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (SEE) - A						Continuous Assessment (CA) - B						Aggregate (A+B)	Credits Earned	
			Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Term Test 3 (TT3)	Term Test Total (TT1 + TT2+ TT3)	Term Work	CA Total (B)			
1	DJS23DCH1601	Quantitative Portfolio Management	3	-	-	3	2	60	-	-	-	60	15	15	10	40	--	40	**100**	3	**4**
2	DJS23DLH1601	Quantitative Portfolio Management Laboratory	-	2	-	1	-	-	-	-	-	-	--	--	-	--	25	25	**25**	1	
		Total	**3**	**2**	-	**4**	**2**	**60**	-	-	-	**60**	**15**	**15**	**10**	**40**	**25**	**65**	**125**	**4**	**4**

Honors in Computational Finance **Semester: VI**

Program: : Computer Science and Engineering (Data Science)

Course: Quantitative Portfolio Management (DJS23DCH1601)

Quantitative Portfolio Management Laboratory (DJS23DLH1601)

Pre-requisite: Basics of Financial Market and Return and Risk Management, Python

Objectives:

1. To have a practical orientation towards the principles of investment, pricing and valuation.
2. To understand various methodologies and techniques of financial analysis and Portfolio Management.

Outcomes: On completion of the course, the learner will be able to:

1. Analyze the measures of risk and return based on the characteristics of different financial assets and value assets such as stocks and bonds for investment
2. Analyze risk and returns of fixed income instruments and stocks using various models for the purpose of investment.
3. Build and analyze efficient portfolio strategies.
4. Estimate risk and return parameters, and build better diversified portfolios and bond valuation.

Quantitative Portfolio Management (DJS23DCH1601)		
Unit	**Description**	**Duration**
1	**Overview of Portfolio Management:** Concept and objectives of Portfolio Management, Types of portfolio management (brief), Role of Portfolio Managers, SEBI regulations related to portfolio operations. **Expected Risk and Returns:** Portfolio Analysis- Meaning and its Components, Calculation of Expected Return and Risk, Calculation of Covariance, Risk – Return Trade off.	**06**
2	**Modern Portfolio Theory & Asset Pricing Models:** Markowitz Model & Efficient Frontier, Optimal risky portfolio, Capital Market Theory: CML & SML, CAPM (assumptions, applications), Single Index Model, Arbitrage Pricing Theory (conceptual + application), Implementation of efficient frontier, GMV, maximum Sharpe portfolio	**07**
3	**Modelling Asset Returns:** Random Walks, Geometric Brownian Motion (GBM) **Simulation Approaches:** Monte Carlo simulation of asset prices, generating price paths, Simulating portfolio returns, Scenario analysis	**07**
4	**Portfolio Optimization in Practice** **Diversification & Optimization Methods:** Naive diversification (1/N rule), Scientific diversification **Risk-Based Approaches:** Measuring risk contributions, Risk budgeting, Simplified risk parity portfolios, Full risk parity portfolios **Covariance Estimation (Brief):** Shrinkage estimators, EWMA (Exponentially Weighted Moving Average), Rolling covariance windows	**07**

	Comparing optimization & diversification approaches: Empirical comparison	
5	**Beyond Diversification: Portfolio Insurance & CPPI** **Limits of Diversification:** When diversification fails, Correlation breakdown, Empirical evidence **CPPI – Constant Proportion Portfolio Insurance:** Concept, floor, cushion, multiplier, CPPI vs buy-and-hold, Drawdown constraints, **CPPI Simulation & Strategy Analysis:** Simulating CPPI using GBM, Monte Carlo evaluation, Analyzing performance, drawdowns, floor violations, Designing and calibrating CPPI strategies (light, conceptual)	**07**
6	**Portfolio Revision, Evaluation & Bond Portfolio Strategies** **Portfolio Revision:** Meaning, need, constraints, Revision strategies **Portfolio Evaluation:** Sharpe Ratio, Treynor Ratio, Jensen's Alpha **Foreign Exchange Risk in Global Portfolios:** Nature of FX exposure, Currency risk measurement, Hedging basics **Bond Portfolio Management Strategies:** Duration-based strategies (immunization); Ladder, Barbell, Bullet; Active vs passive bond portfolio management	**07**
	Total	**42**

Quantitative Portfolio Management Laboratory (DJS23DLH1601)	
Exp.	**Suggested experiments**
Data Sources: Yahoo Finance, Alpha Vantage, FXCM, OANDA, EOD Historical Data	
1	Return Calculation & Risk Metrics
2	Risk-Adjusted Performance Evaluation
3	Markowitz Efficient Frontier
4	CAPM, Beta Estimation & SML
5	Random Walk & GBM Modelling
6	Monte Carlo Portfolio Simulation
7	Naive vs Scientific Diversification
8	Risk-Based Portfolios & Covariance Estimation
9	Implementation of CPPI Strategy
10	Compare and analyze the Covariance Estimation for robust estimates
11	Portfolio Revision Strategy Analysis
12	Bond Portfolio Management Strategies

* The Term Work will be calculated based on Laboratory Performance (15 marks) and Assignments /Quizzes (10 Marks)

Books Recommended:

Text books:

1. Prasanna Chandra, "Investment Analysis and Portfolio Management", McGraw Hill, 7th Edition, 2023.
2. 2Zvi Bodie, Alex Kane, Alan Marcus, "Investments", McGraw Hill, 13th Global Edition, 2022.
3. S. Kevin, "Security Analysis and Portfolio Management", PHI Learning, 3rd Edition, 2019.

Reference Books:

1. Frank J. Fabozzi, Portfolio Construction and Analytics, Wiley Finance, 2nd Edition,2016

2. Attilio Meucci, Risk and Asset Allocation, Springer Finance, 2019 Reprint
3. Lionel Martellini, Philippe Priaulet, Fixed-Income Securities: Valuation, Risk, and Risk Management, Wiley Finance, 2020
4. Yves Hilpisch, Python for Finance: Mastering Data-Driven Finance, O'Reilly, 3rd Edition, 2024

Web Links:

1. Portfolio Management Guide: Portfolio Management - Meaning and Important Concepts - Management Study Guide
2. Securities and Exchange Board of India: www.sebi.gov.in
3. Market Action and Analysis: www.moneycontrol.com
4. Stock Portfolio: www.pms.sharekhan.com
5. Quantitative Finance Tutorials (Python): https://www.quantstart.com
6. Portfolio Visualizer (Free Tool): www.portfoliovisualizer.com

Prepared by Checked by Head of the Department Principal