Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Honors Degree Program in Computational Finance

Computer Science and Engineering (Data Science)

With effect from Year 2025-26

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Honors Degree Program in Computational Finance(w.e.f. 2025-26)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
Sem-III														
1	H1	RCP23DCH1301	Financial Market and Risk Analysis	3			20	20	20	20	60	100	3	3
Sem-IV														
2	H1	RCP23DCH1401	Econometric Modelling	3			20	20	20	20	60	100	3	3
Sem-V														
3	H1	RCP23DCH1501	Computational Methods and Pricing Models	3			20	20	20	20	60	100	3	4
	H1	RCP23DLH1501	Computational Methods and Pricing Models Laboratory			2	25					25	1	
Sem-VI														
4	H1	RCP23DCH1601	Quantitative Portfolio Management	3			20	20	20	20	60	100	3	4
	H1	RCP23DLH1601	Quantitative Portfolio Management Laboratory			2	25					25	1	
Sem-VII														
5	H1	RCP23DCH1701	Stochastic Calculus for Financial Modelling	3			20	20	20	20	60	100	3	3
6	H1	RCP23DLH1701	Mini Project			2	50					50	1	1
Sem-VIII														
7	H1	RCP23DCH1801	Financial Analysis and Decision Science	3			20	20	20	20	60	100	3	3
8	H1	RCP23DLH1801	Financial Analysis and Decision Science Tutorial		1		50					50	1	1
			Total	18	1	6	250			100	360	750	22	

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Prof. S. P. Shukla
C.O.E.

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Dean Academics/Dy. Director

Prof. Dr. J. B. Patil
Director

Honors Degree Program in Computational Finance
Semester - VI

Program: Computer Science & Engineering (Data Science)	**T. Y. B.Tech.**	**Semester: VI**
Quantitative Portfolio Management (RCP23DCH1601)		
Quantitative Portfolio Management Laboratory (RCP23DLH1601)		

Prerequisite: Basics of Financial Market and Return and Risk Management , Python.

Course Objective(s):

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.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	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.	L4	Analyze
CO2	Analyze risk and returns of fixed income instruments and stocks using various models for the purpose of investment.	L4	Analyze
CO3	Build and analyse efficient portfolio strategies.	L6	Create
CO4	Estimate risk and return parameters, and build better diversified portfolios and bond valuation.	L6	Create

Quantitative Portfolio Management (RCP23DCH1601) Course Contents

Unit-I — 06 Hrs.

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.

Unit-II — 07 Hrs.

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

Unit-III — 07 Hrs.

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

Unit-IV — 07 Hrs.

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.

Comparing optimization & diversification approaches:

Empirical comparison

Unit-V 07 Hrs.

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)

Unit-VI 7 Hrs.

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

Quantitative Portfolio Management Laboratory (RCP23DLH1601)

List of Laboratory Experiments

Suggested Experiments(At Least 08)

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

Data Sources: Yahoo Finance, Alpha Vantage, FXCM, OANDA, EOD Historical Data
Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Text Books:

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

Weblinks:

1. Portfolio Management Guide:
   https://www.managementstudyguide.com/portfolio-management.htm
2. Securities and Exchange Board of India:
   https://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