PONDICHERRY UNIVERSITY

Ramanujan School of Mathematical Sciences

Draft Regulations
and
Syllabus for M.Sc. Quantitative Finance
(Under UGC Innovative Programme)

(CBCS Pattern)
Effective from the Academic Year 2017-18 onwards
PONDICHERRY UNIVERSITY
Ramanujan School of Mathematical Sciences

M. Sc. (Quantitative Finance)

CURRICULUM & COURSE STRUCTURE

Eligibility:
A candidate who has secured 55% marks or above in any one of the following or equivalent is eligible to apply. B. Sc. (Mathematics), B. Sc. (Statistics), B. Com./B.B.A/B.B.M with Mathematics, B. A. / B. Sc. (Economics/Econometrics) with Mathematics, Bachelor’s degree in Engineering (Computer Science & Engineering/Information Technology) or Bachelor’s degree in Computer Science/Computer Applications/Information Technology.

Selection Procedure:
Candidates are admitted for M. Sc Quantitative Finance programme is based on an All India level entrance examination conducted by the University. The entrance test for M. Sc is similar to that of any standard All India Management Admission (on lines of GMAT/GRE) with objective type of questions in General English, Reasoning, Problem Solving, Basics of Computer Science, General Engineering Contemporary Business/Economics/Finance Issues and Mathematics (Algebra and Calculus at higher secondary level).

Choice Based Credit System (CBCS)
The M. Sc Quantitative Finance degree programme is offered through a unique ‘Choice Based Credit System (CBCS)’. The Salient features of the CBCS system is that the programme is offered through credit based courses. Subjects are divided into Hard core and Soft core. Hard core subjects are compulsory. The students have choice to select from among the list of Soft core subjects. Soft core subjects are similar to electives. Based on the quantum of syllabus and number of hours of teacher interaction in the classroom, each subject is assigned with certain number of credits.

A student is expected to complete a minimum of 72 credits worth of courses within 4 semesters of M. Sc Quantitative Finance degree programme. Students are assessed and awarded letter grades based on the performances in the respective courses.

This program trains the students to focus on real time application oriented problems using computer oriented packages (Financial and Statistical packages) like Minitab, CMIE-
PROWESS, BLOOMBERG, SPSS, R, EVIEWS and STATA.

Duration of the course:

The normal duration of any PG program is 4 Semesters. However, students are allowed to complete the PG program of the study within a maximum of 8 Semesters

Weightage of Marks:

The weightage of marks for Continuous Internal Assessment (CIA) and End Semester Examination shall be 40 and 60 respectively. A student is declared passed in the given subject when he/she secures a minimum of 50 marks (Both Internal and End Semester put together). A minimum of 40% in end semester exam is essential.

Internal Continuous Assessment Component:

The weightage of 40 marks for Internal Continuous Assessment Component shall consist of the following:

- Written test [2 Class Test(s)] = 30 marks
- Written Assignment(s) = 5 marks
- Seminar Presentation(s)/ Field Work(s) = 5 marks

Total : 40 marks

Evaluation of End Semester Written Examination:

Each student will be assessed by the concerned teacher by conducting internal assessment activities for 40 marks. Since the internal assessment is a continuous assessment of the progress of the student, there will not be any supplementary tests.

End Semester Exam will be conducted at the end of each semester during the prescribed time schedule given by the University. The question paper will be set by the internal experts and the exams will be organized by the department under the direct supervision of the Dean, Ramanujan School of Mathematical Science. The list of External Examiners is to be approved by the Dean Ramanujan School of Mathematical Science from a panel of External Examiners to be given by the Course in-charge for each subject and the consolidated panel of examiners shall be forwarded to the Dean by the HOD/Co-ordinator of the Programme.

The answer scripts of the End Semester Examination shall be evaluated for a weightage of 60 marks and this will be evaluated by the Internal Examiner. The sum of the marks awarded in
the Internal Assessment and by the End Semester examination will be taken for awarding the Grades.

**Supplementary examination:**

(i) A failed student who meets the attendance requirement and has a minimum of 40% in internal assessment marks may be permitted to register for the immediate end semester examination.

(ii) Students who have failed due to insufficient attendance and/or less than 40% in Internal Assessment marks should repeat the course as and when it is offered.

**Summer Internship:**

Every student of M. Sc Quantitative Finance Degree Programme shall undergo an internship in any leading Bank, Financial Institution, Stock Market, Investment Bank, Insurance Companies, Merchant Banking and Stock broking companies for a period of 6 weeks during summer vacation (at the end of second Semester) under the guidance of a Faculty Member in the Department. Once guides are allotted to the students, the students should contact the respective guides periodically and get necessary guidance and feedback on the project work.

Company should be identified by student as well as the Department at the end of second semester examinations and it should be communicated to the department, the name of the company in which he/she is undergoing the project, the exact title of the project, the name of the Company Guide and his contact number etc. In the first week of August, all the students have to give a presentation about their observations made by them in internship. Students have to follow a detailed guidelines being circulated by the department in the preparation of internship report. At the end of the internship period, every student shall submit a structured internship report within 15 days from the date of the completion of the project period.

**Workshop:**

Workshop is an educational seminar or series of meetings emphasizing interaction and exchange of information on financial modeling among students of M. Sc (Quantitative Finance). Students have to produce their own model in their area of specialization at the end of workshop and which will be evaluated and marks will be awarded by an external expert.

**Final Project:**

Every student of M. Sc Quantitative Degree Programme shall carry out a full semester project associated with development of solution for finance industry and leading financial institution for a period of five months during January to May. Once guides are allotted to the students, the
students should contact the respective guides periodically and get necessary guidance and feedback on the project work. There will be two mid course review presentations on the progress of work. An attendance certificate from the company guide on satisfactory completion of the project work is essential.

The Final Project Report and Viva-Voce examination will be conducted, jointly by External Examiner and one Internal Examiner (respective Faculty Guide). The list of External Examiners is to be approved by the Dean, School of Management/Ramanujan School of Mathematical Sciences from a panel of External Examiners to be submitted by the HOD/Co-ordinator of the Programme.

Since focus of the each of the project work is different, every candidate is evaluated independently on the merits of the topic, Quantum of work done and major contributions made, etc. Absolute grading is recommended in the place of relative grading while evaluating the final project and viva-voice.

**Question Paper Pattern:**

The question paper pattern for the theory papers in the End-Semester Written Examinations shall be as given below:

**Section A:** Five questions are to be answered out of eight questions, each carrying 4 marks: $5 \times 4 = 20$ marks

**Section B:** Five questions are to be answered in either or type: $5 \times 8 = 40$ marks

**Total** $= 60$ marks.

**Attendance:**

Each student shall obtain 70 per cent attendance to be eligible for appearing for the End-Semester Examination. While submitting the examination form, the students have to get their attendance certificate certified from concerned teacher and faculty advisor.

**Grading:**

Grading of the marks obtained by the students shall be made as per the norms of Choice Based Credit System (CBCS). The programme committee in the presence of VC’s Nominee will finalize the grades in each paper.
PONDICHERRY UNIVERSITY
M.Sc. QUANTITATIVE FINANCE
(CHOICE BASED CREDIT SYSTEM)
Effective from the Academic Year 2017–2018

<table>
<thead>
<tr>
<th>Non - Credit Bridge Courses</th>
<th>Nature of the Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSQF 401 Basics of Business and Accounting</td>
<td>Hard Core</td>
</tr>
<tr>
<td>MSQF 402 Basics of Computer Programming</td>
<td>Hard Core</td>
</tr>
<tr>
<td>MSQF 403 Basics of Economics</td>
<td>Hard Core</td>
</tr>
<tr>
<td>MSQF 404 Quantitative Techniques for Beginners</td>
<td>Hard Core</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Nature of the Course</th>
<th>No. of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>MSQF 411</td>
<td>Accounting and Financial Analysis</td>
<td>Hard Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 412</td>
<td>Financial Institutions and Markets in India</td>
<td>Hard Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 413</td>
<td>Managerial Economics</td>
<td>Hard Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 414</td>
<td>Probability Distributions</td>
<td>Hard Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 415</td>
<td>Lab I: Financial Statement Analysis(Using Excel)</td>
<td>Hard Core</td>
<td>2</td>
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<tr>
<td></td>
<td>MSQF 416</td>
<td>Lab II: Data Analysis Using SPSS</td>
<td>Hard Core</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>MSQF 421</td>
<td>Portfolio Management</td>
<td>Hard Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 422</td>
<td>Statistical Inference</td>
<td>Hard Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 423</td>
<td>Basic Econometrics</td>
<td>Hard Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 424</td>
<td>Financial Engineering and Derivatives</td>
<td>Hard Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 425</td>
<td>Data Science</td>
<td>Hard Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 426</td>
<td>Financial Management</td>
<td>Hard Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 427</td>
<td>Lab III: Data Analytics using R</td>
<td>Hard Core</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>MSQF 531</td>
<td>Applied Time Series Analysis and Forecasting</td>
<td>Hard Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 532</td>
<td>Applied Regression Modelling using R</td>
<td>Hard Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 533</td>
<td>Risk Management</td>
<td>Hard Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 534</td>
<td>Corporate Internship and Viva</td>
<td>Hard Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 535</td>
<td>Any three papers has to be selected from pool of Electives</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MSQF 536</td>
<td></td>
<td>Soft Core</td>
<td>3</td>
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<tr>
<td></td>
<td>MSQF 537</td>
<td></td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>MSQF 541</td>
<td>Project Course Work</td>
<td>Hard Core</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MSQF 542</td>
<td>Project Work</td>
<td>Hard Core</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>MSQF 543</td>
<td>Comprehensive Viva</td>
<td>Hard Core</td>
<td>3</td>
</tr>
</tbody>
</table>
### Pool of Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Nature of the Course</th>
<th>No. of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Python for Data Analysis</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Stochastic Modeling</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Optimization Techniques</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Statistical Techniques for Managers</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Management Information System</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Information Security</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Global Finance and International Banking</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Big Data Analytics</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Behavioral Finance</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Treasury and Fixed Income Securities</td>
<td>Soft Core</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Algorithmic Trading</td>
<td>Soft Core</td>
<td>3</td>
</tr>
</tbody>
</table>
BRIDGE COURSES

MSQF 401: BASICS OF BUSINESS AND ACCOUNTING


Books for Study


Books for Reference

MSQF 402: BASICS OF COMPUTER

Unit I: Introduction to Excel

Introduction to Excel - Excel menu and options – Excel interface – Basic navigation and Editing

Unit II: Basics of R

Data types, objects, vectors, sequence, lists, arrays. Defining matrices and performing basic matrix operations, Creating data frames – reading files of different file formats data editor to create a data frame.

Unit III: Fundamental of SPSS

Descriptive statistics, correlation – Pearson’s, Spearmen’s. Fundamental of SPSS, reading different file formats, data editing features and summary statistics.

Unit IV: Introduction to EVIEWS, GRETL and STATA

Introduction to the software’s - its menu and options – simple graph and calculations in Eviews, Gretl and Stata

Unit V:

Practical application using software’s

Books for Study

Books for Reference
MSQF 403: BASICS OF ECONOMICS


Unit II: Theory of Demand, Production and Cost: Demand and Law of Demand – Factors and theory of Production — Production function with one variable, two variable inputs - Cost theory and estimation – cost of production and cost curve.


Books for Study


Books for References:

MSQF 404 : QUANTITATIVE TECHNIQUES FOR BEGINNERS

Unit-1
Definition of statistics – measures of central tendency - measures of dispersion - moments- Skewness and kurtosis and their measures. Bivariate data – scatter diagram, Pearsons correlation coefficient, Spearman’s Rank correlation - normal Distribution- Concept of Regression, regression coefficients

Unit-II
Random Experiment: Sample space, Different types of events - Definition of probability: Classical and relative-frequency approach to probability - Addition and multiplication theorem on Probability(statements only) - Conditional probability and Independence of events.

Unit-III
Random variable - discrete and continuous random variables - probability mass function and probability density function - Distribution Function and its properties - expectation, variance - moment generating function and characteristic function - Concept of conditional distributions and conditional expectation.

Unit-IV

Unit-V

Books for Study

Books for Reference
SEMESTER I

MSQF 411: ACCOUNTING AND FINANCIAL ANALYSIS CREDITS: 3

Objectives
- To acquaint the students with the fundamentals principles of Financial, Cost and Management Accounting
- To enable the students to prepare, Analyse and Interpret Financial Statements
- To enable the students to take decisions using Management Accounting Tools

Unit I: Financial Accounting:

Unit II: Joint Stock Company Accounts:
Final Accounts of Companies (Format only) – Banking Company accounts – Preparation of Final Accounts of Banking Companies- Non-Performing Assets – Asset Classification and Provisioning Norms

Unit III: Financial Statement Analysis: Ratios

Unit IV: Financial Statement Analysis: Funds/Cash Flow Analysis
Preparation of Funds Flow Statement – Preparation of Cash Flow statement – Evaluation of Funds and cash Flow analysis

Unit V: Marginal Costing and Profit Planning:

Books for Study

Books for Reference
Objectives

- To get an insight into the constitutions, structure, objectives and working of the Banking Institutions in India
- To evaluate the performance of Banking Institutions and their contribution to the growth of Indian Corporate Sector and
- To have a Bird’s view of the Indian Financial System and in the context of Global Indian Banking System.

Unit I: Introduction to Indian Financial System

Overview of Indian financial system – Functions of financial system – players – structures and growth – regulatory bodies and their role.

Unit II: Money, Capital Markets


Unit III: Merchant bankers


Unit IV: Foreign Exchange Market

Exchange rate – types – determination of exchange rate – nature of forex market - nature of forex inflow and outflow – Current account and Capital account convertibility- ECBs and NREs – RBI and exchange rate management

Unit V: Banking Institution and Financial Regulators


Books for Study:

Books for Reference
MSQF 413: MANAGERIAL ECONOMICS

CREDITS:3

Objectives

❖ This course will help independent business person to take various decisions pertaining analytical skills through integrating their knowledge of the economic theory with decision making techniques.
❖ To acquire knowledge associated with current Economy and organization

Unit I: Definition, Scope & Fundamental concepts: Introduction, Definition, Scope of Managerial economics, Circular flow of Activity -Objective of a firm; Economic theory and managerial theory; Managerial economists role and responsibilities; profit and sales Maximization -The Economics of Effective Management - Fundamental economic concepts – basic concepts of consumption and Utility analysis

Unit II: Quantitative Demand Analysis: Demand determination - Market Forces: Demand and Supply: Individual and market demand functions; Law of demand/ supply, determinants of demand/ supply; Elasticity of demand/ supply- its meaning and importance; Price elasticity income elasticity and cross elasticity; Using elasticity in managerial decisions, Demand estimation for major consumer durable and non durable products; Demand forecasting techniques -Consumer surplus and producers surplus.

Unit III: Theory of individual behavior - Production and cost Analysis: Cardinal utility approach, indifference approach, revealed preference and; Law of variable proportions - Law of returns to scale - Economies and diseconomies of scale Production function - Cost theory and estimation; Short and long run Cost curve – cost forecasting- Analysis of risk and uncertainty.


Books for Study

Books for Reference
5. Yogesh Maheshwari (2009): Managerial Economics; PHI Learning, New Delhi
MSQF 414: PROBABILITY DISTRIBUTIONS  CREDITS: 3

Objectives
- To acquaint the students with the fundamentals of various distributions and their characteristic properties
- To provide illustrations on modelling of financial data using these distributions

Unit I: Discrete distributions
Bernoulll, Binomial, Poisson, Multinomial, Geometric, Hypergeometric, Power series distributions and their characteristics - simple problems

Unit II: Continuous distributions
Uniform, Normal, Exponential, Gamma, Pareto, lognormal distributions and their characteristics - simple problems

Unit III: Sampling distributions
Concept and definition of Sample distribution- standard error - characteristics and uses of sampling distributions. – central limit theorem - Student t, chi-square and Snedecor F distributions and their interrelations.

Unit IV: Truncated and Compound distribution
Concept of truncation – zero truncated binomial and Poisson distribution - Compound distributions – compound binomial, compound Poisson and compound negative exponential (Pareto) distributions – their applications.

Unit V: Order statistics and their distribution
Distribution of minimum and maximum - Distribution of sample median and mid range – sample generation from basic discrete and continuous distributions.

Books for Study

Books for Reference
Objectives

- To enrich data analysis using Excel
- To have a better knowledge towards graphical depiction of data

1. Random number generation
2. Probability distributions
3. Data retrieval and handling
4. Data analysis
   a. Return calculation (Monthly and Weekly)
   b. Estimation of beta
   c. Correlation, Standard deviation and variance
   d. Regression

5. Financial Statement Analysis – tools and techniques
6. Portfolio Analysis
   a. Portfolio Expected Return and Variance
   b. Efficient Frontier Portfolio Performance
   c. CAPM
   d. VAR

Books for Reference

Objectives

- To enrich data analysis using SPSS
- This gives an exposure towards functions and tools available in SPSS

1. Basics – Import and Export of data files, Recoding into different variables, visual binning.
2. Summary statistics using Descriptive option and Means option.
3. Fitting of curves – Linear, parabola and cubic
4. Fitting of curves - exponential, Breakeven point
5. Simple Correlation – Spearman, Pearson and Kendall’s
6. Multiple regression with variable selection
7. Parametric tests: two sample and paired t-test
8. One way with post hoc test (Tukey’s test and Duncan’s test)
9. Two way ANOVA. With post hoc test (Scheffe’s test and LSD)
10. Chi-Square test for goodness of fit and independence of attributes
11. Mann-Whitney U test and Wilcoxon –sign match pair test

Books for Reference

SEMMESTER II

MSQF 421: PORTFOLIO MANAGEMENT CREDITS: 3

Objectives
- To have understanding on investment and avenues of investment
- To have exposure on analysis techniques of capital market and
- To understand various theories of portfolio management

Unit I : Introduction
Meaning, importance, objectives, characteristics, Investment, Gambling, Speculation.

Unit II: Return and Risk

Unit III: Portfolio Analysis: Markowitz risk returns optimization. Single Index Model: Portfolio total risk, portfolio market risk and unique risk; Sharpe’s optimization solution. Capital market line, security market line; Risk free lending and borrowing; recent developments.

Unit IV: Portfolio Construction: Arbitrage pricing theory, principle of arbitrage, arbitrage portfolios; two factor and multi factor models. Techniques of portfolio construction, Index Models,CAPM&APT Modelsofassetreturns, multiindexmodels, singleindexmodel, systematicandspecificrisk, estimation of beta.

Unit V: Performance Evaluation
Measure of return, risk adjusted measures of performance evaluation, market timing, evaluation criteria and procedures, Market Efficiency: Concept, importance and status of Indian capital market.

Books for Study
1. Frank K. Reilly, Keith C. Brown (2011), Investment Analysis and Portfolio Management, South-Western College

Books for Reference
Objectives

- To provide fundamental knowledge in the concepts of estimation theory and hypotheses testing
- To help in making decisions on hypotheses related to financial management

Unit I

Unit II
Methods of estimation: Methods of moments – Method of least squares – Method of Maximum Likelihood Estimation (MLE) – Simple problems – Interval Estimation - Confidence intervals for mean, proportion (large samples)- Simple problems

Unit III
Statistical hypothesis testing – Null and Alternative hypothesis - Simple and Composite hypothesis – Types of errors – Critical region – Level of significance – Power of a test – Computations of probability of Type I, Type II errors and power of the test - Chi-square tests for goodness of fit and independence of attributes

Unit IV
Tests of significance (Large samples): Test for single mean and proportion, Test for equality of means and proportions (two populations) – Test of significance (small samples): Test for single mean, test for equality of means and variances (two populations) – Paired t-test – Analysis of variance – one way and two way classification

Unit V
Concept of Non-Parametric tests – advantages - Sign test – Mann Whitney U test – Test for Randomness (Run Test) – Kruskal Wallis test – Friedman test.

Books for Study

Books for Reference
MSQF 423: BASIC ECONOMETRICS  

CREDITS: 3

Objectives

This course provides knowledge in some advanced topics, such as panel data models, models with dummy dependent variable, and time series econometrics, which are important for empirical researchers in economics and finance.

Unit I: Fundamentals of Econometrics


Unit II: Problems in regression analysis

Violation of assumption of classical regression model – Consequences, detection and remedial measures of multicollinearity, heteroskedasticity, and autocorrelation – Model selection criteria - comparing two linear models - R² – adjusted R².

UNIT-III: Non-Linear Regression and Limited Dependent Variable Models

Non linear least squares estimation; Gradient methods, Newton-Raphson method; testing general Nonlinear hypothesis - Introduction to binary variables; Dummy variables , LPM.

Unit IV: Simultaneous Equation and Distributed Lag Models :

Simultaneity bias, structural versus reduced form, identification: rank versus order condition - methods of estimation including indirect least squares- two-stage least squares- Autoregressive linear regression. Distributed lag models.

Unit V: Introduction to Panel Data Models

Introduction to panel data, advantage and disadvantage of panel data- within and between estimates - pooled OLS, Fixed effect mode- Random effect estimator – Breusch-Pagan test-Hausman test, dynamic Panel model.

Books for Study


Books for Reference

**Objective**

- A broad range of derivative products are examined with a primary focus on how to use these for the management of financial risks.
- The course introduces standard models of pricing forward, futures and options on diverse underlying assets.
- The course then explores hedging methods to conduct risk management for business operations, speculative trades, and issued financial instruments.
- After completing this course students will be familiar with derivatives valuation and their use in risk management.

**Unit I: Introduction**


**Unit II: Financial Derivatives**

Introduction- Meaning- Definition- purpose and types of Derivatives - Derivatives Market in India and other countries- New Financial Derivatives emerging in international financial markets.

**Unit III: Futures**


**Unit IV: Options**


**Unit V: Swaps**

Meaning – Types – Interest Rate Swap – Currency Swaps – Valuation – mechanics of operation – Credit Risk and Swaps -

**Books for Study**


**Books for Reference**

7. Sheldon M. Ross (2002), An Elementary Introduction to Mathematical Finance,2/e, Cambridge University press
Objective

- Able to apply fundamental algorithmic ideas to process data
- Data Science explores novel statistical, algorithmic, and implementation challenges that emerge in processing, storing, and extracting knowledge from data.

Unit I - Data Mining


Unit II –


Unit III - Classification problems


Unit IV

Decision trees- Random Forest, Artificial Neural Networks, Bagging and boosting

Unit – V

Case studies on Data Mining tools.

Books for Study


Books for Reference

1. Jiawei Han et, al., (2000): Data Mining: Concepts and Techniques, Morgan Kaufmaan Series.
5. Hastie, Tibshirani and Friedman (2009), The Elements of Statistical Learning, 2/e, springer.
Objectives

- To know the various sources of finance
- To understand the various uses for finance and
- To familiarize oneself with the techniques used in financial management

Unit I:

Unit II:
Capital Budgeting: Nature of Investment Decisions; Investment evaluation criteria, Net Present Value, Internal Rate of Return, Profitability Index, Payback Method, Accounting Rate of Return, NPV and IRR comparison, Capital rationing, Risk analysis and Capital Budgeting - Cost of Capital: Meaning and significance; Calculation of cost of Debt, Preference Capital, Equity capital and Retained earnings; Combined Cost of Capital (Weighted), Cost of Equity and CAPM.

Unit III:

Unit IV:

Unit V:

Books for Study
2. Gupta P (2012), Financial Management, Vayu Education of India

Books for Reference
Objectives

➢ To enrich data analysis using R language at basic and advanced level

1. One Way ANOVA, Two Way ANOVA, One way MANOVA post hoc tests – Tukey, Bonferonni
2. Assessing Normality: MVN package
3. Pictorial Representations of Multivariate data: 2D-bar, pie, histogram; 3D- pie, bar, histogram and bivariate Box plot, scatter matrix plot.
4. Logistic regression – odds ratio, Wald’s statistic – Variable Selection
5. Discriminant Analysis – Stepwise Method – classification matrix and cross validation
6. Ridge and Lasso Regression.
7. Principal Component Analysis – Scree plot – eigen values – Interpretation and its uses –
8. Factor analysis – Initial extraction of factors through Principal Components – varimax rotation
   - Assigning factor scores and its Applications
9. Concept of Change point analysis – ecp package for detecting single and multiple change points in univariate data structure
10. Concept of Change point analysis – ecp package for detecting single and multiple change points in multivariate data structure
11. Cluster Analysis – K Means – Hierarchical clustering
12. Decision Trees

Books for Study

Objective:

- Providing a clear explanation of the fundamental theory of time series analysis and forecasting
- The book features treatments of forecast improvement with regression and autoregression combination models and model and forecast evaluation, along with a sample size analysis for common time series models to attain adequate statistical power

Unit I: Introduction to Stationary Time Series


Unit II: Smoothing Techniques and Stationary

Smoothing Techniques: Moving Averages: Simple, centered, double and weighted moving averages; single and double exponential smoothing – Holt’s and winter’s methods - Exponential smoothing techniques for series with trend and seasonality - Basic evaluation of exponential smoothing.

Unit III: Stationary and Non-Stationary Time Series Models


Unit IV: Modeling Volatility

Impulse response function, variance decomposition – box Jenkins methodology - Definition and representation of ARCH and GARCH Models - their use in financial time series data - Volatility forecasting using GARCH (1,1) Model - Diagnostic checking of model – analysis of residuals.

Unit V: Evaluating and combining forecast

Introduction to business forecasting – scope - types of forecasting - Forecasting cycle - different forecasting techniques - Exploring data patterns and choosing forecasting technique - Managing forecasting process - measuring forecasting error - Forecasting error comparison.

Books for Study


Books for Reference

Objectives

- To provide in-depth knowledge in model building and its various aspects
- This course familiarizes in applied regression that involves hands-on data analysis

UNIT I
Multiple Regression Analysis – Assumptions – least squares approach- test for overall regression-intercept and slope

UNIT II
Dummy variable approach- methods for comparing two straight lines: using separate regression fits-Parallelism, intercept and coincidence; using single regression equation- Parallelism, intercept and Coincidence.

UNIT III
Regression Diagnostics- residual analysis: outliers detection-violations of model assumptions-Collinearity: Tolerance, Variance Inflation Factor (VIF) and Condition Index- Variable selection: forward, backward and stepwise

UNIT IV
Polynomial regression – least square approach for fitting parabola-ANOVA table-testing overall regression-model adequacy- lack of fits- Poisson regression- likelihood approach- goodness of fit

UNIT V

Books for study

Books for reference
2. Alan Agresti (2012), Categorical Data Analysis, 3/e, John Wiley
Objectives:

- This paper focuses the basic concept of risk management and expose various types of risk faced and It helps to take positions for investing and trading in options and future market.
- Analyse how futures and forward markets operate and be able to calculate theoretical forward and futures prices and values.
- Analyse the sources of financial risk and the importance of implementing effective financial risk management procedures in business entities.
- Evaluate hedging strategies using forwards, futures, options and swaps to hedge identified financial risks in currencies, interest rates, commodities and shares and to evaluate the outcomes of these strategies.

Unit I: Introduction to Risk Management

Sources of risk, currency risk, fixed income risk, equity risk, commodity risk, market risk measurement, VAR as downside risk, definition, parameter, elements of VAR system, stress testing.

Unit II: VAR Methods

An overview of VAR methods, VAR local and full valuation, delta normal methods, historical simulation, Monte Carlo simulation, examples of VAR applications.

Unit III: Hedging

Hedging linear risk, optimal hedging, hedge ratio as regression coefficient, duration hedging, beta hedging, non-linear risk hedging, delta and dynamic hedging.

Unit IV: Credit Risk Management

Settlement risk, introduction to credit risk, measuring credit risk, credit exposure, types of credit derivatives, credit default swap, pricing and hedging credit derivatives, measuring credit VAR, credit risk models, Basel accord, the Basel market risk charges.

Unit V: Operation & Integrated Risk Management

Introduction to operational risk, identifying operational risk, managing operational risk, risk capital, RAROC, risk capital, RAROC methodology, legal accounting, tax risk management.

Books for Study


Books for Reference

Objective

- Internship consists of an exchange of services for experience between the student and an organization.
- The purpose of the student internship is to provide an opportunity to seek, identify and further develop an appropriate level of professionalism.
- To expand network of professional relationships and contacts.

Every student of M. Sc Quantitative Finance Degree Programme shall undergo an internship in any leading Bank, Financial Institution, Stock Market, Investment Bank, Insurance Companies, Merchant Banking and Stock broking companies for a period of 6 weeks during summer vacation (May & June) under the guidance of a Faculty Member in the Department. Once guides are allotted to the students, the students should contact the respective guides periodically and get necessary guidance and feedback on the project work.

Company should be identified by student as well as by the Department at the end of second semester examinations and it should be communicated to the department, the name of the company in which he/she is undergoing the project, the exact title of the project, the name of the Company Guide and his contact number etc. In the first week of July, all the students have to give a presentation about their observations made by them in internship. Students have to follow a detailed guidelines being circulated by the department in the preparation of internship report. At the end of the internship period, every student shall submit a structured internship report within 15 days from the date of the completion of the project period.
objective

- The course develops the research skills to investigating the research problems with a view to arrive at objective findings, interpretation of data and conclusions of their investigation in the form of systematic reports.

Unit I:
Research Approach Meaning of research - objectives of research - Approach to research - Significance of research - Types of research - Research in social science - Facts, theories and concepts in social science research - Research Design - features of a good research design.

Unit II:
Identifying a Research Problem Research problem – Identifying the research problem – formulation of research problem, concept of hypothesis - role and formulation of hypothesis - scientific methods of research - nature of scientific research - stages of scientific methods.

Unit III:

Unit IV:
Survey Techniques Schedule and questionnaire – principle underlying the construction of questionnaire - measurement and scaling techniques - processing and analysis of data

Unit V:
Presentation Interpretation and report writing - steps - bibliography quality of a good research report

Readings

Books for Study

1. R.Panneerselvam (2014), Research Methodology, 2/e PHI, New Delhi

Books for Reference:

MSQF 542 PROJECT WORK  

- To make the student understand the basic concept of project finance
- Provide students with an analytical and conceptual framework to evaluate capital investment proposals.
- To familiarize students with the various management techniques in implementing the project to its successful completion.

MSQF 543 COMPREHENSIVE VIVA  

1. It is an individual compulsory project work offered in IV semester with 8 credits.
2. The Project work shall be guided and supervised by a faculty member assigned in the beginning of the semester.
3. The project work should be undertaken in a reputed and relevant organization and topics are to be selected in such a way that there is enough scope to apply and demonstrate the statistical, financial and econometric techniques learnt in the course.
4. At the end of the semester, before the last working day, project report should be submitted (two copies) with a certificate from industrial guide.
5. The project report shall contain the statement of problem, Methodology adopted, statistical tools used for analysis, findings, conclusions, suggestions and references.
6. The project work will be assessed for 8 credits. Students have to give a seminar of their project report at the end of the semester and which will be evaluated internally.
7. There will be viva-voce examination for 3 credits by an internal and an external examiner.
8. Report shall have the following format: Chapter I for Introduction for providing conceptual clarity, Chapter II for Review of Literature, Chapter III for Methodology, Chapter IV, V & VI for analysis and interpretations of each objectives (Number of chapter can be reduced or increased depending upon the number of objectives), chapter VII for findings and suggestions.
1. PYTHON FOR DATA ANALYSIS

Objective

- The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts.


Unit II: SQL Introduction: Basic SQL query Syntax - MySQL basics and advantages - SQL Commands: SELECT - INSERT - UPDATE - DELETE - DROP - UNION - GROUP BY - Nested Queries


Unit V: Plotting and Visualization: Matplotlib basics - Line plots - Bar plots – Histograms - Scatter plots – Python Visualization tools ecosystems with case study of any two visualization modules.

Books for References:

2. Linn Beighley (2007), Head First SQL, O'Reilly Publishers

Books for Study:

1. Payl Barry (2011), Head First Python, O'Reilly Publishers
2. Wes McKinney O'Reilly (2012), Python for Data Analysis 1st /e

Web Resources:

http://www.elated.com/articles/mysql-for-absolute-beginners/
https://docs.python.org/3/tutorial/index.html
2. STOCHASTIC MODELING

objectives

Unit I: Stochastic Processes

Unit II: Markov Chains

Unit III: Markov Processes

Unit IV: Branching Processes
Discrete Branching Processes (BP) - Simple examples - BP as a Markov Chain - Mean and variance of BP - Concept of extinction -Simple problems.

Unit V: Diffusion Processes

Books for Study


Books for Reference

3. OPTIMIZATION TECHNIQUES

CREDITS: 3

Objective

❖ To introduce to tools and techniques of OR and to equip them to make optimal managerial decisions.

Unit I:

Unit II:

Unit III:

Unit IV:

Unit V:
Network flow models – shortest route problem – project management – the CPM and PERT Networks – sensitivity analysis

Books for Study


Books for Reference

4. STATISTICAL TECHNIQUES FOR MANAGERS

CREDITS: 3

Unit I

Unit II
Control chart for variables – $\bar{X}$ and R chart – simple problems - Control charts for attributes – p, np, c charts – simple problems

Unit III
Basics of Experimental design - Principles of design of experiments: Randomisation, Replication and local control - determination of experimental units and notion of experimental error – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Concepts and Simple problems

Unit IV
Latin Square Design (LSD) – Concepts and simple problems – Estimating a missing value in RBD and LSD - Multiple comparison tests : Duncan’s, Tukey’s and Least Significant Difference test

Unit V
Factorial Experiments – Concepts - $2^2$, $2^3$ and $3^3$ designs – Simple Problems

Books for Study
5. Peter W.M. John (1998), Statistical Design and analysis of experiment, SIAM publications

Books for Reference
5. MANAGEMENT INFORMATION SYSTEMS  CREDITS: 3

Unit I: Introduction
Introduction to Information Systems – Various types of Information Systems– Concept, evolution and meaning of MIS; Goals of MIS; Information system for competitive advantage; Systems approach to problem solving; Challenges in the development of MIS, MIS function in an organization.

Unit II: Information and Managerial Effectiveness
Information as a corporate resource, pervasiveness of information, types of information operational, tactical and strategic; Levels of management and information needs of management; Process of generation of information; Quality of information; Information systems for finance, marketing, manufacturing, research and development and human resource areas.- Competitive Advantages of Using MIS.

Unit III: Information Systems
Information systems and their role in business systems, changing role of information systems, users of information systems; Types of information systems transaction processing system, MIS decision support system, executive support system; Enterprise Resource Planning (ERP) system, geographical information system, business expert system, etc; Procurement options and outsourcing information system services.

Unit IV: System Development Life Cycle
Sequential Process of software development; Computer Aided Software Engineering (CASE); Tools and the modular approach to software development; Information system audit. Development and Management of Data Bases: Relational databases; Data Base Management Systems (DBMS) and their components; Concept of entity and relationships; Data dictionary, SQL and other related concepts in DBMS; Normalisation process.

Unit V: Data Communication and Networking
Uses of computer networks, types of networks, network topologies; Network media and hardware; Data communication over telephone; Intranets and collaborative processing - Methods and steps in implementation of system; Approaches and process of evaluating MIS. Threats to information systems; Vulnerability, risk and control measures.

Books for Study

Books for Reference
6. INFORMATION SECURITY  

Unit I: Security problem in computing


Unit II: Network Security

Threats in network - Types of Threats - Network security control- firewalls – Intrusion detection system- Secure E-mail.

Unit III: Administering security

Security planning - Risk analysis - organizational security policies - Physical security.

Unit IV: Computer security


Unit V: System security


Books for Study


Books for Reference

1. Bruce Schneier, Applied Cryptography, 2/e, John Wiley & Sons
7. GLOBAL FINANCE AND INTERNATIONAL BANKING  CREDITS: 3

Objectives

- To have exposure on International Monetary System
- To understand about Balance of Payments and currency Exposure and
- To introduce and familiarize the International Banking, Financial Markets and Instruments

Unit I: International Business Environment


Unit II: International Financial Centers


Unit III: Exchange Rate


Unit IV: International Finance


Unit V: International Banking


Books for Study

Books for Reference
Objectives:

- This course deploys a structured lifecycle approach to data science and big data analytics projects
- select visualization techniques and tools to analyze big data and create statistical models

Unit I: Introduction to Big Data Analytics

Big Data Overview - State of the Practice in Analytics - The Data Scientist - Big Data Analytics in Industry Verticals - Data Analytics Lifecycle

Unit II: Review of the Basic Data Analytic Methods using R

Introduction to R – look at the data - Analyzing and Exploring the Data- Statistics for Model Building and Evaluation

Unit III: Advanced Analytics


Unit IV: Big Data Analysis Models and Algorithms

Analytics for Unstructured Data (MapReduce and Hadoop)- The Hadoop Ecosystem- In-database Analytics – SQL Essentials- Advanced SQL and MADlib for in-database Analytics

Unit V: New Research Trends and Applications

Operationalizing an Analytics Project -Creating the Final Deliverables- Data Visualization Techniques- Final Lab: Application of Data Analytics Lifecycle to a Big Data Analytics Challenge

Books for Study


Books for Reference

9. BEHAVIORAL FINANCE

CREDITS: 3

Objectives

➢ To Examine how the insights of behavioral finance theories shed light on the behavior of individual investors and finance professionals in investment decision-making and corporate financial decision-making.
➢ To explore the possibility to improve investment performance and corporate performance by recognizing the cognitive biases and applying appropriate ‘debasing’ techniques.
➢ To investigate the implications of behavioral finance for the construction of good corporate governance mechanism

Unit I: Information Perception and Intertemporal Choice
Cognitive information perception, peculiarities (biases) of quantitative and numerical information perception, Weber law, subjective probability, overconfidence, representativeness, anchoring, asymmetric perception of gains and losses, framing and other behavioral effects

Unit II: Human Preferences and Market efficiency
Decision-making under risk and uncertainty, Expected utility theory, Prospect theory, Barnewall Two-Way Model, Bailard, Biehl, and Kaiser Five-Way Model, Allais and Elsberg’s paradoxes, rationality from an economics and evolutionary prospective, different ways to definerationality: dependence on time horizon, individual or group rationality, examples from experimental economics: ultimatum and public goods games, experiments in isolated societies, bounded rationality, investor rationality and market efficiency.

UNIT III: Behavioral Factors and Financial Markets
Fundamental information and financial markets, market predictability, the concept of limits of arbitrage, Asset management and behavioral factors, active portfolio management: return statistics and sources of systematic underperformance, technical analysis and behavioral factors

UNIT IV: External factors and investor behavior
Weather, emotions, and financial markets: sunshine, geomagnetic activity, Mechanisms of the external factor influence on risk perception and attitudes, Connection to human psychophysiology and emotional regulation, Misattribution as a mechanism for externals factors influence, Emotional content of news articles and their correlation with market dynamics, Social trends and market dynamics: music, fashion, demographics, Group Behavior: Conformism, herding, fatal attractions

UNIT V: Behavioral Corporate Finance
Behavioral factors and corporate decisions on capital structure and dividend policy, capital structure dependence on timing of good and bad corporate news announcement, mergers and acquisitions: the Winner’s curse and market timing, systematic excessive optimism and overconfidence in managers’ decisions, company name and its market value, sunk costs and mental accounting, evolutionary explanations for behavioral effects, evidence from behavioral game theory, systematic approach to using behavioral factors in corporate decision-making

Books for Study
1. M. M. Sulphey,(2014) Behavioural Finance, PHI Learning

Books for Reference
2. William Forbes,(2009)) Behavioural Finance, Wiley India Pvt Ltd
5. Paul V. Azzopardi,(2010), Behavioural Technical Analysis, Harriman House Ltd
10. TREASURY AND FIXED INCOME SECURITIES  CREDITS:3

Objectives
- Immerse the student in the fundamental principles of Treasury and fixed-income securities with a special emphasis on structured products.
- Deepen the student’s understanding of fixed-income valuation models including the valuation of bonds with embedded options.
- Give each student the opportunity to solve problems encountered by practitioners in fixed-income markets.

Unit I: Introduction to Fixed Income Securities
Time value of money, discount factors, the law of one price, arbitrage, bond prices, spot prices, STRIPS, coupon bonds, definition and interpretation of yield-to-maturity, coupon effect, yield-to-maturity and spot rates and forward rates

Unit II: Fixed Income Market in India
An introduction to the Indian debt market, the government securities market, bond, T-bills, the corporate bonds, commercial papers, repos, the trading mechanism in the NSE-WDM, regulations in the bond market, Realized YTM,YTC.

Unit III: Measure of Price Sensitivity and Hedging
One-factor measure of price sensitivity, modified and Macaulay duration and convexity, par bonds and perpetuities, measure of price sensitivity based on parallel yield shift, bond immunization, hedging strategies, volatility weighted hedging and regression based hedging

Unit IV: Term Structure Models
The science of term structure models, normally distributed rates and zero drift models, time dependent drift - Ho-Lee model, the mean reversion model: Vasicek model, the volatility models: the Cox- Ingersoll-Ross model, Time structure: Theories of term structure

Unit V: Multi-Factor Term Structure Models
Motivation for principal component models, the two factor models, properties of the two factormodels, multi-factor models, trading with term structure models and case studies, hedging to the model versus hedging to the market

Books for Study

Books for Reference
11. Algorithmic Trading

Objectives

❖ Helps to understand Quantitative Algorithmic Strategies
❖ To inspire towards a successful Algorithmic trading career, by focusing on derivatives, quantitative trading, electronic market-making or trading related technology and risk management.

Unit I - Introduction to algorithmic trading - Building blocks of the algorithms - Benefits of Algorithmic Trading - Global trends - Lifecycle in development of AT - Government and regulatory structures - Taxation, transaction cost in India - Current trends in India market - Challenges

Unit II - Mathematical elements of AT - Stdev - correlation analysis - Spread, volume curve - volatility based trading - Mean reversion - Mean Reversion of Stocks and ETFs - Mean Reversion of Currencies and Futures


Unit IV - Risk management in AT - Optimal Leverage - Constant Proportion Portfolio Insurance - Stop loss - Risk Indicators

Unit V – applications using software’s like Excel, Python and R language
Practical Hands on in back-testing and Monte Carlo simulation - Alpha generation: hands on using regression - Hands on training on designing a VWAP algorithm - Hands on training on designing an automated pair-trading algorithm using soft wares

References:

2) Edward A Leshik and Jane Cralle (2011): An Introduction to Algorithmic Trading, Wiley
4) Barry C. Johnson(2009), Algorithmic Trading and DMA, Myeloma Press
5) Ruey Tsay (2014), Analysis of financial Time Series, Wiley