PROGRAMME STRUCTURE AND DETAIL
SYLLABI

MASTER OF SCIENCE IN BANKING AND FINANCIAL ANALYTICS
[M.Sc. (BFA)]

Semester I

Sr No	Course Code	Course Title / Name	Pre-requisite	L T P	Credit	Marks
1	MSBFA11	Financial Economics.	NIL	3 1 0	4	100
2	MSBFA12	Banking Operations and MIS Implementation in Digital Era.	NIL	3 1 0	4	100
3	MSBFA13	Fundamentals of Computer Science and Programming.	NIL	3 1 0	4	100
4	MSBFA14	Mathematics and Statistics for Banking and Finance.	NIL	3 1 0	4	100
5	MSLAB 11	Python Programming for Banking and Finance.	NIL	0 0 4	2	50
6	MSLAB 12	Fundamentals of R -Programming for Banking and Finance.	NIL	0 0 4	2	50
					20	500

Semester II

Sr No	Course Code	Course Title / Name	Pre-requisite	L T P	Credit	Marks
1	MSBFA21	Risk Analysis and Insurance.	12	3 1 0	4	100
2	MSBFA22	Corporate Finance.	12	3 1 0	4	100
3	MSBFA23	Data Base Management System.	13	3 1 0	4	100
4	MSBFA24	Optimization and Quantitative Analysis.	14	3 1 0	4	100
5	MSLAB 21	DBMS Lab (SQL, PL/SQL, Locking).	NIL	0 0 4	2	50
6	MSLAB 22	Data Visualization (Power BI and Tableau).	NIL	0 0 4	2	50
					20	500

Semester III

Sr No	Course Code	Course Title / Name	Pre-requisit	L T P	Credit	Marks
1	MSBFA31	Portfolio Management and Investment Analysis	21,22	3 1 0	4	100
2	MSBFA32	Financial Econometrics	14	3 1 0	4	100
3	MSBFA33	Applications of Artificial Intelligence in Banking and	13	3 1 0	4	100
4	MSBFAE1	Elective I	N.A.	3 1 0	4	100
5	MSBFAE2	Elective II	N.A.	3 1 0	4	100
6	MSLAB 31	Applied AI for Banking and Finance	13	0 0 4	2	50
					22	550

Semester IV

Sr No	Course Code	Course Title / Name	Pre-requisite	L T P	Credit	Marks
1	MSBPJ61	***Industrial Major Project (Capstone Course)	Must clear 50% (**10 Credits**) Courses of	N.A.	20	500

***Industrial Major Project may be developed preferably from Industries, Banks, Financial Institutions, RBI, Government and Public Bodies, HEIs and even from JMI as well.**

List of Electives (MSBFAE1/E2)

Sr No	Course Code	Electives (Course Title / Name)
1	MSBFAE1/E2	Islamic Finance
2	MSBFAE1/E2	Merger and Acquisitions
3	MSBFAE1/E2	Modelling and Simulation
4	MSBFAE1/E2	Data Analytics and Machine Learning
5	MSBFAE1/E2	Game Theory and Behavioural Finance
6	MSBFAE1/E2	Global Practices in Bank and Finance
7	MSBFAE1/E2	Applied Probability and Stochastic Analysis
8	MSBFAE1/E2	Business Ethics and Corporate Governance
9	MSBFAE1/E2	Advanced Financial Reporting and Analysis
10	MSBFAE1/E2	International Financial Market and Instruments
11	MSBFAE1/E2	Learning Organization and Knowledge Management
12	MSBFAE1/E2	Creativity and Innovation for Entrepreneur Excellence

MSBFA 11: FINANCIAL ECONOMICS

Course Code	:	MSBFA 11
L-T-P	:	3-1-0
Credit	:	4
Course Prerequisite	:	NIL
Course Status	:	Core Course

Course Description

Financial Economics provides students with an in-depth introduction to the fundamentals related to modern finance. The emphasis is laid on learning basic concepts of financial market, it's role and functions and different types of financial markets. The theory of choice under certainty and uncertainty will arm students with strong micro foundations to analyse investors' behaviour and market equilibrium. The students will also be introduced to the theory of market efficiency and evaluation of the same.

Objectives

At the end of the course and having completed the essential reading and activities students should be able to:

- Understand the functioning of financial markets and its regulation.
- Understand the fundamentals of finance and role of transaction costs and information asymmetry theories in providing an economic justification for return on different asset.
- Discuss whether stock prices reflect all available information, and evaluate the empirical evidence on informational efficiency in financial markets.
- Handle the problems on interest rate, market efficiency and risk using various computer tools and software packages.

Unit-Wise Syllabus

Unit 1. Financial Markets

Financial Markets – Role and Functions, Real Assets and Financial Assets, Types of Financial Markets - Primary and Secondary Markets, Indian Financial Markets – Equity Market, Mutual Funds and Commodity Market, Regulations and SEBI, Capital Asset Pricing Model (CAPM).

Unit 2. Theory of Uncertainty

Axioms of choice under uncertainty; utility functions; expected utility theorem; Certainty equivalence, measures of risk-absolute and relative risk aversions; Measures of investment risk-variance of return, semi-variance of return, Shortfall probabilities.

Unit 3. Market Efficiency and Financial Inclusion

Defining capital market efficiency; Degrees of capital market efficiency; relationship between the value of information and efficient market Efficient capital market theory and empirical models; Efficient Market Hypothesis (EMH) & Implications for financial markets; Financial Inclusion: Technology and financial inclusion; Financial Literacy and frauds; Case studies on financial inclusion and financial literacy.

Text Books:
1. Brealey, R., S. Myers, F. Allen, and P. Mohanty (2014), *Principles of Corporate Finance*, Eleventh Edition, New McGraw Hill Education (India) Pvt. Ltd.
2. Z. Bodie, Robert Merton and David Cleeton (2012), *Financial Economics*, Second Edition, Pearson Learning Solutions.
3. Bailey, R.E. (2005), The *Economics of Financial Markets*, Cambridge University Press, UK.

References:
1. Hull, J.C. (2002), *Options, Futures, and Other Derivatives*, Fifth Edition, Prentice-Hall of India Private Limited, New Delhi.
2. Cuthbertson, Keith and Dirk Nitzsche (2004), *Quantitative Financial Economics: Stocks, Bonds and Foreign Exchange*, Second Edition, John Wiley & Sons Ltd., England.
3. Alexander, G.J., W.F. Sharpe and J.V. Bailey (2002), *Fundamentals of Investments*, Third Edition, Prentice-Hall of India Private Limited, New Delhi.
4. Campbell, Y.J., Andrew W. Lo, and A. Craig MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton University Press, USA.
5. Ross, S.M. (2003), *An Elementary Introduction to Mathematical Finance: Options and Other Topics*, Second Edition, Cambridge University Press, U.K.
6. Houthakker, H.S. and P.J. Williamson (1996), *Economics of Financial Markets*, Oxford University Press.

MSBFA 12: <u>BANKING OPERATIONS AND MIS IMPLEMENTATION IN DIGITAL ERA</u>

Course Code	:	MSBFA 12
L-T-P	:	3-1-0
Credit	:	4
Course Prerequisite	:	NIL
Course Status	:	Core Course

Course Description

The Course deals with complete banking operations, including MIS implementation a bank does through its various channels like Branch, ATM, phone banking, home banking, internet banking and POS, depending upon the customers' convenience to save time and money. It is an important paper to cover the functioning of Banks and integrated operations through branches and sister bodies and MIS and onlinetransactions in digital era. The course will also cover the MIS implementation, internet banking and othercontemporary issues in digital era.

Objectives

The objective of the course is to build a pool of competent banking professionals, who can sustain the growing momentum of the banking sector and help to breach new standards of profit margins and customer responsiveness. More specifically, its focus will be on understanding of core banking, understanding of banking channels and payments, practices on banking technology to enhance business ofbanking sector.

<u>Unit-wise Syllabus</u>

Unit 1. Branch Operation and Delivery Channels

Introduction and Evolution of Banking Management- Technological Impact in Banking Operations-Total Branch Computerisation- Concept of Opportunities- Centralised Banking-Concept, Opportunities, Challenges and Implementation. Delivery channels- Overview of delivery channels-Automated Teller Machine (ATM)- Phone Banking- Call Centres-Internet Banking-Mobile Banking-Payment Gateways- card technologies-MICR electronic clearing.

Unit 2. **MIS Implementation and Financial Management of Bank**
Management Information System; application of MIS in banking; Customer Relationship Management (CRM)- Operational CRM; Analytical CRM. Bank's financial statements: Bank Liabilities- Bank Assets- Contingency liabilities – the income statements of Indian Banks-

Analysing Bank Financial Statements-Key performance indicators (KPI)- Bank financial statement analysis models- interest income and non-interest income.

Unit 3. Internet Banking and Contemporary issues:

Inter bank payment system-interface with Payment system Network- Structured Financial Messaging system-Electronic Fund transfer-RTGSS-Negotiating dealing systems and securities settlement systems- electronic money- E-Cheques: Contemporary Issues in Banking Techniques-Analysis of Rangarajan Committee Reports-E Banking-Budgeting- Baking Sorftwares- Case Study: Analysis of Recent Core Banking Software.

Text Books:

1. Jessica Keyes (2005), Financial Services Information Systems, Auerbach publication; 2ndedition.
2. Kaptan S.S. & Choubey N.S. (2003) E-Indian Banking in Electronic Era, Sarup & Sons, NewDelhi.

References:

1. Vasudeva (2005), E- Banking, Common Wealth Publishers, New Delhi
2. Turban, E., Rainer, R. K., & Potter, R. E. (2003). Information Technology.Banking Technology-Indian Institute of Bankers Publication.
3. James F. Kurose, Keith W. Ross (2005) Computer Networking – A Top -Down ApproachFeaturing the Internet, Pearson Education.
4. W.S. Jawadekhar (2003), Management Information Systems, Tata McGraw Hill PublishingCompany Limited.

MSBFA 13: <u>FUNDAMENTALS OF COMPUTER SCIENCE AND PROGRAMMING</u>

Course Code	:	MSBFA 13
L-T-P	:	3-1-0
Credit	:	4
Course Prerequisite	:	BASIC MATHEMATICS
Course Status	:	Core Course

Course Description

The course provides a comprehensive exploration of computing fundamentals and digital systems within the context of computer science, with a special emphasis on programming essentials and problem solving. Students delve into the foundational layers of computing systems, emphasizing the concept of abstraction and tracing the historical development of computing hardware and software. They explore the role of computers as both a tool and a discipline, gaining insight into various number systems and their applications in computing. Additionally, students learn fundamental concepts like computer architecture components, memory hierarchy, and the Von Neumann model. Emphasis is placed on developing problem-solving skills, analyzing algorithms, and mastering programming essentials, preparing students for further academic pursuits and professional endeavors in computer science.

Objectives

At the end of the course and having completed the essential reading and activities students should be able to:

- Demonstrate a comprehensive understanding of various number systems, including binary, octal, and hexadecimal, and apply arithmetic operations in different positional systems.
- Design and analyze basic combinational circuits using Boolean algebra and logic gates, and explain the fundamental components of computer architecture such as memory hierarchy and the Von Neumann model
- Apply problem-solving strategies, develop algorithms, and implement basic programming tasks such as variable exchange and factorial computation, while also understanding the importance of algorithm efficiency

<u>**Unit-wise Syllabus**</u>

Unit 1. Computers and Data representation system

Layers of A Computing Systems; Abstraction; History of Computing Hardware and Software; Computers as a Tool and Discipline; Number Systems; Numbers and Computing; Positional Systems; Binary, Octal and Hexadecimal System; Arithmetic in Order Bases; Conversion from Base 10 to Other Bases; Various Representations of Data.

Unit 2. Digital Circuit Organization

Boolean Algebra; Logic Gates; Simple Combinational circuits (Half adder and Full Adder); Computer Components; Von Neumann Architecture; Fetch-Execute Cycle; I/O Devices; Memory Hierarchy: Registers, Cache, ROM, RAM, and their Relative Characteristics.

Unit 3. Problem Solving and Programming Essentials

Introduction, the problem-solving aspect, Top-down design, Algorithms and Flowcharts; Analysis of algorithms; Basic algorithms: Exchanging the values of two variables, Counting, Summation of a set of numbers, Factorial computation, Calculating Sin(x) and Cos(x) values, Reversing the digits of an integer.

Text Books:

1. Dale, N., & Lewis, J. (2007). Computer Science Illuminated (3rd Edition). Narosa Publishing House.
2. Sinha, P. K., & Sinha, P. (2020). Computer fundamentals (8th Edition). BPB Publications.
3. Mano, M. M. (2017). Digital logic and computer design. Pearson Education India.
4. Morley, D., & Parker, C. S. (2012). Understanding Computers (16th ed.). Cengage Learning.
5. Dromey, R. G. (2016). How to solve it by computers. Pearson Education India.

Course Code   :MSBFA 14

L-T-P   :3-1-0

Credit   :4

Course Prerequisite   **:NIL**

Course Status   **:**Core Course

Course Description:

This course introduces the basic mathematical and statistical skills required to understand financial theory and analytics. The course is abstract in nature but will show the directions of their usage in finance, data analytics, and statistical modelling. The course deals with basic concepts from linear algebra, analysis, probability distribution and mathematical statistics. The course will prepare students to undertake advanced courses in finance, analytics, and optimization. The course assumes familiarity of the notion of probability.

Objectives:

1. To introduce the required mathematical and statistical skills for understanding financial theory and analytics.
2. To help students master abstract ideas.
3. To prepare students for advanced courses.

<u>Unit-wise Syllabus</u>

Unit 1: Linear Algebra

Vectors: vector spaces, vector operations, independence and dependence of vectors, rank and basis, inner product and norm.

Matrices: matrix operations, some special matrices, rank of a matrix, inverse of a matrix, simultaneous linear equations, existence and uniqueness of solutions, calculation of solutions, determinants and its properties, matrix inversion, Cramer's rule.

Characteristic Value Problem: Eigenvalues, eigenvectors, trace and determinant of a matrix, spectral decomposition of symmetric matrices, quadratic forms, characterization of quadratic forms.

Unit 2: Probability and Probability Distribution

Random Variables: Discrete and continuous random variables, probability density function, distribution functions, expectation, variance, moment-generating function.

Special Distributions: Binomial distribution, Poisson distribution, normal, uniform, and gamma distributions.

Multivariate Distribution: Joint distribution of two or more discrete or continuous random variables; marginal and conditional distributions; independence; properties of expectation, variance, covariance, and correlation.

Unit 3: Sampling

Population versus sample, methods of sampling, simple random sample, sampling distribution of sample mean for normal and non-normal populations.

Sampling distribution: Use of Z, chi-square, t and F statistics – large sample and small sample tests for mean, and their properties. Estimation of parameters: basic concepts - parameter and statistics, estimator and estimate, sampling distribution, sampling variance and mean squared error. Properties of an estimator - unbiasedness, consistency, efficiency, sufficiency. Cramer-Rao inequality, point and interval estimations, Chebyshev's Inequality, Central Limit Theorem.

Textbooks:

1. Mathematics for Economists by Carl P. Simon and Lawrence Blume, (1994), W. W. Norton & Company.
2. Principles of Mathematical Analysis, Rudin, W., Third Edition, McGraw Hill International.
3. Introduction to Mathematical Statistics, Robert V Hogg, Joseph W. McKean, and Allen T. Craig, Seventh Edition, Pearson.

References:

1. Mathematical Statistics, J. E. Freund and R. E. Walpole (1987), Prentice-Hall Inc.
2. Introduction to Mathematical Statistics, P.G. Hoel, S.C. Port, and C.J. Stone, (1984), Wiley, Fifth Edition.
3. Mathematical Statistics and Data Analysis, J. A. Rice, (1995), 2nd Edition, Duxbury Press.
4. An Introduction to Probability Theory and Mathematical Statistics, Macmillan, V.K. Rohtagi, (1976), Wiley-Blackwell.

Semester II

MSBFA 21: RISK ANALYSIS AND INSURANCE

Course Code   :   MSBFA 21

L-T-P   :   3-1-0

Credit   :   4

Course Prerequisite   :   MSBFA 12

Course Status   :   Core Course

Course Description:

Companies must take risks if they are to survive and prosper and the risk management function's primary responsibility is to understand the portfolio of risks that the company is currently taking and the risks it plans to take in the future. It must then decide whether the risks are acceptable and, if they are not acceptable, what action should be taken. The course starts with an introduction to the classification of risk. Then we will discuss the methods to manage market risk. The students will learn about rigorous modeling for risk analysis like Value at Risk (VaR) and its applications to risk management practices. Furthermore, the course introduces the concept of endogenous risks and demonstrates how financial risks originate within the financial system. The course also highlights behavioral aspects of risk and discusses important limitations of current risk management practices. Next, we turn to credit risk, with a focus on ratings based and structural models. In addition to credit risk on portfolios the role of insurance in risk management will be covered.

Objective:

- The risk analysis involves identification of risks and associated potential costs, analysis of the causes of risk of financial loss, determination of various strategies to treat risk, selection of strategies appropriate to the goals and objectives of the business
- The objective of the course is to develop the knowledge and understanding of risk management practices for participants aiming to advance their careers in financial risk management.
- The course will focus on how to model the risk of portfolios emanating from fluctuations in market prices, or market risk, while the main focus of the course is on the management of financial risks. Participants will become familiar with the main tools and practices needed to assess and evaluate financial risks, they will understand the risk management practices in an industry setting and will be able to critically assess risk management reports and research.

<center>**Unit-wise Syllabus**</center>

Unit 1. Market Risk Analysis

Market Risk: Linear Derivative, Quadratic Derivative, Simulation Based Valuation; Market Risk Models: Coherent Risk Measure, Risk Contribution. Value at Risk (VaR)- Historical Simulation Approach, Variance-Covariance Approach, Time Scaling VaR and Conditional VaR. Market Liquidity Risk, Scenario Analysis and Stress Testing.

Unit 2. Credit Risk Analysis

Credit Risk, 5 C's of credit; Loss Variable, Exposure at Default (EAD), Loss Given Default (LGD), Default Probability, Expected Loss (EL), Unexpected Loss (UL), Economic Capital (ECα), Credit Loss Distribution (Monte-Carlo Simulation and Analytical Approximation), Today's Industry Models- Credit Metrics and KMV-Model.

Unit 3. Insurance in Risk Management

Risk in Insurance and methodologies of Premium calculations, types of Risks in Insurance, Factors affecting Insurance Premium, Risks transfers via Reinsurance,Elements of Traditional Life Insurance, Term Assurance and Pure Endowment.

Text books:

1. Skoglund, J., & Chen, W. (2015). *Financial risk management: Applications in market, credit,asset and liability management and firm wide risk*. John Wiley & Sons.
2. Bluhm, C., Overbeck, L., & Wagner, C. (2016). *Introduction to credit risk modeling*. Chapmanand Hall/CRC.
3. Melnikov, A. (2011). *Risk analysis in finance and insurance*. Chapman and Hall/CRC.

References

1. Skoglund, J., & Chen, W. (2015). Financial risk management: Applications in market, credit, asset and liability management and firm wide risk. John Wiley & Sons.
2. Bluhm, C., Overbeck, L., & Wagner, C. (2016). Introduction to credit risk modeling. Chapman and Hall/CRC.
3. Duffie, D., & Singleton, K. J. (2012). Credit risk: pricing, measurement, and management. Princeton university press.
4. Giesecke, K. (2004). Credit risk modeling and valuation: An introduction. Available at SSRN479323. http://www.stanford.edu/dept/MSandE/people/faculty/giesecke/introduction.pdf, 2004
5. Hull, J. C. (2003). Options futures and other derivatives. Pearson Education India.
6. Melnikov, A. (2011). Risk analysis in finance and insurance. Chapman and Hall/CR.

MSBFA 22: <u>CORPORATE FINANCE</u>

Course Code : MSBFA 22

L-T-P : 3-1-0

Credit : 4

Course Prerequisite : MSBFA 12

Course Status : Core Course

Course Description

This course is designed to provide an applied and practical approach to corporate finance, enabling to use the concepts and tools to address topical issues. The emphasis on learning basic capital structure and valuation techniques and decisions in presence of taxation, agency frictions, and asymmetric information. The course will then take students beyond the analysis of capital structure and valuation techniques, by focusing on market breakdown, monitoring and takeover in corporations.

Objectives

On successful completion of this course, students should be able to:

- Understand the interaction between financial and strategic decisions of corporations.
- Understand and explain different capital structure theories and capital budgeting techniques.
- Understand the trade-off firms face between tax advantages of debt and various costs of debt, including information asymmetry and agency conflict.
- Understand how companies issue new shares, and calculate related price impact in securityofferings
- Analyse corporate finances by handling financial data of different companies.

<u>Unit-wise Syllabus</u>

Unit 1. Corporate Finance & Borrowings

The Corporate Firm; Limited Liability; Balance-Sheet model of the firm; Capital Structure; Modigliani-Miller theorem; Credit analysis and Loan Covenants; Determinants of Corporate borrowing- diversification, collateralization; Group lending; Debt overhang; Cash flow and investment sensitivity; Liquidity- Accountability trade-off.

Unit 2. **Asymmetric Information and Corporate Financing**

Lemons problem and market breakdown; Pecking order hypothesis; Market breakdown and cross subsidisation; Signalling; Incentives Compensation; Agency problem in Capital Budgeting; Creative accounting and earning manipulation.

Unit 3 Monitoring and Lending Relationship

Models of Corporate Governance-Anglo-Saxon model, German model, Japanese model; Market Monitoring and limits; Costs of monitoring; Investor activism; Share concentration; learning by lending; Corporate Charter; Takeover- Friendly takeover, Hostile takeover; Reverse takeover, Creeping takeover; Poison pill.

Text Books:

1. Tirole, J. (2006), *The Theory of Corporate Finance*, Princeton University Press, Princeton, UK.
2. Brealey, R., S. Myers, F. Allen, and P. Mohanty (2014), *Principles of Corporate Finance*, Eleventh Edition, New McGraw Hill Education (India) Pvt. Ltd.
3. Ross, S.A., R.W. Westerfield and Jeffrey Jaffe (2005), *Corporate Finance*, Seventh Edition, TataMcgraw-Hill Publishing Company Limited, New York.

References:

1. Berk J. and De Marzo (2016), *Corporate Finance*: *The Core*, Fourth Edition, Pearson GlobalEdition.
2. Campbell, Y.J., Andrew W. Lo, and A. Craig MacKinlay (1997), *The Econometrics of FinancialMarkets*, Princeton University Press, USA.
3. Grinblatt M. and S. Titman (2001), *Financial Markets and Corporate Strategy*, Second Edition,McGraw-Hill.
4. Cuthbertson, Keith and Dirk Nitzsche (2004), *Quantitative Financial Economics: Stocks, Bondsand Foreign Exchange*, Second Edition, John Wiley & Sons Ltd., England.

MSBFA23: Data Base Management System

Course Code   : MSBFA23
L-T-P   : 3-1-0
Credit   : 4
Course Prerequisites: : Nil
Course Status   : Core Course

Course Description:

This course provides a thorough exploration of database management principles tailored for the banking and finance sector. Students will learn to design databases using the Entity Relationship Model, optimize structures through normalization techniques, and execute SQL queries proficiently to extract pertinent financial data. Emphasis is placed on understanding concurrency control mechanisms and deadlock recovery strategies crucial for maintaining data integrity in high-stakes financial environments. Additionally, students will gain insights into storage and retrieval mechanisms across application-specific databases such as Temporal, Spatial, Multimedia, Web, Mobile, and Distributed databases, enabling them to navigate the complex data landscape inherent to banking and finance with confidence and proficiency.

Course Objectives:
1) Understand and apply the principles of conceptual database design using the Entity Relationship Model to develop databases tailored to specific scenarios.
2) Demonstrate proficiency in normalization techniques to optimize database structures and minimize data redundancy.
3) Acquire the skills to formulate and execute SQL queries proficiently to extract relevant data from databases based on given scenarios.
4) Comprehend and articulate the principles governing concurrency control mechanisms and strategies for recovering from deadlocks in database systems.
5) Gain insights into the storage and retrieval mechanisms utilized in various application-specific databases, including Temporal, Spatial, Multimedia, Web, Mobile, and Distributed databases.

Unit-wise Syllabus

Unit 1: Data Model Implementation And E-R Diagram

Database – Characteristics, advantages, disadvantages, and applications. Data models - Hierarchical, Network and relational model. Three schema architecture and data independence. Client server architecture for DBMS. Classification of DBMS Data modelling using E-R diagram, Entity type, entity sets, attribute and keys. Weak entity. Relational model concepts, Relational database schemas, Constraint violations.

Unit 2: Normalization And Data Redundancy

Design guidelines for Relational schemas, Functional dependency, Normal forms based on primary keys. Definition of First Normal form, Second normal form, Third normal form and BCNF. Multivalued Dependency and Fourth Normal form, Join dependencies.

Unit 3: Structured Query Language and Transaction Management

Data Manipulation, Data Definition, Commercial RDMS: Oracle / MySql / Sql Server , PL/SQL . PL/SQL programming, views, Transaction processing concepts, Locks, Serializability and Concurrency Control, Database Security. Introductions to Distributed database, Object oriented database, Mobile database, Multimedia database.

Textbooks:

1. Elmasri, Navathe, "Fundamentals of Database Systems", 4th Edition Pearson Education.
2. Anthony Debarros, "Practical SQL: A Beginner's Guide to Storytelling with Data", 2nd Edition, No Starch Press.

References
1. "Henry F Korth, Abraham Silberschatz, S. Sudurshan, "Database system concepts", 7th Edition McGraw-Hill.
2. C.J.Date, "An Introduction to Database Systems", 8th Edition, Pearson Education.

MSBFA 24: <u>OPTIMIZATION METHODS FOR BANKING AND FINANCE</u>

Course Code	:	MSBFA 24
L-T-P	:	3-1-0
Credit	:	4
Course Prerequisite	:	MSBFA14
Course Status	:	Core Course

Course Description**:**

This course introduces the required mathematical tools to under-stand optimization techniques. The coursetakes the approach of modeling financial decisions as optimization problems and then developing appropriate optimization techniques to solve them. The course deals with the class of optimization problems both linear and non-linear: linear and non-linear programming and integer programming.

Optimization is ubiquitous in almost every decision-makingprocessfinancially or otherwise. In finance, forinstance what portfolio one should choose, how can we construct an index fund? etc. require deep understanding of optimization methods. This course will equip the students to use them appropriately and correctly. MSBFA 14 is the prerequisite for this course. This course also assumes familiarity with differential calculus.

Objectives:

- To cultivate a basic understanding of optimization methodologies used in financial decisionmaking.
- To introduce required mathematics for understanding optimization methods.
- To equip the students to use linear and non-linear optimization methods most appropriate for aparticular financial optimization problem

Unit-wise Syllabus

Unit 1: Classical Optimization

Existence and uniqueness of solution, global maximum and minimum and their sufficient conditions, local maxima and minima and their necessary and sufficient conditions, Convex sets, convex combination, continuous and differentiable functions on convex sets, concave and convex functions, Separating hyperplane theorem. Polyhedral and polytopes Farkas Lemma, Caratheodery theorem Application.

Unit 2: Linear Programming

Formulation of the problems, graphical optimal solution, Simplex method. Writing and interpreting the dual; duality theorems; Applications: short-run financing and asset pricing; Linear relaxation of integer programs, branch and bounds. Totally unimodular matrices; Application: construction of an index fund, assignment problems, prices

Unit 3: Non-linear Optimization

Constrained Optimization: global maximum and minimum and their sufficient conditions, local maxima and minima and their necessary and sufficient conditions, Lan-grangian Method with several equality and inequality constraints, saddles points, Slater' condition, Kuhn- Tucker conditions, meaning of Langrange multiplier, envelopes theorem, Application: mean- variance optimization.

Text Books :

1. RakeshVohra (2004) Advanced Mathematical Economics First Edition, Routledge,.
2. Cornuejols, G., Tutuncu, R , (2018), Optimization Methods in Finance Second Edition, CambridgeUniversity Press,.
3. Rangarajan K. Sundaram(1996), A Course in Optimization Theory by 1996, Cambridge UniversityPress.

References:

1. Vanderbei, J. Robert Linear Programming: Foundations and Extensions, Third Edition, Springer,2008.
2. Boyd, S., and Vandenberghe, L., (2004), Convex Optimization, First Edition, Cambridge University Press, 2004.
3. Simon Carl and Blume, Lawrence,(1994),Mathematics for Economists, , W. W. Norton & Company.
4. Hohn, Franz E., Elementary Matrix Algebra, New Delhi: Amerind.
5. Gale, David, (1986), The Theory of Linear Economic Models, New York: McGraw-Hill

Semester III

MSBFA 31: PORTFOLIO MANAGEMENT AND INVESTMENT ANALYSIS

Course Code	:	MSBFA 31
L-T-P	:	3-1-0
Credit	:	4
Course Prerequisite	:	MSBFA 21, MSBFA 22
Course Status	:	Core Course

Course Description

The course is designed to study the theory and empirical evidence relevant for investing, particularly in the context of portfolio management. The major topics will include security markets and the investment industry, optimal portfolio selection, the relation between risk and return in one way or another. The course is geared mostly towards the understanding and implementation of "modern portfolio theory," which is a general approach for maximizing the expected return of a portfolio given a certain amount of risk. The course is also designed to prepare students to do quantitative and statistical analysis in a broad range of settings.

Objectives

The successful completion of this course will help students:
- in understanding the theories of portfolio selection and recent development in the field.
- in understand risk, hedging, and numerous financial securities as tools to manage risk
- in handling mathematical and statistical tools.

Unit-wise Syllabus

Unit 1. Optimum Portfolio Selection & Analysis

Mean Variance Portfolio Theory; Expected Return and Risk of an Asset; Expected Return and Risk of a Portfolio; Mean- Variance analysis; single index model; Multi index models; International Diversification of Portfolio; Aggregate asset Allocation; Forecasting individual security returns; Risk tolerance.

Unit 2. Basics of Investment Analysis

Basic theory of interest; discounting and present value; Internal rate of return; evaluation criteria; Fixed-income securities; bond prices and yields; Interest rate sensitivity and duration; immunization; The term structure of interest rates; yield curves.

Unit 3. Options and Other Derivatives

Introduction to derivatives and options; forward and futures contracts; Forward and future prices Stock index futures & the use of futures for hedging; Interest rate futures; Option markets; call and put options; factors affecting option prices; The principle of arbitrage; risk neutral valuation model; two state option model.

Text Book:

1. Alexander, G.J., W.F. Sharpe and J.V. Bailey (2002), *Fundamentals of Investments*, ThirdEdition, Prentice-Hall of India Private Limited, New Delhi.
2. Elton, Edwin J., M.J. Gruber, S.J. Brown, and W.N. Goetzmann (2014), *Modern PortfolioTheory and Investment Analysis*, Wiley Student Edition, Eighth Edition, UK.

References:

1. Hull, J.C. (2002), *Options, Futures, and Other Derivatives*, Fifth Edition, Prentice-Hall ofIndia Private Limited, New Delhi.
2. Brealey, R., S. Myers, F. Allen, and P. Mohanty (2014), *Principles of Corporate Finance*,Eleventh Edition, New McGraw Hill Education (India) Pvt. Ltd.
3. Bhole, L.M. and J. Mahakud (2017). *Financial Institutions and Markets*, Sixth Edition, McGraw Hill Education (India) Pvt. Ltd.
4. Luenberger, David G. (2012), *Investment Science*, Indian Edition, OUP

MSBFA32: Financial Econometrics

Course Code   : MSBFA-32

L-T-P   : 3-1-0

Credit   : 4

Course Description

Financial Econometric is essential for economic and finance students. The objective of this paper is to demonstrate how statistical and econometric methods can be applied to financial data. This paper is builds on the basis of materials covered in basic econometrics and time series component of applications of econometrics. It provides the necessary tools for the analysis of dynamics, volatility, and risk in financial markets. The paper offers a mixture of theoretical and practical components. This paper is highly important for the students who are interested in empirical investigations of financial market volatility and fluctuations, identify the issues and opportunities in financial time series modelling, and apply the appropriate techniques to financial data using econometrics software.

Objectives

1. Essential knowledge and understanding of subject matter of financial econometrics, including theoretical models and empirical evidence.
2. Enhance the intuitive research competencies such as framing the problem and the ability to assemble and estimate the complex evidence.
3. Practical and Technical skills such as, modelling skills, qualitative and quantitative analysis.
4. Critically review empirical works that use financial time series

Unit 1: Simple Linear Regression

Introduction to Econometrics and its applications; Simple Regression with Classical Assumptions; Least Square Estimation and BLUE, Properties of estimators, Multiple Regression Model and Hypothesis Testing Related to Parameters – Simple and Joint. Functional forms of regression models.
Violations of Classical Assumptions: multicollinearity, heteroscedasticity, autocorrelation and model specification errors, methods to take care of violations of assumptions, goodness of fit.

Unit 2: Time Series Econometrics

Time Series econometrics: stationary stochastic processes, nonstationary Stochastic Processes, unit root stochastic processes, trend Stationary and difference Stationary stochastic processes.

Tests of stationarity- graphical analysis and autocorrelation function (ACF) and correlogram statistical significance of autocorrelation coefficients. The unit root test – the augmented dickey-fuller (ADF) test. Transforming nonstationary financial time series – difference stationary processes and trend- Stationary process; exponential smoothing; seasonal model.

Unit 3: Financial Market Volatility, Forecasting and Econometric Analysis

Volatility Modeling: The ARCH; GARCH; EGARCH; MGARCH; TGARCH
Time Series Forecasting: AR, MA, ARMA, ARIMA
Market Integration: Granger Causality; Cointegration, ECM,
Behavioral Finance and VAR Framework (Unrestricted- VAR & VECM, ARDL Model)

Textbooks

1. Ruey S.T. (2010), *Analysis of Financial Time Series*, Third Edition, Wiley.
2. Augung, I. G. N., (2009), *Time Series Data Analysis Using Eviews*, John Wiley & Sons (Asia) Pte Ltd.
3. Jeffery Wooldridge, (2012), *Introductory Econometrics: A Modern Approach*, Fifth Edition, Cengage Learning, Inc.

References

1. Peter Daalgard (2008), *Introductory Statistics with R*, Second Edition, Springer.
2. James H. Stock and Mark W. Watson (2007), *Introduction to Econometrics*, Third Edition, Pearson/Addison Wesley.
3. James D. Hamilton (1994), *Time Series Analysis*, First Edition, Princeton University Press.
4. Walter Enders (2013), *Applied Econometric Time Series*, Third Edition, Wiley.
5. William H. Greene (2011), *Econometric Analysis*, Seventh Edition, Prentice-Hall.
6. Jack Johnston and John Dinardo (1997), *Econometric Methods*, Fourth Edition, McGraw Hill Higher Education.

MSBFA 33: Applications of Artificial Intelligence in Banking and Finance

Course Code   : MSBFA33
L-T-P   : 3-1-0
Credit   : 4
Course Prerequisites: : Basic Maths, Python Programming
Course Status   : Core Course

Course Description:

This course offers a comprehensive exploration of Artificial Intelligence (AI), presenting it as a cohesive body of theories and methods. Students will delve into classic programs within the field, gaining an understanding of their underlying principles and theories. The primary objective is to introduce students to AI and its evolution as one of the oldest disciplines in computer science, with a focus on constructing intelligent entities and systems. Throughout the course, students will explore the concept of intelligence and its integration into problem-solving processes. Emphasis is placed on fundamental AI techniques and applications, including problem-solving paradigms, search algorithms, and deep neural networks. Moreover, students will investigate the application of the latest novel algorithms within the context of banking and finance, making this applications-oriented course. By the course's conclusion, students will possess both a general overview and in-depth knowledge of AI, equipping them with the skills to tackle real-world challenges in banking and finance using modern AI algorithms.

Objectives:

By the end of this course, the student must be able to:

- Develop a comprehensive understanding of Artificial Intelligence (AI) as a unified field encompassing theories and methods.
- Analyze and comprehend the underlying principles and theories of classic AI programs to grasp their significance and evolution within computer science.
- Construct intelligent entities and systems by applying fundamental AI techniques, emphasizing problem-solving paradigms, search algorithms, and deep neural networks.
- Explore the concept of intelligence and its integration into problem-solving processes, fostering a deeper understanding of AI's role in addressing real-world challenges.
- Investigate and apply the latest novel algorithms within the context of banking and finance, emphasizing the practical applications of AI in tackling industry-specific problems.
- Acquire both a general overview and in-depth knowledge of AI by the course's conclusion, enabling students to effectively leverage modern AI algorithms to address complex challenges in banking and finance.

Unit-wise Syllabus

Unit 1: AI history, applications and problem-solving using search.
Introduction to Artificial Intelligence, Definition of Artificial Intelligence, History of Artificial Intelligence, Turing Test, Types of Artificial Intelligence, Types of AI-Logic Based, Knowledge Based AI, Contemporary AI Intelligent Agents, Rationality, Intelligent Agent, PEAS Framework, Task Environment, Types of Agents, Problem solving agents, Uninformed search strategies, Informed search strategies AI vs ML vs DL.

Unit 2: Introduction to Neural Networks.
Definitions, Types of Neural Networks, Deep Learning basics, CNNs, RNN, Autoencoders and their types, Deep Generative Models, Attention mechanism-based networks, Applications of Deep networks in Computer Vision, Time Series analysis and NLP.

Unit 3: AI and Machine Learning in Financial Services.
Customer focused user-credit scoring, insurance and client facing chatbots, Trading and portfolio management-Robo-Advisory, Algorithmic Trading, Operation focused uses-Capital optimization, model risk management and stress testing, market impact analysis using Python.

Textbooks:

1. Stuart Russel and Peter Norvig: Artificial Intelligence- A Modern Approach, 3rd Edition Pearson Publication.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville," Deep Learning", 2016 MIT Press.

References:

1. FSB(2017), Artificial Intelligence and machine learning in financial services, Financial Stability Board, https://www.fsb.org/wp-content/uploads/P011117.pdf
2. WEF(2018),The new physics of financial services, http://www3.weforum.org/docs/WEF_New_Physics_of_Financial_Services.pdf .
3. Buchanan B.G.(2019), Artificial Intelligence in Finance, Alan Turing Institute, https://www.turing.ac.uk/sites/default/files/2019-04/artificial_intelligence_in_finance_-_turing_report_0.pdf.

Electives Syllabi

MSBFA E1/E2: Data Analytics and Machine Learning

Course Code   : MSBFA E1/E2

L-T-P   : 3-1-0

Credit   : 4

Course Prerequisites: : Basic Maths, Python Programming

Course Status   : Elective

Course Description:

This course prepares students to gather, describe, and analyze data, and use advanced data analytics and machine learning to make decisions on banking, operations, risk management, finance, marketing, etc. Analysis is done targeting economic and financial decisions in complex systems that involve multiple partners. Broad topics include data Exploration and Preparation, Prediction and Classification, and Ensemble Methods, Association Rules, Text Analytics, Random Forests.

Course Objectives:

- To learn to apply concepts of data analytics and machine learning that enables businesses, in banking and finance, to effectively interpret big data, essential for competition today.
- To learn not only the principles of data analytics and machine learning, but apply them to achieve real, pragmatic solutions.
- To illustrate each technique with hands-on examples and include in-depth case studies that apply data analytics and machine learning to common business scenarios.

Unit-wise Syllabus

Unit 1: Data Exploration and Preparation
Introduction to Data Preprocessing; Descriptive Data Summarization: Measuring and Central Tendency and Dispersion of Data; Visualization of Descriptive Data Summaries; Data Cleaning: Handling Missing Values, Filtering Noisy Data – Binning Method; Numerical and categorical attributes; Data Integration; Data Transformation: Smoothing, Aggregation, Generalization, Normalization and Feature Selection.

Unit 2: Introduction to Data Mining

KDD, Process and Data Mining; KDD Steps; Types of Data for Data Mining, Data Mining Functionalities: Data Characterization, Data Discrimination, Mining Frequent Patterns, Association, Correlation, Classification, Prediction, Cluster Analysis, Outlier Analysis, and Evolution Analysis; Classification of Data Mining Systems; Data Mining Task Primitives; Major Issues in Data Mining; Frequent Itemsets, Maximal and Closed Itemsets, and Association Rules; Support and Confidence; Apriori Algorithm for Mining Frequent Itemsets Using Candidate Generation; Generating Association Rules from Frequent Itemsets; Mining Closed Frequent Itemsets.

Unit 3: Prediction and Classification
Introduction to Machine Learning; Introduction to Classification and Prediction; Linear Regression; Logistic Regression; Classification by Decision Induction; Attribute Selection Measures: Information Gain, Gain Ratio, and Gini Index; Bayesian Classification: Bayes' Theorem, Naïve Bayesian Classification; Classifier Accuracy Measures, Bagging and Boosting; Lazy Learners: K-Nearest- Neighbour Classifier; Support Vector Machines; Ensemble Methods: Bagging and Boosting; Clustering; Categorization of Clustering Methods; Representative based Clustering: K-means algorithm, K medoid algorithm; Hierarchical Clustering; Density based Clustering- DBSCAN.

Textbooks

1. Zaki and Meira: Data Mining and Analytics – Cambridge University Press, 3rd Edition.
2. Jiawei Han, Micheline Kamber: Data Mining Concepts and Techniques, 2nd Edition, Morgan Kaufman Publishers.
3. Tan, Steinbach and Kumar: Introduction to Data Mining 2nd Edition– Pearson Publication.

References

1. Christopher M. Bishop Pattern Recognition and Machine Learning, 2016, Springer Publication.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman: The Elements of Statistical Learning, 2009 Springer Publication.

MSBFA E1: ISLAMIC FINANCE

Course Code	:	MSBFA E2
L-T-P	:	3-1-0
Credit	:	4
Course Prerequisite	:	NIL
Course Status	:	Elective

Course-Description

Islamic Finance provides students with an in-depth introduction to the fundamentals related to Islamic finance. This course is designed to provide a theoretical and practical approach to Islamic finance, enabling to use the concepts and tools to address topical issues. The features of Islamic Finance will arm students with strong foundations to understand Islamic Economics and Islamic welfare approach. The topics in Financial Institutions and contracts will encompass Islamic banking, Islamic Capital Markets, Islamic Mutual Funds and Contracts. The students will also be introduced to the various Islamic Financial Products and Services.

Objectives

At the end of the course and having completed the essential reading and activities students should be able to:

- Understand the fundamentals of Islamic finance and Islamic Welfare Approach. Understand the operations of various financial institutions.
- Understand the framework and essential features of Islamic contract.

The objective of the course is to develop the knowledge and understanding of practices related to Islamic Finance for participants aiming to advance their careers in Islamic Banking and Islamic Finance.

Unit-Wise Syllabus

Unit 1. Fundamentals of Islamic Finance

Conceptual Framework: Islamic Shariah, Islamic Economics: Ownership of Resources, Property Rights, Islamic Welfare Approach, Factors of Production: Main Prohibitions: Riba, Gharar, Maisir, Qimar; Business Ethics and Norms, Liberalism versus State Intervention, Recent Developments in Islamic Finance.

Unit 2. Financial Institutions and Islamic Law of Contracts

Islamic Banking: Major Retail Banking proucts; Islamic Capital Markets, Islamic Mutual Funds, Islamic Mutual Funds, Islamic Investment banking, Islamic Insurance: Takaful; Shariah Compliant Sale and Purchase Contracts, Framework of Islamic Contracts: Muamalat, Wadah, Hamish Jiddiyah; Types of Islamic contracts: Fasid and Batil, Case study of Malaysian Islamic Banks.

Unit 3. Islamic Financial Products and Services

Participatory Finance: MudaraBaH and Musharaka; Asset based Financing: Trade and Lending Contracts, Murabaha, Ijara, Salam, Istisna; Islamic Asset based Securities: Sukuk, Types of Sukuk: Sukuk Al-Ijara, Sukuk Al-Musharaka.

Text books:

1. Ayub, M. (2007). *Understanding Islamic Finance*. John Wiley & Sons Ltd.
2. Millar, R., & Anwar, H. (Eds.). (2009). *Islamic finance: A guide for international business and investment*. Blue Ibex.
3. El-Gamal, M. A. (2006). *Islamic finance: Law, economics, and practice*. Cambridge University Press.

References:

1. Iqbal, Z., Abbas, M. (2006*). An introduction to Islamic finance – Theory and practice*. John Wiley & Sons.
2. Usmani, M. T. (2000). *Introduction to Islamic finance*. Idaratul Ma'arif, Karachi.
3. Saleh, N. (1992). *Unlawful gain and legitimate profit in Islamic law. Ribâ, Gharar and Islamic banking.* Graham & Trotman, London.
4. Visser, H. (2019). *Islamic finance: Principles and practice.* Edward Elgar Publishing.