JAI HIND COLLEGE

Basantsing Institute of Science & J. T. Lalvani College of Commerce

and Sheila Gopal Raheja College of Management.

Empowered Autonomous

"A" Road, Churchgate, Mumbai - 400 020, India

Affiliated to
University of Mumbai

Bachelor of Science

Program: B.Sc. in Actuarial and Quantitative Finance

Choice Based Credit System (CBCS) under NEP-2020 with effect from the academic year 2025-2026

Syllabus as approved by Statutory Committees

LOCF Document

Preamble

The B.Sc. in Actuarial and Quantitative Finance program at Jai Hind College is meticulously designed to develop future leaders in finance, risk management, and actuarial science. This program integrates rigorous theoretical foundations with advanced analytical and quantitative techniques, providing students with a comprehensive skill set highly valued in the financial and insurance sectors.

The curriculum's first two years lay a strong interdisciplinary foundation, encompassing actuarial science, quantitative finance, economics, and data analysis, fostering critical thinking and problem-solving abilities. In the final year, students choose a specialized track—either Actuarial Science or Quantitative Finance—allowing for focused, in-depth study tailored to their career aspirations. This specialization, coupled with practical exposure to industry practices, ensures that graduates are adept at navigating complex financial landscapes and equipped for professional certifications.

By aligning with national and international actuarial standards, the program ensures graduates are globally competitive and prepared for influential roles. This academic journey at Jai Hind College is committed to producing ethical, analytically skilled professionals poised to drive innovation and impact in today’s dynamic financial world.

Credit Framework

Semester 1: Fundamentals of Financial and Actuarial Mathematics

This semester establishes a rigorous foundation in financial mathematics, statistics, and economic theory, vital for advanced actuarial and quantitative finance careers.

Sr. No.	Course	Course Type	Total Credits
1	Fundamentals of Finance	Major	4
2	Economic Principles and Market Dynamics	Minor	2
3	Principles of Corporate Finance and Governance	Minor	2
4	Fundamentals of Statistics and Probability	OE	3
5	Mathematical Foundations for Quantitative Analysis	OE	3
6	General Communication	AEC	2
7	Introduction to Basic Excel	VSC	1
8	Introduction to R Programming and Python	SEC	1
9	Digital Literacy	VEC	2
10	Indian Knowledge System	IKS	2
		Total	**22**

Semester 2: Analytical Tools for Finance and Risk Management

Students gain advanced proficiency in financial mathematics, statistical inference, and economic analysis, building essential tools for finance and insurance industries.

Sr. No.	Course	Course Type	Total Credits
1	Essentials of Quantitative Finance	Major	4
2	Inference and Credibility Analysis	Major	4
3	Macroeconomic Analysis	Minor	2
4	Corporate Financial Insight	Minor	2
5	Business Management	OE	2
6	Business Communication	AEC	1
7	Advance Excel with VBA	VSC	2
8	Statistical Computing with R	SEC	2
9	Ethics and Professionalism in Financial Decision-Making	VEC	2
10	Co-Curricular	Co-Curricular	1
		Total	**22**

Learning Outcome-based Approach

The National Higher Education Qualifications Framework (NHEQF) mandates that graduates demonstrate specific competencies and qualities gained from their program, covering both discipline-specific and general learning outcomes. These learning outcomes are crucial for both recognition and career readiness, answering the essential question: *What can you now do as a graduate in Actuarial Science or Quantitative Finance?*

Clearly specifying intended educational outcomes enhances the effectiveness of the educational experience. Every aspect of the program—from curriculum design to teaching methods and evaluation techniques—is directed towards achieving these defined goals. Learning outcomes reflect the competencies that graduates acquire upon completing the undergraduate Actuarial Science or Quantitative Finance program, preparing them for professional and academic advancement.

Graduate Attributes

- **Comprehensive Knowledge and Intellectual Agility**
  Graduates exhibit a deep and comprehensive understanding of their discipline, adeptly engaging with diverse perspectives and applying their expertise in multidisciplinary and professional contexts.

- **Innovative Problem-Solving and Critical Analysis**
  Graduates excel in critical and creative thinking, leveraging evidence-based reasoning to develop forward-looking, innovative solutions to complex challenges.

- **Effective Communication and Collaborative Proficiency**
  Graduates communicate concepts clearly across diverse audiences and contexts, contributing constructively to team efforts and fostering collaboration to achieve shared objectives.

- **Professionalism and Leadership Potential**
  Graduates demonstrate high standards of integrity and professionalism, with the insight and potential to lead, innovate, and make impactful contributions in their fields and communities.

- **Self-Directed and Lifelong Learning**
  Graduates embody a commitment to lifelong learning, continually enhancing their adaptability, resilience, and transferable skills to meet evolving professional demands.

- **Advanced Research and Analytical Skills**
  Graduates are proficient in defining complex problems, conducting rigorous research, evaluating resources critically, and formulating well-grounded, actionable solutions.

Programme Objectives

1. **Develop Core Expertise in Actuarial Science and Quantitative Finance**
   Equip students with in-depth knowledge and analytical skills in actuarial science, quantitative finance, and risk management, preparing them to address complex financial and insurance challenges.

2. **Cultivate Agility with Emerging Financial Technologies**
   Foster adaptability to integrate advanced technologies, such as data science, artificial intelligence, and fintech applications, within actuarial and financial contexts.

3. **Advance Analytical and Problem-Solving Competence**
   Enable students to systematically analyze financial problems and apply mathematical, statistical, and computational solutions with precision and efficiency.

4. **Promote Data-Driven Decision-Making and Risk Management**
   Train students to interpret data effectively for informed decision-making and proactive risk management in financial contexts.

5. **Foster Research Excellence and Methodological Rigor**
   Encourage a research-oriented approach, equipping students with robust methodologies to conduct impactful studies addressing industry challenges.

6. **Enable Practical Application of Theory to Industry Needs**
   Strengthen students' ability to apply theoretical insights to solve real-world issues, contributing innovative solutions to finance, insurance, and risk sectors.

7. **Instill Professionalism and Ethical Responsibility**
   Embed high standards of professionalism and ethical responsibility, preparing students to uphold integrity in managing financial information and client trust.

8. **Strengthen Communication and Collaborative Skills**
   Equip students to communicate complex concepts effectively and collaborate in team settings, essential for leadership in diverse professional environments.

9. **Develop Strategic and Leadership Potential**
   Enhance students' managerial and strategic capabilities through experiential learning, nurturing skills needed for decision-making roles in finance.

10. **Master Business Writing and Professional Communication**
    Guide students in effective business writing and presentation, ensuring clear, professional documentation and stakeholder engagement.

11. **Prepare for Career Success and Lifelong Growth**
    Empower students with career planning, networking, and continuous learning strategies for sustained professional advancement.

Teaching and Learning Process

1. **Lectures and Expert Seminars**
   Lectures provide in-depth analysis and advanced perspectives on key actuarial and financial topics, emphasizing rigorous theoretical foundations and real-world applicability. Delivered by experienced faculty and industry experts, these sessions are highly interactive, fostering critical discussions and enabling students to connect academic theory with practical insights.

2. **Interactive Discussions and Roundtables**
   Structured discussions and roundtables facilitate critical engagement with advanced concepts in finance, risk management, and actuarial science. These sessions promote analytical thinking, allowing students to challenge assumptions, explore emerging trends, and develop creative solutions to complex industry issues in a collaborative setting.

3. **Experiential Learning through Simulations and Real-World Projects**
   Experiential learning emphasizes "learning by doing," with students engaging in simulations, financial modeling exercises, and mini-projects that mirror industry scenarios. This approach sharpens technical skills, analytical capabilities, and decision-making under uncertainty, preparing students for the complexities of professional practice.

4. **Case Studies and Applied Problem-Solving**
   Case-based learning is integral to developing practical problem-solving skills. Students analyze real-world scenarios drawn from finance, insurance, and risk management, developing strategic and data-driven solutions. This method encourages deep analysis, strategic thinking, and an ability to apply theoretical frameworks to dynamic, real-world

challenges.

5. **Collaborative Team-Based Learning**
   Collaboration is critical in the actuarial and finance professions. Team-based projects and assignments build skills in leadership, negotiation, and collaborative problem-solving. These experiences teach students to leverage diverse perspectives, manage projects effectively, and develop solutions as part of a multidisciplinary team.

6. **Industry Exposure through Field Visits and Immersive Learning**
   Field visits to financial institutions, regulatory bodies, and insurance companies offer students an immersive experience, enabling them to observe and engage with industry practices. These excursions provide a direct link between classroom learning and industry operations, enhancing students' understanding of how academic concepts translate into practical applications.

7. **Academic-Industry Integration and Mentorship Programs**
   The program actively promotes partnerships with industry, offering internships, training programs, and mentorship opportunities with leaders in finance and actuarial science. This interface ensures that students gain hands-on experience, develop professional networks, and stay updated on current industry practices and standards.

8. **Blended and Hybrid Learning Models**
   A combination of online learning resources and in-person instruction provides flexibility and personalized learning paths. Digital platforms offer access to recorded lectures, interactive tutorials, and self-assessment tools, while in-person sessions emphasize collaborative learning and direct engagement with faculty.

9. **Flipped Classroom Model for Active Learning**
   The flipped classroom approach enhances engagement by encouraging students to study foundational material independently through online resources, such as video lectures and reading materials. Classroom time is then dedicated to interactive problem-solving, discussion, and application of concepts, enabling deeper understanding and more meaningful learning experiences.

10. **Research-Driven Learning and Capstone Projects**
    Research-based learning encourages students to explore contemporary issues in finance and actuarial science. Through capstone projects, students conduct original research, identify industry challenges, and propose evidence-based solutions. This process develops critical research skills, analytical thinking, and an innovation-oriented mindset.

11. **Global Perspectives and Cross-Cultural Competence**
    The curriculum emphasizes global perspectives in finance and actuarial science, preparing students for a globalized industry. Case studies and coursework often draw on international scenarios, fostering cross-cultural competence and a deeper understanding of global market dynamics.

12. **Ethics and Professionalism Workshops**
    Regular workshops and seminars on ethics and professionalism are integral to the curriculum, aligning with the high standards expected in the actuarial and financial industries. These sessions emphasize ethical decision-making, integrity, and professional conduct, preparing students to responsibly manage financial information, uphold public trust, and contribute positively to their fields.

13. **Continuous Feedback and Reflective Learning**
    Emphasis is placed on continuous feedback, with students receiving regular input on their progress through assessments, peer reviews, and mentoring sessions. Reflective learning practices, such as self-assessment and portfolio development, enable students to evaluate their strengths and areas for improvement, fostering a growth mindset.

14. **Digital Literacy and Technology-Enhanced Learning**
    The program incorporates modern digital tools and platforms to enhance learning and ensure students are proficient with the technology used in today's finance and actuarial professions. Students gain hands-on experience with industry-standard software for financial modeling, data analytics, and risk assessment. This approach prepares them to confidently use digital resources, tools, and applications essential for professional success and adaptability in an increasingly digital financial landscape.

Assessment Methods / Evaluation Scheme

The B.Sc. Actuarial Science and Quantitative Finance program employs a rigorous assessment framework, aligned with learning outcomes and designed to foster the essential academic, analytical, and technical competencies expected in actuarial and finance professions. A diverse array of assessment methods ensures thorough evaluation across theoretical knowledge, practical skills, and professional acumen, meeting the high standards for international accreditation.

Assessment methods include:

1. **Scheduled Regular Assessments (Oral and Written)**
    Regularly scheduled assessments, both oral and written, evaluate foundational understanding, technical proficiency, and the analytical rigor required for actuarial and

financial analysis.

2. **Advanced Problem-Solving Exercises**
   Focused exercises allow students to apply mathematical, statistical, and computational techniques to solve complex, real-world actuarial and financial challenges, reflecting the problem-solving demands of the profession.

3. **Closed-Book and Open-Book Examinations**
   These varied exam formats assess students' ability to synthesize and apply knowledge in structured settings, challenging them to perform under both routine and complex, unpredictable scenarios.

4. **Practical Skills and Technical Documentation**
   Assessment of practical assignments—including data analytics, financial modeling, and programming—ensures students' competencies in key technical areas. Emphasis is also placed on accurate and thorough documentation of methodologies, mirroring industry standards.

5. **Individual and Team-Based Projects**
   Projects encourage students to demonstrate research, analytical, and project management skills. Team-based projects build collaboration and communication capabilities, simulating the interdisciplinary teamwork required in industry settings.

6. **Seminar Presentations and Professional Communication**
   Students are assessed on their ability to communicate complex actuarial and financial concepts effectively through formal presentations. This assessment hones their skills in articulating technical ideas with clarity to both technical and non-technical audiences.

7. **Group Discussions and Case Study Analysis**
   Engaging in structured group discussions and case studies, students analyze and debate real-world scenarios. These exercises develop critical thinking, strategic insight, and collaborative skills, essential for decision-making in professional contexts.

8. **Viva Voce Examinations**
   Oral examinations test the depth and clarity of students' conceptual understanding, as well as their ability to think critically and respond precisely, reinforcing both technical knowledge and professional poise.

9. **Proficiency in Digital Tools and Software**
   Students demonstrate competency in industry-standard tools such as R, Python, Excel

with VBA, and actuarial software, applying these technologies to solve actuarial and financial problems, mirroring the digital proficiency required in modern practice.

10. **Research and Literature Evaluation**
    Research-based assessments, including literature reviews and evaluations, cultivate students' ability to critically assess academic and industry developments, deepening their understanding of current trends and theoretical advancements in actuarial science and finance.

11. **Enhanced Communication Skills (Written, Oral, and Interpersonal)**
    Through a range of assignments—such as reports, reflective essays, oral presentations, group discussions, and role-play scenarios—students refine their written and verbal communication skills. These activities focus on precise, professional communication, preparing students for client-facing and collaborative roles.

12. **Peer and Self-Assessment**
    Peer and self-assessment encourage reflective learning and self-awareness. Students evaluate their contributions and those of peers, fostering constructive feedback skills and a collaborative ethos, essential for continuous professional development.

13. **Continuous Reading and Critical Engagement**
    Regular reading assignments encourage engagement with scholarly and industry literature. Structured feedback and peer mentoring reinforce comprehension and critical analysis, helping students stay current with developments in actuarial and quantitative finance.

This robust and multifaceted evaluation scheme ensures that students graduate with a balanced skill set encompassing analytical rigor, technical expertise, and professional competencies, meeting the high standards expected in the global actuarial and finance industries.

Discipline Specific Core Courses – Major Core Courses

	Course Title : Finance Fundamentals	**Credits: 03 Lectures/Week: 03**
Course description	This course provides a comprehensive foundation in interest rate theory and time value of money, both essential to financial mathematics, actuarial science, and quantitative finance. Covering the spectrum from simple to complex interest calculations, students will explore various types of interest rates, compounding methods, discounting techniques, and cashflow valuation strategies. The curriculum emphasizes practical applications and problem-solving, equipping students for professional actuarial exams and careers in finance.	
Learning objectives	1. Develop a thorough understanding of time value of money, including simple and compound interest principles. 2. Differentiate and apply nominal, real, and effective interest rates in various financial contexts. 3. Analyze cashflows with discounting techniques to determine present and future values. 4. Master compound interest functions for valuing structured financial instruments and cashflows.	
Course Outcomes	1. Upon completing this course, students will be able to: 2. Calculate and interpret various interest rates for real-world applications. 3. Apply time value of money concepts to evaluate financial cashflows. 4. Use discounting and compounding techniques to solve valuation problems in finance. 5. Utilize compound interest functions to assess structured financial instruments, annuities, and perpetuities.	
	THEORY	**45 Lectures**
Sub Unit	**Unit – I: Introduction to Interest Rates and Time Value of Money**	**10 Lectures**
1.	**Simple Interest and Discount Rates** • Overview of simple interest: Definition, formula, and applications in short-term transactions. • Simple discount rate: Explanation and use in situations where repayment is made before maturity.	

	• Practical examples in commercial and retail finance.	
2.	**Time Value of Money** • Core concept of time value of money (TVM): Why money today is worth more than in the future. • Importance of TVM in investment decision-making and financial planning.	
3.	**Types of Interest Rates** • Nominal, real, and effective interest rates: Definitions and relationships between them. • Real-world implications of using each rate type in finance.	
4.	**Compounding and Force of Interest** • Explanation of periodic and continuous compounding. • Force of interest as a measure of continuous compounding and its uses in high-frequency finance. • *Outcome*: Build a strong foundational understanding of basic interest concepts, providing the basis for more advanced financial mathematics.	
	Unit – II: Real and Nominal Interest Rates in Financial Applications	**6 Lectures**
1.	**Nominal vs. Real Interest Rates** • Distinguishing nominal rates from real (inflation-adjusted) rates. • Calculation of real interest rates, with consideration for inflation's impact.	
2.	**Impact of Inflation on Interest Rates** • Adjusting interest rates for inflation: Practical applications and implications on purchasing power. • Inflation-adjusted returns in investment planning.	

3.	**Application of Real and Nominal Rates in Decision-Making** • How nominal and real rates influence investment choices. • Case studies on how inflation considerations affect long-term financial planning. • *Outcome*: Equip students to adjust for inflation when evaluating investments, enhancing their decision-making capabilities.	
	Unit – III: Compound Interest and Discounting Techniques	**10 Lectures**
1.	**Compound Interest Fundamentals** • Concept of compound interest and its financial implications. • Calculation of future values under compound interest, including various compounding intervals.	
2.	**Present Value Calculations** • Importance of present value in determining current worth of future cashflows. • Calculating present value using different discount rates and frequencies.	
3.	**Commercial Discounting** • Application of commercial discounting in evaluating short-term financial products. • Use in bills of exchange, promissory notes, and other discounted financial instruments.	
4.	**Discounting Methods and Approaches** • Explanation of net present value (NPV) and other discounting approaches. • Practice problems on discounting single and multiple cashflows. • *Outcome*: Develop the ability to apply compound interest and discounting methods for precise	

	financial analysis.	
	Unit – IV: Valuation of Cashflows under Different Interest Rate Conditions	**12 Lectures**
1.	**Valuing Cashflows with Constant Interest Rates** • Methods for calculating present and future values of cashflows when interest rates are constant. • Applications to loans, bonds, and annuities with fixed payments.	
2.	**Variable Cashflows and Time-Dependent Rates** • Techniques for valuing cashflows that change over time. • Valuation with variable interest rates and the impact on long-term financial planning.	
3.	**Deferred Cashflows and Applications** • Concepts of deferred cashflows, where payments are postponed for a specified period. • Application in financial products with deferral options, such as pensions and insurance.	
4.	**Analyzing Cashflows with Time-Dependent Rates** • Calculation of present and future values when interest rates vary over time. • Practical scenarios illustrating how time-dependent rates affect valuation. • *Outcome*: Enable students to handle complex cashflow scenarios and assess investments under varying interest conditions.	
	Unit – V: Advanced Compound Interest Functions and Annuities	**7 Lectures**
1.	**Derivation of Compound Interest Functions**	

	• Key compound interest functions: Present value, future value, and annuity formulas. • Differences between payments made in advance (annuity due) and at the end of the period (ordinary annuity).	
2.	**Deferred Annuities and Structured Cashflows** • Evaluation of deferred annuities, including calculations for structured and non-uniform payments. • Practical uses in retirement planning, insurance products, and long-term investments.	
3.	**Annuity and Perpetuity Applications** • Introduction to perpetuities and their role in valuation of indefinite cashflows. • Real-world applications in corporate finance, project evaluation, and endowment planning. • *Outcome*: Equip students with skills to evaluate structured financial products and utilize annuity functions for in-depth financial modeling.	

	Course Title: Finance Fundamentals I Practical	**Credits: 01** **Practical/Week: 2 Hours**
	• Calculate simple interest and simple discount rates in real-life contexts, such as short-term loans and retail finance scenarios. • Analyze the implications of different interest rates on financial decisions using simple interest calculations. • Explore the conversion between simple and compound interest, focusing on various compounding intervals. • Examine how compounding affects total returns over different time periods through comparative analysis. • Conduct detailed calculations for present value (PV) of single cashflows and cashflow series. • Perform future value (FV) calculations to evaluate investment opportunities and loan offers. • Investigate the impact of different compounding frequencies on both PV and FV. • Compute and compare nominal, real, and effective interest rates across various scenarios. • Execute inflation-adjusted interest rate calculations to illustrate the effects of inflation on purchasing power. • Utilize case studies to assess investment choices, focusing on the suitability of nominal versus real returns. • Apply discounting techniques to evaluate cashflows in practical scenarios, calculating present values using different rates. • Assess the valuation of deferred cashflows and analyze projects with time-dependent interest rates. • Calculate values for different types of annuities, including ordinary annuities and annuities due. • Compute perpetuity values and relate them to scenarios involving indefinite cashflows, such as endowments. • Engage in a comprehensive case study that integrates knowledge from various topics, making decisions based on calculations and theoretical understanding. • Design a capstone project that includes a detailed cashflow valuation model or interest rate scenario analysis. • Prepare a comprehensive report covering calculations, interpretations, and strategic insights to demonstrate mastery of practical applications in finance.	

Minor Core Courses

	Course Title : Economic Principles and Market Dynamics	**Credits: 02 Lectures/Week: 02**
Course description	This course offers a rigorous exploration of economic principles with a focus on their applications in business and markets. Students will gain insights into consumer and producer behavior, market dynamics, and strategic pricing. By balancing theoretical frameworks with practical examples, this course prepares students for advanced studies in economics, finance, and policy analysis, enabling them to apply economic reasoning in real-world business scenarios.	
Learning objectives	1. Develop a foundational understanding of economics and its relevance to business decisions. 2. Analyze consumer and firm behavior in various market conditions. 3. Examine market structures and understand the implications for pricing, competition, and profitability. 4. Explore the strategic role of advertising, elasticity, and market power in business.	
Course Outcomes	Upon completing this course, students will be able to: 1. Apply economic principles to evaluate resource allocation and decision-making in business contexts. 2. Interpret and analyze consumer demand, elasticity, and market equilibrium. 3. Assess cost structures and revenue strategies across different market structures. 4. Critically evaluate the impact of advertising, competition, and market power on market dynamics.	
	THEORY	**30 Lectures**
Sub Unit	**Unit – I: Foundations of Economic Theory and Business Relevance**	**6 Lectures**
1.	**Basic Economic Principles for Business Decision-Making** • **Opportunity Cost and Scarcity**: Examine the concepts of opportunity cost and scarcity, their significance in making choices, and how these concepts drive resource allocation in business.	

	• **Trade-offs and Marginal Analysis**: Understand how trade-offs are essential in decision-making, and the role of marginal analysis in optimizing resources. • **Application in Business**: Explore how businesses use these principles to make decisions about production, investment, and resource allocation.	
2.	**Microeconomics vs. Macroeconomics** • **Microeconomic Focus**: Study individual markets, consumer behavior, and firm dynamics to understand the "small picture" in economics. • **Macroeconomic Overview**: Discuss broad economic factors such as inflation, GDP, and policy that affect the entire economy. • **Relevance to Business Strategy**: Learn how macro and microeconomic insights are applied in strategic business planning.	
3.	**Historical Perspectives in Economics** • **Overview of Economic Schools of Thought**: Explore classical, Marxian, neoclassical, Keynesian, monetarist, and Austrian perspectives. • **Impact on Modern Business**: Analyze how these theories have influenced current business practices and policy-making.	
	Unit – II: Market Mechanisms and Consumer Demand	**7 Lectures**
1.	**The Role of the Price Mechanism** • **Market Equilibrium**: Understand how prices are determined by supply and demand and how equilibrium is achieved. • **Price Adjustments**: Examine how changes in demand or supply impact equilibrium prices and quantities. • **Real-World Examples**: Apply these concepts to real-life cases, such as pricing in commodity markets or shifts in consumer goods demand.	

2.	**Determinants of Demand and Supply** • **Factors Influencing Demand**: Income, preferences, substitutes, and complements. • **Supply Determinants**: Production costs, technology, and government regulations. • **Elasticities and Business Implications**: Analyze how elasticity affects pricing and revenue strategies.	
3.	**Elasticity and its Applications** • **Price Elasticity of Demand and Supply**: Learn to calculate elasticity and interpret its implications for revenue, tax incidence, and consumer behavior. • **Income and Cross Elasticity**: Understand the responsiveness of demand to income changes and the effects of substitute or complementary goods. • **Case Studies**: Practical applications in sectors like luxury goods, essential items, and technology.	
4.	**Consumer Choice Theory** • **Utility and Preferences**: Introduction to utility theory, where consumers make choices to maximize satisfaction. • **Budget Constraints and Indifference Curves**: Visual representation of consumer preferences and decision-making within budget limits. • **Application in Consumer Targeting**: How firms use these insights to optimize product offerings and pricing strategies.	
	Unit – III: Production, Cost Analysis, and Efficiency	**6 Lectures**
1.	**The Production Function and Output Decisions** • **Inputs and Outputs Relationship**: Understand the production process and the role of inputs in generating outputs. • **Short-Run vs. Long-Run Production**: Differentiate between fixed and variable inputs and analyze production capabilities over time. • **Applications in Business**: Evaluate how production	

	decisions impact business scalability and efficiency.	
2.	**Cost Structures in Business** • **Total, Fixed, Variable, and Marginal Costs**: Definitions and implications of different cost types for business decision-making. • **Economies of Scale**: Explore how increasing production can lead to lower average costs and competitive advantage. • **Diseconomies of Scale**: Discuss limitations to growth and situations where increased scale leads to inefficiencies.	
3.	**Revenue and Profit Maximization** • **Understanding Revenue Streams**: Definitions of average and marginal revenue and their relevance to business strategy. • **Profit Maximization in the Short and Long Run**: Analyze how firms make decisions to maximize profits under different market conditions. • **Shutdown Point and Break-Even Analysis**: Practical applications for identifying when a business should continue operating or exit the market.	
	Unit – IV: Market Structures and Strategic Firm Behavior	**6 Lectures**
1.	**Introduction to Market Structures** • **Characteristics of Perfect Competition and Monopoly**: Understand the features, pricing strategies, and output decisions in perfectly competitive and monopolistic markets. • **Real-World Applications**: How industries like agriculture (perfect competition) and utilities (monopoly) operate within these structures.	
2.	**Monopolistic Competition and Product Differentiation** • **Market Characteristics**: Key features of monopolistic competition, including product	

	differentiation and non-price competition. • **Impact on Business Strategy**: How firms in these markets use branding and differentiation to attract consumers.	
3.	**Oligopoly and Strategic Interaction** • **Features of Oligopolistic Markets**: Concentrated market power, interdependent firms, and the impact of few competitors. • **Game Theory Basics**: Introduction to strategic decision-making through concepts like Nash equilibrium and the prisoner's dilemma. • **Collusion and Cartels**: Analyze the conditions under which firms may collude and the legal and economic implications.	
4.	**Barriers to Entry and Market Power** • **Entry Barriers**: Explore how economies of scale, patents, and government regulations can prevent new firms from entering the market. • **Implications for Competition and Market Dynamics**: Understand how barriers to entry influence competition, pricing power, and market profitability.	
	Unit – V: Strategic Pricing, Advertising, and Behavioral Insights	**5 Lectures**
1.	**Advanced Pricing Strategies** • **Cost-Based Pricing and Price Discrimination**: Different pricing approaches and when they are appropriate in various market structures. • **Lifecycle-Based Pricing**: Analyze how pricing strategies change at different stages of a product's life. • **Multi-Product Pricing**: Considerations for setting prices across a range of products within a portfolio.	
2.	**Advertising and Market Influence**	

	• **Role of Advertising in Demand Creation**: How advertising shifts consumer preferences and increases demand elasticity. • **Advertising Strategies in Competitive Markets**: Examine approaches to maximize market share, build brand loyalty, and drive sales.	
3.	**Behavioral Economics and Consumer Decision-Making** • **Bounded Rationality and Heuristics**: Introduction to behavioral concepts like bounded rationality and cognitive biases. • **Implications for Business Strategy**: How firms can leverage insights from behavioral economics to design marketing, pricing, and product strategies that resonate with consumers.	

	Course Title : Principles of Corporate Finance and Governance	**Credits: 02 Lectures/Week: 02**
Course description	This course introduces essential principles of corporate governance and finance, covering corporate structures, financing methods, taxation, and project evaluation. It is designed to provide students with a foundational understanding of corporate financial management and decision-making, focusing on maximizing shareholder value while adhering to ethical standards.	
Learning objectives	1. Grasp the core principles of corporate governance and financial regulation. 2. Analyze corporate financing options and the role of ethical responsibilities.	

	3. Understand various financing instruments used by corporates. 4. Assess taxation's impact on financial decisions. 5. Examine strategies for corporate growth and project evaluation techniques.	
Course Outcomes	Upon completion, students will: 5. Explain corporate governance and its regulatory importance. 6. Differentiate corporate financing mechanisms and their strategic implications. 7. Demonstrate awareness of ethical obligations in corporate finance. 8. Evaluate corporate growth strategies and project investments. 9. Apply basic financial analysis techniques for assessing corporate projects.	
	THEORY	**30 Lectures**
Sub Unit	**Unit – I: Corporate Governance and Finance Principles**	**6 Lectures**
1.	**Corporate Governance Fundamentals**: Introduction to corporate governance, regulatory frameworks, and the importance of transparency and accountability. Examine the role of boards and management in maintaining ethical standards.	
2.	**Finance and Stakeholder Relationships**: Explore how finance aligns with corporate objectives, emphasizing the relationships between finance, resources, and stakeholders (lenders, investors).	
3.	**Capital Markets and Shareholder Wealth**: Role of capital markets in corporate finance, focusing on maximizing shareholder wealth. Address common challenges such as agency problems and balancing profitability with social responsibility.	
	Unit – II: Corporate Structures and Long-Term Financing	**6 Lectures**
1.	**Types of Business Entities**: Characteristics of sole traders, partnerships, limited companies, and social enterprises, and how each structure affects financing needs and opportunities.	
2.	**Equity and Debt Financing**: Overview of long-term financing methods, including share capital and loan capital,	

	and the strategic implications of equity vs. debt in capital structuring.	
3.	**Introduction to Capital Structure**: Brief discussion on how a company's choice of capital structure influences its market valuation and risk profile.	
	Unit – III: Short-Term and Alternative Financing	**6 Lectures**
1.	**Medium- and Short-Term Financing Options**: Overview of financing needs for medium and short-term objectives, including bank loans, leasing, credit sales, trade credit, factoring, and commercial paper.	
2.	**Alternative Finance**: Explore emerging financing options outside the traditional banking system, such as peer-to-peer lending, crowdfunding, and microfinance, with a focus on their potential benefits and risks.	
	Unit – IV: Taxation in Corporate Finance	**6 Lectures**
1.	**Corporate Taxation Principles**: Key aspects of corporate taxation, including income tax and capital gains tax, and how these impact corporate financing decisions.	
2.	**Double Taxation and Offshore Finance**: Introduction to double taxation relief and reasons for the offshore structuring of investment funds.	
3.	**Tax Implications on Corporate Decisions**: Explore how tax considerations affect financing and capital structure choices, including implications for shareholders and the corporation itself.	
	Unit – V: Corporate Growth, Mergers, and Project Evaluation	**6 Lectures**
1.	**Corporate Growth Strategies**: Motivations for growth, internal vs. external growth, and constraints to growth. Introduction to mergers and acquisitions, including key considerations in evaluating target companies.	
2.	**Project Evaluation Techniques**: Basic methods for appraising capital investments, including calculating cost of	

	capital, projecting cash flows, and evaluating risk through simulation and certainty equivalents.	
3.	**Risk Assessment in Projects**: Introduction to methods for assessing project risks, including probability and impact analyses, and understanding financial outcomes.	

Discipline Specific Open Elective Courses

	Course Title : Fundamentals of Statistics and Probability	**Credits: 03 Lectures/Week: 03**
Course description	This course provides an in-depth introduction to statistical methods fundamental to quantitative and actuarial sciences. Covering data analysis, probability, random variables, dependency, generating functions, and simulations, it combines theory with practical applications, preparing students to analyze data, assess risk, and make decisions under uncertainty. The curriculum aligns with international standards and provides a rigorous statistical foundation for careers in quantitative finance, data science, and actuarial fields.	
Learning objectives	1. Develop skills in exploratory data analysis, data summarization, and visualization. 2. Understand and apply probability theory to calculate and interpret event probabilities and manage uncertainty. 3. Analyze and interpret properties of random variables, including dependencies and linear combinations. 4. Master the use of generating functions, key distributions, and simulation techniques for practical data modeling.	
Course Outcomes	Upon successful completion, students will be able to: 1. Summarize, represent, and interpret data effectively using statistical techniques. 2. Apply probability theory to assess risks and calculate event probabilities in various models. 3. Evaluate random variables, including joint distributions, and calculate key statistical measures such as expected values, variances, and covariances. 4. Use generating functions and simulate distributions to model real-world problems, supporting data-driven decision-making.	
	THEORY	**45 Lectures**
Sub Unit	**Unit – I: Data Analysis and Summary Statistics**	**7 Lectures**
1.	**Data Representation and Summarization**: Techniques for organizing and summarizing data, including frequency distributions, tables, and visual displays (e.g., line plots, histograms, bar charts, and stem-and-leaf plots).	

2.	**Central Tendency Measures**: Understand and calculate measures such as mean, median, and mode to describe central characteristics of data.	
3.	**Measures of Variability**: Calculate standard deviation, range, and interquartile range to understand the spread and variability in data.	
4.	**Shape and Distribution Characteristics**: Introduction to symmetry, skewness, and kurtosis, examining how distribution shapes impact data interpretation.	
	Unit – II: Probability Theory and Basic Rules	**8 Lectures**
1.	**Fundamentals of Probability**: Introduction to probability as a mathematical concept, covering set functions, sample spaces, events, and basic axioms.	
2.	**Rules of Probability**: Application of addition and multiplication rules for calculating the likelihood of events and understanding their combined effects.	
3.	**Conditional Probability and Bayes' Theorem**: Learn the concepts of conditional probability and independence, and apply Bayes' Theorem for probability revision in various scenarios.	
4.	**Practical Probability Applications**: Explore real-world applications of probability theory in risk modeling, forecasting, and decision-making.	
	Unit – III: Random Variables and Their Properties	**7 Lectures**
1.	**Discrete and Continuous Random Variables**: Define and differentiate between discrete and continuous random variables, with examples to illustrate their applications.	
2.	**Probability and Density Functions**: Understand the use of probability functions for discrete variables and density functions for continuous variables.	
3.	**Expected Value, Variance, and Standard Deviation**: Calculation of expected value, mean, variance, and standard deviation to evaluate the central tendency and variability of random variables.	
4.	**Higher-Order Moments**: Analyze skewness and kurtosis to examine distribution shapes and understand the probability of extreme values.	

	Unit – IV: Joint Distributions and Dependency Analysis	**8 Lectures**
1.	**Jointly Distributed Random Variables**: Explanation of joint distributions, calculating marginal distributions, and understanding the relationships between multiple variables.	
2.	**Marginal and Conditional Distributions**: Detailed calculations and interpretations of marginal and conditional distributions, crucial for multi-variable analysis.	
3.	**Covariance and Correlation Analysis**: Calculation and interpretation of covariance and correlation to assess the strength and direction of relationships between variables.	
4.	**Linear Combinations of Random Variables**: Explore the mean and variance of linear combinations, understanding their applications in portfolio analysis and risk aggregation.	
	Unit – V: Generating Functions and Moment Analysis	**7 Lectures**
1.	**Probability Generating Functions (PGF)**: Introduction to generating functions for discrete random variables, their definitions, and applications for calculating probabilities.	
2.	**Moment and Cumulant Generating Functions (MGF, CGF)**: Learn how to calculate moments and cumulants using moment and cumulant generating functions.	
3.	**Application of Generating Functions for Moments**: Techniques for using generating functions to derive moments and cumulants, enhancing understanding of distribution properties.	
4.	**Relevance of Generating Functions in Quantitative Analysis**: Practical applications of generating functions in simplifying complex calculations, applicable to risk analysis, forecasting, and data modeling.	
	Unit – VI: Key Probability Distributions and Simulation Techniques	**8 Lectures**
1.	**Core Discrete Distributions**: Detailed study of important discrete distributions, including geometric, binomial, negative binomial, hypergeometric, Poisson, and uniform distributions, with applications in modeling discrete events.	
2.	**Key Continuous Distributions**: Exploration of essential continuous distributions, such as normal, lognormal, exponential, gamma, chi-square, t, F, beta, and uniform	

	distributions, used in modeling continuous processes.	
3.	**Poisson Process and Event Modeling**: Understanding the Poisson process and its use in modeling the occurrence and frequency of events over time.	
4.	**Simulation of Random Variables**: Introduction to simulation techniques for generating values from distributions, focusing on applications in risk analysis, forecasting, and quantitative modeling.	

	Course Title: Fundamentals of Statistics and Probability I Practical	**Credits: 01** **Practical/Week: 2 Hours**
	• Collect and organize data from surveys, experiments, or observational studies, ensuring proper sampling techniques. • Explore data by calculating summary statistics, including mean, median, mode, and measures of variability such as standard deviation and range. • Create various graphical representations by hand, including histograms, box plots, and scatter plots, to visualize data distributions and relationships. • Conduct probability experiments and record outcomes to empirically calculate probabilities, comparing experimental results with theoretical probabilities. • Solve theoretical probability problems by applying addition and multiplication rules, including complementary events. • Explore conditional probability through real-life scenarios, calculating probabilities and updating them using Bayes' Theorem. • Construct a frequency distribution table for collected data, calculating relative frequencies and interpreting the results. • Simulate discrete random variables through manual experiments and analyze outcomes to calculate expected values and variances. • Analyze properties of random variables by performing manual calculations	

	of expected values and variances. • Use bivariate data sets to construct joint frequency tables, calculating marginal and conditional distributions and interpreting the significance of these distributions. • Investigate relationships between variables by calculating covariance and correlation coefficients by hand. • Derive probability generating functions (PGFs) for specific discrete random variables and apply these to calculate expected values and other moments. • Calculate moments (mean, variance) for different distributions using hand calculations and interpret them. • Fit theoretical data to key probability distributions through manual calculations, assessing the appropriateness of each distribution. • Conduct hypothesis tests based on theoretical data sets, manually calculating test statistics and p-values. • Develop basic statistical models using collected data, including regression analysis, and interpret the results. • Engage in scenario-based exercises to model risk and uncertainty, employing statistical reasoning for decision-making. • Present findings through written reports or oral presentations, emphasizing clarity in statistical interpretation and communication. • Collaborate in groups to select relevant real-world problems, conduct statistical analyses, and present findings. • Participate in peer review sessions, providing and receiving constructive feedback on statistical analyses and reports. • Discuss the broader implications of statistical findings in decision-making contexts, linking theory to practice.

	Course Title : Mathematical Foundations for Quantitative Analysis	Credits: 03 Lectures/Week: 03
Course description	This course provides a comprehensive foundation in essential mathematical techniques for actuarial science and quantitative finance, covering algebra, calculus, matrices, vectors, and numerical methods. Aligned with international standards and designed for IFOA accreditation, this course focuses on the precision and analytical methods essential for rigorous quantitative and financial modeling. By progressing through logically structured modules, students will gain core skills for professional examinations and advanced studies in financial and actuarial fields.	
Learning objectives	□ To introduce students to essential mathematical terminology, symbols, and proof techniques critical for quantitative analysis. □ To equip students with numerical and algebraic skills, emphasizing precision and error analysis. □ To enable students to explore functions, sequences, and series, and understand their applications in finance and actuarial contexts. □ To develop students' calculus and linear algebra skills for multivariate analysis, optimization, and financial modeling. □ To prepare students to critically analyze quantitative problems using advanced mathematical tools.	
Course Outcomes	By the end of this course, students will: • Demonstrate proficiency in interpreting mathematical notation and constructing proofs. • Perform accurate numerical calculations with attention to precision and error estimation. • Execute algebraic manipulations, including sequences, series, and functions, for financial modeling. • Apply calculus techniques, including differentiation, integration, and differential equations, to solve optimization and analysis problems. • Use matrix and vector operations to solve multivariate problems and understand transformations in finance and risk assessment.	
	THEORY	**45 Lectures**
Sub Unit	**Unit – I: Mathematical Notation, Logic, and Proof**	**6 Lectures**

1.	**Mathematical Symbols and Set Theory:** Overview of mathematical symbols, operations, and set theory fundamentals, including types of sets (finite, infinite, countable, uncountable), Venn diagrams, and operations on sets (union, intersection, complement).	
2.	**Number Systems and Properties:** Examination of integer, rational, irrational, and complex numbers; properties of real numbers; and rules of operations, essential for handling quantitative data.	
3.	**Greek Alphabet and Symbols in Quantitative Contexts:** Introduction to Greek symbols widely used in mathematical and statistical equations, common financial variables, and conventions, to ensure consistent terminology.	
4.	**Basic Logical Operations and Quantifiers:** Understanding truth tables, logical connectives (AND, OR, NOT), implications, equivalences, and the role of quantifiers (universal and existential) in mathematical logic.	
5.	**Introduction to Proof Techniques:** Techniques in constructing mathematical proofs, focusing on direct proofs, proof by contradiction, and mathematical induction. These methods establish critical thinking skills for verifying assumptions and claims in financial and risk analysis.	
	Unit – II: Dimensional Analysis and Numerical Skills	**6 Lectures**
1.	**Calculator and Computation Skills:** Mastery of calculator functions, including advanced functions (e.g., factorials, combinations, logarithms) necessary for evaluating financial models and complex equations.	
2.	**Dimensional Analysis and Consistency:** Introduction to the concept of dimensional analysis, including unit conversions, consistency in equations, and dimensionless quantities. Emphasis on ensuring units align across calculations, particularly in real-world financial and actuarial models.	
3.	**Rounding and Significant Figures:** Techniques for determining significant figures, rounding rules, and approximations. Students will	

	learn how to communicate results with appropriate precision based on model requirements and potential implications of rounding errors.	
4.	**Error Estimation and Propagation:** Understanding absolute and relative errors, and techniques to estimate and manage errors throughout calculations, essential for minimizing discrepancies in quantitative models.	
	Unit – III: Algebra and Functions	**8 Lectures**
1.	**Algebraic Manipulations and Transformations:** Techniques for simplifying and transforming expressions involving powers, roots, and logarithms. Focus on factorization, expansion, and rearrangement of complex expressions.	
2.	**Solving Linear and Non-Linear Equations:** Strategies for solving linear, quadratic, and higher-order polynomial equations. Introduction to solving systems of equations using substitution, elimination, and graphical methods, which are essential in multivariate models.	
3.	**Inequalities and Their Applications:** Solving and interpreting inequalities, absolute value inequalities, and applying inequalities in optimization and risk assessment models.	
4.	**Exponential, Logarithmic, and Trigonometric Functions:** Introduction to standard functions, including exponential growth and decay, logarithmic scales, and bounded trigonometric functions, with applications to continuous compounding, interest calculations, and periodic financial models.	
	Unit – IV: Sequences, Series, and the Binomial Theorem	**8 Lectures**
1.	**Sequences and Types:** Introduction to sequences, including arithmetic, geometric, and harmonic sequences. Emphasis on identifying patterns and deriving general terms, crucial for projections in finance and risk management.	
2.	**Series and Summation Notation:** Understanding finite and infinite series, summation	

	notation, and evaluating series sums. Focus on applications to financial annuities, loan repayments, and periodic investments.	
3.	**Convergence and Divergence of Series:** Criteria for convergence and divergence in series. Introduction to convergence tests (e.g., ratio test), important for understanding stability in financial models.	
4.	**The Binomial Theorem and Its Applications:** Expanding binomial expressions, applications to probability models, and expected value calculations. Emphasis on the use of binomial expansion in calculating premiums, payouts, and other probabilistic financial events	
	Unit – V: Calculus - Differentiation, Integration, and Differential Equations	**10 Lectures**
1.	**Limits and Continuity:** Introduction to limits and the concept of continuity. Students will understand the behavior of functions at boundary values, critical for financial models and actuarial calculations.	
2.	**Differentiation Techniques and Applications:** Differentiation rules, including product, quotient, and chain rules, and higher-order derivatives. Applications in analyzing rates of change, sensitivity analysis, and elasticity in economic and financial contexts.	
3.	**Applications of Derivatives in Optimization:** Techniques for finding maxima, minima, and inflection points. Practical applications include optimizing revenue, minimizing risk, and calculating peak points in financial models.	
4.	**Basic Integration and Applications:** Understanding indefinite and definite integrals, integration techniques (e.g., substitution), and applications in calculating areas, accumulation functions, and present value calculations for cash flows.	
5.	**Introduction to Ordinary Differential Equations (ODEs):** Solving first and second-order differential equations, applications in modeling growth and decay, and	

	equilibrium points in finance and risk models.	
	Unit – VI: Matrices, Vectors, and Multivariate Analysis	**7 Lectures**
1.	**Vectors and Their Properties:** Introduction to vectors, vector addition, scalar multiplication, dot products, and orthogonality. Applications in representing multi-dimensional data and understanding directional movement in risk assessment.	
2.	**Matrix Algebra:** Understanding matrix types, matrix operations (addition, subtraction, multiplication), and properties such as transpose and determinants, crucial for financial modeling and data analysis.	
3.	**Solving Systems of Linear Equations with Matrices:** Gaussian elimination and matrix inversion methods to solve linear systems. Practical applications in portfolio optimization, resource allocation, and multivariate problem-solving.	
4.	**Eigenvalues and Eigenvectors:** Introduction to eigenvalues and eigenvectors and their role in transformations, stability analysis, and principal component analysis (PCA), commonly used in risk and data modeling.	

Skill Enhancement Elective Course

	Course Title : Introduction to Basic Excel	**Credits: 01** **Lectures/Week: 01**
Course description	The "Introduction to Basic Excel" course is designed as a foundational, practical course for students aiming to acquire essential Excel skills for data organization, basic analysis, and visualization. This 1-credit, 30-hour course introduces students to the Excel interface, core functionalities, and essential tools that facilitate effective data management. Through step-by-step exercises, students learn cell referencing, basic formulas, data sorting, filtering, and visualization techniques. This course prepares students for advanced Excel applications, emphasizing accuracy, efficiency, and presentation in data handling.	
Learning objectives	1. **Understand the Excel Interface**: Navigate Excel's workspace efficiently, understanding its layout, toolbars, and workbook structure. 2. **Master Basic Cell Operations**: Perform essential operations, including data entry, referencing, and formatting cells for readability. 3. **Apply Basic Formulas and Functions**: Use arithmetic and logical functions for simple data analysis. 4. **Organize and Validate Data**: Sort, filter, and validate data to ensure accuracy and ease of analysis. 5. **Create Basic Visualizations**: Generate charts and sparklines to represent data visually, enhancing data interpretation. 6. **Develop Professional Practices**: Structure and document spreadsheets effectively for professional use and clarity.	
Course Outcomes	Upon completion, students will be able to: 1. Navigate and manage Excel workbooks, using essential cell operations for data entry and management. 2. Format cells and data tables to improve readability and maintain data integrity. 3. Create and troubleshoot basic formulas, applying functions like SUM, AVERAGE, IF, and COUNT. 4. Sort, filter, and validate data to extract insights and maintain consistency in datasets. 5. Develop clear, professional charts and sparklines, utilizing Excel's visualization tools. 6. Implement best practices in spreadsheet organization, creating templates and using documentation techniques for professional, reusable Excel files.	

	Practical	**30 Hours**
Sub Unit	**Unit – I: Excel Interface and Basic Operations**	**5 Hours**
1.	**Understanding the Excel Interface**: • Navigating the Excel workspace: ribbons, tabs, and quick access toolbar. • Basic workbook structure: sheets, cells, rows, and columns. • Overview of file management: creating, saving, and organizing Excel files effectively.	
2.	**Cell Operations**: • Basic data entry: entering, editing, and clearing cell content. • Copying, cutting, pasting, moving, and deleting cells and ranges. • Using cell referencing: understanding relative, absolute, and mixed cell references to maintain formula accuracy.	
	Unit – II: Data Entry and Formatting Techniques	**5 Hours**
1.	**Data Types and Formatting Basics**: • Entering different data types: text, numbers, dates, and times. • Formatting cells: applying number formats (currency, percentages, dates). • Basic text formatting: font styles, size, color, and text alignment.	
2.	**Data Organization and Table Creation**: • Organizing data with rows and columns: inserting, deleting, resizing. • Creating tables with headers for structured data analysis. • Freezing and unfreezing panes for easier navigation in large datasets.	

3.	**Conditional Formatting**: • Using basic conditional formatting to highlight data (e.g., color scales, data bars). • Custom rules for conditional formatting (e.g., highlighting values above a certain threshold).	
	Unit – III: Formulas and Key Functions	**8 Hours**
1.	**Introduction to Formulas and Calculations**: • Writing basic formulas with arithmetic operators (+, -, *, /). • Understanding the order of operations (PEMDAS) to ensure formula accuracy.	
2.	**Essential Functions for Basic Analysis**: • Core statistical functions: SUM, AVERAGE, MIN, MAX, MEDIAN for summarizing data. • Counting functions: COUNT (for numbers), COUNTA (for non-empty cells).	
3.	**Logical Functions**: • Using IF functions for conditional calculations: creating basic logic statements. • Introduction to combining IF with AND, OR for multiple conditions.	
4.	**Error Handling**: • Identifying and understanding common error messages (#VALUE!, #DIV/0!, etc.). • Basic troubleshooting techniques to correct common formula errors.	
	Unit – IV: Data Sorting, Filtering, and Validation	**6 Hours**

1.	**Sorting Data**: • Sorting data by single criteria (e.g., alphabetically or numerically). • Multi-level sorting (e.g., sorting by name, then by date) for more complex data arrangements.	
2.	**Filtering for Data Analysis**: • Using filters to extract specific data subsets (e.g., by criteria or date range). • Custom filters to work with text, numbers, or dates effectively.	
3.	**Data Validation**: • Introduction to data validation for controlling data entry. • Creating drop-down lists for consistent data input. • Setting data validation rules (e.g., restricting entries to certain ranges or formats).	
	Unit – V: Data Visualization Basics	**6 Hours**
1.	**Creating Basic Charts**: • Overview of chart types: bar, column, line, and pie charts, with guidance on when to use each type. • Step-by-step chart creation, focusing on selecting and setting up data ranges.	
2.	**Chart Customization**: • Customizing chart elements: adding and formatting titles, axis labels, legends, and data labels. • Modifying data series and adjusting axis scales for better visualization.	
3.	**Using Sparklines**:	

	• Creating sparklines to display quick trends within cells (e.g., line or bar sparklines). • Practical applications of sparklines for mini-trends analysis within tables.	
	Unit – VI: Data Visualization Basics (Optional Extension)	**4 Hours**
1.	**Organizational Techniques**: • Structuring spreadsheets for readability and auditability: using headers, footers, and clear section labels. • Best practices in organizing sheets and using consistent formats for long-term clarity.	
2.	**Avoiding Common Pitfalls**: • Ensuring calculation accuracy by avoiding hard-coding values in formulas. • Best practices for documenting work, including comments and clear labeling of key sections.	
3.	**Templates for Repeated Use**: • Introduction to creating and saving templates for recurring reports or data entry tasks. • Tips for using Excel templates to streamline tasks and maintain consistency.	

Vocational Skill Elective Course

	Course Title : Introduction to R Programming and Python	**Credits: 01** **Lectures/Week: 01**
Course description	This course provides a comprehensive foundation in R and Python programming, focusing on data handling, basic programming concepts, and data visualization. Students will gain hands-on experience with essential data manipulation techniques, statistical summaries, and visualization libraries. This course prepares students for advanced statistical analysis, financial modeling, and actuarial applications in future semesters by building practical skills in programming and data analysis.	
Learning objectives	7. Introduce students to the R and Python programming environments, including syntax, interfaces, and basic commands. 8. Develop proficiency with core data types and data structures, such as vectors, data frames, lists, and dictionaries, in both R and Python. 9. Teach essential data manipulation techniques for importing, cleaning, transforming, and summarizing datasets. 10. Build foundational skills in data visualization using ggplot2 in R and matplotlib and seaborn in Python. 11. Enable students to write basic functions and apply programming constructs like loops, conditionals, and error handling for effective data processing.	
Course Outcomes	Upon successful completion of this course, students will be able to: 1. Navigate and use RStudio and Jupyter Notebook environments to perform data analysis tasks. 2. Work with fundamental data structures and apply data handling techniques in both R and Python. 3. Perform basic data cleaning, manipulation, and statistical summary calculations on datasets. 4. Create clear, insightful data visualizations using standard plotting libraries in R and Python. 5. Write functions, use loops and conditionals, and apply error handling in both R and Python, preparing them for more complex applications in actuarial and financial analysis.	
	Practical	**30 Hours**
Sub Unit	**Unit – I: R Environment, Data Types, and Basic**	**6 Hours**

	Operations	
1.	**Introduction to R and RStudio:** • Installation and setup of R and RStudio. • Understanding the RStudio interface: Console, Environment, Script Editor, and Files pane. • Writing and running R scripts, basic R syntax, managing the workspace.	
2.	**Core Data Types and Structures:** • Working with primary data types: numeric, character, logical, and factors. • Introduction to data structures: creating and manipulating vectors, matrices, lists, and data frames.	
3.	**Basic Operations and Data Exploration:** • Performing basic arithmetic and logical operations. • Using functions like head(), tail(), summary(), str() to inspect and understand data. • Subsetting data frames by rows and columns, filtering data using conditions.	
4.	**File Paths and Working Directories**: • Setting and managing working directories and file paths in R. • Understanding relative and absolute paths for reading and writing files.	
	Unit – II: Data Manipulation and Importing/Exporting Data in R	**6 Hours**
1.	**Data Import and Export:** • Reading and writing data from CSV, Excel, and text files. • Using readr and dplyr packages to streamline data	

	import and manipulation.	
2.	**Data Cleaning and Transformation:** • Handling missing values, renaming columns, converting data types for analysis. • Introduction to key dplyr functions: select() for choosing columns, filter() for row selection, mutate() for creating new variables, summarize() for aggregating data, and arrange() for ordering rows. • Grouped operations for summary statistics and data aggregation, including group_by() and summarize().	
3.	**Basic Statistical Summaries**: • Calculating mean, median, variance, and mode within datasets. • Applying group-wise aggregations for segmented data analysis.	
	Unit – III: : Data Visualization, String Manipulation, and Basic Programming in R	**6 Hours**
1.	**Data Visualization with ggplot2:** • Introduction to ggplot2 for creating high-quality plots and visualizations. • Creating common chart types: scatter plots, bar charts, histograms, boxplots, and line graphs. • Customizing visualizations: adjusting titles, labels, color schemes, and themes. • Understanding how ggplot2 handles different data types (categorical vs. continuous).	
2.	**String Manipulation Basics:** • Using functions such as paste, substring, toupper, and tolower for basic string handling.	
3.	**Basic Programming Concepts in R:**	

	• Writing simple functions with parameters and return values. • Using loops (for, while) to iterate over data and conditional statements (if, else) for control flow in data processing.	
4.	**Basic Error Handling**: • Introduction to tryCatch for simple error handling in R.	
	Unit – IV: Python Environment, Data Types, Core Libraries, and String Manipulation	**6 Hours**
1.	**Introduction to Python and Jupyter Notebook:** • Installation of Python and Jupyter Notebook, navigating the Jupyter interface. • Writing and running in Jupyter notebooks, understanding code cells, markdown cells, and notebook organization.	
2.	**Data Types and Core Data Structures**: • Fundamental Python data types: integers, floats, strings, and booleans. • Working with data structures: lists (creating, appending, indexing, slicing), tuples (immutable lists), dictionaries (key-value pairs), and sets (unique elements).	
3.	**Introduction to NumPy and Pandas:** • Basics of NumPy for array operations: creating arrays, reshaping, indexing, and slicing. • Using Pandas to create, inspect, and manipulate data frames.	
4.	**String Manipulation Basics:** Handling strings with len, upper, lower, split, join, and slicing for text-based data.	

	Unit – V: Data Handling, Basic Programming, and Error Handling in Python	**6 Hours**
1.	**Data Analysis with Pandas:** • Importing and exporting data using Pandas (CSV, Excel). • Data cleaning techniques: handling missing values, renaming columns, changing data types. • Data transformation and analysis with groupby operations and aggregation functions.	
2.	**Python Programming Basics:** • Writing functions with arguments, return values, and default parameters. • Using loops (for, while) to process data, and conditional statements (if, else) to control program flow. • Introduction to list comprehensions for efficient data processing and cleaner code.	
3.	**Basic Error Handling**: • Using try-except blocks for basic error handling in Python to manage and debug code.	

Discipline Specific Core Courses – Major Courses

	Course Title : Quantitative Finance Essentials	**Credits: 03 Lectures/Week: 03**
Course description	This course explores financial mathematics, focusing on valuation, interest rate theories, and risk management. The curriculum provides both theoretical insights and practical skills, preparing students to analyze and apply mathematical concepts across real-world financial contexts. Each module builds progressively, covering fundamental principles, project appraisals, loan structures, bond and equity valuations, interest rate dynamics, and immunisation techniques.	
Learning objectives	1. Master foundational principles in financial mathematics, including valuation and time value concepts. 2. Develop skills to analyze loans, bonds, equities, and investment projects. 3. Interpret and assess the term structure of interest rates for financial applications. 4. Apply advanced techniques for managing interest rate risk using duration, convexity, and immunisation.	
Course Outcomes	1. Upon completion, students will be able to: 2. Employ the equation of value in cash flow valuation. 3. Design and analyze structured loan repayment plans. 4. Evaluate investment projects with metrics such as NPV, IRR, and payback period. 5. Assess bond and equity valuations, factoring in yields and tax considerations. 6. Analyze the term structure of interest rates and derive spot and forward rates. 7. Use duration and convexity to manage interest rate risk and employ immunisation strategies.	
	THEORY	**45 Lectures**
Sub Unit	**Unit – I: Fundamentals of the Equation of Value**	**3 Lectures**
1.	**Conceptual Foundation**: Define the equation of value as a central concept in financial mathematics, introducing its role in establishing equivalence between cash flows at different times.	
2.	**Conditions for Solvability**: Identify essential conditions for obtaining exact solutions within the equation of value framework.	

3.	**Practical Applications**: Demonstrate applications of the equation of value in basic financial calculations, setting the stage for more complex financial instruments.	
	Unit – II: Loan Structuring and Repayment Analysis	**6 Lectures**
1.	**Loan Amortization**: Explain the amortization process, emphasizing repayment structures that combine interest and principal in scheduled payments.	
2.	**Effective Interest Rate (APR)**: Calculate the annual percentage rate to facilitate comparison across different loan structures and costs.	
3.	**Repayment Schedules**: Construct comprehensive repayment schedules, illustrating the allocation of each payment toward interest and principal reduction.	
4.	**Advanced Loan Scenarios**: Discuss special cases, such as loans with balloon payments, variable interest rates, and refinancing options.	
	Unit – III: Investment Appraisal and Project Valuation	**10 Lectures**
1.	**Discounted Cash Flow (DCF) Techniques**: Calculate net present value (NPV) and accumulated profit using appropriate discount rates for future cash flows, laying the foundation for financial decision-making.	
2.	**Internal Rate of Return (IRR) and Payback Metrics**: Use IRR and payback period metrics, including the discounted payback period, to assess investment attractiveness and feasibility.	
3.	**Comparative Decision Framework**: Analyze these metrics within the context of project selection and prioritization, evaluating investment viability in terms of profitability, risk, and time horizon.	
	Unit – IV: Valuation of Bonds, Equities, and Financial Instruments	**10 Lectures**
1.	**Bond Pricing and Yield Calculations**: Calculate bond prices, running yields, and redemption yields, addressing tax impacts on income and capital gains. Highlight techniques for fixed-interest and index-linked bonds.	
2.	**Yield Boundaries for Bonds with Flexible Redemption Dates**: Define and compute upper and lower bounds for bonds when the	

	redemption date is within a range, allowing for the borrower's optionality.	
3.	**Equity Valuation**: Evaluate ordinary shares based on expected dividend growth models, considering constant and variable growth rates in assessing fair value.	
4.	**Property Valuation**: Calculate property yields under varying rent growth assumptions, assessing investment in property as a long-term financial asset.	
	Unit – V: Term Structure of Interest Rates	**6 Lectures**
1.	**Determinants of Interest Rate Structures**: Analyze the main economic drivers influencing the term structure, such as inflation expectations, monetary policy, and macroeconomic conditions.	
2.	**Spot and Forward Rate Theory**: Derive and interpret discrete and continuous spot and forward rates, applying these concepts to assess yield curves and predict future interest rate movements.	
3.	**Par Yield and Yield to Maturity**: Define par yield and yield to maturity, discussing their implications in bond pricing, investor returns, and market yield curve analysis.	
	Unit – V: Duration, Convexity, and Interest Rate Immunisation	**10 Lectures**
1.	**Duration and Convexity**: Define duration and convexity as measures of cash flow sensitivity to interest rate changes. Discuss their relevance in assessing interest rate risk for both individual bonds and portfolios.	
2.	**Managing Interest Rate Risk with Duration and Convexity**: Illustrate how these metrics are applied in constructing portfolios that are less susceptible to interest rate fluctuations.	
3.	**Redington's Immunisation Strategy**: Introduce Redington's immunisation theory, emphasizing techniques to stabilize liability portfolios. Use practical examples to demonstrate the application of immunisation strategies to mitigate interest rate risk.	

	Course Title: Quantitative Finance Essentials II Practical	**Credits: 01** **Practical/Week: 2 Hours**
	• Solve various cash flow problems using the equation of value, demonstrating adjustments for different time periods and interest rates through detailed manual calculations. • Participate in group discussions analyzing real-world case studies that utilize the equation of value, evaluating the implications of these cases in financial decision-making. • Manually construct amortization schedules for various loan types, detailing the breakdown of each payment into interest and principal components using provided loan terms (principal, interest rate, term length). • Conduct workshops where students create hypothetical loan scenarios (e.g., fixed vs. variable rates) and calculate total payments and interest over the loan's lifetime. • Using cash flow projections from hypothetical projects, manually calculate net present value (NPV) and internal rate of return (IRR), interpreting the results in the context of investment decision-making. • Work collaboratively in groups to assess a proposed investment project, utilizing manual calculations to evaluate project viability and presenting findings on key metrics. • Perform manual calculations to determine the prices of various bonds (fixed and index-linked) based on provided coupon rates and maturity dates, including the impact of taxes on cash flows. • Engage in a role-playing exercise where students present and defend different equity valuation methods based on hypothetical scenarios of dividend growth. • Collect and analyze historical interest rate data from reputable sources, drawing conclusions about trends and their implications for the term structure of interest rates. • Create spot and forward rate curves manually using provided interest rate data and discuss their influence on investment	

	decisions. • Manually calculate the duration of various bonds and portfolios based on cash flow data, emphasizing how duration measures sensitivity to interest rate changes. • Engage in practical exercises to compute the convexity of cash flows, discussing the significance of convexity in assessing bond price movements due to interest rate fluctuations. • Review and analyze case studies of organizations that successfully implemented immunisation strategies, evaluating the methods used and their effectiveness in managing interest rate risk. • Develop and analyze mock portfolios based on hypothetical cash flows and liabilities, strategizing adjustments to achieve immunisation against interest rate changes. • Maintain reflective journals documenting experiences, calculations, and insights from each practical activity. • Present findings from group projects and case studies, highlighting key calculations and their financial implications. • Prepare and submit detailed reports summarizing manual calculations, methodologies employed, and outcomes from practical activities.

	Course Title : Inference and Credibility Analysis	**Credits: 03 Lectures/Week: 03**
Course description	This course provides a thorough introduction to statistical inference, including both frequentist and Bayesian methods. Covering foundational concepts in sampling theory, estimation techniques, interval estimation, hypothesis testing, and credibility theory, the syllabus prepares students for applications in actuarial science and finance.	
Learning objectives	1. To understand core principles in statistical inference and sampling theory, including the Central Limit Theorem. 2. To apply estimation techniques, including confidence and prediction	

	intervals, for various statistical parameters. 3. To perform hypothesis tests on statistical parameters across multiple distributions. 4. To develop foundational skills in Bayesian inference and credibility theory.	
Course Outcomes	Upon completing this course, students will be able to: 1. Apply statistical inference principles, including the Central Limit Theorem and sampling distributions. 2. Construct and interpret confidence and prediction intervals for parameters in normal, binomial, and Poisson populations. 3. Conduct hypothesis tests for means, variances, and proportions across specified distributions. 4. Derive Bayesian estimates using loss functions and apply credibility theory in actuarial contexts.	
	THEORY	**45 Lectures**
Sub Unit	**Unit – I: Foundations of Statistical Inference and Central Limit Theorem**	**6 Lectures**
1.	**Introduction to Statistical Inference**: Key concepts in statistical inference, differentiating populations from samples, and an introduction to parameters and statistics.	
2.	**Sampling Distributions**: Explanation of sampling distributions for sample means and variances, setting a foundation for inferential statistics.	
3.	**Central Limit Theorem (CLT)**: Statement and application of the Central Limit Theorem, emphasizing its importance in approximating sampling distributions for means.	
4.	**Applications of CLT in Actuarial Science**: Practical applications, such as estimating aggregated claims or averages in finance and insurance.	
	Unit – II: Estimation Techniques and Properties of Estimators	**6 Lectures**
1.	**Point Estimation Methods**: Detailed study of point estimation, covering methods such as the method of moments and maximum likelihood estimation (MLE).	
2.	**Properties of Estimators**: Comprehensive discussion on	

	important properties of estimators—bias, efficiency, consistency, and mean squared error—and their implications for estimator selection.	
3.	**Introduction to Interval Estimation**: Basic principles of interval estimation, setting up the foundation for confidence and prediction intervals.	
	Unit – III: Confidence and Prediction Intervals	**8 Lectures**
1.	**Confidence Intervals for Parameters**: Constructing and interpreting confidence intervals for population parameters (means, variances, proportions) across normal, binomial, and Poisson distributions.	
2.	**Comparing Means and Variances Across Populations**: Constructing confidence intervals for differences in means and ratios of variances in two-sample cases, applicable to normal, binomial, and Poisson populations.	
3.	**Prediction Intervals**: Definition, construction, and interpretation of prediction intervals for estimating the range for future observations based on sample data.	
4.	**Applications in Actuarial Science**: Practical exercises involving confidence and prediction intervals for real-world problems, such as reserve ranges and risk metrics.	
	Unit – IV: Hypothesis Testing and Goodness of Fit	**10 Lectures**
1.	**Hypothesis Testing Framework**: Introduction to the hypothesis testing process, including formulating null and alternative hypotheses, type I and type II errors, and significance levels.	
2.	**One-Sample and Two-Sample Tests**: Hypothesis tests for one-sample and two-sample cases, focusing on means, variances, and proportions for normal, binomial, and Poisson distributions.	
3.	**Tests for Differences and Ratios**: Hypothesis tests for comparing differences in means and ratios of variances between two populations, with examples in actuarial and financial contexts.	
4.	**Chi-square Tests for Independence and Goodness of Fit**: Application of chi-square tests for evaluating independence of categorical variables and goodness of fit.	
5.	**Likelihood Ratio and Power of a Test**: Explanation of the	

	likelihood ratio and power of a test, with practical examples in hypothesis testing.	
	Unit – V: Bayesian Inference and Credible Intervals	**8 Lectures**
1.	**Fundamental Concepts in Bayesian Inference**: Introduction to Bayesian inference, including prior beliefs, likelihood functions, and posterior distributions.	
2.	**Bayes' Theorem**: Application of Bayes' theorem for posterior probability calculation, focusing on conceptual understanding without computational complexity.	
3.	**Simple Loss Functions and Bayesian Estimates**: Explanation of loss functions, including simple loss functions like squared error, and deriving Bayesian estimates for parameters.	
4.	**Credible Intervals**: Constructing credible intervals as Bayesian counterparts to confidence intervals, with interpretation and comparison in simple cases.	
	Unit – VI: Credibility Theory and Actuarial Applications	**7 Lectures**
1.	**Introduction to Credibility Theory**: Overview of credibility theory, highlighting its importance in actuarial science for adjusting premiums and predicting claims.	
2.	**Credibility Premium Formula**: Explanation of the credibility premium formula, including the calculation of credibility factors and their role in weighted premium estimation.	
3.	**Bayesian Approach to Credibility**: Application of Bayesian principles to credibility theory, integrating prior information with observed data for premium calculations.	
4.	**Empirical Bayes Approach to Credibility**: Explanation of empirical Bayes methods, useful when prior distributions are derived from historical data rather than subjective beliefs.	
5.	**Comparing Bayesian and Empirical Bayes Approaches**: Discussion on differences, including assumptions and limitations, with practical examples in finance and insurance.	

	Course Title: Inference and Credibility Analysis II Practical	**Credits: 01** **Practical/Week: 2 Hours**
	• Generate sampling distributions of sample means and variances manually by drawing random samples from a known population. Analyze how these distributions approach normality as sample size increases through manual calculations. • Calculate point estimates (mean, median, mode) for a provided dataset. Compare these estimates to known population parameters (if available) and discuss the accuracy of the estimates. • Manually calculate confidence intervals for means and proportions using various datasets from normal, binomial, and Poisson distributions. Include complex scenarios with small sample sizes and finite populations to deepen understanding. • Derive and analyze prediction intervals for future observations based on sample data. Include complex cases with different data distributions and discuss the impact of sample size on interval width. • Conduct one-sample hypothesis tests (t-tests) for evaluating population means using manual calculations. Formulate null and alternative hypotheses, perform the calculations, and interpret the results, including p-values and confidence intervals. • Perform two-sample hypothesis tests to compare means, including independent and paired sample t-tests. Manually calculate the test statistics and interpret the results in the context of the problem. • Perform hypothesis tests for proportions, analyzing data from binomial distributions. Use manual calculations to determine test statistics and compare with critical values. • Conduct chi-square tests for independence using contingency tables. Manually calculate the expected frequencies, chi-square statistics, and interpret the results to evaluate relationships between categorical variables. • Implement chi-square goodness of fit tests by calculating the expected	

	frequencies for a theoretical distribution and comparing them with observed frequencies using manual calculations. • Define prior distributions based on historical data and manually apply Bayes' theorem to update beliefs with new evidence. Calculate posterior distributions and derive credible intervals without software. • Explore loss functions in Bayesian estimation by calculating expected loss for different estimators manually. Analyze how different loss functions impact the choice of estimators. • Apply the credibility premium formula to case studies involving premium calculations. Manually calculate credibility factors and derive credibility premiums, emphasizing different data scenarios. • Analyze datasets to derive empirical Bayes estimates by calculating prior distributions from observed data. Discuss how these estimates can influence decision-making in actuarial contexts. • Prepare a comprehensive report summarizing the findings from practical activities, including manual calculations, statistical methods used, results obtained, and their implications for real-world decision-making. • Analyze complex real-world case studies that involve statistical inference and credibility analysis in actuarial contexts. Perform manual calculations to derive insights and discuss the relevance of statistical methods used. • Work in groups to prepare and present findings from practical activities and case studies to peers, focusing on manual calculations and clear articulation of statistical concepts and implications. • Maintain a journal documenting insights, challenges, and learning experiences from practical sessions, emphasizing the manual calculations performed and their relation to the theoretical concepts covered in the course.

Minor Core Courses

	Course Title : Macroeconomic Analysis	**Credits: 02 Lectures/Week: 02**
Course description	This course provides a comprehensive exploration of macroeconomic principles, emphasizing the interplay between economic policies, global factors, and financial systems. Students will engage with historical events, theoretical frameworks, and contemporary case studies to understand how macroeconomic forces shape stability, growth, and crises. The course is designed to enhance critical thinking and analytical skills, preparing students for careers in finance, economics, and actuarial science.	
Learning objectives	□ To analyze the evolution of macroeconomic theories and their practical applications. □ To examine significant economic events and their long-term impacts on policy and practice. □ To explore the roles of government intervention, monetary policy, and international organizations in maintaining economic stability. □ To understand globalization, trade dynamics, and the implications of financial systems on business and economic development.	
Course Outcomes	Upon completion, students will be able to: 10. Apply macroeconomic theories to evaluate policy decisions and economic conditions. 11. Critically assess economic crises and interpret their implications for global stability. 12. Analyze government interventions and economic indicators in various contexts. 13. Understand globalization's effects on trade, exchange rates, and business growth.	
	THEORY	**30 Lectures**
Sub Unit	**Unit – I: Foundations of Macroeconomic Thought and Historical Perspectives**	**5 Lectures**
1.	**Macroeconomic Theories** • Overview of classical, Keynesian, Monetarist, and	

	Austrian schools of thought, discussing their core principles and assumptions. • Theoretical implications addressing inflation, unemployment, and economic growth.	
2.	**Historical Economic Crises** • Analysis of major crises, such as the Great Depression and the 2008 financial crisis, focusing on causes, consequences, and recovery strategies. • Discussion on how these events led to shifts in macroeconomic policy frameworks and theories.	
3.	**Lessons from History** • Crisis management and policy reform based on historical responses to economic crises. • Influence on modern economics and policy decisions.	
	Unit – II: The 2008 Financial Crisis and Global Responses	**5 Lectures**
1.	**Understanding the 2008 Crisis** • Systemic risk factors, market behavior, and the conditions leading to the crisis. • Impact on global economies, particularly banking, housing, and consumer markets.	
2.	**Economic Impacts** • Analysis of the crisis's impact on various sectors and social consequences, including rising unemployment and shifts in public sentiment.	
3.	**Policy Responses and Effectiveness** • Evaluation of fiscal and monetary policies implemented in response to the crisis, including stimulus packages and interest rate adjustments. • Analysis of the effectiveness and limitations of these	

	measures.	
4.	**Regulatory Reforms** • Examination of post-crisis regulatory changes such as the Dodd-Frank Act and Basel III. • The stimulus-austerity debate and its implications for economic recovery.	
	Unit – III: Government, Market Failures, and Social Efficiency	**5 Lectures**
1.	**Government Intervention Rationale** • Detailed discussion of market failures, including public goods, externalities, and information asymmetries. • Analysis of social welfare considerations in government intervention.	
2.	**Corrective Policies and Regulation** • Examination of various forms of government intervention, including taxation, subsidies, and regulation. • Assessment of the effectiveness and potential drawbacks of these interventions.	
3.	**Competition Policy and Market Regulation** • Overview of competition policy, its objectives, and effectiveness in promoting market efficiency. • Case studies on real-world applications of competition policy.	
	Unit – IV: Globalization, Trade, and Economic Integration	**5 Lectures**
1.	**Understanding Globalization**	

	• Exploration of the economic, technological, and political factors driving globalization. • Discussion of the impacts on domestic markets, industries, and labor.	
2.	**International Trade Theories** • Examination of the theory of comparative advantage and its implications for trade policies. • Analysis of trade barriers, protectionism, and their impacts.	
3.	**Role of International Institutions** • Overview of the role of the World Trade Organization in facilitating international trade. • Examination of regional trade agreements and their impacts on economic integration.	
4.	**Global Economic Challenges** • Discussion of trade imbalances, currency issues, and their implications for global economic stability. • Consideration of sustainable practices in international trade.	
	Unit – V: Monetary Policy, Exchange Rates, and Financial Stability	**5 Lectures**
1.	**Monetary Policy Fundamentals** • Examination of the roles and responsibilities of central banks in managing monetary policy. • Analysis of tools such as interest rate adjustments, open market operations, and reserve requirements.	
2.	**Exchange Rate Dynamics** • Understanding factors influencing exchange rates and the implications for trade and investment. • Discussion of fixed vs. floating exchange rates and	

	their economic impacts.	
3.	**Financial Markets and Economic Stability** • Overview of the structure of financial markets and their role in economic growth and stability. • Analysis of how financial stability influences economic cycles, unemployment, and inflation.	
4.	**Policy Responses to Financial Crises** • Evaluation of policy responses to financial instability and macroprudential regulations. • Discussion of emerging challenges in monetary policy and financial regulation.	

	Course Title : Corporate Financial Insights	**Credits: 02 Lectures/Week: 02**
Course description	This course provides an extensive study of corporate financial reporting, focusing on constructing, interpreting, and analyzing financial statements. It covers foundational accounting principles, the structure and purpose of various financial statements, and complex reporting for specialized entities and consolidated accounts. Through topics such as ESG reporting, ratio analysis, and ethical considerations, students will gain skills in assessing a company's financial health, identifying potential misstatements, and applying critical judgment to financial disclosures. This course prepares students for advanced finance and actuarial roles, adhering to global standards.	
Learning objectives	1. Understand core principles of corporate financial reporting and its importance for transparency and decision-making. 2. Construct and interpret primary financial statements to assess corporate financial health. 3. Develop critical analysis skills using financial ratios, cash flow analysis, and other evaluation tools. 4. Explore the impact of sustainability and ethical standards on financial reporting. 5. Recognize limitations and potential biases in financial reporting.	
Course Outcomes	Upon completion of this course, students will be able to: 1. Prepare and analyze key financial statements, understanding their role in strategic decision-making. 2. Apply ESG reporting frameworks to evaluate the impact of corporate activities on sustainability. 3. Consolidate accounts for complex ownership structures, including subsidiaries and associates. 4. Conduct comprehensive ratio analysis for evaluating company performance. 5. Identify limitations and ethical challenges in financial reporting, applying critical thinking to detect potential misstatements.	
	THEORY	**30 Lectures**
Sub Unit	**Unit – I: Foundations of Financial Reporting and Accounting Principles**	**6 Lectures**
1.	**Purpose and Importance of Financial Reporting:** Explain the objectives of financial reporting, emphasizing its role in	

	providing useful information for decision-making, accountability, and transparency to investors, creditors, and regulatory bodies.	
2.	**Core Accounting Principles:** Detailed study of foundational principles such as going concern (assumption of business continuity), accruals (matching expenses and revenues to the period they occur), consistency (uniformity in accounting methods), prudence (conservative approach to reporting), and materiality (significance of information in decision-making).	
3.	**Introduction to ESG and Sustainability Reporting:** Examine how modern financial reporting includes environmental, social, and governance (ESG) disclosures, addressing investor demand for sustainable practices and ethical considerations in corporate transparency.	
	Unit – II: Structure and Analysis of Core Financial Statements	**8 Lectures**
1.	**Statement of Financial Position (Balance Sheet):** • **Components and Classification:** Explore assets (current and non-current), liabilities, and shareholders' equity. • **Financial Health Indicators:** Analyze liquidity and solvency indicators based on balance sheet components. • **Link with Other Statements:** Understand how the balance sheet interacts with the income statement and cash flow statement to provide a complete financial picture.	
2.	**Income Statement (Statement of Comprehensive Income):** • **Revenue, Expenses, and Profit Analysis:** Examine revenue generation, expense categories, and profit measurement, assessing operational performance. • **Comprehensive Income:** Explain items affecting equity that are not part of profit or loss (e.g., foreign currency translation adjustments), enhancing understanding of total income.	

3.	**Cash Flow Statement:** • **Cash Flow Categories:** Discuss the segregation of cash flows into operating, investing, and financing activities to evaluate liquidity and cash management. • **Importance of Cash Flow Analysis:** Emphasize the role of cash flows in understanding a company's financial flexibility and operational health.	
4.	**Notes to Financial Statements:** • **Additional Disclosures:** Discuss the role of notes in providing details on accounting policies, contingent liabilities, and any events that impact financial interpretation. • **Importance for Transparency:** Explain how notes enhance the clarity and credibility of financial statements.	
	Unit – III: Advanced Financial Reporting for Specialized Entities and Consolidated Accounts	**8 Lectures**
1.	**Financial Reporting for Insurance and Banking Companies:** • **Unique Accounting Treatments:** Explore the distinct financial structures of insurance and banking firms, including the treatment of premiums, reserves, and loan losses. • **Regulatory Requirements:** Brief overview of regulatory standards applicable to financial institutions, emphasizing risk management in financial reporting.	
2.	**Subsidiary and Associate Companies:** • **Definition and Classification:** Differentiate between subsidiaries (entities controlled by a parent) and associates (entities with significant influence). • **Accounting for Different Ownership Structures:** Explain equity method for associates and full consolidation for subsidiaries.	

3.	**Consolidated Financial Statements:** • **Group Financial Reporting:** Learn the process of creating consolidated financial statements, which aggregate financials across all entities under common control. • **Intra-group Transactions and Minority Interests:** Explain how transactions within the group are eliminated to avoid double-counting and how minority interests are represented.	
4.	**Goodwill and its Treatment in Consolidation:** • **Recognition and Valuation of Goodwill:** Introduce the concept of goodwill in acquisitions, its impact on the consolidated balance sheet, and the process of impairment testing. • **Impairment Testing and Financial Implications:** Discuss the treatment of goodwill over time and how impairment reflects economic realities.	
	Unit – IV: Financial Analysis Techniques for Performance and Position Evaluation	**6 Lectures**
1.	**Ratio Analysis and Interpretation:** • **Profitability Ratios:** Calculate and interpret ratios like return on assets (ROA) and return on equity (ROE) to measure profitability. • **Liquidity Ratios:** Use ratios such as the current ratio and quick ratio to evaluate a company's ability to meet short-term obligations. • **Efficiency Ratios:** Explore metrics such as inventory turnover and asset turnover to assess operational efficiency.	
2.	**Dividend and Earnings Ratios:** • **Earnings per Share (EPS) and Dividend Yield:** Analyze EPS as a measure of company profitability for shareholders and dividend yield as a measure of	

	income from investments. • **Dividend Cover:** Evaluate dividend cover to assess a company's ability to sustain dividend payments.	
3.	**Cash Flow Analysis for Liquidity and Stability:** • **Operating Cash Flow:** Understand the implications of cash flow from operations for ongoing business activities. • **Free Cash Flow:** Calculate free cash flow to assess a company's ability to fund expansion, dividends, and debt repayment.	
4.	**Limitations of Ratio Analysis and Financial Interpretation:** • **Impact of External Factors:** Discuss how economic cycles, inflation, and international differences in accounting standards affect ratio interpretation. • **Accounting Choices and Policy Differences:** Examine how variations in accounting policies can impact comparability between companies.	
	Unit – V: Ethical and Practical Limitations of Financial Reporting	**2 Lectures**
1.	**Corporate Governance and Financial Ethics:** • **Ethical Standards in Reporting:** Discuss the role of corporate governance in maintaining ethical standards in financial reporting, promoting transparency and accountability. • **Implications for Stakeholders:** Examine the responsibility of financial professionals in upholding integrity for the benefit of stakeholders, including shareholders and regulators.	
2.	**Limitations of Historical Cost Accounting:** • **Impact on Asset Valuation:** Analyze how historical cost accounting can distort asset values over time, particularly in inflationary environments. • **Alternative Valuation Methods:** Briefly introduce alternative approaches, such as fair value accounting,	

	for a more accurate reflection of current asset values.	
3.	**Detecting Financial Manipulation and Biases:** • **Common Red Flags:** Identify typical signs of financial manipulation, such as aggressive revenue recognition and understated liabilities. • **Role of Critical Thinking in Analysis:** Emphasize the importance of ethical judgment and critical analysis in identifying potential misstatements.	

Open Elective Course

Skill Enhancement Elective Course

	Course Title : Statistical Computing with R	**Credits: 02** **Lectures/Week: 01**
Course description	This advanced R programming course equips students with essential skills in applying statistical techniques using R. Covering probability distributions, joint distributions, simulation, statistical inference, Bayesian analysis, and credibility theory, the course emphasizes hands-on applications to prepare students for complex data analysis and quantitative problem-solving with precision and efficiency.	
Learning objectives	12. Develop proficiency in using R for advanced statistical analysis, focusing on probability distributions, joint distributions, and Bayesian methods. 13. Strengthen skills in statistical inference, hypothesis testing, and credibility theory, enabling students to tackle complex data analysis tasks. 14. Equip students to simulate data scenarios, model probabilities, and apply decision-making based on statistical principles.	
Course Outcomes	Upon completing this course, students will be able to: 6. Perform simulations, model probability distributions, and apply statistical techniques in R. 7. Conduct joint distribution and conditional expectation analysis in complex data scenarios. 8. Apply statistical inference methods, including hypothesis testing, confidence intervals, and parameter estimation. 9. Use Bayesian analysis and credibility theory in R for robust decision-making under uncertainty. 10. Demonstrate advanced R programming skills to solve real-world quantitative challenges across diverse statistical applications.	
	Practical	**60 Hours**
Sub Unit	**Unit – I: Advanced Probability Distributions and Simulation**	**15 Hours**

1.	**Discrete and Continuous Distributions**: • Detailed analysis of discrete distributions relevant to actuarial contexts: geometric, binomial, negative binomial, hypergeometric, and Poisson. • Working with continuous distributions essential for actuarial science, including normal, exponential, gamma, chi-square, t, F, and beta.	
2.	**Poisson Process and Applications**: • Simulation and application of the Poisson process for event modeling in insurance, including inter-arrival times and risk modeling.	
3.	**Simulation of Random Variables**: • Implementing Monte Carlo simulations for actuarial problem-solving. • Using the inverse transform method and rejection sampling to simulate various distributions in complex actuarial scenarios.	
	Unit – II: Joint Distributions and Expectation	**12 Hours**
1.	**Jointly Distributed Random Variables**: • Calculating marginal and conditional distributions and applying them in multi-variable actuarial analysis. • Calculating covariance, correlation, and the expected values of functions involving multiple variables.	
2.	**Conditional Expectation**: • Applying conditional expectation calculations for claims modeling and other actuarial applications.	
3.	**Linear Combinations of Random Variables**: • Understanding and computing mean, variance, and	

	covariance of linear combinations, vital for modeling portfolios and aggregate claims in actuarial science.	
	Unit – III: : Statistical Inference and Hypothesis Testing	**15 Hours**
1.	**Estimation Techniques**: • Applying method of moments and maximum likelihood estimation (MLE) for parameter estimation, with an emphasis on actuarial data applications. • Understanding estimator properties: efficiency, bias, consistency, and asymptotic distribution.	
2.	**Confidence Intervals and Prediction Intervals**: • Constructing confidence intervals for means, proportions, and variances, applying these to actuarial decision-making.	
3.	**Hypothesis Testing**: • Performing hypothesis tests for various scenarios in actuarial data, including t-tests, chi-square tests, and non-parametric tests (e.g., Wilcoxon, Mann-Whitney).	
4.	**Goodness-of-Fit Tests**: • Applying chi-square and Kolmogorov-Smirnov goodness-of-fit tests to validate model assumptions in actuarial contexts.	
	Unit – IV: Bayesian Analysis in Actuarial Science	**10 Hours**
1.	**Bayesian Framework for Actuarial Applications**: • Introduction to Bayesian inference, applying Bayes' theorem for calculating posterior distributions with conjugate priors. • Developing an understanding of prior and posterior	

	distributions, credible intervals, and Bayesian updating in actuarial settings.	
2.	**Loss Functions in Bayesian Estimation**: • Implementing and evaluating Bayesian estimators using quadratic and absolute error loss functions.	
3.	**Bayesian Credibility**: • Applying Bayesian credibility techniques for experience rating and actuarial credibility models, with practical case studies in insurance.	
4.	**String Manipulation Basics:** • Handling strings with len, upper, lower, split, join, and slicing for text-based data.	
	Unit – V: Credibility Theory and Empirical Bayes Methods	**8 Hours**
1.	**Introduction to Credibility Theory**: • Concepts and applications of limited fluctuation and greatest accuracy credibility in actuarial contexts. • Calculating credibility premiums and factors, and understanding their use in insurance pricing and reserving.	
2.	**Empirical Bayes Estimation**: • Applying empirical Bayes methods for parameter estimation in insurance claims modeling and actuarial data analysis. • Comparing empirical Bayes and full Bayesian methods, discussing assumptions and practical limitations in actuarial applications.	

Vocational Skill Elective Course

	Course Title : Advanced Excel with VBA	**Credits: 02** **Lectures/Week: 01**
Course description	"Advanced Excel with VBA" is a hands-on, practical course designed to equip students with advanced Excel functions, data analysis tools, and VBA (Visual Basic for Applications) programming skills. This course delves into complex functions, data analysis techniques, and introduces students to macro automation through VBA, enabling them to create dynamic, interactive dashboards and professional reports. By the end of the course, students will be proficient in optimizing data management processes, automating tasks, and building custom solutions tailored to real-world financial and business scenarios.	
Learning objectives	1. **Master Advanced Excel Functions**: Use dynamic arrays, logical, text, and statistical functions to solve complex problems and perform in-depth data analysis. 2. **Automate Data Management with VBA**: Develop custom VBA macros to streamline repetitive tasks, manage data across multiple sheets, and improve productivity. 3. **Design Interactive User Interfaces**: Create user-friendly dashboards and user forms for enhanced data entry, reporting, and interactive analysis. 4. **Develop Professional Analytical Solutions**: Apply Excel's data analysis and optimization tools like Solver, Goal Seek, and Pivot Tables to financial and business scenarios. 5. **Implement Error-Handling Techniques**: Learn best practices in debugging and handling errors to ensure the accuracy and reliability of VBA scripts and Excel models.	

Course Outcomes	Upon successful completion of this course, students will be able to: 1. Utilize a broad range of advanced Excel functions for dynamic data handling and analysis, enhancing their efficiency in data-related tasks. 2. Create and customize VBA macros to automate tasks, improving consistency and reducing time spent on repetitive processes. 3. Develop interactive dashboards and user forms that facilitate data-driven decision-making in professional settings. 4. Apply data analysis tools effectively for sensitivity analysis, scenario testing, and optimization, enabling robust financial and operational modeling. 5. Execute error-handling and debugging strategies in VBA to maintain high standards of accuracy and professionalism in their Excel projects.	
	Practical	**60 Hours**
Sub Unit	**Unit – I: Advanced Functions and Dynamic Arrays**	**12 Hours**
1.	**Lookup and Reference Functions**: • Mastering VLOOKUP, HLOOKUP, and XLOOKUP for varied data retrieval needs. • INDEX and MATCH for flexible and complex lookups, including two-dimensional lookups. • Combining INDEX and MATCH with conditional functions for dynamic retrieval.	
2.	**Dynamic Array Functions**: • Comprehensive use of SORT, FILTER, UNIQUE, SEQUENCE, and RANDARRAY for dynamic data handling. • Working with multi-cell array formulas for efficient data management.	
3.	**Logical and Conditional Functions**: • Deep dive into nested IF statements, IFS, and SWITCH functions. • Applying conditional functions like SUMIF, AVERAGEIF, COUNTIF, and multi-condition functions (SUMIFS, AVERAGEIFS, COUNTIFS) for	

	advanced calculations.	
4.	**New Functions for Complex Calculations**: • Introduction to LET and LAMBDA functions to simplify and optimize complex formulas.	
	Unit – II: Text, Date, and Statistical Functions	**10 Hours**
1.	**Text Manipulation Functions**: • Advanced text handling: LEFT, RIGHT, MID, CONCATENATE, TEXTJOIN, and TRIM. • Case conversion functions (UPPER, LOWER, PROPER) and using FIND, SEARCH, REPLACE, SUBSTITUTE for text extraction.	
2.	**Date and Time Functions**: • Calculating intervals and durations with DATEDIF, EOMONTH, WORKDAY.INTL, NETWORKDAYS.INTL. • Formatting dates for time-sensitive analysis and using EDATE in financial models.	
3.	**Statistical and Financial Functions**: • Statistical functions: VAR, STDEV, MEDIAN, and MODE. • Financial functions: NPV, XNPV, IRR, XIRR for cash flow analysis.	
	Unit – III: Data Analysis Tools and Optimization Techniques	**10 Hours**
1.	**Data Tables and Sensitivity Analysis**: • Creating and interpreting one-variable and two-variable data tables.	

	• Using data tables for goal-oriented sensitivity analysis.	
2.	**Scenario Analysis**: • Scenario Manager to explore outcomes in finance and actuarial calculations.	
3.	**Goal Seek and Solver**: • Goal Seek for target-based calculations. • Solver for multi-variable optimization problems (e.g., portfolio optimization).	
4.	**Pivot Tables and Pivot Charts**: • Advanced grouping, calculated fields, value filters in pivot tables. • Creating dynamic pivot charts with slicers and timelines.	
	Unit – IV: VBA Fundamentals and Macro Automation	**12 Hours**
1.	**Introduction to the VBA Environment**: • Understanding the VBA editor, setting up macros, using modules. • Variable declarations, data types, and using constants.	
2.	**Macro Recording and Editing**: • Recording macros for automating repetitive tasks, editing recorded macros for enhanced functionality.	
3.	**Variables and Control Structures**: • Using variables, arrays, and constants for efficient coding. • Control structures: If...Then, For...Next, Do...Loop,	

	Select Case.	
4.	**User-Defined Functions (UDFs)**: • Creating reusable UDFs for custom calculations in Excel.	
	Unit – V: Advanced VBA Programming and Error Handling	**8 Hours**
1.	**Advanced VBA Techniques**: • Manipulating and dynamically resizing ranges. • Automating data cleaning, formatting, and data consolidation.	
2.	**Working with Multiple Workbooks and Worksheets**: • Automating tasks across multiple sheets and workbooks. • Building scripts to consolidate data from different sources.	
3.	**Error Handling and Debugging**: • Error handling with On Error statements, debugging techniques with breakpoints and watches.	
	Unit – VI: Interactive Dashboards, User Forms, and Professional Spreadsheet Design	**8 Hours**
1.	**Designing Interactive User Forms**: • Building custom forms for data entry and reporting, adding controls (buttons, text boxes, combo boxes).	
2.	**Automated Dashboards with VBA**:	

	• Integrating pivot tables, slicers, and charts for dynamic dashboards. • Customizing dashboard elements for professional presentation.	
3.	**Automated Report Generation** • Creating automated reports with VBA, exporting reports to PDF and other formats.	
4.	**Best Practices in Spreadsheet Design**: • Structuring spreadsheets for clarity, accuracy, auditability, and efficiency.	