Programme Structure					
Semester	**Course Code**	**Course Name**	**Credit Value**	**Status**	**Th/Pr**
1	MIS1112	Basic statistics in industry	2	C	Th
	MIS1122	Introduction to Probability and Distributions	2	C	Th
	MFM1112	Computing for Finance 1	2	C	Pr
	MSF1113	Calculus I	3	C	Th
	MFM1122	Operational Research I	2	C	Th
	MFM1132	Financial Management	2	C	Th
	MSF1123	Programming Techniques	3	C	Th
2	MIS1213	Mathematical Statistics	3	C	Th
	MIS1222	Statistical Computing (R and Python software)	2	C	Pr
	MFM1213	Financial Mathematics I	3	C	Th
	MFM1222	Introduction to Economics	2	C	Th
	MSF1212	Numerical Analysis I	2	C	Th
	MSF1222	Operational Research II	2	C	Th
	MSF1233	File organization and DBMS	3	C	Th
3	MIS2113	Inferential Statistics	3	C	Th
	MIS2122	Sampling Techniques and survey designs	2	C	Th
	MSF2112	Calculus II	2	C	Th
	MFM2112	Mathematical Economics	2	C	Th
	MSF2122	Research Methodology	2	C	Th
	MSF2132	Linear Algebra	2	C	Th
	MFM2123	Financial Mathematics II	3	C	Th
4	MIS2213	Regression Analysis	3	C	Th
	MIS2223	Survival Analysis	3	C	Th
	MFM2213	Financial Mathematics III (Market Models and Risk Management in Discrete Time)	3	C	Th
	MSF2212	Calculus III	2	C	Th
	MFM2222	Computing for Finance II	2	C	Pr
	MSF2223	Numerical Analysis II	3	C	Th
	MIS2231	Case Study I	1	C	Pr
5	MFM3113	Financial Time Series	3	C	Th
	MIS3113	Design and Analysis of Experiment	3	C	Th

	MFM3123	Life Insurance	3	C	Th
	MFM3133	Financial Mathematics IV (Market Models and Risk Management in Continuous Time)	3	C	Th
	MFM3142	Operational Research III	2	C	Th
	MIS3122	Non-Parametric Statistics	2	C	Th
	MSF3112	Decision Theory	2	C	Th
	MFM3151	Case Study II	1	C	Pr
6	MIS3212	Bayesian Inference	2	C	Th
	MIS3222	Multivariate Data Analysis	2	C	Th
	MFM3213	Non-Life Insurance	3	C	Th
	MFM3222	Computing for Finance III	2	C	Pr
	MFM3232*	Business Proposals and Report Writing	2	C(Elective)	Th
	MSF3212	Fundamentals of Management	2	C	Th
	MSF3222*	Scientific Writing and Communication	2	C(Elective)	Th
	MIS3232	Stochastic Processes	2	C	Th
7	MSF4116	Industrial Training	6	C (Non GPA)	
	MSF4126	Research Project	6	C	
8	MIS4212	Statistical Quality Control	2	O	Th
	MIS4222	Reliability Theory	2	O	Th
	MIS4232	Categorical Data Analysis	2	O	Th
	MFM4212	Credibility	2	O	Th
	MFM4222	Computing for Finance IV	2	C	Pr
	MFM4232	Stochastic Processes in Finance	2	O	Th
	MFM4242	Measure-theoretic Probability with Applications in Finance	2	O	Th
	MIS4241	Statistical Consulting	1	C	Pr
	MFM4252	Introduction to Information Theory & Information Geometry with Applications to Finance	2	O	Th
	MSF4212	Human Resource Management	2	O	Th

MFM3232* and MSF3222* are elective, but one of these options must be taken.

Semester	**1**		
Course Code:	MIS1112		
Course Name:	**Basic Statistics in Industry**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	20	20	-

Course Aim

- This course unit intends to solve some practical problems by statistical methods. It will help students to develop skills in thinking and analyzing problems in industry from a probabilistic and statistical point of view.

Intended Learning Outcomes:

Upon successful completion of the course unit, students will be able to:

- explain clearly concepts from probability and statistics.
- perform statistical representations and computations using computer software.
- apply statistical methods to a range of problems in industry.
- develop the ability to select the relevant statistical methods for analyzing practical problems.

Course Content:

Introduction to Statistics

Population and sample, Types of data, Sources of Data, Descriptive Statistics, Inferential statistics

Descriptive Statistics

Organizing and summarizing Univariate data:

Displaying data with tables and graphs, Displaying numerical data, summarizing data with statistics, describing a distribution

Summarizing relationships between variables:

Scatterplots, correlation, Least squares regression, Relationships among categorical data

Minitab package

Teaching /Learning Methods:

Lectures and practical sessions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 30%	Practical (%) 30%	Other (%)(specify) ……

References/Reading Materials:

- Basic Statistics and Data Analysis, Larry J. Kitchens
- Introduction to Statistics & Data Analysis, Roxy Peck, Chris Olsen, Jay Devore

Semester	**1**		
Course Code:	MIS1122		
Course Name:	**Introduction to Probability and Distributions**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

- improve the basic knowledge of probability theory and statistics
- introduce the concept of probability as quantified uncertainty
- model day to day life problems using simple statistical models

Intended Learning Outcomes:

After following this course unit, the students should be able to

- identify the role of descriptive statistics and the importance of summary measures to describe characteristics of a data set
- explain fundamentals of probability and various probability rules that help students to measure uncertainty.
- describe the characteristics and compute probabilities using both discrete and continuous probability distributions

Course Content:

Introduction to Statistics: Brief introduction of Population, Sample, Descriptive Statistics, Probability Theory, Inferential Statistics;

Probability: Probability definitions; counting rules, permutations and combinations, finite sample space, events, probability rules, conditional probability, independence, multiplication rule, Bayes' theorem;

One dimensional random variables; Probability density function and probability (mass) function, cum. distribution function, expected value, variance, associated theorems, and moment generating function, distribution of functions of random variables;

Discrete distributions: Uniform, Bernoulli, Binomial, Poisson, Hypergeometric, Negative Binomial and their applications;

Continuous distributions: Uniform, Exponential, Normal and their Applications; Central limit theorem (without proof) and applications.

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10%, assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Probability & Statistics for engineers & scientists, Ronald E. Walpole, Raymond H. Myers,Sharon L. Myers and Keying Ye, 9th ed.
- Mathematical Statistics with Applications, Dennis D. Wackerly, William Mendenhall III and Rechard L. Scheaffer, 6th Edition

<table>
<tr><td>Semester</td><td colspan="3">1</td></tr>
<tr><td>Course Code:</td><td colspan="3">MFM1112</td></tr>
<tr><td>Course Name:</td><td colspan="3">Computing for Finance 1</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>-</td><td>60</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ enhance some basic knowledge in excel
➢ obtain experience of simple applications in Financial Mathematics and in statistics using excel
Intended Learning Outcomes:
By the end of this course, the students will be able to
➢ work with many types of data in excel
➢ familiar with many data handling operations available in excel
➢ apply many operations to make simple and advanced financial reports
➢ data analysis</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
➢ Introduction
Overview, Common Excel Errors, Systematic Design Methods, Auditing
➢ Data Organization
➢ Data Analysis
➢ Data Formatting
➢ Data Collaboration
➢ Data Management
➢ Basic Financial Arithmetic and Cash Flows
➢ Basic Statistics</td></tr>
<tr><td colspan="4">Teaching /Learning Methods:
Conducting Practical and Tutorial classes</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
40%</td><td colspan="2">Final Assessment
60%</td></tr>
<tr><td colspan="2" rowspan="2">Details: quizzes :10% mid-term:10%
assignment: 20%</td><td>Theory (%)
……..</td><td>Practical (%)
60%</td><td>Other (%)(specify)
……</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Advanced Excel 2010: Business Finances</td></tr>
</table>

Semester	**1**		
Course Code:	MSF1113		
Course Name:	**Calculus l**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim The objectives of this course unit are to

- introduce students to the basic ideas of elementary logic, real number system, sequences and limits, continuity and differentiability of functions
- develop the theory of real analysis carefully and rigorously from basic principles, giving the student of mathematics the ability to construct, analyze, and critique mathematical proof in analysis.

Intended Learning Outcomes: On completion of this course unit students should be able to

- identify, apply, and manipulate elementary logical expressions
- classify real numbers and analyze their properties with proofs
- analyze convergence and divergence of sequences of numbers
- identify continuity of functions, find limits and derivatives of functions
- demonstrate the knowledge of the content of the major theorems associated with real numbers, sequences, functions and derivatives of functions.
- prove lemmas and theorems on real numbers and functions to make direct applications of those theorems to real problems.

Course Content: (Main topics, Sub topics)

Elementary Logic: Mathematical logic including logical equivalences and Quantifiers, Methods of Mathematical proofs.

Set Theory and Functions: Basic set theory, injective, surjective, bijective functions.

The Real Number System: Extend axiom, Field axioms, Order axiom, Modulus, Inequalities, Upper and Lower bounds, Least upper bound (supremum) and Greatest lower bound (infimum), Completeness axiom.

Sequences: Introducing sequences, Convergence of sequences and related theorems, Subsequences and related results, Monotone sequences, Monotone convergence theorem.

Limits and Continuity of Functions: Limit of functions, Epsilon terminology, Related theorems, Continuity of functions at a point and in an interval, Basic consequences of continuity.

Differentiability and Applications: Differentiable functions, Rules of differentiation, Related theorems, Rolle's Theorem, Mean Value Theorems and Consequences, Maxima, Minima and Critical points of real valued functions, L'Hospital Rule, Applications in Business and Economics.

Teaching /Learning Methods: Lectures, Reading materials, Tutorial discussions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- A First Course in Mathematical Analysis, David Alexander Brannan
- Elements of Real Analysis, Shanthi Narayan, Risinghania, M.D.
- Mathematical Analysis and Applications, Deshpande, J.V.
- Calculus Volume l, One Variable Calculus, with an Introduction to Linear Algebra, Tom M. Apostol

<table>
<tr><td>Semester 1</td><td colspan="3">1</td></tr>
<tr><td>Course Code:</td><td colspan="3">MFM1122</td></tr>
<tr><td>Course Name:</td><td colspan="3">Operational Research I</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>25</td><td>10</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
The aims of this course unit are to acquaint students with
➢ principles and methods of linear programming (LP) and integer linear programming(ILP),
➢ Applications of LP and ILP in finance.
Intended Learning Outcomes:
Upon successful completion of this course, students will be able to:
➢ formulate LP and ILP models in finance,
➢ solve such problems by means of basic solution methods of LP and ILP problems (simplex method in detail) and specialized software tools like LINGO or MS Excel,
➢ analyse given solutions of LP and ILP problems.</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Linear Programming:
Examples and Modelling with LP, Geometric View of LP;
The Simplex Method: Simplex Algorithm, Revised Simplex Algorithm, Two-Phase Simplex Method;
Duality in LP: Dual Linear Programs, Properties and applications of Duality, Dual Simplex Algorithm;
LP Models in Finance: Asset/Liability Cash Flow Matching, Asset Pricing and Arbitrage.
Integer Linear Programming:
Integer Programming Models, Formulating Integer Programs, Cutting Plane Algorithms, Branch and Bound Algorithm;
ILP Models in Finance: Constructing an Index Fund
Practical Component: A few modelling computation tools and software: Excel Solver, AMPL, and Mat Lab will be introduced</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Lectures and Tutorial classes</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
40%</td><td colspan="3">Final Assessment
60%</td></tr>
<tr><td>Details: quizzes :10% , mid-term:10%
assignment: 20%</td><td>Theory (%)

60%</td><td>Practical (%)

……..</td><td>Other (%)(specify)

……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ G.B. Dantzig (1998), Linear Programming and Extensions, Princeton University Press.
➢ B. Kolman, R. E. Beck (1995), Elementary Linear Programming with Applications, Second Edition, Academic Press.
➢ G. Cornuejols, R. Tutuncu (2006) Optimization Methods in Finance,Cambridge University Press.</td></tr>
</table>

<table>
<tr><td>Semester</td><td colspan="3">1</td></tr>
<tr><td>Course Code:</td><td colspan="3">MFM1132</td></tr>
<tr><td>Course Name:</td><td colspan="3">Financial Management</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>30</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ enhance some basic concepts in financial management.
➢ provide appropriate tools and techniques to maximize the firm value.
➢ provide techniques to make investment and financial decisions.
Intended Learning Outcomes:
At the end of this course, the student will be able to;
➢ describe key financial management concepts.
➢ apply financial management concepts and techniques in evaluating alternative investment opportunities.
➢ evaluate the effectiveness of financial management decisions.</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
➢ Introduction to Financial Management
➢ Time value of money
➢ Cost of capital and valuation of capital
➢ Capital investment decisions
➢ Risk, return and portfolio theory
➢ Working capital management
➢ Capital structure theories
➢ Dividend theories and policies
➢ Financial and operating leverage
➢ Emerging issues in financial management</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Lecture and Tutorial classes</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
40%</td><td colspan="2">Final Assessment
60%</td></tr>
<tr><td>Details: quizzes :10% , mid-term:10%
assignment: 20%</td><td>Theory (%)
60%</td><td>Practical (%)
……..</td><td>Other (%)(specify)
……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Pandy, I. M. (2008). Financial Management (12 ed.): New Delhi Vikas
➢ Maheshwari, S. N. (2004). Financial Management- Principle and Practice (5 ed.).
➢ Van Horn, J. C. (2004). Financial Management and Policy (12 ed.). New Delhi.: Prentice-Hall.</td></tr>
</table>

Semester	**1**		
Course Code:	MSF1123		
Course Name:	**Programming Techniques**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	30	90

Course Aim

The objective of the course is to

- enable the student apply high level language for solution of simple scientific problems, and for this purpose
- manipulate the inputs/outputs of a computer program

Intended Learning Outcomes:

Students will be able to

- explain about the basic principles in programming and the problem-solving strategies
- identify the process of creation of computer program, and the different approaches
- use high level language to code write, compile, link, and execute a program with emphasis, on scientific application

Course Content: (Main topics, Sub topics)

- Introduction to programming methodology and problem solving strategies
- Algorithm development using pseudo code
- Basic program structure and the Integrated Development Environment (Essential program structure, Documentation and standard programming practices, Integrated development environment(IDE) Editing ,Compilation, Execution and Debugging)
- Program development using a higher level programming language such as C
- Basic input and output
- Variables and Expressions
- Library functions
- Standard programming practices for variables and assignments
- Decision structures
- Loop Structures
- Input and output using files
- Simple data structures
- Functions
- Introduction to the Object Oriented Approach.

Teaching /Learning Methods:

Lecture: 2 hours per week and Lab work 2 hours per week

Assessment Strategy:

Continuous Assessment 30%	Final Assessment 70%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 70%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Brookshear, J.G., Computer Science, an Overview, Benjamin/Cummings, 1994.
- C. PROGRAMMING. LANGUAGE. Second Edition. Brian W.Kernighan 0 Dennis M. Ritchie. AT&T Bell Laboratories.Murray Hill, New Jersey. PRENTICE HALL.

Semester	**2**		
Course Code:	MIS1213		
Course Name:	**Mathematical Statistics**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

The objective of this course unit is to

- provide students with basic knowledge of two dimensional random variables
- provide skills of applying sampling distributions and other main distributions used in industries.

Intended Learning Outcomes:

On completion of the course the student should be able to:

- solve real world problems associated with joint probability distributions
- apply ideas and theorems of sampling distribution for other distributions
- use various statistical distributions for applications and decisions.

Course Content: (Main topics, Sub topics)

Joint Distributions :

Joint probability distributions, Joint Cumulative Distribution functions, Conditional Distribution functions, Independence and Expectations, Expectation and Variance of linear functions of random variables, Joint Moment Generating functions and Joint moments, Covariance and correlation coefficients.

Distribution of functions of random variables:

Cumulative Distribution Function technique, Moment generating functions technique, Transformation technique.

Order Statistics

Sampling distributions: Random sample, Statistic, Sample moment, Sample mean, Sample variance, Sampling Distributions related to the Normal Distribution. The Distribution of sample mean, Laws of Large numbers, Central Limit theorem and the applications.

Other distributions:

Chi-square Distribution, F Distribution, Student-t-Distribution

Teaching /Learning Methods: Lectures, Discussions and Reading materials

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Mathematical Statistics with Applications Sixth Edition by Dannis D. Wackerly, William Mendenhall III, Richard L Scheaffer
- Mathematical Statistics by John E. Freund

<table>
<tr><td>Semester</td><td colspan="3">2</td></tr>
<tr><td>Course Code:</td><td colspan="3">MIS1222</td></tr>
<tr><td>Course Name:</td><td colspan="3">Statistical Computing (R and Python software)</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>-</td><td>60</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
The main objective is to understand how to do a statistical data analysis using R or Python software.
Intended Learning Outcomes:
After completing this course, students should be able to do the following given practical problems:
➢ Suggest methods to obtain relevant data.
➢ Summarize low-dimensional data sets, both graphical and numerically.
➢ Identify the pattern of the given data set and apply the statistical techniques according to that.</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Summarizing, analysing and representing univariate, bivariate and multivariate data sets with computers using ‘R’ and SPSS</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Lectures and Practical sessions</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
50%</td><td colspan="3">Final Assessment
50%</td></tr>
<tr><td>Details: quizzes :10% , mid-term:10%
assignment: 20%</td><td>Theory (%)
……..</td><td>Practical (%)
50%</td><td>Other (%)(specify)
……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Basic Statistics and Data Analysis, Larry J. Kitchens</td></tr>
</table>

Semester	**2**		
Course Code:	MFM1213		
Course Name:	**Financial Mathematics I**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

The objective of this course unit is to

- enhance the basic knowledge of traditional material in interest theory
- give deep understanding of annuities, loan repayment, bonds
- providesome ideas of Asset Liability Management.
- discuss some real world applications of these financial instruments.

Intended Learning Outcomes:

After successfully completing this course students should be able to

- distinguish different types of interest rates that can be used in real world problems
- calculate annuities and bond prices and apply these concepts in real applications
- identify possible methods in loan repayment and their applications
- explain concepts like duration, convexity and immunization and apply them in asset liability management.

Course Content: (Main topics, Sub topics)

Introduction: Time Value of Money, Compound Interest, Simple Interest, Present Value, Future Value, Accumulation Function, Discount Rate, Continuous Interest, Force of Interest, and Equation of Value.

Annuities: Immediate, Due, Time Lines, Perpetuities, Continuous Annuities, Variable Annuities, and Reinvestment Problems.

Loan Repayment: Amortization, Prospective/Retrospective Methods, Instalment Loan, Sinking Funds, Net Interest, and Capitalization of Interest.

Bonds: Face value, Par value, Coupon rate, Redemption Value, Bond Price, Makeham's Formula, Amortization of Premium/Discount, Callable Bond, Price-Plus Accrued, Market Price, and True Price.

Yield Structure of Interest Rate: Internal Rate of Return, Cash Flows, Borrowing Projects, Time/Dollar Weighted Rates, Portfolio Method, and Net Present Value.

Term Structure Interest Rates: Term Structure of Interest Rates, Risk Free Rates, Yield Curve, and Forward Rate.

Asset Liability Management, Duration and Immunization: Assets, Liabilities Management, Duration, Convexity, Immunization, Stocks, Dividends, and Mutual Funds.

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term: 10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Actuarial Mathematics, Newton L. Bowers, JR, Hans U Gerber, James C Hickman, Donald A Jones, Cecil J Nesbitt, The Society of Actuaries, 1993
- Models for Quantifying Risk, Second Edition, Robin Cunningham, Thomas Herzog, Richard L. London

Semester	**2**		
Course Code:	MFM1222		
Course Name:	**Introduction to Economics**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

This course is designed to

- explore how individuals and societies deal with the fundamental problem of scarce resources
- understand the basic theories of Microeconomics and Macroeconomics
- identify the possible applications of basic theories in Economics in handling real world economic problems

Intended Learning Outcomes:

At the end of the course, the students should be able to:

- Apply the basic principles of microeconomics and macroeconomics for decision making in marketing, production and investment.
- Analyse, evaluate and make choices of alternative uses of scare resources.

Course Content: (Main topics, Sub topics)

- Theory of Production
- Production in the Long-run
- Theory of Cost
- Derivation of Supply and Demand
- Elasticity of Demand and Supply
- Determination of Market Price in Perfect Competition
- Determination of Output, Revenue and Profit
- Imperfect Competition
- Macro Economics: The Business Cycle and National Income
- Inflation and Taxation
- Introduction to Factor Market
- Basic concepts of Project Appraisals

Teaching /Learning Methods:

Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Economics, Mc-Graw Hill, Samulelson, Paul A. and Nordhaus. William D,
- Macroeconomics Theory and Policy, Ahuja, L.H., S.Chand & Company Ltd

Semester	**2**		
Course Code:	MSF1212		
Course Name:	**Numerical Analysis I**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	20	20	-

Course Aim

The primary objectives of this module are to provide

- an introduction to MATLAB
- an overview of how MATLAB's calculator (software) is used to implement interactive computations
- the skills to write MATLAB programs to implement numerical methods
- provide basic computational methods (scientific computing)
- acquaint students with the potentialities of the modern computer for solving the numerical problems that will arise in their professions.
- give the students an opportunity to improve their skills in programming and in problem solving.

Intended Learning Outcomes:

By the end of the course, students will be able to

- describe the basic principles of programming and of implementing mathematical concepts and procedures in MATLAB.
- write efficient programs in MATLAB that uses the underlying vector matrix paradigm to manipulate data and implement numerical solution algorithms.
- produce effective plots of numerical data using MATLAB's various data visualization functions.
- select appropriate numerical methods to apply to various types of problems in applied sciences, concerning accuracy requirements, and available computational resources.
- implement the numerical solution algorithms for problems such as finding roots of equations, curve fitting, interpolation and approximation, numerical differentiation and integration.

Course Content: (Main topics, Sub topics)

Introduction to MATLAB, matrices and vectors and their manipulations, basics of plotting using MATLAB, MATLAB script and function files using loops, conditions and cases, if-then-else statements, logical operations, call functions, arrays/vectors/matrices, plotting and visualization of data, Use of MATLAB programming in solving problems numerically.

Numerical methods in solving nonlinear equations of one variable: Methods of Bisection, Newton's and Fixed Point Iteration, including error estimates, Implementation of each method using MATLAB. Curve fittings, Interpolation: Newton, Lagrange and their error bounds Cubic Splines, Study of implementations via available MATLAB commands.

Approximations, least squared methods (both linear and quadratic), Implementations.

Numerical Differentiation and Integration: Numerical quadrature, Trapezoidal and Simson's rule with their composite forms, Newton Cotes Formulae, Error Analysis, Study of available MATLAB codes for each and writing new codes.

Teaching /Learning Methods: Lectures during practical sessions, Reading Materials, Assignment based learning as laboratory works

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% mid-term:10% assignment: 20%	Theory (%) 30%	Practical (%) 30%	Other (%)(specify) ……

References/Reading Materials:

- MATLAB: An Introduction with Applications, by Amos Gilat, 2nd edition, Wiley, 2004, ISBN-13978-0471694205.
- Applied Numerical Methods with MATLAB" by S.C. Chapra, 3rd Edition 2012 McGraw Hill.
- Numerical Methods Using MATLAB by John H. Mathews and Kurtis D. Fink, 3rd ed. 1999.
- Numerical Analysis, 10th Edition 2014, Richard L. Burden, Youngstown State University J. Douglas Faires, Annette M. Burden

Semester	**2**		
Course Code:	MSF1222		
Course Name:	**Operational Research II**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

The aims of this course unit are to acquaint students with

- basic principles and methods of Goal Programming(GP), and Game Theory (GT), and
- applications of NLP and QP in finance.

Intended Learning Outcomes:

Upon successful completion of this course, students will be able to:

- demonstrate the basic principles of GP and GT,
- build GP and GT models,
- solve such problems by means of basic solution methods of GP and GT,
- analyse given solutions of GP and GT problems.

Course Content: (Main topics, Sub topics)

Goal Programming:

Examples and Modelling with Goal Programming, Goal Programming Algorithms; The Weights Method, The pre-emptive Method, Goal Programming Applications in Financial Management.

Game Theory:

Two Person Zero-Sum Games, The Maximin, Minimax Principle, Games with and without Saddle Points, Dominance Property, Graphical and Algebraic Methods for Solving Games, Fundamental Theorem of Game Theory, Games Theory Models In Finance.

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……	Other (%)(specify) ……

References/Reading Materials:

- Hamdy A. Taha (2007), Operations Research: An Introduction, 8th edition, Pearson Education, INC.
- F. S. Hillier, G. J. Lieberman (2001), Introduction to Operations Research, Seventh Edition, Holden – Day, INC,
- M. J. Schniederjans (1995), Goal Programming: Methodology and Applications, Kluwer Academic.

Semester	**2**		
Course Code:	MSF1233		
Course Name:	File organization & Database Management Systems		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	30	90

Course Aim

- Encourage the learner to understand fundamental concepts necessary for designing, using, and implementing database systems and applications.

Intended Learning Outcomes:

- Identify limitations of file oriented systems
- Define & describe basic DBMS terminologies
- Distinguish among internal, conceptual and external levels using
- ANSI/SPARC three level architecture
- Define and manipulate data using SQL
- Construct entity relational (ER) diagrams
- Explain relational model
- Map ER-to-relational model
- Recognize problems associated with bad relational models
- Construct 1NF, 2NF, 3NF, BCNF relational models
- Retrieve data using Relational algebra and Relational calculus
- Use appropriate techniques for enforcing security in database system

Course Content: (Main topics, Sub topics)

File organization : Introduction to file organization, Storage devices, Disk parameters, Record structure and design, Indexes, Hashing Database

Management Systems: Introduction& Definitions, DBMS Architecture, Data models, DBMS languages, ER model concepts, Relational model concepts, ER-to-relational mapping, Functional dependencies and normalization process, Relational algebra, Relational calculus, Database security and authorization Practical using MySQL

Teaching /Learning Methods:

Lectures, Case studies , Tutorials & Discussions, Practical classes, Assignments & Discussions

Assessment Strategy:

Continuous Assessment 0%	Final Assessment 100%		
Details:…… % ……..% ……..%	Theory (%) 100%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Fundamentals of database systems, Elmasri, Ramez and Navathe,Shamkant B.
- Database management system, Ramakrishnan, Raghu and Gehrke, Johannes
- Modern Database management, McFadden, Fred R

Semester	**3**		
Course Code:	MIS2113		
Course Name:	**Inferential Statistics**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

- The objective of this course unit is to introduce the main ideas of mathematical statistics and how they are used in industrial applications.

Intended Learning Outcomes:

On completion of this course unit the students should be able to

- estimate population parameters.
- explain the differences between an estimator and an estimate.
- identify the properties of estimators
- discuss the concept of confidence interval
- construct a confidence interval for a population parameter.
- formulate null and alternative hypotheses.
- determine which test statistic is suitable for a testing procedure.
- select the level of significance and the criteria for rejection of the null hypotheses

Course Content: (Main topics, Sub topics)

Point estimation: The method of moments, The method of Maximum Likelihood, Properties of point estimation: Unbiasedness, Efficiency, Consistency, Sufficiency; Exponential family, Cramer-Rao Inequality, Rao-Blackwell Theorem., Minimum Variance Unbiased Estimation.

Interval Estimation: Confidence Intervals for the mean and variance,

Test of Hypotheses: Introduction, Simple Hypothesis, Composite Hypothesis, Critical Region, Types of Error, Power function, Size of test, Simple Likelihood–ratio Test, Most powerful Test, Neyman-Pearson lemma, Generalized Likelihood-ratio test, Uniformly Most Powerful test.

Hypothesis testing for mean and variance of the normal population.

Teaching /Learning Methods: Lectures, Discussions and Reading materials

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Probability & statistics for engineers & scientists, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, 9th ed.
- Mathematical Statistics with Applications, Dennis D. Wackerly, William Mendenhall III and Rechard L. Scheaffer, 6th Edition
- Introduction to Probability and Statistics, J. Susan Milton, Jesse C. Arnold

<table>
<tr><td>Semester</td><td colspan="3">3</td></tr>
<tr><td>Course Code:</td><td colspan="3">MIS2122</td></tr>
<tr><td>Course Name:</td><td colspan="3">Sampling Techniques and Survey Designs</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>20</td><td>20</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
➢ The aim of this course unit is to provide students with the knowledge of implementing sampling surveys and using suitable sampling techniques.
Intended Learning Outcomes:
On completion of the course unit, the student should be able to
➢ construct questionnaires in data collection process.
➢ apply suitable sampling techniques for Industrial problems and make estimations and decisions.</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Planning of a survey, Questionnaire design, Problems arising in execution of a survey, Census and samples, The principal steps in a sample survey, The role of sampling theory. The probability and non probability sampling.

The simple random sample, Estimating population mean, variance, total and proportion, Variances of estimates, The finite population correction, Confidence limits, Estimation of a ratio, Sample size determination, Stratified random sampling, Properties of estimates, Proportional allocation, Neymann allocation, Optimum allocation of cost. Relative precision of stratified random and simple random sampling. Systematic sampling, Linear systematic sampling and circular systematic sampling. Quata sampling, Cluster sampling, multistage sampling.</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Lectures and Practical sessions</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
40%</td><td colspan="2">Final Assessment
60%</td></tr>
<tr><td colspan="2" rowspan="2">Details: quizzes :10% mid-term:10%
assignment: 20%</td><td>Theory (%)

30%</td><td>Practical (%)

30%</td><td>Other (%)(specify)
……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Sampling techniques- Third edition by William G Cochran.</td></tr>
</table>

Semester	**3**		
Course Code:	MSF2112		
Course Name:	**Calculus ll**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30		

Course Aim

The objectives of this course unit are to provide the students with the understanding of

- different forms of infinite sequences and series, and their convergences
- the concept of Riemann integration of functions.

Intended Learning Outcomes:

On completion of the course unit the students will be able to

- discuss the convergence of infinite sequences and series.
- evaluate definite integrals and find areas under functions using Riemann integration.

Course Content: (Main topics, Sub topics)

Infinite series: Infinite series with positive terms, Alternating series and there convergence. Convergence of series of functions, Power series, Taylor Series.

Integration: Application of integration, areas, volumes, arc length and surfaces of revolution. Integration of transcendental functions and applications of force of interest and force of death. Construction and properties of the Reimann integral.

Teaching /Learning Methods: Lectures, Reading Materials, Tutorial discussions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Mathematical Analysis, Malik Arora
- A First Course in Mathematical Analysis, David Alexander Brannan
- Elements of Real Analysis, Shanthi Narayan, Raisinghania, M.D.

<table>
<tr><td>Semester</td><td colspan="3">3</td></tr>
<tr><td>Course Code:</td><td colspan="3">MFM2112</td></tr>
<tr><td>Course Name:</td><td colspan="3">Mathematical Economics</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>30</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ describe the relationship between mathematical approaches and economics.
➢ provide major concepts of economics using mathematical concepts
Intended Learning Outcomes:
By the end of this course, the students will be able to
➢ identify possible techniques in mathematics to obtain solution for economic applications.
➢ apply mathematical methods in economic related problems.</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
➢ Relationship between Mathematics and Economics
➢ Introduction to Linear and Non-Linear functions
➢ Equilibrium Analysis
➢ The Derivatives and Rules of Differentiation
➢ Economics Applications of Derivatives
➢ Integrations
➢ Economics Applications of Integrations
➢ The Fundamentals of Matrices and their use in Economics</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Lectures and Tutorial classes</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
40%</td><td colspan="2">Final Assessment
60%</td></tr>
<tr><td colspan="2" rowspan="2">Details: quizzes :10% , mid-term:10%
assignment: 20%</td><td>Theory (%)

60%</td><td>Practical (%)

……..</td><td>Other (%)(specify)

……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Chiang, A fundamental Methods of Mathematical Economics, 3rd Ed, McGrew Hill
➢ Dowling, T.E., Mathematical Economics, 2nd Ed, Schanm’s outlines</td></tr>
</table>

Semester	**3**		
Course Code:	MSF2122		
Course Name:	**Research Methodology**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

- This unit is designed to provide the students with an understanding of the key concepts of business research and skills required for planning and conducting effective research project.

Intended Learning Outcomes:

By the end of this course, the students will be able to

- appraise the role of Research in contemporary businesses
- develop essential skills necessary in Research
- plan, design and conduct effective researches to provide insights for business decision making

Course Content: (Main topics, Sub topics)

Research Paradigm and Methodology

- Searching the Literature
- Research Designs
- Data Collection
- Quantitative Data Analysis
- Qualitative Data Analysis
- Writing up the Research
- Making Presentation
- Research Ethics

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……	Other (%)(specify) ……

References/Reading Materials:

- Collis, J. and Hussy, R. Business Research: A practical guide for undergraduate and postgraduate students, Palgrave Macmillan-latest edition
- Compulsory Reading Materials given in the Class

Semester	**3**		
Course Code:	MSF2132		
Course Name:	**Linear Algebra**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30		

Course Aim

The objectives of this course unit are to

- provide students with good understanding of the concepts and methods of linear algebra
- help the students to use linear algebra to solve real world problems
- develop abstract and critical reasoning by studying logical proof and the axiomatic methods as applied to linear algebra.

Intended Learning Outcomes:

On completion of the course unit students will be able to

- solve systems of equations using matrix algebra
- explain the concepts and methods of linear algebra
- use linear algebra to solve real world problems.

Course Content: (Main topics, Sub topics)

Matrices and Determinants: Definitions, Operations on Matrices, Properties and criterion for a matrix to be invertible.

Systems of Linear Equations: Operations on system of linear equations. Echelon form, Rank, Consistency, Homogeneous and non-homogeneous systems, Elimination and Iterative methods.

Vector Spaces: Linearly independent and spanning sets, bases, dimension, subspaces.

Linear Transformations: Definition, Kernel and Image of a linear transformation. Matrix of a linear transformation, Change of Basis

Diagonalization: Eigen values and Eigenvectors, Invarient spaces, Matrix diagonalization.

Bilinear Forms: Inner products, Norms, Cauchy-Schwartz inequality.

Orthonormal Systems: The Gram-Schmidt process.

Teaching /Learning Methods: Lectures, Reading Materials, Tutorial discussions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Linear Algebra and its Applications, David C. Lay

Semester	**3**		
Course Code:	MFM2123		
Course Name:	**Financial Mathematics II**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

This course is designed to

- enhance the basic knowledge of Derivative Securities.
- give deep understand of some strategies that combines two or more options
- finally, some ideas of Futures and Forward contracts.
- discuss some real world applications of these financial instruments.

Intended Learning Outcomes:

By the end of this course, the students will be able to

- distinguish different types of derivatives that can be used in real world applications
- calculate the prices of different type of derivatives
- identify commonly used strategies that combine two more options
- identify and price calculations of Forward and Futures Contracts.

Course Content: (Main topics, Sub topics)

Derivative Security, Hedging, Bid-ask spread, Short Sale of Stock, Long Position in Stock, Forward Contract, Spot Price, Stock Index, Cash Settlement, Long, Short and Payoff , Profit for Forward, Zero Coupon Bond Profit, Call and Put Option, In the money, At the money, Out of the money option, Options in Insurance

Floor Strategy, Cap Strategy, Covered Call, Put-Call Parity, Synthetic Forward, Spread, Bull Spread, Bear Spread, Collar, Hedging with Zero Cost Collar, Straddle,
Strangle

Prepaid Forward Price, Arbitrage Pricing, Forward Contract on Stock, Pricing Forward Premium, Synthetic Stock, Cost of Carry, Lease Rate, Futures Contracts, Market to Market, S&P 500 Future Contract, Margin

Spot Rate, Forward Interest Rate, Zero-Coupon Bonds, Implied Forward Rate

Swap. Oil, Swap Payment, Dealer as Swap Counterparty, Swap Rate R, Swap Curve

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Options, Futures, and Other Derivatives, Sixth Edition, John C. Hull, Prentice Hall

Semester	**4**		
Course Code:	MIS2213		
Course Name:	**Regression Analysis**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	40	10	-

Course Aim

This course is designed to

- give basic knowledge of correlation analysis, simple linear regression and multiple linear regression
- discuss estimation and testing methods for the parameters in the models
- discuss residual analysis for the adequacy of the model and predications.
- give the basic knowledge of various statistical packages that will be used for practical application of regression analysis.

Intended Learning Outcomes:

After the successful completion of this course, the students should be able to

- determine when regression analysis is the appropriate statistical tool in analyzing a problem
- understand how regression helps us make predictions using the least squares concept
- be aware of the assumptions underlying regression analysis and how to assess them to interpret

Course Content: (Main topics, Sub topics)

Introduction: Correlation analysis, regression and model building, use of regression, role of the computer.

Correlation Analysis: Population Correlation coefficient and sample correlation coefficient. Hypothesis testing for population correlation coefficient.

Simple Linear Regression: simple linear regression model, least-square estimation of the parameters, hypothesis testing on the slop and intercept, interval estimation in simple linear regression, prediction of new observations, coefficient of determination, estimation by maximum likelihood.

Multiple Linear Regression: Multiple linear regression models, Estimation of the parameters, Hypothesis testing in multiple linear regression, Confidence interval in multiple regression, prediction of new observations.

Model Adequacy Checking: Residual analysis, Lack of fit of the regression model.

Indicator Variables, Variable Selection and Model Building, Introduction to Nonlinear Regression, Introduction to Generalized Linear Models.

Teaching /Learning Methods: Lectures, Tutorial and Practical sessions

Assessment Strategy:

Continuous Assessment 50%	Final Assessment 50%		
Details: quizzes :10%, practical:20% assignment: 20%	Theory (%) 50%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Introduction to linear regression analysis (Douglas C. Montgometry, Elizabeth A Peck, G. Geoffrey Vining)
- Introduction to Probability and Statistics (J. Susan Milton, Jesse C. Arnold)
- Applied Regression Analysis (Draper & Smith)

Semester	**4**		
Course Code:	MIS2223		
Course Name:	**Survival Analysis**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	40	10	-

Course Aim

The aims of this course unit are to

- provide the basic knowledge of Survival Analysis
- give deep understanding of Nelson-Aalen and Kaplan-Meier estimators
- give basic understanding to use parametric maximum likelihood technique for estimation of above estimators
- provide an idea to use R to estimate and graph the above estimators

Intended Learning Outcomes:

After the successful completion of this course, the students will be able to

- distinguish different types of censoring
- estimate the cumulative hazard function and Kaplan-Meier Estimator with real data
- identify possible methods for estimation above two estimators
- use R for calculation and plotting

Course Content: (Main topics, Sub topics)

Introduction, Right Censoring, Distribution of Time to Event, Survival Function, Mean Survival Time, Median Survival Time, p^{th} Quantile of Survival Time, Mean Residual Life Time, Hazard Function, Cumulative Hazard Function, Common Parametric Models in Survival |Analysis, Exponential, Weibull and Gamma Distributions.

Right Censoring, Calendar Time, Patient Time, Life Table or Actuarial Estimator of Distribution of Time to Event, Delta Method, Estimate of the variance of Life Table Estimator, Nelson-Aalen Estimator of Cumulative Hazard Function, Kaplan Meier Estimation for Distribution of Time to Event, Greenwood's Formula for the Variance of the Life-Table Estimator, Asymptotic Distributions of Nelson-Aalen Estimator and Kaplan-Meier Estimator, Confidence Intervals for above two Estimators, Other Types of Censoring, Likelihood and Censored Survival Data, Review of Parametric Maximum Likelihood Estimation, Score Equation, Fisher Information Matrix and Observed Information Matrix, Wald Test, Likelihood Ratio Test, Likelihood and Likelihood Estimation for Censoring Survival Data, R codes for Estimation and Plotting Kaplan-Meier Estimator.

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 50%	Final Assessment 50%		
Details: quizzes :10% , practical:20% assignment: 20%	Theory (%) 50%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Counting Processes and Survival Analysis, Thomas R. Fleming, David P. Harrington, 1991, Wiley, New York

Semester	**4**		
Course Code:	MFM2213		
Course Name:	**Financial Mathematics III** **(Market Models and Risk Management in Discrete Time)**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

This course is designed to

- provide the basic principles behind the construction of an arbitrage opportunity
- calculate option prices with a one-period and multi-period binomial trees
- provide basic understanding of risk-neutral probabilities
- build three types of binomial trees: forward, Cox-Ross-Rubinstein, and Jarrow-Rudd
- understand the concept of state prices and Greek Letters
- have basic understanding of elasticity of financial instruments

Intended Learning Outcomes:

By the end of this course, the students will be able to

- apply the binomial model to options on stock indexes, currencies, and future contracts
- calculate risk neutral probabilities for price calculation of financial instruments
- distinguish between true and risk-neutral probabilities
- Identify the relation between state prices, risk-neutral probabilities and true probability
- Identify different measures of risk and calculate the Greek Letters for Binomial Trees
- calculate the mean return, volatility and the elasticity of a derivative,

Course Content: (Main topics, Sub topics)

Review: Stocks and Stock Indices, Dividends, Prepaid Forward Prices and Forward Prices, Arbitrage Opportunities, Call and Put Options, Put-Call Parity for European Options.

Risk-neutral valuation in Discrete-time: A One-Period Binomial Tree, Arbitraging a mispriced Option, Risk-Neutral Probabilities, Multi-period Binomial Tree, Risk-neutral Formula Based on a Two-Period Binomial Tree, Pricing American Options, Constructing a Binomial Tree with known Volatility, Options on Stock Indexes, Currencies, Futures Contracts, True Probabilities, Pricing with true probabilities, State Prices, Pricing using state Prices, Trinomial Tree Model, The relation between State Prices and Other Valuation Methods.

Greek Letters and Elasticity: Delta, Gamma and Theta, Properties of Greek Letters, The Approximations related to Greek Letters, Greek Letters of a Portfolio of Derivatives, Vega, Rho and Psi, Mean Return and Volatility of a Derivative, Elasticity of a Derivative, Financial interpretation of Elasticity, Option elasticity of a Portfolio, Greek Letters for Binomial Trees

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Options, Futures, and Other Derivatives, Sixth Edition, John C. Hull, Prentice Hall

Semester	**4**		
Course Code:	MSF2212		
Course Name:	**Calculus lll**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

Objectives of this course unit are provided students with

- knowledge of open sets, closed sets and limit points in multidimensional spaces
- explanation of the properties of real valued and vector valued multivariable functions (Limits, Continuity, Derivatives)
- knowledge on how to find and classify extrema of multivariable functions with and without constraints.

Intended Learning Outcomes:

On completion of the course unit the students should be able to

- identify the properties of subsets in multidimensional space (Closed sets, Open sets, Limit points)
- find Directional derivatives, Partial derivatives, Gradients of multivariable functions
- explain Continuity and Differentiability of real valued and vector valued multivariable functions
- identify sufficient conditions for the equality of mixed partial derivatives of multivariable functions
- identify the extremes and their types of multivariable functions with and without constraints.

Course Content: (Main topics, Sub topics)

Multidimensional Spaces: Closed sets, Open sets, Limit points in R^n. Functions in multidimensional spaces, Limits and continuity.

Vector valued Functions: Differentiation and integration, Tangent and normal vectors, Arc length and curvature.

Functions of several Variables: Limits and continuity, Partial derivatives and differentiability, Chain rule, Directional derivatives and gradients, Extrema of functions of two variables and applications, Lagrange multipliers.

Multiple Integration: Double integrals and volumes. Change of variable and polar coordinates, Triple integrals.

Vector Analysis: Vector fields, Line integrals, Conservative vector fields, Green's theorem, Surface integrals, Divergence theorem, Stoke's theorem.

Teaching /Learning Methods: Lectures, Reading Materials, Tutorial discussions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- The Calculus with Analytic Geometry Part ll – Vectors, Functions of Several Variables and Infinite Series, Louis Leithold
- Mathematical Analysis, 2nd edition, Tom M. Apostol

<table>
<tr><td>Semester</td><td colspan="3">4</td></tr>
<tr><td>Course Code:</td><td colspan="3">MFM2222</td></tr>
<tr><td>Course Name:</td><td colspan="3">Computing for Finance II</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>10</td><td>40</td><td></td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ enhance some basic knowledge in excel
➢ master financial mathematics concepts learned in MFM2122 in excel.
Intended Learning Outcomes:
By the end of this course, the students should be able to
➢ calculate the prices of a swaps in excel
➢ calculate forward interest rates in excel
➢ deal with Futures and foreign exchange bond in excel
➢ handle various types of options in risk management using excel.</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Swaps: Definition, How swaps save money, Advantages of swaps, Terminating interest rate swaps, implicit credit risk, Valuation, Cross currency swap, worked example, Swaptions
Forward interest rates: Definitions, Example forward rates, Hedging principles, Forward rate agreement, Yield curves
Futures: Benefits, Clearinghouse operation, Bond futures, Hedging mechanisms, Hedging examples
Foreign exchange: Risk, Spot rates, Longer dates, Equivalence, Comparisons and arbitrage
Options: Underlying asset, Call and Put options, Covered call, Insurance using a stock and a long put, Pricing models, Greeks</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Practical and Tutorial classes</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
40%</td><td colspan="3">Final Assessment
60%</td></tr>
<tr><td>Details: quizzes :10% , mid-term:10%
assignment: 20%</td><td>Theory (%)
……..</td><td>Practical (%)
60%</td><td>Other (%)(specify)
……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Options, Futures, and Other Derivatives, Sixth Edition, John C. Hull, Prentice Hall</td></tr>
</table>

Semester	**4**		
Course Code:	MSF2223		
Course Name:	**Numerical Analysis II**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	30	

Course Aim

The objectives of this course unit are to provide students with the knowledge and skills of

- numerical techniques for solving linear systems.
- solving problem with differential equations (ODE and PDE) numerically.

Intended Learning Outcomes:

On successful completion of the course unit, the students should be able to

- apply the Numerical methods for other sciences and Engineering in real world problem solving.
- compare the solutions obtained using numerical methods with those using analytical methods.
- analyse various numerical methods.

Course Content: (Main topics, Sub topics)

Solving Linear systems:

Matrix notation, Direct methods, Gauss and Jordan eliminations, LU decomposition techniques.

Iterative Methods - Theorems related to convergence of iterative sequences and convergence criteria, Jacobi, Gauss Seidel, implement the numerical solution for solving large linear systems of equations using existing MATLAB functions/codes.

Numerical solutions of ordinary differential equations (ODE):

Numerical Methods for initial value problems, Euler (explicit and implicit) and Modified Euler methods, RungeKutta method..

Higher order Taylor expansion for solving ordinary differential equations and Higher order Differential equations.

Implement the numerical solution algorithms via MATLAB for solving initial value problems using available functions in MATLAB.

Numerical solutions of partial differential equations :

Parabolic type, Elliptic type, Hyperbolic type using finite difference methods.

Implementations of Finite Difference Schemes via MATLAB for boundary value problems associated to Partial Differential Equations

Teaching /Learning Methods: Lectures during practical sessions, Reading Materials, Assignment based learning as laboratory works

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 30%	Practical (%) 30%	Other (%)(specify) ……

References/Reading Materials:

- Numerical Analysis by Richard L. Burden, J Douglas Faires and Albert C Reynolds
- Numerical Methods for Engineers and Scientists by J N. Sharma
- Numerical Methods for Mathematics, Science and Engineering by John H Mathews
- Applied Numerical Methods with MATLAB" by S.C. Chapra, 3rd Edition 2012, McGraw Hill.
- Numerical Methods Using MATLAB by John H. Mathews and Kurtis D. Fink, 3rd ed. 1999.

Course Code:	MIS2231		
Course Name:	**Case Study I**		
Credit Value:	1		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	10	20	45

Course Aim

This course is designed to

- enhance the knowledge acquired in basic statistics courses in Level I and II by applying in real applications

Intended Learning Outcomes:

By the end of this course, the students should be able to

- use the theoretical knowledge learned in classes in real world applications
- use computing knowledge in applications
- make a report
- present the results

Course Content: (Main topics, Sub topics)

Students will be provided the opportunities to learn about statistics based research projects as real world applications with proper guidance.

Guide the students to practice for solving real world problems using the statistics as a tool and report writing and presentation

Teaching /Learning Methods: Conducting Lecture and self-learning

Assessment Strategy:

Continuous Assessment	Final Assessment (Report and Viva)		
40%	60%		
Details: assignment: 40%	Theory (%)	Practical (%)	Other (%)(specify)
	……	60%	……

References/Reading Materials:

- Probability & Statistics for engineers & scientists, Ronald E. Walpole, Raymond H. Myers,Sharon L. Myers and Keying Ye, 9th ed.
- Mathematical Statistics with Applications, Dennis D. Wackerly, William Mendenhall III and Rechard L. Scheaffer, 6th Edition
- Other References will be provided during the project work

Semester	**5**		
Course Code:	MFM3113		
Course Name:	**Financial Time Series**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	30	-

Course Aim

This course is designed to

- enhance the basic knowledge of traditional time series models.
- give basic understanding conditional heteroscedastic models.
- enhance the basic knowledge of nonlinear models for financial modelling and forecasting.
- discuss some financial applications of time series models.
- discuss some risk measures with time series models.

Intended Learning Outcomes:

By the end of this course, the students should be able to

- distinguish different types of time series models.
- calculate variance or volatility of stock prices using conditional heteroscedastic models.
- identity the possible models for forecasting.
- use time series models for financial modelling.
- Calculate the risk measures such as VaR

Course Content: (Main topics, Sub topics)

Financial Time Series and Their Characteristics

Asset Returns, Distributional Properties of Returns

Linear Time Series and Its Applications: Stationary, Correlation and Autocorrelation Function, White Noise and Linear Time Series, Simple Autogressive Models, Simple Moving-Average Models, Simple ARMA Models, Unit-Root Nonstationarity, Seasonal Models

Conditional Heteroscedastic Models: Characteristics of Volatility, Structure of a model, The ARCH model, The GARCH models, The Integrated and the Exponential GARCH models, The Stochastic Volatility Model

Nonlinear Models and Their Applications: Nonlinear Models, Nonlinear Tests, Modelling and Forecasting

Continuous-Time Models and Their Applications: Some Continuous-Time Stochastic Processes, Black-Scholes Formulas, Stochastic Integrals

Extreme Values, Quantile Estimation, and Value at Risk: Value at Risk, Riskmetrics, An Econometric Approach to VaR Calculation, Quantile Estimation, Extreme Value approach to VaR

Teaching /Learning Methods: Conducting Lecture and Tutorial class

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% mid-term:10% assignment: 20%	Theory (%)	Practical (%)	Other (%)(specify)
	30%	30%	……

References/Reading Materials:

- Actuarial Mathematics, Newton L. Bowers, JR, Hans U Gerber, James C Hickman, Donald A Jones, Cecil J Nesbitt, The Society of Actuaries, 1993
- Models for Quantifying Risk, Second Edition, Robin Cunningham, Thomas Herzog, Richard L. London

Semester	**5**		
Course Code:	MIS3113		
Course Name:	**Design and Analysis of Experiments**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	30	-

Course Aim

The objectives of this course unit is to

- explain the difference between CRD, RCB, and LS.
- explain the assumptions necessary to perform an ANOVA.
- construct a regression analysis table to describe the relationship between two variables.
- describe the appropriate ways to transform data that are not normally distributed.

Intended Learning Outcomes:

After this course you should be able to

- identify completely randomized designs, factorial designs, and complete block designs
- perform correct analysis of experimental data using R software
- plan and estimate treatment comparisons using appropriate multiple comparison techniques
- assess model fit and validity of assumptions
- suggest remedial measures or alternative analyses when assumptions are not met
- distinguish fixed and random effects

Course Content: (Main topics, Sub topics)

- Experimental Principles and Basic Statistics
- Analysis of Variance (ANOVA)
- Completely Randomized Design (CRD) and Randomized Complete Block (RCB) Design
- Latin Square (LS) and Factorial Experiments
- Comparison of Multiple Treatment Means and Other Mean Comparisons
- Power and Sample Size
- Assumptions and Data Transformation, Missing Values
- Comparing Regression Lines and Analysis of Covariance
- Analysis of Counts Non-Parametric Methods, Random Effects Models
- Mixed Models and Nested Effects
- Split Plot Designs and Repeated Measures Designs

Teaching /Learning Methods: Conducting Lectures, Lab sessions, and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 30%	Practical (%) 30%	Other (%)(specify) ……

References/Reading Materials:

- Design and Analysis of Experiments, Douglas C. Montgomery, Sixth Edition , John Wiley & Sons, New York, 2004.
- Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building, George E. P. Box, William G. Hunter, J. Stuart Hunter, Second Edition, John Wiley & Sons, New York, 2005.

Semester	**5**		
Course Code:	MFM3123		
Course Name:	**Life Insurance**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

This course is designed to

- enhance the basic knowledge of the individual risk models
- give deep understand of annuities, calculation of their present values
- finally, .give some understanding of benefit premiums and benefit reserves
- enhance the basic knowledge of some types of life insurance

Intended Learning Outcomes:

By the end of this course, the students will be able to

- understand some concepts of survival distribution and Life table
- identify some basic types of life insurance
- identify continuous and discrete type life annuities

finally understand the concepts of benefit premiums and benefit reserves

Course Content: (Main topics, Sub topics)

The Economics of Insurance: Introduction, Utility Theory, Insurance and Utility, Elements of Insurance, Optimal Insurance

The Individual Risk Models for a Short Term: Models for Individual Claim Random variables, Sums of Independent Random Variables, Applications to Insurance

Survival Distribution and Life Table: Probability for the Age-at-Death, The Survival function, Time-until-Death for a Person Age x, Curtate-Future-Lifetimes, Force of mortality, Life tables, Other Life table characteristics, Assumptions for fractional Ages.

Life Insurance: Insurances Payable at the Moment of Death-Level Benefit, Endowment, Deferred, Varying Benefit Insurance, Insurances Payable at the end of the year of death, Relationships between Insurances Payable at the Moment of Death and the End of the Year of Death

Life Annuities: Continuous and Discrete life annuities, Life annuity with m-thly payments.

Benefit Premiums: Fully Continuous and Discrete Premiums, True m-thly Premiums, Apportionable Premiums, Accumulation-Type Benefits.

Benefit Reserves: Fully continuous and Discrete Reserves, Other Formulas for fully continuous Benefit Reserves, Benefit Reserves Based on a Semicontinuous Basis and true m-thly Benefits.

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……	Other (%)(specify) ……

References/Reading Materials:

- Actuarial Mathematics, Newton L. Bowers, JR, Hans U Gerber, James C Hickman, Donald A Jones, Cecil J Nesbitt, The Society of Actuaries, 1993
- Models for Quantifying Risk, Second Edition, Robin Cunningham, Thomas Herzog, Richard L. London

Semester	**5**		
Course Code:	MFM3133		
Course Name:	**Financial Mathematics IV** **(Market Models and Risk Management in Continuous Time)**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

This course is designed to

- review the basic knowledge of stochastic calculus
- review of the basic stochastic processes for stock price dynamics
- understand the assumptions behind the Black-Scholes model
- perform delta-hedging and calculate a hedge profit and its variance
- understand the effect of the strike prices and time to expiration on option values
- understand various bounds for option prices

Intended Learning Outcomes:

By the end of this course, the students should be able to

- study the basic type of stochastic processes that can be used in stock price dynamics
- derive the Black-Scholes formula for financial derivatives
- calculate prices of financial derivatives using the Black-Scholes model
- study Greek Letters
- hedge using multiple Greeks
- study the basic concepts of self-financing and rebalancing the hedge portfolio
- study the factors related to the early exercise of American options

Course Content: (Main topics, Sub topics)

Review: The random walk model, Standard Brownian Motion, Arithmetic Brownian Motion, Geometric Brownian Motion, Stochastic Differential equations, Ito's Lemma, An Integral Representation, Differentiation Rule for Stochastic Integrals, Solutions of Three SDES, Variations of Brownian Motions

Modelling Stock Price Dynamics: A review of the lognormal distribution, Modelling stock prices with GBM, stock Prices Dynamics under the Black-Scholes Framework, Lognormality of Stock Prices

Introduction to the Black-Scholes Formula: Binary Options, The Black-Scholes formulas for options, Applying the pricing formula for other assets, Options on stock with discrete dividends

Risk Management Technique: Delta-hedging a Portfolio, Understanding the Profit from a hedged Portfolio, Self-financing Delta-hedged Portfolio, Rebalancing the hedge Portfolio, The Boyle-Emanuel formula, Gamma Neutrality, Risk-neutral valuation

General Properties of Options: Different Strike prices, Bounds for Option Prices, Different times to Expiration, Early Exercise for American Options

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Options, Futures, and Other Derivatives, Sixth Edition, John C. Hull, Prentice Hall

Semester	**5**		
Course Code:	MFM3142		
Course Name:	**Operational research III**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

The aims of this course unitare to acquaint students with

- basic principles and methods of Nonlinear Programming (NLP), and Quadratic Programming (QP), and
- applications of NLPand QP in finance.

Intended Learning Outcomes:

Upon successful completion of this course, students will be able to:

- describe the basic principles of NLP and QP
- formulate NLP and QP models
- solve such problems by means of basic solution methods of NLP and QP, and software tools
- analyze given solutions of NLP and QP problems.

Course Content: (Main topics, Sub topics)

Nonlinear Programming:

Single-variable Optimization: Optimality Criteria, Direct Search Methods Algorithms, Gradient-based methods algorithms,

Multivariable Optimization: Optimality Criteria, Direct Search Methods Algorithms, Gradient-based methods algorithms,

Constrained Optimization: Kuhn-Tucker Conditions, Transformation methods, Direct Search and linearized search techniques.

Quadratic Programming:

Optimality Conditions, Interior Point Methods**.**

NLP and QP Models in Finance.

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- M.S. Bazaraa, H.D. Sherali, C. M. Shetty(2006), *Nonlinear Programming: Theory and Algorithms*, 3rd Edition, Wiley.
- G. Cornuejols, R. Tutuncu (2006) *Optimization Methods in Finance*,Cambridge University Press.

<table>
<tr><td>Semester</td><td colspan="4">5</td></tr>
<tr><td>Course Code:</td><td colspan="4">MIS3122</td></tr>
<tr><td>Course Name:</td><td colspan="4">Non-Parametric Statistics</td></tr>
<tr><td>Credit Value:</td><td colspan="4">2</td></tr>
<tr><td>Core/Optional</td><td colspan="4">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td colspan="2">Independent Learning</td></tr>
<tr><td>20</td><td>20</td><td colspan="2">-</td></tr>
<tr><td colspan="5">Course Aim
The objective of this course unit is to provide students with the
➢ knowledge of hypothesis testing and the ability of handling non parametric tests.
Intended Learning Outcomes:
On completion of the course unit, the student should be able to
➢ identify the hypotheses relevant to parameters.
➢ formulate null and alternative hypotheses.
➢ determine which test statistic is suitable for a testing procedure.
➢ select the level of significance and the test criterion for rejection of null hypothesis.</td></tr>
<tr><td colspan="5">Course Content: (Main topics, Sub topics)
Non parametric tests :
Kolmogorov Smirnov tests, One sample sign test, One sample runs test, Two sample runs test, Mann Whitney U test, Two sample sign test, Wilcoxon Match pairs sign rank test, Kruskal-Wallis H Test, Friedman rank sum test. The normal approximations for these tests.
Chi Square tests : Goodness of fit test, Contingency tables for testing independence</td></tr>
<tr><td colspan="5">Teaching /Learning Methods: Lectures and practical sessions</td></tr>
<tr><td colspan="5">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
40%</td><td colspan="3">Final Assessment
60%</td></tr>
<tr><td colspan="2" rowspan="2">Details: quizzes :10% , mid-term:10%
assignment: 20%</td><td>Theory (%)</td><td>Practical (%)</td><td>Other (%)(specify)</td></tr>
<tr><td>30%</td><td>30%</td><td>……</td></tr>
<tr><td colspan="5">References/Reading Materials:
➢ Non parametric Statistics for the behavioral Sciences by Sidney Siegel.</td></tr>
</table>

<table>
<tr><td>Semester</td><td colspan="3">5</td></tr>
<tr><td>Course Code:</td><td colspan="3">MSF3112</td></tr>
<tr><td>Course Name:</td><td colspan="3">Decision Theory</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>30</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ give basic idea of the mathematical reasoning
➢ acquaint students the best strategy for any given conditions in order to optimize the outcome.
➢ provide how to analyze the different conditions of entering in to the market,
➢ discuss some real world applications.
Intended Learning Outcomes:
After successfully completing this course unit, students should be able to
➢ explain the different games in real world problems.
➢ identify the possible outcomes (win or loss) in competitive environments in real world applications, and
➢ apply techniques of the mathematics of finance to common personal financial situations found in everyday life.</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Arguments with Sets and Venn diagrams: Sets, Venn diagrams, data analysis;
Decision Theory and Group Decisions: Under uncertainty – various views and the study of risk. Utility Theory Introduction: Uncertainty, Expected Utility, Interference curve, Indifference curves and risk aversion, Utility functions, Pratt’s risk aversion measurement,;
Utility maximization: The Budget constraint, Maximization using Lagrangian multiplier, Cobb-Douglas Utility function, Expenditure function.</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Lectures, class discussion, tutorial discussion.</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
40%</td><td colspan="2">Final Assessment
60%</td></tr>
<tr><td colspan="2" rowspan="2">Details: quizzes :10% mid-term:10%
assignment: 20%</td><td>Theory (%)</td><td>Practical (%)</td><td>Other (%)(specify)</td></tr>
<tr><td>60%</td><td>……..</td><td>……</td></tr>
<tr><td colspan="4">References/Reading Materials:
• Basic mathematics for economics, business, and finance, Ummer, E. K, London..</td></tr>
</table>

<table>
<tr><td>Semester</td><td colspan="3">5</td></tr>
<tr><td>Course Code:</td><td colspan="3">MFM3151</td></tr>
<tr><td>Course Name:</td><td colspan="3">Case Study II</td></tr>
<tr><td>Credit Value:</td><td colspan="3">1</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>10</td><td>20</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ enhance the knowledge acquired in basic Financial Mathematics courses in Level I & II by applying in real applications
Intended Learning Outcomes:
By the end of this course, the students should be able to
➢ use the theoretical knowledge learned in classes in real world applications
➢ use computing knowledge in applications
➢ make a report
➢ present the results</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Students will be provided the opportunities to learn about statistics based research projects as real world applications with proper guidance.
Guide the students to practice for solving real world problems using the Financial Mathematics as a tool and report writing and presentation</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Lecture and self-learning</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
40%</td><td colspan="3">Final Assessment
60%</td></tr>
<tr><td>Details: Assignments: 40%</td><td>Theory (%)
……..</td><td>Practical (%)
60%</td><td>Other (%)(specify)
……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Options, Futures, and Other Derivatives, Sixth Edition, John C. Hull, Prentice Hall
➢ Other References will be provided during the project work</td></tr>
</table>

Semester	**6**		
Course Code:	MIS3212		
Course Name:	**Bayesian Inference**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	25	10	-

Course Aim

- This course introduces students to the Bayesian theory and modern computational methods for Bayesian inference.

Intended Learning Outcomes:

- Students will learn the commonalities and differences between the Bayesian and frequentist approaches to statistical inference, how to approach a statistics problem from the Bayesian perspective, and how to combine data with informed expert judgment in a sound way to derive useful and policy relevant conclusions.
- Students will learn the necessary theory to develop a firm understanding of when and how to apply Bayesian and frequentist methods, and will also learn practical procedures for inference, hypothesis testing, and developing statistical models for phenomena.
- Specifically, students will learn the fundamentals of the Bayesian theory of inference, including probability as a representation for degrees of belief, the likelihood principle, the use of Bayes Rule to revise beliefs based on evidence, conjugate prior distributions for common statistical models.

Course Content: (Main topics, Sub topics)

Fundamentals of the Bayesian theory of inference, probability as a representation for degrees of belief, the likelihood principle, the use of Bayes Rule to revise beliefs based on evidence, conjugate prior distributions for common statistical models, methods for approximating the posterior distribution. Graphical models for representing complex probability and decision models by specifying modular components.

Teaching /Learning Methods: Lectures and Tutorial sessions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% mid-term:10% assignment: 20%	Theory (%) 40%	Practical (%) 20%	Other (%)(specify) ……

References/Reading Materials:

- Introduction to Bayesian Statistics, William M Bolstad

Semester	**6**		
Course Code:	MIS3222		
Course Name:	**Multivariate Data Analysis**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	20	20	-

Course Aim

This course is designed to

- introduce the language of multivariate data analysis
- provide the characteristics of multivariate quantitative research, including strengths and weaknesses

Intended Learning Outcomes:

- discuss the principles and characteristics of the multivariate data analysis techniques
- distinguish between dependence and interdependence methods in multivariate data analysis
- identify the most appropriate statistical techniques for a multivariate dataset
- carry out and apply commonly used multivariate data analysis techniques, and interpret results
- use statistical software packages for the analysis of multivariate data

Course Content: (Main topics, Sub topics)

Multivariate data and multivariate statistics: Introduction, Types of data, Basic multivariate statistics, The aims of multivariate analysis.

Bivariate normal distribution and density, Multivariate normal distribution: Mean vector and variance covariance matrix, Correlation matrix, outliers, multivariate plots, checking for multivariate normality.

Two independent samples, paired samples, Profile analysis, MANOVA, Repeated measurements.

Cluster analysis, Principle component analysis, discriminant analysis and factor analysis.

Teaching /Learning Methods: Lectures ,Tutorial and Practical sessions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 20%	Practical (%) 20%	Other (%)(specify) ……

References/Reading Materials:

- Methods of Multivariate Analysis, ALVIN C. RENCHER
- Applied Multivariate Statistical Analysis, Richard A Johnson, Dean W. Wichern.
- Applied Multivariate Data Analysis Everitt B.S. and Dunn G. (2001), Arnold, London

Semester	**6**		
Course Code:	MFM3213		
Course Name:	**Non-Life Insurance**		
Credit Value:	3		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	45	-	-

Course Aim

This course is designed to

- enhance the basic knowledge of censoring and truncation
- give deep understand of policy limits and deductibles
- some ideas of Asset Liability Management.
- discuss some real world applications of these financial instruments.

Intended Learning Outcomes:

By the end of this course, the students should be able to

- distinguish different types of interest rates that can be used in real world problems
- calculate annuities and bond prices and apply these concepts in real applications
- identify possible methods in loan repayment and their applications
- explain concepts like duration, convexity and immunization and apply them in asset liability management.

Course Content: (Main topics, Sub topics)

Limited and Excess-Loss Random Variables: Left Censoring and Limiting of distributions, The limited loss Variable, Limited loss random variable with limit u, the left-censoring and shifted variable, The excess loss random Variable

Policy Limits: Severity and frequency distributions, Policy Limit u, limited loss random variable with policy limit u, cost per loss, expected cost per loss

Policy deductibled: Expected cost per loss, expected cost per payment, Franchise deductible, The mean residual lifetime, Loss elimination ratio, combine policy limit and deductible, Modelling bonus payments, Graphical representation of expected cost per loss

Additional Policy Adjustments: Coinsurance factor, Maximum covered loss u in combination with u and coinsurance, inflation, inflation factor in insurance policy, policy adjustments for parametric distributions

Models for the number of claims, frequency: Severity distributions, collective risk model, individual risk model, Models for the number claims, The (a,b,0) class of discrete distributions

Models for Aggregate losses: The collective or compound model for aggregate claims, Modification of the severity distribution

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Actuarial Mathematics, Newton L. Bowers, JR, Hans U Gerber, James C Hickman, Donald A Jones, Cecil J Nesbitt, The Society of Actuaries, 1993.
- Models for Quantifying Risk, Second Edition, Robin Cunningham, Thomas Herzog, Richard L. London.

Semester	**6**		
Course Code:	MFM3222		
Course Name:	**Computing for Finance III**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	10	40	

Course Aim

This course is designed to

- enhance some basic knowledge in excel
- master Actuarial Mathematics concepts learned in MFM3123 and MFM3213 in excel.

Intended Learning Outcomes:

By the end of this course, the students should be able to

- calculate the prices of annuities in excel
- calculate present values of life insurance annuities in excel
- deal with the non-life insurance calculations in excel
- handle various types of options in risk management in insurance using excel.

Course Content: (Main topics, Sub topics)

Some applications in MFM2123 and MFM3123 using excel.

Teaching /Learning Methods: Conducting Practical and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 20%	Practical (%) 40%	Other (%)(specify) ……

References/Reading Materials:

- Actuarial Mathematics, Newton L. Bowers, JR, Hans U Gerber, James C Hickman, Donald A Jones, Cecil J Nesbitt, The Society of Actuaries, 1993.
- Models for Quantifying Risk, Second Edition, Robin Cunningham, Thomas Herzog, Richard L. London

Semester	**6**		
Course Code:	MFM3232		
Course Name:	**Business Proposals and Report Writing**		
Credit Value:	2		
Core/Optional	C(Elective)		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

This course is designed to

- explain fluency in the writing process: planning, drafting, revising, editing, and preparing final papers.
- explain competence in the varied elements of writing: thesis, stance, content, organization, sentences, diction, and technical matters**.**
- explain awareness of rhetorical strategies in various forms of writing, with particular attention to audience.
- assess the usefulness and reliability of sources, including Internet sources.
- synthesize and critique material from a variety of sources with an emphasis on scholarly and professional publications; incorporate sources; document sources properly.
- exhibit critical thinking as readers and as writers.
- understand the relevance of good writing to real-world situations.

Intended Learning Outcomes:

By the end of this course, the students will be able to

- use effective data displays and correct writing techniques, style, tone, and format in writing business reports of various degrees of formality.
- analyse business and organizational situations to identify problems and factors relevant to understanding and handling the situations; and plan an organized procedure for obtaining the facts needed to resolve the situation.
- analyse the consumers of their communications and will prepare written and verbal presentations to meet the needs of the consumers of reports and to achieve the purposes of the originator.
- compare types of primary and secondary data-gathering techniques and sources and will gather and analyse data and draw conclusions and/or make recommendations based on the data analysis.
- use the documentation style delineated by the American Psychological Association (APA style) and will apply ethical considerations to making recommendations for solutions to business problems based on their chosen sources and analysis.
- present report findings and conclusions orally using effective delivery techniques and support their conclusions with sound recommendations based on thorough analysis and documentation.
- demonstrate convincing arguments upon which they base their recommendations to real-world business and organizational situations.

Course Content: (Main topics, Sub topics)

- Communication in the business environment with emphasis on written reports: Communication process and role of communication in organizations, audience adaptation.
- Basic language and writing techniques with emphasis on style, tone, and situation considerations: coherence, credibility, readability, bias (e.g., gender, racial, and ethnic), clarity, conciseness, and accuracy.
- Short, informal reports: functions and objectives of reports; short, informal reports of various types, format and style of short reports.
- Formal reports: Collecting primary and secondary data; analyzing, organizing, and summarizing data; evaluating and interpreting data; drawing and support conclusions and recommendations; formatting formal reports.
- Visual aids (including computer graphics)
- Oral presentation

Teaching /Learning Methods: Conducting Lectures

Assessment Strategy:

Continuous Assessment 30%	Final Assessment 70%		
Details: quizzes :10% assignment: 20%	Theory (%) 70%	Practical (%) ……	Other (%)(specify) ……

References/Reading Materials:

- *Business Communication* (custom edition for Business Report Writing, BEIT)

<table>
<tr><td>Semester</td><td colspan="3">6</td></tr>
<tr><td>Course Code:</td><td colspan="3">MSF3212</td></tr>
<tr><td>Course Name:</td><td colspan="3">Fundamentals of Management</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>30</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
➢ To introduce management concepts, principles, techniques and theories used in the business environment.
➢ To examine the relevance of theories and principles in specific culture and organizational context.
➢ To make aware of the current management practices in changing business environment.
Intended Learning Outcomes:
➢ Explain the function of management and identify other major elements in the management process.
➢ Describe the factors influencing work organization and how managers consider such factor to make managerial decisions.
➢ Discuss nature of new work place and the management competencies needed to deal with rapid change in the organizations</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
➢ Introduction to management
➢ The challenges of management
➢ Pioneering ideas in management
➢ Business environment
➢ Social responsibility, ethics and culture
➢ Functions of management
➢ Managerial decisions making
➢ Current issues in business world</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Lectures, Tutorials and case studies</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td colspan="2">Continuous Assessment
30%</td><td colspan="2">Final Assessment
70%</td></tr>
<tr><td colspan="2" rowspan="2">Details: quizzes :10% , mid-term:10%
assignment: 10%</td><td>Theory (%)

70%</td><td>Practical (%)

……..</td><td>Other (%)(specify)

……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Daft, L.R. (2013). Management. . (11th Edi).Cengage Learning.
➢ Robbins, S.P &Coulter, M. (2010). Management. (11thEdi).Prentice Hall.
➢ Griffin, R.W, (2008).Management. (10th Edi).South Western</td></tr>
</table>

Semester	**6**		
Course Code:	MSF3222		
Course Name:	**Scientific Writing and Communication**		
Credit Value:	2		
Core/Optional	C(Elective)		
Hourly Breakdown	Theory	Practical	Independent Learning
	20	30	-

Course Aim

- To enhance science report writing ability
- To use proper structure and language in scientific writing
- To enhance communication skills
- To improve presentation skills
- To make students aware in ethics in publishing
- To develop tools for effective literature search
- To present statistics and figures effectively

Intended Learning Outcomes:

Upon successful completion of the course, the student will be able to

- Write a proper scientific report/dissertation/manuscript
- improve writing and communicating ability
- understand ethics in publishing
- improve presentation skills
- use proper literature searching tools
- write a better structured scientific article/report

Course Content: (Main topics, Sub topics)

- Communicating science
- Types of written communication
- Use proper techniques in English language for precise writing
- Components of scientific paper
- Presenting statistics
- Writing a structured scientific article
- Oral and poster presentations
- Ethics in publishing
- Tools for effective literature search

Teaching /Learning Methods: Lectures, Discussions, presentations, practical sessions, group activities

Assessment Strategy:

Continuous Assessment 30%	Final Assessment 70%		
Details: quizzes :10%, assignment: 20%	Theory (%) 30%	Practical (%) 40%	Other (%)(specify) ……

References/Reading Materials:

- Science Communication in Theory and Practice, Springer Science & Business Media S.M. Stocklmayer, R. Gore and C.R. Bryant (2012).

Semester	**6**		
Course Code:	MIS3232		
Course Name:	**Stochastic Processes**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

- To review probability theory briefly and present a systematic mathematical treatment to discrete and continuous stochastic processes, Ito calculus, Stochastic differential equations.

Intended Learning Outcomes:

After successfully completing this course students will be able to

- iIdentify stochastic processes in discrete and continuous time.
- understand basic concepts in stochastic calculus.

Course Content: (Main topics, Sub topics)

Probability theory – a brief review. Probability spaces, random variables and vectors, convergence of a sequence of random variables, limit theorems etc., lognormal and bivariate Gaussian distributions.

Discrete time stochastic processes. A first look at martingales, Stochastic processes - discrete in time, Markov chains in discrete time, The Poisson process etc., Conditional expectations, Random walks, Change of probabilities, Martingales, Martingale representation theorem.

Continuous time processes and their connection to PDE. Markov processes in continuous time, Brownian motion, Brownian bridge, Brownian motion with drift and Wiener processes, Geometric Brownian motion, Stochastic integration, Stochastic differential equations and Ito's lemma.

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- *Stochastic Processes*, 2nd Ed. Sheldon M. Ross, Wiley and Sons Inc., 1996.
- *Introduction to Probability Models*, 11th Ed. by Sheldon M. Ross, Academic Press, 2014.
- *Brownian Motion and Stochastic Calculus*, 2nd Ed., I. Karatzas, S.E. Shreve, Springer, 1991.

<table>
<tr><td>Semester</td><td colspan="3">7</td></tr>
<tr><td>Course Code:</td><td colspan="3">MSF4116</td></tr>
<tr><td>Course Name:</td><td colspan="3">Industrial Training</td></tr>
<tr><td>Credit Value:</td><td colspan="3">6</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C (Non GPA)</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>Whole Semester</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ enhance the knowledge acquired in basic Statistics and Financial Mathematics courses in Level I, II and III by applying in real applications
Intended Learning Outcomes:
By the end of this course, the students should be able to
➢ use the theoretical knowledge learned in classes in real world applications
➢ visit related companies and meet experts
➢ use computing knowledge in applications
➢ make a report
➢ present the results</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Students will be provided the opportunities to learn about statistics based research projects as real world applications with proper guidance.
Guide the students to practice for solving real world problems using the Financial Mathematics as a tool and report writing and presentation</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Lecture and self-learning</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
30%</td><td colspan="3">Final Assessment
70%</td></tr>
<tr><td>Details: Assignment and presentations: 30%</td><td>Theory (%)

…….</td><td>Practical (%)

…….</td><td>Other (%)(specify)
70%
Final Presentation and Final Report</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Probability & Statistics for engineers & scientists, 9th ed , Ronald E. Walpole, Raymond H. Myers,Sharon L. Myers and Keying Ye.
➢ Mathematical Statistics with Applications, 6th Edition, Dennis D. Wackerly, William Mendenhall III and Rechard L. Scheaffer.
➢ Options, Futures, and Other Derivatives, Sixth Edition, John C. Hull, Prentice Hall
➢ Other References will be provided during the project work</td></tr>
</table>

<table>
<tr><td>Semester</td><td colspan="3">7</td></tr>
<tr><td>Course Code:</td><td colspan="3">MSF4126</td></tr>
<tr><td>Course Name:</td><td colspan="3">Research Project</td></tr>
<tr><td>Credit Value:</td><td colspan="3">6</td></tr>
<tr><td>Core/Optional</td><td colspan="3">C</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>Whole Semester</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ enhance the knowledge acquired in basic Statistics and Financial Mathematics courses in Level I, II and III by applying in real applications
Intended Learning Outcomes:
By the end of this course, the students should be able to
➢ use the theoretical knowledge learned in classes in real world applications
➢ use computing knowledge in applications
➢ make a report
➢ present the results</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Students will be provided the opportunities to learn about statistics based research projects as real world applications with proper guidance.
Guide the students to practice for solving real world problems using the Financial Mathematics as a tool and report writing and presentation</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Lecture and self-learning</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
30%</td><td colspan="3">Final Assessment

70%</td></tr>
<tr><td>Details: Assignment and presentations: 30%</td><td>Theory (%)

……..</td><td>Practical (%)</td><td>Other (%)(specify)
70%
Final Presentation and Final Report</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Depend on the selected topic for the research</td></tr>
</table>

<table>
<tr><td>Semester</td><td colspan="3">8</td></tr>
<tr><td>Course Code:</td><td colspan="3">MIS4212</td></tr>
<tr><td>Course Name:</td><td colspan="3">Statistical Quality Control</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">O</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>20</td><td>20</td><td></td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ discuss the use of statistical methods and other problem-solving techniques to improve the quality of the products used by our society.
➢ discuss Quality improvement methods which can be applied to any area within a company or organization.
➢ discuss and use the technical tools that are needed to achieve quality improvement.
Intended Learning Outcomes:
After following this course student should be able to :
➢ apply the role of statistical tools in quality improvement
➢ identify the different types of variability and how a control chart is used to detect assignable causes
➢ demonstrate the general form of a control chart and how to apply zone rules and pattern analysis to detect assignable causes
➢ construct and interpret control charts for variables and attributes
➢ calculate and interpret process capability ratios
➢ construct and interpret a cumulative sum and exponentially weighted averaged control chart
➢ use other statistical process control problem-solving tools</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Quality Improvement and Statistics: Statistical quality control, Statistical process control;
Introduction to Control Charts: Basic Principles, Design of a control chart, Analysis of control charts;
Control charts for measurements ($\overline{X}$ and R or S control charts) ; Control charts for attributes (P chart , U chart, C chart) ; Process Capability Analysis; Cumulative Sum Control Chart, Exponentially Weighted Moving Average Control Chart; Acceptance-Sampling: Single-Sampling Plans for Attributes, OC curve, Double, Multiple, and Sequential Sampling</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Lectures, tutorial classes and Practical sessions</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
40%</td><td colspan="3">Final Assessment
60%</td></tr>
<tr><td>Details: quizzes :10%, mid-term:10%
assignment: 20%</td><td>Theory (%)

30%</td><td>Practical (%)

30%</td><td>Other (%)(specify)

……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Introduction to Statistical Quality Control, Sixth Edition by Montgomery, Douglas, C</td></tr>
</table>

Semester	**8**		
Course Code:	MIS4222		
Course Name:	**Reliability Theory**		
Credit Value:	2		
Core/Optional	O		
Hourly Breakdown	Theory	Practical	Independent Learning
	20	20	

Course Aim

The aims of this course unit are to

- provide the basic knowledge of Survival Analysis
- give deep understanding of Nelson-Aalen and Kaplan-Meier estimators
- give basic understanding to use parametric maximum likelihood technique for estimation of above estimators
- provide an idea to use R to estimate and graph the above estimators

Intended Learning Outcomes:

After the successful completion of this course, the students will be able to

- distinguish different types of censoring
- estimate the cumulative hazard function and Kaplan-Meier Estimator with real data
- identify possible methods for estimation above two estimators
- use R for calculation and plotting

Course Content: (Main topics, Sub topics)

Reliability Concepts and Reliability Data: Examples of Reliability Data, General Models for Reliability Data, Repairable Systems and Nonrepairable Units, Strategy for Data Collection, Modelling and Analysis.

Models, Censoring, and Likelihood for Failure-Time data: Models for Continuous Failure-Time Processes, Models for Discrete Data from Continuous Process, Censoring, Likelihood

Nonparametric Estimation: Estimation from Singly Censored Interval Data, Basic idea of Statistical Inference, Confidence Intervals from Complete or Singly Censored Data

Location-Scale-Based Parametric Distributions: Quantities of Interest in Reliability Applications, Location-Scale and Log-Location Scale Distributions, Parameters and Parameterization

Teaching /Learning Methods: Conducting Lecture and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: bquizzes :10% , mid-term:10% assignment: 20%	Theory (%) 30%	Practical (%) 30%	Other (%)(specify) ……

References/Reading Materials:

- Statistical Methods for Reliability Data, William Q. Meeker, Luis A. Escobar, John Wiley & sons INC, New York

Semester	**8**		
Course Code:	MIS4232		
Course Name:	**Categorical Data Analysis**		
Credit Value:	2		
Core/Optional	O		
Hourly Breakdown	Theory	Practical	Independent Learning
	25	10	-

Course Aim

This course is designed to

- enhance the ability to identify one dimensional, two dimensional and multidimensional categorical data
- improve the knowledge of descriptive and inferential statistical methods for analysing categorical data.
- apply statistical software to analyse the categorical data

Intended Learning Outcomes:

On successful completion of the course, you will be able to:

- identify and model categorical data
- visualize and interpret categorical data
- make inferences on categorical data
- use statistical software to analyze the categorical data

Course Content: (Main topics, Sub topics)

Introduction to Distributions and Inference for Categorical Data: Categorical response data, distributions for categorical data, statistical inference for categorical data.

Describing Contingency Tables: Probability structure for contingency tables, comparing two proportions, partial association in stratified 2 x 2 tables, Extensions for I x J tables.

Inference for Contingency Tables: Confidence intervals for association parameters, Testing independence in two-way contingency tables, two-way tables with ordered classification, small-sample tests of independence.

Logistic Regression: Interpreting parameters in logistic regression, Inference for logistic regression, Multiple Logistic Regression, Fitting logistic regression models. Building and Applying Logistic Regression Models, Log-linear models for contingency tables and building of log-linear Models

Teaching /Learning Methods: Lectures, Tutorial and Practical sessions

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% mid-term:10% assignment: 20%	Theory (%) 50%	Practical (%) 10%	Other (%)(specify) ……

References/Reading Materials:

- Categorical Data Analysis, Second Edition, Alan Agresti
- Categorical Data Analysis for the behavioral and Social Sciences.

<table>
<tr><td>Semester</td><td colspan="3">8</td></tr>
<tr><td>Course Code:</td><td colspan="3">MFM4212</td></tr>
<tr><td>Course Name:</td><td colspan="3">Credibility</td></tr>
<tr><td>Credit Value:</td><td colspan="3">2</td></tr>
<tr><td>Core/Optional</td><td colspan="3">O</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>30</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Course Aim
This course is designed to
➢ enhance the basic knowledge of Credibility Theory.
➢ provide basic understand of a frequency distribution and a Poisson random variables, Compound Distributions, and Partial Credibility
➢ discuss Bayesian Probability Estimates on a Discrete Prior Distributions
➢ discuss Bayesian Credibility with continuous Priors
Intended Learning Outcomes:
By the end of this course, the students will be able to
➢ identify the basic elements in credibility theory
➢ demonstrate the ability of using Poisson and Compounding distributions in credulity applications
➢ demonstrate the ability to use discrete and continuous priors in credibility applications</td></tr>
<tr><td colspan="4">Course Content: (Main topics, Sub topics)
Limited Fluctuation Credibility: Introductory Comments of Credibility Theory, The Limited Fluctuation Credibility Theory, Standard for full Credibility, Full Credibility applied to a frequency distribution and a Poisson Random Variables, Review of Compound Distributions, Partial Credibility
Bayesian Probability Estimates on a Discrete Prior Distributions: Prior distributions, Likelihood or data, posterior distributions, basic examples of Bayesian analysis with discrete Priors, Predictive Expectation-The Bayesian Premium, Bayesian Credibility questions,
Bayesian Credibility with continuous Priors: Predictive Distributions, The Bayesian Structure, Some examples, The Double Expectation rule applied to Bayesian Credibility, The Gamma-Poisson Credibility Model, Some Additional Comments on Bayesian Estimators</td></tr>
<tr><td colspan="4">Teaching /Learning Methods: Conducting Lecture and Tutorial classes</td></tr>
<tr><td colspan="4">Assessment Strategy:</td></tr>
<tr><td>Continuous Assessment
40%</td><td colspan="3">Final Assessment
60%</td></tr>
<tr><td>Details: quizzes :10%, mid-term:10%
assignment: 20%</td><td>Theory (%)
60%</td><td>Practical (%)
……..</td><td>Other (%)(specify)
……</td></tr>
<tr><td colspan="4">References/Reading Materials:
➢ Actuarial Mathematics, Newton L. Bowers, JR, Hans U Gerber, James C Hickman, Donald A Jones, Cecil J Nesbitt, The Society of Actuaries, 1993.
➢ Models for Quantifying Risk, Second Edition, Robin Cunningham, Thomas Herzog, Richard L. London</td></tr>
</table>

Semester	**8**		
Course Code:	MFM4222		
Course Name:	**Computing for Finance IV**		
Credit Value:	2		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	15	30	

Course Aim

The objectives of this course unit are to

- provide students with the knowledge and skills of solving problem with partial differential equations using finite difference method

Intended Learning Outcomes:

On successful completion of the course unit, the students should be able to

- apply the finite difference methods for solving parabolic partial differential equations appeared in Financial Applications.
- Apply numerical techniques with MATLAB or Excel to solve stochastic differential equations
- use various numerical methods for handing financial problems.

Course Content: (Main topics, Sub topics)

Computational techniques for solving mathematical problems arising in finance. Numerical solution of parabolic partial differential equations, basic schemes, general theory, relation to binomial and trinomial trees, boundary conditions for American options, computation of sensitivities, application to one factor and multi factor models. Stochastic simulation and Monte Carlo. Pseudo random number generators, generating random variables with specified distributions, statistical analysis of simulation data and error bars. Numerical solution of stochastic differential equations.
Higher order Taylor expansion for solving ordinary differential equations and Higher order Differential equations.

Teaching /Learning Methods: Lectures during practical sessions, Reading Materials, Assignment based learning as laboratory works

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 30%	Practical (%) 30%	Other (%)(specify) ……

References/Reading Materials:

- Applied Numerical Methods with MATLAB" by S.C. Chapra, 3rd Edition 2012 McGraw Hill.
- Numerical Methods Using MATLAB by John H. Mathews and Kurtis D. Fink, 3rd ed. 1999.
- Finite Difference Methods in Financial Engineering: A Partial Differential Equation Approach, Daniel J. Duffy, WILEY Finance, ISBN-13: 978-0470858820,
- Pricing Financial Instruments: The Finite Difference Method, Domingo Tavella, Cart Randall, WILEY Financial Engineering

Semester	**8**		
Course Code:	MFM4232		
Course Name:	**Stochastic Processes in Finance**		
Credit Value:	2		
Core/Optional	O		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

- To review probability theory briefly and present a systematic mathematical treatment to discrete and continuous stochastic processes, Ito calculus, Stochastic differential equations and their applications in finance.

Intended Learning Outcomes:

After successfully completing this course students will be

- familiar with stochastic processes in discrete and continuous time, stochastic calculus, and their basic applications in finance.
- able to apply that knowledge to model real world situations mainly related to financial market.

Course Content: (Main topics, Sub topics)

Probability theory – a brief review. Probability spaces, random variables and vectors, convergence of a sequence of random variables, limit theorems etc., lognormal and bivariate Gaussian distributions.

Motivating example-Derivatives. What is a derivative security? Types of derivatives, The basic problem: How much should I pay for an option? Fair price, Expectation pricing, Arbitrage and no arbitrage. The simple case of futures. Arbitrage arguments, The arbitrage theorem, Arbitrage pricing and hedging.

Discrete time stochastic processes and pricing models. Binomial methods, Arbitrage and reassigning probabilities, A first look at martingales, Stochastic processes - discrete in time, Markov chains in discrete time, The Poisson process etc., Conditional expectations, Random walks, Change of probabilities, Martingales, Martingale representation theorem, Pricing a derivative and hedging portfolios, Martingale approach to dynamic asset allocation.

Continuous time processes and their connection to PDE. Markov processes in continuous time, Brownian Motion, Brownian bridge, Brownian motion with drift and Wiener processes, Stochastic integration, Stochastic differential equations and Ito's lemma, Black-Scholes model, Derivation of the Black-Scholes Partial Differential Equation, Solving the Black Scholes equation, Comparison with martingale method, Optimal portfolio selection.

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- *Introduction to Probability Models*, 11th Ed. by Sheldon M. Ross, Academic Press, 2014.
- *Stochastic Processes with Applications*, Rabi N. Bhattacharya and Edward C. Waymire, SIAM, 2009.

Semester	**8**		
Course Code:	MFM4242		
Course Name:	**Measure-theoretic Probability with Applications in Finance**		
Credit Value:	2		
Core/Optional	O		
Hourly Breakdown	Theory	Practical	Independent Learning
	30	-	-

Course Aim

- To introduce basic concepts in Measure theoretic probability with applications to financial mathematics

Intended Learning Outcomes:

After successfully completing this course students should be able to

- understand the basic concepts in measure theoretic probability
- apply those concepts in simple problems related to finance.

Course Content: (Main topics, Sub topics)

Definitions: sigma-algebra, measure, measurable space, measure space, set functions, measurable functions etc.

Probability space: countable case, general case, Lebesgue measure and Cantor set, probability measures, Borel-Cantelli lemma

Random variables: measure theoretic point of view, probabilistic approach

Expectation: definition, elementary convergence theorems (Fatou's lemma, monotone convergence theorem, dominated convergence theorem), product measures and Fubini's theorem, elementary inequalities (Chebysheff, Jensen's, Holder's, Minkowski's)

Conditional expectation and independence: conditioning with respect to an event, independence, conditioning with respect to a partition, Radon-Nikodym theorem, conditioning with respect to a sigma-algebra

Simple numerical calculations and applications of above concepts in financial mathematics

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- *Probability and Measure*. P. Billingsley, Wiley Series in Probability and Mathematical Statistics, 1986.
- *A Course in Probability Theory*. K. L. Chung, Academic Press, 1970.
- *A Basic Course in Measure and Probability*.*Theory and Applications*. R. Leadbetter, S. Cambanis and V. Pipiras, Cambridge University Press, New York, 2014.

Semester	**8**		
Course Code:	MIS4241		
Course Name:	**Statistical Consulting**		
Credit Value:	1		
Core/Optional	C		
Hourly Breakdown	Theory	Practical	Independent Learning
	-	15	-

Course Aim

The objectives of this course unit is to

- provide communication styles to ensure accurate flow of information between the client and the statistical consultant.
- explain the needs of the client through various questioning techniques, select and apply appropriate methods of analysis, and effectively communicate results through oral and written presentations.
- discuss statistical consulting in a real world setting.

Intended Learning Outcomes:

After successfully completing this course, students should be able to

- skillfully engage in statistical collaboration with clients
- demonstrate excellent presentation skills and statistical concepts and findings to a general scientific audience.
- identify appropriate statistical tools to address specific scientific questions.

Course Content: (Main topics, Sub topics)

- Introduction to Statistical Consulting
- Verbal, Written, and Presentation Communications
- Negotiating a Satisfactory Exchange
- Dealing with Difficult Situations
- Methodological Aspects of Statistical Consulting
- Grant Proposals and Manuscripts
- Anatomy of a Study

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10%, mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Statistical Consulting: A Guide to Effective Communication, Janice Derr, Duxbury Press, Belmont CA, 2000.
- Statistical Consulting, Javier Cabrera and Andrew McDougall, Springer-Verlag, New York, 2002.
- Statistical Consulting, Springer-Verlag, Cabrera, J. & McDougall, A. (2002), ISBN: 0-387-98863-7

Semester	**8**		
Course Code:	MFM4252		
Course Name:	**Introduction to Information Theory & Information Geometry with Applications to Finance**		
Credit Value:	2		
Core/Optional	O		
Hourly Breakdown	Theory	Practical	Independent Learning
	30		

Course Aim

The main objectives of this course are to

- explain the relationships between probability & information and statistics & differential geometry.
- introduce the student to the multidisciplinary subjects of information theory and information geometry.
- discuss some applications of information theory and information geometry particularly in finance.

Intended Learning Outcomes:

After successful completion of this course, student should be able to

- understand the basic concepts in information theory and information geometry.
- gain familiarity with the applications of information theory and information geometry in finance and related areas.
- appreciate the importance and usefulness of these two fields in financial analysis.

Course Content: (Main topics, Sub topics)

Introduction to information storage and information transmission as two basic problems in information theory and role of differential geometry in statistics.

How to quantify information - Shannon's information measures: entropy, joint entropy, conditional entropy, relative entropy, mutual information,

Basic inequalities - Convex / Concave functions, Jensen's inequality and its consequences, Log sum inequality and its applications , Data processing inequality

Communication channels - how to model a communication channel, channel capacity: for example, Noiseless Binary Channel, Binary Symmetric Channel (BSC), etc. Shannon's noiseless & noisy coding theorems, Asymptotic Equipartition Property (AEP), Information-theoretical version of the Law of Large Numbers (LLN),

Information measures for continuous random variables - differential entropy, relative entropy, mutual information, etc.

Basic concepts of information geometry - Manifolds of Probability distributions/densities, Riemannian metric, Fisher information as the unique Riemannian metric, parallel transport, sub manifolds, geodesics, exponential and mixture families etc.

Applications - Information theory and information geometry of financial market, interest rate theory, portfolio theory, etc.

Teaching /Learning Methods: Conducting Lectures and Tutorial classes

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes :10% , mid-term:10% assignment: 20%	Theory (%) 60%	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- *Elements of Information Theory.* Thomas M. Cover and Joy A. Thomas, Wiley Inter science, 2006.
- *Methods of Information Geometry.* S. I. Amari and H. Nagaoka, American Mathematical Society and Oxford University Press, 2000.

Semester	**8**		
Course Code:	MSF4212		
Course Name:	Human Resources Management		
Credit Value:	2		
Core/Optional	O		
Hourly Breakdown	Theory	Practical	Independent Learning
	30		

Course Aim

- To introduce Human Resource Management Concepts, theories, techniques and policies regarding the human Resource Management Functions.
- To understand the role of HR Manager in improving efficiency and effectiveness of the organization To provide necessary skill to make human resource related decisions

Intended Learning Outcomes:

- Know what HRM is
- Understand the functions of HRM.
- Develop a right attitude to appreciate the overwhelming importance of management of people at work.
- Develop an adequate ability to make appropriate decisions with regard to general aspects of HRM in an organization.

Course Content: (Main topics, Sub topics)

- Introduction to Human Resource Management
- Job Design and Job Analysis and Human Resource Planning
- Recruitment and Selection placement and Induction
- Employee Training and Development
- Employee Performance Evaluation
- Employee Compensation
- Employee Health and Safety Management
- Employee Discipline and Employee Grievances Handling
- Labour-Management Relations
- Human Resource Information Systems

Teaching /Learning Methods: Lectures, Group discussions, Assignments

Assessment Strategy:

Continuous Assessment 30%	Final Assessment 70%		
Details: quizzes :10% , assignment: 20%	Theory (%) 70%.	Practical (%) ……..	Other (%)(specify) ……

References/Reading Materials:

- Opatha, H.H.D.N.P. (2012). Human Resource Management, Sri Lanka: Author Publisher
- Dessler, G. (2008). Human Resource Management. (11th edition) New Delhi: Prentice Hall
- Adikaram, A., (2008). Industrial Relations, Stamford lake