MSc/PGD in Business Statistics

Department of Mathematics
Faculty of Engineering
University of Moratuwa
Moratuwa

CURRICULUM
(Intake 2020/21 Onwards)

Code	Compulsory Module	Credits	Evaluation (%)	
			Continuous Assessments	Final Exam
Term 1				
MA 5210	Probability and Statistics	3	40±10	60±10
MA 5233	Statistical Modelling in Business	3	40±10	60±10
MA 5212	Survey Sampling for Business	3	40±10	60±10
MA 5213	Statistical Quality Control	3	40±10	60±10
Term 2				
MA 5203	Time Series Analysis for Business Forecasting	4	40±10	60±10
MA 5224	Investment and Portfolio Analysis	3	40±10	60±10
MA 5231	Computer Software in Business and Management	3	40±10	60±10
MA 5211	Quantitative Analysis for Management	3	40±10	60±10
Term 3				
MA 5234	Applied Multivariate Techniques in Business	4	40±10	60±10
MA 5214	Operational Research Techniques	3	40±10	60±10
MA 5235	Financial Derivatives	3	40±10	60±10
MA 5215	Analysis of Categorical Data in Business	3	40±10	60±10
MA 5290	Project on Business Statistics for Diploma	4	-	100
Research Project				
MA 5291	Research Project for M. Sc.	20	-	100

SYLLABI OF PROPOSED COURSE UNITS

MA5210   Probability and Statistics (3 Credits)

Learning Objectives:
The aim of this course is to train students to carry out explanatory data analysis using probability and distribution theory along with descriptive statistics and interpret results and use hypothesis test under business environment

Outline Syllabus:
Probability distribution theory, conditional probability, Bayes theorem, discrete and continuous random variables, estimations, bias and unbiased estimators, confidence intervals under different conditions, properties of common probability distributions (Binomial, Normal, Poisson, Exponential, Gamma), sample and population properties, testing statistical hypothesis, decision theory and utility theory, describing data sets using various statistical indicators, summarizing data, methods of presenting variability in data series, use of SPSS and MINITAB software for explanatory data analysis. Introduction to few non-parametric techniques.

Data Analysis: Real data sets are analysed using SPSS and Minitab and SAS

Learning Outcomes:
- Able to understand a working knowledge of basic techniques in probability
- Able to analyse data using descriptive statistics and interpret findings in a scientific manner
- Able to look at data more logically, analytically, critically and creatively
- Able to use statistical hypothesis tests for scientific decisions in Business

MA 5233   Statistical Modelling in Business (3 Credits)

Learning Objectives:
The aim of this course is to introduce statistical linear methods for analysing quantitative response data in business environment.

Outline Syllabus:
Regression Analysis: Concept of statistical modelling, Introduction to simple linear regression, parameter estimation using least square methods, coefficient of determination, properties of the parameters, inferences in regression, lack of fit tests, multiple linear regression, model selection procedures in multiple regression, residuals and influence diagnostics, detecting and combating multicollinearity, linear transformations, Box-Cox transformation, comparison of regression models and use of dummy variables in regression.

Experimental Designs: Basic concepts of experimental design, Completely Randomized Design, Randomized Complete Block Design, Factorial experiments

Data Analysis: Real data sets are analysed using SPSS, Minitab and SAS

Learning Outcomes:
- Able to appreciate the importance of statistical models in business and management
- Able to use statistical software with confident
- Able to apply statistical models to solve business problems
- Able to interpret statistical inferences to understand the business people

MA 5212   Survey Samplings for Business (3 Credits)

Learning Objectives:
This objective of this course is to provide sound knowledge in conducting and analysing a survey for business/marketing project.

Outline Syllabus:
Basic ideas in sampling, simple random sampling, probability proportional sampling, systematic sampling, stratified sampling, cluster sampling, multistage-sampling, double sampling procedures, allocation of sample, estimation problems, ratio and regression estimators, questionnaire design, management of surveys, coding variables, computerizing data, preparing tables and figures, common techniques in analysis of survey data and writing survey reports.

Data Analysis: Real data sets are analysed using SPSS

Learning Outcomes:
- Able to design a survey depending on the conditions
- Able to design a questionnaire to acquire information for the survey
- Able to analyse data from a survey and write a report
- Able to interpret findings in a scientific and concise manner

MA5213   Statistical Quality Control (3 Credits)

Learning Objectives:
The objective of the course is to provide students statistical quality control techniques for producing affordable products that meet customer and consumer expectations.

Outline Syllabus:
Fundamental concepts of quality control, concepts of statistical quality control, quality improvement tools, systematic variation, random variation. chance and assignable causes, Standardization and Concepts on Total Quality Management, Quality Management Systems, Laboratory Management, Statistical Process Control in Production and Service Systems, Control charts for x , R, and S, control charts for attributes, control charts for fractional rejected, control charts for nonconformities, accepting sampling problem, operating characteristic curve, single sampling plan for attributes, double, multiple, and sequential sampling, the Dodge-Roming sampling plans (AOQL and LTPD plans), capable process, capability & performance indices, control charts for multiple assignable causes.

Data Analysis: Real data sets are analysed using Minitab & SPSS

Learning Outcomes:
- Able to learn about many statistical methods commonly used by industry for quality controlling
- Able to monitor and improve the quality of products resulting from industrial processes after statistical analysis

MA 5203   Time Series Analysis for Business Forecasting (4 Credits)

Learning Objectives:
The purpose of this course is to provide students various statistical tools for forecasting of production and financial time series data.

Outline Syllabus:
Introduction of time series, concept of autocorrelation and partial autocorrelation, casual models in forecasting, decomposition analysis in forecasting, smoothing techniques in forecasting, concept of stationary time-series data, Box-Jenkins models in forecasting, use of seasonal ARIMA models, filtering techniques, heteroskedasticity in financial time series, ARCH and GARCH models, development of multivariate time series models (VAR and VEM models), co-integration modelling, Dickey-Fuller test.

Data Analysis: Real data sets are analysed using SAS, SPSS and Minitab

Learning Outcomes:
- Able to understand the various times series forecasting models
- Able to select the best fitted forecasting model for a given set of data series
- Able to understand the difference between normal time series and financial time
- Able to develop ARCH/GARCH models for financial time series data
- Able to use software such as EViews, Minitab and SPSS with confident

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MA 5224   Investment and Portfolio Analysis (3 credits)

Learning Objectives:
The purpose of this course is to introduce the fundamental concepts of financial derivatives and portfolio risk measurement and management. Identify and analyze available investment assets and their price behavior in the market.

Outline Syllabus:
Introduction to Portfolio Risk, Identifying and Classifying different kinds of Financial Risks such as market risk, credit risk, operational risk, political risks, Risk Measurement and Management, Market and liquidity risk measurement, Credit risk measurement (traditional and modern approaches), Value at Risk, Expected Shortfall, Managing Market Risk, Portfolio Management and Evaluation, Fixed-income portfolio, Equity portfolio , Evaluating Portfolio Performance, International Diversification, Hedge Funds, The Theory of Active Portfolio Management

Learning Outcomes:
- Able to understand the basic concepts of the portfolio management
- Able to understand the portfolio performance evaluation method
- Able to identify several types of financial risks, such as market risk, credit risk and sovereign risk
- Able to apply risk measurement and management processes to a variety of portfolio risks

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MA 5231   Computer Software in Business and Management (3 Credits)

Learning Objectives:

The aim of this course is to make the students confident to use common statistical and spreadsheet computer packages in business environment

Outline Syllabus:

Data management, summarizing and analysis in Excel and use of macros in Excel, Use of various graphs in Excel, Hands on experience with Cameo Business Modeler product family, Deliver Business Intelligence solutions, Integrate data & Easily consolidate data , Present business insights & Reporting Services, Delivering ad hoc reports , Building a scorecards and dashboards, Creating a KPI within a cube, Smart-analysing data, Forecasting trends with data-mining techniques, Big data application, Working with large datasets, Combine data from totally different data sources much more effectively, Best practices on working with pivot tables and pivot charts, Creating interactive dashboards to answer business questions, Better understanding how databases are designed

Learning Outcomes:
- Able to use Excel for data management in business
- Able to develop simple macros for Excel
- Able to know new application in business intelligence
- Able to new trends in smart data analysing

MA 5211   Quantitative Analysis for Management (3 Credits)

Learning Objectives:

The objective of this course is to introduce the use of mathematical approaches to solve managerial problems.

Outline Syllabus: Linear programming problems, graphical method, Simplex method, economic interpretation of LPP, transportation algorithms, balanced and unbalanced transportation problems, degeneracy, assignment problems, transhipment problems, network flows, maximal flow, minimal flow, minimum spanning tree, and shortest path algorithm in the network, labelling technique, connection between network flow and transportation, matrix solution, and inventory control.

Learning Outcomes:
- Able to understand a working knowledge of basic techniques in operational research
- Able to report and interpret findings in a scientific and concise manner
- Able to solve problems independently and collaboratively as part of a team

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MA 5234   Applied Multivariate Techniques in Business (4 Credits)

Learning Objectives:

The aim of the course is to focus on the analysis of multivariate data in business environment.

Outline Syllabus:

Types of measurement scales, geometric concept of multivariate data, multivariate plots and diagrams, basic concept of matrices and eigen values, introduction to data mining and warehousing, properties of multivariate normal distribution, multivariate regression techniques, principal component analysis, explanatory factor analysis, confirmatory factor analysis, cluster analysis, discriminate analysis (two groups and multiple groups), canonical correlation analysis, multivariate analysis of variance

Data Analysis: Real data are analysed using statistical software such as Minitab, SPSS and SAS

Learning Outcomes:
- Able to use various multivariate statistical data mining methods
- Able to identify the most suitable multivariate techniques for a given data
- Able to interpret the results and apply for decision making
- Able to use Minitab, SPSS and SAS for multivariate data analysis

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MA 5214   Operational Research Techniques (3 Credits)

Learning Objectives:
The aim of the course is to introduce students the probabilistic approach to managerial decision-making.

Outline Syllabus:
Revised simplex algorithm, Dual Simplex Algorithm, sensitivity analysis, parametric programming, integer programming, Gomory's cutting plane, branch and bound, the Knapsack problem, delayed column generation, the cutting stock problem, decision theory, structuring the decision situations, decision making under uncertainty, utility theory, dynamic programming, waiting line theory, queue discipline, introduction to stochastic processes, Markov chains, Basics in game theory and introduction to simulation.

Learning Outcomes:
- Able to understand a working knowledge of advance techniques in operational research
- Able to solve problems independently and collaboratively as part of a team
- Able to write reports and interpret the findings in a scientific and concise manner

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MA 5235   Financial Derivatives (3 Credits)

Learning Objectives:
The purpose of this course is to provide skills and knowledge in understanding and analysing financial derivative in the market.

Outline Syllabus:
This discusses the basic derivatives such as, forward contracts, futures contracts, options and SWAPs, types of trades such as, hedgers, speculators and arbitrageurs, pricing methods such as binomial models and Black-Scholes-Merton model, uses of derivatives such as, hedging, speculation and to make arbitrage profits, the market mechanism for various types of derivative trading and the lessons for users of derivatives in financial and non-financial firms, Future options, evaluation of future options using a binomial tree, Black's model for valuing future's options, Options of stock indices

Learning Outcomes:
On satisfactory completion of this course student will be able to:
- Understand various derivative securities available in financial markets
- Understand characteristics and pricing of various derivatives
- Understand the use of derivative securities
- Understand the theories that explain the relationships between prices of underline assets and derivatives

- Understand the lessons for users of derivatives

Learning Objectives:
The purpose of this course is to provide an analytical skill in qualitative data often arises in business environment.

Outline Syllabus:
Data types, Analysis of ordinal data, analysis of binary data, concept of odd ration, use of odd ration in interpretation, analysis of count data (2-way, multi-way tables), use of log linear models to analysis multi- way tables, binary and multi nominal logistic models (binary and multinomial),

Data Analysis: Real data are analysed using statistical software such as SPSS and Minitab.

Learning Outcomes:
- Able to understand various statistical methods for categorical data analysis
- Able to identify the most suitable methods for a given data
- Able to interpret the results and apply for decision making
- Able to use SPSS and Minitab for categorical data analysis
- Able to analyse large survey data and write reports