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1. ELIGIBILITY REQUIREMENTS

Candidates applying for the Master of Science in Business Statistics or Postgraduate Diploma in Business Statistics shall have

- (a) An Honours Bachelor's degree of the University of Moratuwa.

OR

- (b) Any other four year degree in a relevant field from a recognized university as may be approved by the Senate of University of Moratuwa.

OR

- (c) Any other three year degree in a relevant field from a recognized university, and a minimum of one year of appropriate experience after obtaining such degree as may be approved by the Senate of University of Moratuwa.

OR

- (d) Any recognized category of membership of a recognized Professional Institute obtained through an academic route and with a minimum of one year of appropriate experience after obtaining such membership as may be approved by the Senate of University of Moratuwa.

2. COURSE CURRICULUM AND SCHEME OF EVALUATION

Code	Compulsory Modules	Credits ¹	Existing Evaluation ² (%)		Proposed Evaluation (%)	
			Continuous Assessments	Final Exam	Continuous Assessments	Final Exam
Term 1						
MA 5210	Probability and Statistics	3	40±10	60±10	100	0
MA 5212	Survey Sampling for Business	3	40±10	60±10	100	0
MA 5233	Statistical Modelling in Business	3	40±10	60±10	100	0
MA 5213	Statistical Quality Control	3	40±10	60±10	100	0
Term 2						
MA 5203	Time Series Analysis for Business Forecasting	4	40±10	60±10	100	0
MA 5224	Investment and Portfolio Analysis	3	40±10	60±10	100	0
MA 5231	Computer Software in Business and Management	3	40±10	60±10	100	0
MA 5211	Quantitative Analysis for Management	3	40±10	60±10	100	0
Term 3						
MA 5234	Applied Multivariate Techniques in Business	4	40±10	60±10	100	0
MA 5214	Operational Research Techniques	3	40±10	60±10	100	0
MA 5235	Financial Derivatives	3	40±10	60±10	100	0
MA 5215	Analysis of Categorical Data in Business	3	40±10	60±10	100	0
MA 5290	Project on Business Statistics for Diploma	4	-	100	No change	
Research Project						
MA 5291	Research Project for M. Sc.	20	-	100	No change	

¹ 1 credit corresponds to 14 hours of lectures or equivalent.

² The mean value in the evaluation scheme is the default value. It can be changed by the Lecturer/Examiner concerned, within the specified range, by announcement to the students at the commencement of the course unit.

* Evaluation is based on the requirements as specified in clause 4.1(c) of the By-Law.

* **Proposed criteria will be effective from the date approved by the senate an effective during the Covid- 19 situation and will be automatically revert back to the existing criteria.**

3. SYLLABI OF 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 softwares for explanatory data analysis. Introduction to few nonparametric 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 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
-

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
-

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 \bar{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-Romig 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

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 behaviour 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

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, transshipment 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

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

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

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
-

MA 5215 Analysis of Categorical Data in Business (3 Credits)

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

MA 5290 Project on Business Statistics for PG Diploma

Learning Objective:

The aim of the project is to provide an opportunity of further practicing in analysing a set of real data in the field of Business using statistical techniques and interpretation results in order to make the students more comfortable to tackle the analytical problem independently. The students have to write a short report on the data analysis of which consists of minimum of 40 pages.

Assessment: Report (60%) and Oral Presentation (40%)

MA 5291 Research Project for M. Sc.

Learning Objective:

This subject aim student in the development of research methodology appropriate to the practice of Business Statistics and gives students the opportunity to work on problems of Business Statistics that have real significance value. The work should usually relate to the any subject area on Business Statistics, and requires knowledge and skill acquired in the course. A dissertation and an oral presentation are required upon completion of the project

Assessment: Dissertation (60%) and Oral Presentation (40%)

4. PERFORMANCE CRITERIA

4.1 TITLE OF DEGREE: Master of Science

- **Title of Award:** Master of Science in Business Statistics
- **Programme Type:** A
- **Programme Mode:** Part-time

4.2 PARTICIPATION IN THE ACADEMIC PROGRAMME

- 80% attendance is usually required in lectures, as specified under clause 4.1.1(a) of the By Law.
- Participation is compulsory in assignments, as specified under clause 4.1.1(b) of the By Law.
- Undertaking research in a specific area is compulsory, as specified in clause 4.1.1(c) of the By Law.
- The Master's degree programme is expected to be completed in the normal duration but may go on till the permitted duration of study without the need of an extension as specified under section 5 of the By Law.
- It is the responsibility of the student to obtain an extension to the permitted duration through the Head of Department. Such requests to extend the duration will be taken considering the progress of the student at the time of request.
- Prior approval must be obtained in writing from the University, with the necessary documentation, for leave of absence (as defined by the Senate). Only such leave will be considered for any official purpose, such as considering subsequent attempt as a first attempt.
- Only approved leave obtained on medical grounds will be normally be considered by the Senate in extending the maximum duration of study.

4.3 EVALUATION AND GRADING

- The performance of each student in each module will be evaluated by continuous assessment (CA) and end-of-semester examination (WE).
- The CA component in a module normally carries a weightage of not less than 30% and not more than 60% of the total marks.

- The continuous assessment of a student may be based on a specified combination of assignments including coursework, project work, design project work, laboratory work, tutorials, field trips, field camps, quizzes, presentations, term papers and participation in the course activities.
- Each Candidate should obtain at least 40% from each of CA and WE components to obtain a pass grade a module.
- Grade C+ or above is required to earn credit for and pass a module.
- A student failing to reach 40% in one of CA or WE components receive an incomplete grade I, and is required to repeat only the failed component/s as a repeat candidate to complete the module.
- A student obtaining at least 40% in each of CA and WE components but fails to pass a module receives an incomplete grade I, and is required to repeat either of the component/s as a repeat candidate to complete the module.
- A student failing to reach 40% in both CA and WE components receives an F grade and must repeat both components in order to upgrade the result.
- The grades F or I can be improved up to a C+ grade and considered for calculating the GPA. Students who wish to upgrade need to complete their examinations and obtain the upgraded grade before the relevant final board of examiners after the graduation requirements are met.
- The grade achieved for each module will be entered on the student's permanent record in the registry. The grade at the first attempt or the improved grade earned at a subsequent attempt, if any, will be recorded.
- Except when an Academic Concession has been granted, the highest grade obtainable at a repeat attempt is the grade "C+" and it will be used for calculating Grade Point Average (GPA).
- Grade N signifies an Academic Concession has been granted, in the event a student is unable to sit for the WE due to illness or other compelling reason accepted by Senate. In such instances the students must make an appeal, with supporting documents to the Director Postgraduate Studies for an Academic concession.
- Letter grades based on the Grade point system and corresponding description as illustrated in the following Table will be used to express the performance at each module. Benchmark percentages are given for the guidance of the examiner and

may be changed upwards or downwards by the moderator in consultation with the examiner.

Table: Grading System

Benchmark Percentage	Grade	Grade Point	Description
85 and above	A+	4.2	
75 to 84	A	4.0	Excellent
70 to 74	A-	3.7	
65 to 69	B+	3.3	
60 to 64	B	3.0	Good
55 to 59	B-	2.7	
50 to 54	C+	2.3	Pass
	I	0.0	Incomplete
	F	0.0	Fail
	N	--	Academic Concession

- The Grade Point Average (GPA) is calculated based on the summation Grade Points earned for all modules registered for credit (except those awarded with academic concession or withdrawn) weighted according to number of credits, as follows.

$$GPA = \frac{\sum n_i \times g_i}{\sum n_i}$$

where n_i is the number of credits for the i^{th} module and g_i is the grade points earned for that module.

- The GPA is rounded to the nearest second decimal place and reported on the transcript.

4.4 ACADEMIC CONCESSION

- A student who has missed a WE or any other course requirements because of illness or other compelling reason may appeal with supporting documents to the Director Postgraduate Studies through the Head of Department for an Academic Concession. In case of an examination, the student should submit an application with supporting documents within two weeks from the date of an examination. In instances where a student misses any other course activity such as CA, the student should submit the application with supporting documents before the last date of academic activities of the relevant semester or term.
- An Academic Concession may be granted for medical reasons and other exceptional circumstances subject to the approval by the Senate of the University.

4.5 GRADUATION REQUIREMENTS

- A candidate is deemed to have passed the Postgraduate Diploma if candidate has successfully completed at least 40 credits including:
 - (a) subjects specified under clause 4.1 (a) of the By Law
 - (b) assignments specified under clause 4.1 (b) of the By Law
 - (c) project specified under clause 4.1 (c) of the By Law
- If the student is unsuccessful in any parts (a), (b), (c) mentioned above, the student may be re-examined.
- Classes will not be awarded.

5. ADMINISTRATION PROCEDURE

5.1 EVALUATION OF DISSERTATION

- A candidate should inform the tentative date of initial submission of Dissertation at least 3 months prior to the initial submission for the coordinator to proceed with the appointment of panel of evaluation.
- A candidate intends to submit his/her Dissertation for evaluation, should submit the draft Dissertation to the supervisor for his/her concurrence.
- If the supervisor is satisfied with the draft Dissertation, and complies with the University Policy on Plagiarism, supervisor shall recommend the submission of the examinable copy of the dissertation.
- The candidate shall complete the Form **PGBoS/005: Form for Initial Submission of Dissertation** and make the “Initial Submission” of the Examinable copies of the Dissertation to the Head of Department (HoD) through the Dissertation Supervisor and Course Coordinator within the permitted duration, if extension has been granted by the Senate.
- The Candidate shall make a Presentation and face the Viva-voce examination. The evaluation of the candidate shall be made by the panel.
- If the supervisor/examination panel satisfies with the final Dissertation, and if it complies with the University Policy on Plagiarism, supervisor/examination panel shall recommend the final submission of Dissertation.
- The Dissertation candidate shall complete the Form **PGBoS/007B: Form for Final Submission of Dissertation and Award of Degree** *and* **PGBoS/008: Student Clearance** and submits them with two copies of “Final Dissertation” to the HoD through the Supervisor through Course Coordinator.

Note: *In all correspondence make with regards to the dissertation submission, the candidate shall provide a copy of the student record book including the photograph and the payment details.*

5.2 AWARD OF DEGREE

- The registry shall check the satisfaction of following requirements and other requirements as per the By Laws, to be considered being eligible for the award:
 - a) Has pursued an approval programme;
 - b) Has fulfilled all academic requirements of programme;

- c) Has successfully completed all prescribed evaluations including Written examination(s) and Assignments;
- d) Has fulfilled duration requirements (minimum and maximum);
- e) Has paid all fees;
- f) Has no dues to the academic department, Library and other divisions;
- A candidate for a degree, once determined as successful by the Senate, shall be considered as a graduand until the award of the degree
- A graduand shall supplicate to obtain the degree at the Convocation either in person or in absentia, as per the relevant By Law.

5.3 STUDENT REQUEST

- Formally registered students shall make request for changes to the normal academic programme such as:
 - a) Sit examinations with next batch as first attempt candidate
 - b) Deferment of the programme
 - c) De-registration from the programme
 - d) De-registration from course module(s)
 - e) Leave
- If request justifiable, the Course Coordinator and HoD shall recommend the student request and forward it to D/PGS.
- No student will be allowed to change the normal academic programme without the Senate approval for such changes.

6. TEACHING AND EXAMINATION PANEL

- Prof (Ms) N R Abeynayake, Wayamba University
- Prof. Chandana Gunathilake, University of Jayawardenepura
- Mr. Rohana Dissanayake, University of Moratuwa
- Ms. D R T Jayasundara, University of Moratuwa
- Dr. P M Edirisinghe, University of Moratuwa
- Mr. Wimal Nanayakkara, Former Director, Department of Census and Statistics
- Dr.(Ms) J A B U Jayasinghe, University of Moratuwa
- Dr.(Ms) Pansujee Dissanayake, University of Kelaniya
- Dr. Ranga Abeysooriya, University of Moratuwa
- Dr. J H D S P Tissera, University of Colombo
- Dr. S C Mathugama, Institute of Technology, University of Moratuwa
- Mr. P Dias, University of Jayawardenepura
- Dr. W C W Nawaratne, Open University
- Dr. B Kumarendran, M.D., University of Jaffna
- Dr.(Ms) C H Magalla, University of Colombo
- Dr.(Ms) A A Sunethra, University of Colombo
- Dr.Romesh Thanuja, University of Moratuwa