SUBJECT DESCRIPTION FORM

Subject Title: Applied Statistical Methods

Subject Code: AMA2631

Co-requisite: Probability and Distributions (AMA2691)

Exclusion: Applied Statistical Methods (AMA263)

Objectives:

To provide students with an overview of the Linear Model approach (regression analysis) and the Sum of Squares approach (analysis of variance) to analyze data. To enable students to have a thorough understanding of the methods of regression analysis as one of the most widely used statistical techniques for analyzing data. To help students to develop their ability to analyze the practical problems with the use of computer statistical packages such as MINITAB and SPSS, as well as commercial software EXCEL.

Learning Outcome:

Upon satisfactory completion of the subject, students should be able to:

1. gain a basic knowledge and understanding of the Analysis of Variance (ANOVA) approach to analyze data , and the assumptions behind ANOVA;
2. identify and describe Fixed-effects Model and Random-effects Model when dealing with One-Factor ANOVA problems;
3. analyze and report the results of the ANOVA problems and assess their significance;
4. formulate and tackle Simple/Multiple Linear Regression problems so as to identify the appropriate model for the problems, to perform variables selection, estimation and inference on the parameters of the regression model built, and to diagnose if any problems arise due to violation of assumptions of Least Square Regression models;
5. develop the competence in the use of appropriate statistical packages/commercial software for the analysis of data using Univariate ANOVA and Linear Least Squares Regression approaches;
6. manage their own learning and to make use of appropriate texts, learning materials and relevant web-sites;
7. communicate effectively in a well-structured manner and build up an open-minded attitude.

Learning Approach:

Lecture		28 hours
Tutorial		14 hours
	Total	42 hours

Learning outcomes 1-4 will be achieved via lectures and tutorial exercises. Learning outcomes 5-7 will be acquired via tutorial discussions, statistical package laboratory sessions and mini-projects.

Assessment:

Continuous Assessment		40%
Examination		60%
	Total	100%

Learning outcomes 1- 4 are assessed by tests and examination. Learning outcomes 3, 5 and 6 are assessed by computer assignments with real data.

To pass this subject, students are required to obtain Grade D or above in both the Continuous Assessment and the Examination components.

Syllabus:

Simple linear regression
Model and assumptions; least squares estimation of parameters; inference on the parameters; coefficient of determination; confidence interval for the mean value of the response variable; prediction interval; test for lack of fit; examination of residuals. (9 hours)

Multiple linear regression models
An extension of the simple linear regression model and as a special case of the general linear model $y = X\beta + \varepsilon$; estimation and inference on the parameters; partial *F*-tests; polynomial regression. (6 hours)

Variable Selection and Model Building
Selection of independent variables; criteria for subset regression; the methods of all regressions, backward elimination, forward selection and stepwise regression. (6 hours)

Indicator Variables
Concept of indicator variables; use of indicator variables. (3 hours)

Multicollinearity
The problem of multicollinearity; multicollinearity diagnostics; solutions to multicollinearity. (3 hours)

Autocorrelation
Sources and effects of autocorrelation; detecting the presence of autocorrelation; parameter estimation procedures with autocorrelated errors. (3 hours)

Analysis of variance
One-way classification, partitioning of the total sum of squares and the degrees of freedom; ANOVA table; fixed-effects model and random-effects model; expectations of mean squares, estimation of the overall mean and components of variance. Regression approach to ANOVA. (12 hours)

Recommended Textbook:

Kutner, M.H., Neter, J, and Wasserman, W.	Applied Linear Statistical Models, 5th edition	McGraw-Hill Irwin, 2005

References:

Bowerman, B.L., O'Connell, R.T. and Dickey, D.A.	Linear Statistical Models, An Applied Approach, 2nd edition	Duxbury, 1990
Montgomery, Peck and Vining	Introduction to Linear Regression Analysis, 3rd edition	Wiley, 2001
Dretzke, B. J.	Statistics with Microsoft Excel, 2nd edition	Prentice Hall, 2001