

Programme : M.Com.
 Course Code : **COO447**
 Course Title : **Advanced Statistical Analytical Models**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Certain business problems are too complex involving varied factors, assumptions and analytical goals. The data sets that are used in resolving such complex business problems require skills in application of advanced statistical modelling techniques. The course in Advanced Statistical Analytical Models provides an opportunity to learners to acquire these skills and develop expertise in resolving distinct and complex business problems.
Description of the Course	: This course provides training in advanced regression models including ridge regressions, ordinal and multinomial logit regression models that are used in understanding distinct and significant marketing problems. Further, it covers path modelling based on partial least squares which is emerging as a significant format of structural equation modelling. Mixed effects modelling that address the modelling needs of hierarchical data. The advanced risk analysis models including survival analysis are also included in this course. Learners can acquire skills in using software applications for optimization problems through linear programming.
Objectives of the Course	: (i) To enable learners understand estimation and interpretation of advanced regression models. (ii) To enable learners in acquiring skills in structural equation modelling using partial least squares methodology. (iii) To develop skills in learners on modelling of hierarchical data. (iv) To facilitate estimation of risk analysis and optimization models using modern software applications.

Course Content

Unit 1	:Advanced Regression Models	14 Hours
Ridge regression – Regression models for counts and proportions – Ordinal regression models – Multinomial logit model.		
Unit 2	: Path Modelling	14 Hours
Partial Least Squares path modelling – PLS regression and PLS SEM models – Path diagrams – Reflective and formative models – Inner and outer models – Confirmatory Tetrad Analysis - Validity testing in PLS-SEM – Importance Performance Map Analysis - Estimation with blindfolding - Mediation – Moderation – Partitioning – Bootstrapped significance output – Multi group analysis.		
Unit 3	: Mixed Effects Modelling	12 Hours
Nature of hierarchical data – Concept and need for mixed effects models – Crossed and nested designs – Fixed and random effects – Preparing data for mixed effects modeling – Fitting fixed effects model –		

Mixed effects modeling procedure - Model fit – Custom hypothesis tests - Multilevel analysis – Mixed model ANOVA.

Unit 4	: Risk Analysis and Optimization Models	12 Hours
Concept of risk analysis – Meaning and applications of Survival Analysis – Semi-Parametric survival models: Kaplan-Meier Curves (Logrank tests) – Life-table analysis – Cumulative incidence analysis – Cox regression – Parametric survival regression - Linear programming models.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Malhotra, N. and Dash, S. (2013), Marketing Research: An Applied Orientation, 6e, Pearson. 2. Hutcheson, G. and Moutinho, L. (2008), Statistical Modeling for Management, Sage Publications. 3. Garson, G. (2016), Partial Least Squares: Regression and Structural Equation Models, Statistical Publishing Associates, USA. 4. Hair, J., Hult, G, Ringle C. and Sarstedt, M. (2014), A Primer on Partial Least Squares Structural Equation Modeling, Sage Publishing. 5. Gujarati, D. (2011), Econometrics by Example, Palgrave MacMillan. 6. Hosmer, D., Lemeshow, S., May, S. (2008), Applied Survival Analysis: Regression Modelling of Time-to-Event Data, 2nd Edn., Wiley. 7. Galwey, N. (2007), Introduction to Mixed Modelling: Beyond Regression and Analysis of Variance, Wiley. 8. Saleh, A., Arashi, M., Kibria, B. (2019), Theory of Ridge Regression Estimation with Applications, Wiley. 9. Stevens, J. (2009), Applied Multivariate Statistics for the Social Sciences, 5th Edn., Routledge. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1 Estimate and interpret advanced regression models for special circumstances and limited dependent variable. CO2 Develop path models using partial least squares estimations. CO3 Demonstrate application of mixed effects models for modelling hierarchical data. CO4 Apply advanced risk analysis models including survival analysis and Cox regressions in business decision making. CO5 Demonstrate usage of software applications in resolving optimization issues.	

Online Resources	<ul style="list-style-type: none"> • https://www.statisticshowto.com/ridge-regression/ • https://www.smartpls.com/documentation/getting-started/pls-sem-academy • https://stats.idre.ucla.edu/other/mult-pkg/introduction-to-linear-mixed-models/ • https://towardsdatascience.com/using-mixed-effects-models-for-linear-regression-7b7941d249b • https://ademos.people.uic.edu/Chapter17.html • https://ourcodingclub.github.io/tutorials/mixed-models/ • https://www.mygreatlearning.com/blog/kaplan-meier-curve-explained/ • http://www.ru.ac.bd/wp-content/uploads/sites/25/2019/03/402_08_-Elandt-Johnson-Survival-Models-and-Data-Analysis-1980.pdf
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