GUJARAT UNIVERSITY

M.PHIL COMMERCE

SUBJECT: APPLIED STATISTICS

(To be Effective from Academic Year 2017-18)

Structure of Course Work

There shall be Four Papers to be covered by the student registered for M. Phil. Commerce Degree with specialization in Applied Statistics as follows:

Part-I	**3 Theory Papers**	
Paper-1	**Research Methodology**	**100 Marks (70 External + 30 Internal) 4 Credits; 60 Hours**
Paper-II	**Optimization Analytics**	**100 Marks (70 External + 30 Internal) 4 Credits; 60 Hours**
Paper-III	**Statistical Techniques for Business Analytics**	**100 Marks (70 External + 30 Internal) 4 Credits; 60 Hours**
Part-II	**Practical Work**	
(1) Paper-IV	**Conferences/Seminar/ Field Work/ Departmental Teaching**	**100 Marks (70 External + 30 Internal) 4 Credits; 60 Hours**
(2)	**Dissertation**	**200 marks of 8 Credits; (140 Marks of Evaluation, 60 Marks of *Viva Voce)***

The respective department will give the details of the Course Curriculum for Paper-IV and the Assessment of this paper will be done by the Dissertation Supervisor along with the Head of the Department concerned. The curriculum for 3 theory Papers and some proposed areas of research for Dissertation purpose are given below:

To be Effective from Academic Year 2017-18

Paper-1: Research Methodology

Unit 1: Introduction to Research:

Business Research, Nature and Scope of Business Research, Meaning and types of Research: Basic Research, Pure Research, Applied Research, Modern Scientific approach to Research, Research in Business, Research process. Structuring a Research proposal, Designing a research study: Exploratory, Descriptive and Causal Research Designs, Criteria of Good Research, Scope of a Research Study, Structuring a Research Proposal, Evaluations of Research study, Writing a Research Report, General Format of a Research Report, Research Report Writing, Criteria for evaluation of a Research study, Research Design Statistical Thinking and Definition of Statistics - Basic Statistical Terms - Variable Type and Data Measurement Scales

Unit-2: Data Preparation and Processing:

Exploring Data Patterns, Data Visualization, Data Cleaning and Transformation, Missing Observations and Outliers, Checking for the Assumptions of Multivariate Analysis: Tests of Normality, Tests for Heteroscedasticity, Tests for Linearity, Testing for Correlated Errors, Tests for Randomness

Unit-3: Advanced Multivariate Techniques

Concept and need of Multivariate Analysis, Multivariate Normal distribution - Some important properties, Concept of Hoteling T^2 distribution (without derivation) & its applications. Comparisons of several multivariate means, multivariable analysis of variances Hotelling T^2 Statistic, application in tests on mean vector for one and two multivariate normal populations and in testing equality of the components of mean vector (Problem of symmetry) D^2 Statistic, Fisher-Beheran's Problem, Wishart Distribution and its properties.

Unit-4: Quality Control:

Review of Quality and Statistical Quality control concepts, Control Charts for Measurements: CUSUM Chart, EWMA charts, Total Quality Management: Concept of Total Quality Management (TQM Concepts of quality planning, control, assurance and improvement, Elements of quality management system, Deming's Approach, Juran's Trilogy, Crosby's Approach and Taguchi;s Approach to TQM, quality circle, Quality Function Deployment, PDCA cycle, , Service Quality vs Product Quality, Strategic Quality Planning, The Cost of Quality, Cost of Quality Defined Different views of Quality Costs, Quality Costs and its Measurement. Criteria for Quality Programs ISO 9000 and onwards. Quality Awards, Award Process, Role of statistical techniques in quality management. Quality Control in Service Sector, Six Sigma as a problem solving methodology, Six-Sigma programmes in the industry, DMAIC and DMADV methodology, Six Sigma Tool Box: Seven quality tools, Quality function deployment (QFD), SIPOC, Statistical process control, Value stream mapping, TRIZ Classification and regression trees (CART), Chi-squared automatic interaction detector (CHAID) Lean thinking: Lean manufacturing, Value stream mapping

REFERENCES:

1. Deepak Chawla & Neena Sondhi: "Research Methodology: Concepts and Cases" Vikas Publications
1. Cooper & Schindler "Business Research Methods" Tata Mc.Graw Hill Publication
2. Amitava Maitra: Fundamentals of Quality Control and Improvement, Wiley Publication
3. N. Logothetis : Managing for Total Quality from Deming to Taguchi and SPC, Prentice Hall Publication
4. Duncan, A.J. and Erwin, R.D. (1974): Quality Control and Industrial Statistics, 4 th Edn. Taraporewala and Sons.
5. Grant, E.L. (1999): Statistical Quality Control. Tata McGraw-Hill.
6. Montgomery, D.C. (2007): Introduction to Statistical Quality Control. Wiley India
7. Hair, Black, Babin, Anderson: "Multivariate Data Analysis: A Global Perspective" 7th Edition, Pearson Education Publication

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Paper-II: Optimization Analytics

Unit-1: Duality in Linear Programming & Sensitivity Analysis

1.1 Definition of Dual Problem.

1.2 Rules for converting any Primal into its Dual

!!!!!!!!!!1.3 Properties of Duality

1.4 Dual-Simplex Method

1.5 Basic concepts of Sensitivity Analysis

1.6 Changes in the coefficient of objective function

1.7 Changes in the components of vector b and of Matrix A

1.8 Addition / Deletion of variable in the problem

1.9 Addition / Deletion of constraint in the problem

Unit-2: Integer Programming:

2.1 Introduction

2.2 All and mixed integer programming (IPP) problems

2.3 Gomory's All-IPP algorithm

2.4 The branch and bound technique

2.5 Zero - one programming

Unit-3: Goal Programming:

3.1 Definitions and Concepts

3.2 Formulation of Goal Programming Problem (GPP)

3.3 Solution of GPP by Graphical and Extended Simplex Methods

Unit-4: Simulation

4.1 Introduction & definitions

4.2 Types of simulation

4.3 Uses & limitation

4.4 Phases of simulation Model

4.5 Monte-Carlo Simulation & its applications

4.6 Advantages and Disadvantages ℄!

REFERENCES

1. Sharma J K: " Operations Research: Theory & Applications" MacMillan Publication
2. Kapoor V.K. (2006) : "Operations Research"; 7th Edition, Jain Book Depot
3. Sharma S.D. (2005): "Operations Research"; 15th Ed., Kedar Nath Ram Nath & Co. Publishers, Meerut,
4. Hira, D.S., Gupta, P.K. (2007): "Operations Research", S. Chand & Co., New Delhi

To be Effective from Academic Year 2017-18

Paper-III: Statistical Techniques for Business Analytics

Unit-1: Introduction to Business Analytics and Predictive Analytics:

Meaning of Business Analytics, Business Analytics Vs. Business Intelligence, Business Analytics Life Cycle, Business Analytics Process, Ethical Issues in Business Analytics, Selection of variables: Formulation of the problem, Simple and Multiple Linear Regression, R^2, adj. R^2 , ANOVA, Interpretation of coefficients, Dummy Variables, Residual Analysis, Outliers, Logistic Regression, Assumptions, Logistic Function, Chi-Square, -2 Log Likelihood, Interpreting Coefficients, Dependent Variable Prediction, All possible regressions and "Best Subset" regression, stepwise regression, Backward Elimination, Stepwise Method, Consequences of variable deletion, use of regression equations, Significance levels for selection procedures, Econometric Methods: Multicollinearity and Variable Selection, Variable Selection Using Ridge Regression, Generalized Least Squares, Indirect Least Squares, Weighted Least Squares, Two-Stage Least Squares, Power transformations for dependent and independent variables: Non-linear regression models, Generalized linear models: Analysis of binary and grouped data by using logistic models, Log-linear models.

Unit 2: Time Series Models and Business Forecasting:

Definition and importance of time series analysis, Time Series vs. Causal Models, Components of a Time series, Exploring Data Patterns, Choosing a Forecasting Technique, Moving Average, Exponential Smoothing, Double Moving Average, Holt's Method, Winter's Method, Decomposition Methods, Forecast Accuracy, Stationary Vs. Non-Stationary Time Series, Box-Jenkins Methodology, Introduction to Autoregressive (AR) Models, Moving Average (MA) Models, Mixed Autoregressive Moving Average (ARMA) Models, Autoregressive Integrated Moving Average (ARIMA) Models. Properties of these models. ARCH (Auto-Regressive Conditional Heteroscedasticity) and GARCH

(Generalized Auto-Regressive Conditional Heteroscedasticity), Causal modeling using linear regression, Analysis of Panel Data: Fixed effect, Random and mixed effect models, Judgmental Elements in Forecasting

Unit-3: Stochastic Models:

Introduction to stochastic models, Markov models, Classification of states, Steady-state probability estimation, Brand switching and loyalty modeling, Market share estimation Poisson process, Cumulative Poisson process, Birth and Death Processes, Gambler's Ruin Problem, Applications of Poisson and cumulative Poisson in operations, marketing and insurance, Renewal theory, Applications of renewal theory in operations and supply chain management, Markov decision process, Applications of Markov decision process in sequential decision- making

Unit-4: Data Mining Techniques:

Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization. Introduction to Data Mining, Applications of Data Mining, The process of Data Mining, Types of data for Data Mining: Relational Data, Data Warehouses, Transactional Data, Advance database system, Data Description: Clustering , Link Analysis, Data Mining Techniques: Market Basket Analysis, Apriori, FP Growth, Evaluation Methods: Lift, Kulc, IR, Chi –Square, Classification, Decision Tree Induction, Bayes Methods, Rule-Based Classification, Model Evaluation and Selection, Ensemble Approaches, Clustering, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering

REFERENCES:

1. Margaret H. Dunham: "Data Mining - Introductory and Advance Topics"; Pearson Edu.,
2. Jiawei Han, Micheline Kamber(2006) : "Data Mining"; II-Ed., Morgan Kaufmann Publishers,
3. ℄Hillol Kargupta, Jiawei Han, Philip S. Yu(2008): Next Generation of Data Mining, CRC Press,

4. Bates, D. M. and Watts, D. G.: Nonlinear Regression Analysis and its Application, Wiley, New York.
5. Chatterjee S., Hadi, A. S. and Price, B.: Regression Analysis by Examples, 3rd Ed., Wiley, New York.
6. Cook, R. D. and Weisberg, S.: Residuals and Inference in Regression, Chapman and Hall, London.Draper, N. R. and Smith, H.: Applied Regression Analysis, 3rd Ed.,Wiley,New York
7. McCullagh, P. and Nelder, J. A.: Generalized Linear Models, 2nd Ed., Chapman and Hall, London.
8. Chatfield Chris(2003) :"The Analysis Of Time Series: An Introduction"; Sixth Edition, Chapman & Hall
9. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.
10. Eric Siegel, Thomas H. Davenport, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", Wiley, 2013.
11. James R Evans, "Business Analytics – Methods, Models and Decisions", Pearson 2013.
12. R. N. Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2015.
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14. R. N. Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2015.
15. M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Foundation, 2011.
16. David Hand, Heiki Mannila, Padhria Smyth, "Principles of Data Mining", PHI 2013.
17. Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, "Forecasting methods and applications", Wiley 2013(Reprint).
18. David Hand, Heikki Mannila, Padhraic Smyth, "Principles of Data mining", PHI 2013.
19. Fundamentals of Predictive Analytics with JMP By Ron Klimberg and B. D. McCullough Publisher: SAS Institute. (e-book is available through Ohiolink).
20. Daniel T. Larose & Chantal D. Larose: "Discovering Knowledge in

21. Data: An Introduction to Data Mining", Wiley, Second Edition.

22. Bowerman, Connel & Koehler: "Forecasting, Time Series and Regression: An Applied Approach" DUXBURY, Cengage Learning

23. Draper & Smith: "Applied Regression Analysis" 3rd Edition Wiley Publication
24. Hanke, Wichern, Reitsch " Business Forecasting" 2nd Edition Pearson Education Publication
25. Medhi, J. (2009): Stochastic Processes, New Age International Publishers.
26. Bhat, B.R. (2000): Stochastic Models: Analysis and Applications, New Age International Publishers. pp. 199-201

Part-II
Dissertation

For Dissertation purpose the student can choose any specialization area of Commerce such as Finance, Marketing, Management and Accountancy and apply the Statistical Tools and Techniques to solve the various research problems in these areas. The Topic must be chosen with the consent of the Guide (Supervisor) and an approval of the University must be obtained and it must illustrate a considerable quality of the Dissertation by vast applications of the Statistical Techniques in various areas of Commerce. The broad suggested areas for Dissertation:

1. Applications of Operations Research Techniques in the field of Commerce
2. Utility and Probability Assessment in getting an insurance claim
3. Trend Analysis in Technological Forecasting
4. Sample information in marketing a new product
5. Company Sales Forecasting using various Statistical Forecasting Methods

6. Applying Multivariate Techniques to the various problems of Marketing and Management
7. Applications of Statistical Techniques in Management accounting and Finance
8. Quality Management Using Statistical Techniques
9. Any other topic in consultation with the Guide (Supervisor)

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