CURRICULUM

BS (4-Year) - *Statistics*

Department of Statistics
Abdul Wali Khan University Mardan

Aims and Objectives

The major aims and objectives of the curriculum of Statistics are to adapt the international standard in the curriculum.

1. To provide a sound footing of the subject matter of statistical theory with applications, so that they can pursue higher degrees and research in the field of statistics.

2. To upgrade the graduates with the knowledge of statistical theory with applications, statistical software and techniques of data collection and analysis so that they can compete in the job market.

3. To enhance and involve the graduates with the participation of project based activities so that they can be better trained in the field of published research.

4. To develop a solid foundation for the effective operational and strategic decisions using statistical theory in almost every discipline.

Scheme of Studies for BS Statistics:

BS Statistics is a four years course with eight semesters. The details of these courses are as under:

- The Details of Courses for BS-4years Program

Semester	Course Code	Name of the Courses	cr. (Hrs.)
1st	STAT-301	Introductory Statistics	3(3+0)
	ENG-301	Functional English	3(3+0)
	ISL-301	Islamic Studies/Ethics	2(2+0)
	MATH-312	Calculus-I	3(3+0)
	ECON - 301	Introduction to Economics	3(3+0)
	MATH-321	General Algebra	3(3+0)
	Semester Total		**17**
2nd	STAT-352	Introduction to Probability Distribution	3(3+0)
	PS-351	Pakistan Studies	2(2+0)
	ENG-351	Communication Skills	3(3+0)
	MATH-353	Calculus-II	3(3+0)
	ECON- 402	Issues in Pakistan Economy	3(3+0)
	CS-351	Introduction to Computers	3(3+0)
	Semester Total		**17**
3rd	STAT-431	Basic Statistical Inference	3(3+0)
	CS-433	Computer Programming	3(3+0)
	STAT-453	Linear Algebra	3(3+0)
	ENG-401	English-III (Technical Writing)	3(3+0)
	MATH-432	Calculus-III	3(3+0)
	MGT-351	Principles of Management & Marketing	3(3+0)
	Semester Total		**18**
4th	STAT-451	Introduction to Regression Analysis and Experimental Design	3(3+0)
	STAT-456	Numerical Methods	3(3+0)
	STAT-452	Applied Statistics	3(3+0)
	MATH-454	Differential Equations	3(3+0)
	PHY-301	Introduction to Physics	3(3+0)
	Semester Total		**15**

5th	STAT-501 STAT-502 STAT-554 STAT-629 STAT-553	Probability & Probability Distribution-I Sampling Techniques-I Population Studies (Demography) Bio Statistics (Elective) Statistical Methods (Elective)	3(3+0) 4(3+1) 3(3+0) 3(3+0) 3(3+0)
	Semester Total		17
6th	STAT-551 STAT-552 STAT-503 STAT-553 STAT-504	Probability and Probability Distribution-II Sampling Techniques-II Regression Analysis Nonparametric Methods Statistical Packages and Data Analysis	3(3+0) 4(3+1) 4(3+1) 3(3+0) 3(3+0)
	Semester Total		17
7th	STAT-601 STAT-602 STAT-555 STAT-603 STAT-653	Statistical Inference-I Design & Analysis of Experiments- I Econometrics Research Methodology Applied Multivariate Analysis	3(3+0) 4(3+1) 4(3+1) 3(3+0) 4(3+1)
	Semester Total		18
8th	STAT-651 STAT-652 STAT-604 STAT-634 STAT-699	Statistical Inference-II Design & Analysis of Experiments- II Time Series Analysis and Forecasting Categorical Data Analysis (Elective) Research Project	3(3+0) 4(3+1) 3(3+0) 3(3+0) 4(3+1)
	Semester Total		17
	Grand Total		**136**

FRAME WORK FOR BS (4-YEAR) IN STATISTICS LAYOUT

Compulsory Requirements (the student has no choice)		**General Courses to be chosen from other Departments**		**Discipline Specific Foundation Courses**	
9 courses		**7-8 courses**		**9-10 courses**	
25 Credit hours		**21-24 Cr. Hours**		**30-33 Credit hours**	
Subject	**Cr Hr**	**Subject**	**Cr Hr**	**Subject**	**Cr Hr**
1. English I	**3**	1. Introduction to Psychology	**3**	Introductory Statistics	**3**
2. English II	**3**	2. Introduction to Logic	**3**	Introduction to Probability & Probability Distributions	**3**
3. English III	**3**	3. Fundamentals of Economics	**3**	Basic Statistical Inference	**3**
4. Communication Skill	**3**	4. International Relations	**3**	Linear Algebra	**3**
5. Pakistan Studies	**2**	5. Basics of Sociology	**3**	Introduction to Regression Analysis & Experimental Design	**3**
6. Islamic Studies / Ethics	**2**	6. Introduction to Environmental Sciences	**3**	Applied Statistics	**3**
7. Calculus-I	**3**	7. Principles of Management	**3**	Probability Distribution-1	**3**
8. Calculus- II	**3**	8. Business Administration 9. (Entrepreneurshi p)	**3**	Sampling Techniques-I	**3**
9. Introduction to Computer er	**3**	**OR** *** from the list of general courses given in Annexure on Page 5**		Statistical Packages	**3**
TOTAL	**25**		**21**		**27**

Major courses including research project/internship		**Elective Courses within the major**	
11-13 courses		**4 courses**	
36-42 Credit hours		**12 Credit Hours**	
Subject	**Cr Hr**	**Subject**	**Cr Hr**
1. Regression Analysis	**4**	1. Operations Research	**3**
2. Design & Analysis of Experiment-I	**4**	2. Stochastic Process	**3**
3. Probability and Probability Distribution-II	**3**	3. Reliability Analysis	**3**
4. Sampling Techniques-II	**4**	4. Time Series Analysis	**3**
5. Econometrics	**4**	5. Research Methodology	**3**
6. Design & Analysis of Experiment-II	**4**	6. Non-Parametric Methods	**3**
7. Statistical Inference-1	**3**	**OR** **** from the list of elective courses.**	
8. Multivariate Analysis-I	**3**		
9. Multivariate Analysis-II	**4**		
10. Population Studies	**3**		
11. Statistical Inference-II	**4**		
12. `Official Statistics	**3**		
13. Research Project / Internship	**3**		
TOTAL	**46**		**12**

MODEL SCHEME OF STUDIES FOR BS (4-YEAR) IN STATISTICS

Semester / Year	Name of Subject	Credits
First	Introductory Statistics	3
	Pakistan Studies	2
	English-I (Functional English)	3
	Calculus-I	3
	General-I	3
	General-II	3
		17
Second	Introduction to Probability Distributions	3
	Islamic Studies/Ethics	2
	English-II	3
	Calculus-II	3
	General-III	3
	General-IV	3
		17
Third	Basic Statistical Inference	3
	English-III	3
	Introduction to Computer	3
	General-V	3
	General-VI	3
		15
Fourth	Applied Statistics	3
	Introduction to Regression Analysis & Experimental Design	3
	Communication Skills	3
	Linear Algebra	3
	General-VII	3
		15
Fifth	Probability Distribution-1	3
	Sampling Technique-I	4
	Design & Analysis of Experiment-I	4
	Regression Analysis	4
	Statistical Packages	3
		18
Sixth	Probability Distribution-II	3
	Sampling Techniques-II	4
	Design & Analysis of Experiment-II	4
	Econometrics	4
	Official Statistics	3
		18
Seventh	Statistical Inference-1	3
	Applied Multivariate Analysis	4
	Time Series Analysis	3
	Elective I	3
	Elective-II	3
		16

Eight	Statistical Inference-II	3
	Population Studies	4
	Research Project / Internship	3
	Elective-III	3
	Elective-IV	3
		16
	Total	**132**

* LIST OF GENERAL COURSES FOR STATISTICS

Seven courses are to be selected from the following list of courses, according to available facilities and faculty of the universities.

1. Business Administration (Entrepreneurship)
2. Human Resource Management
3. Environmental Sciences
4. Principles of Management & Marketing
5. Basic Financial Management
6. History of Human Civilization
7. Introduction to Biology
8. Foreign Language other than English
9. Introduction to Physics
10. Advanced Calculus
11. Introduction to Genetics
12. Introduction to Geography

or any other subject depending upon the expertise available.

** Elective Courses for BS (4-Year) Program for Statistics

1. Operations Research
2. Stochastic Process
3. Reliability Analysis
4. Decision Theory
5. Robust Methods
6. Survival Analysis
7. Bio-Statistics
8. Data Mining
9. Actuarial Statistics-I
10. Actuarial Statistics-II
11. Mathematical Models and Simulation
12. Categorical Data Analysis
13. Numerical Methods
14. Bayesian Inference
15. Statistical Quality Control,

or any other subject depending upon the expertise available.

Foundation Courses:

1. STAT-301: Introductory Statistics
2. STAT-352: Introduction to Probability Distributions
3. STAT-431: Basic Statistical Inference
4. STAT-453: Linear Algebra
5. STAT-451: Introduction to Regression Analysis & Experimental Design
6. STAT-452: Applied Statistics
7. STAT-456: Numerical Method
8. STAT-501: Probability & Probability Distribution -1
9. STAT-502: Sampling Technique - I
10. STAT-504: Statistical Packages

Major Courses:

1. STAT-503: Regression Analysis
2. STAT-602: Design & Analysis of Experiments-I
3. STAT-551: Probability and Probability Distribution -II
4. STAT-552: Sampling Techniques-II
5. STAT-555: Econometrics
6. STAT-652: Design & Analysis of Experiments-II
7. STAT-553: Non-Parametric Methods
8. STAT-601: Statistical Inference-1
9. STAT-653: Applied Multivariate Analysis
10. STAT-603: Research Methods / Internship
11. STAT-554: Population Studies (Demography)
12. STAT-651: Statistical Inference-II
13. STAT-699: Project

LIST OF GENERAL COURSES FOR STATISTICS

Seven courses are to be selected from the following list of courses, according to the available facilities and faculty of the University.

1.	Psychology	3 credit hrs.
2.	Philosophy	"
3.	Introduction to Economics	"
4.	International Relations	"
5.	Mass Communication	"
6.	Sociology	"
7.	Business Administration (Entrepreneurship)	"
8.	Human Resource Management	"
9.	Environmental Sciences	"
10.	Principles of Management & Marketing	"
11.	Basic Financial Management	"
12.	History of Human Civilization	"
13.	*Introduction to Physics*	"
14.	*Computer Programming*	"
15.	*Issues in Pakistan Economy*	"
16.	*Advanced Calculus (Calculus-III)*	"
17.	*Differential Equation*	"

ELECTIVE COURSES FOR BS (4 YEAR) PROGRAMME

1.	Operations Research	STAT-621
2.	Stochastic Process	STAT-622
3.	Reliability Analysis	STAT-623
4.	Time Series & Forecasting	STAT-624
5.	Decision Theory	STAT-625
6.	Robust Methods	STAT-626
7.	Official Statistics	STAT-627
8.	Survival Analysis	STAT-628
9.	Bio-Statistics	STAT-629
10.	Data Mining	STAT-630
11.	Actuarial Statistics-I	STAT-631
12.	Actuarial Statistics-II	STAT-632
13.	Mathematical Models and Simulations	STAT-633
14.	Categorical Data Analysis	STAT-634
15.	Bayesian Statistics	STAT-636
16.	Statistical Quality Control	STAT-637

DETAILS OF THE COURSES
The proposed outlines of the BS Program in Statistics are as under:

STAT-301 Introductory Statistics

The Nature and Scope of Statistics. Organizing of Data, classification of data, Graphs and Charts: Stem-and leaf diagram, Box and Whisker plots and their interpretation. Measures of Central Tendency and Dispersion: Their properties, usage, limitations and comparison. Calculations for the ungrouped and grouped data. Measures of Skewness and Kurtosis and Distribution shapes.

Probability Concepts, Addition and Multiplication rules, Bivariate frequency tables, joint and marginal probabilities, Conditional probability and independence, Bayes' rule.

Books Recommended

1. Spiegel, M.R., Schiller, J.L. and Sirinivasan, R.L. (2000) "Probability *and Statistics",* 2nd ed. Schaums Outlines Series. McGraw Hill. NY.

2. Clark, G.M and Cooke, D. (1998), "A *Basic Course in Statistics"* 4th ed, Arnold, London.

3.* Walpole, R.E., Myers, R.H and Myers, S.L. (1998), "Probability *and Statistics for Engineers and Scientist"* 6th edition, Prentice Hall, NY.

4. Mclave, J.T., Benson, P.G. and Snitch, T. (2005) "Statistics *for Business & Economics"* 9th ed. Prentice Hall, New Jersey.

5. Weiss,N.A.(1997),"IntroductoryStatistics"4thed.Addison-Wesley Pub. Company, Inc.

6. Chaudhry, S.M.and Kamal, S. (1996), "Introduction *to Statistical Theory"* Parts I & II, 6th ed, Ilmi Kitab Khana, Lahore, Pakistan.

*** (Text Book)**

ENG-301 English I (Functional English)

Basics of Grammar: Parts of speech and use of articles, Sentence structure, active and passive voice, Practice in unified sentence, Analysis of phrase, clause and sentence structure
Transitive and intransitive verbs, Punctuation and spelling
Comprehension: Answers to questions on a given text
Discussion: General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)
Listening: To be improved by showing documentaries/films carefully selected by

subject teachers
Translation skills: Urdu to English
Paragraph writing: Topics to be chosen at the discretion of the teacher
Presentation skills: Introduction

Note: Extensive reading is required for vocabulary building

Recommended Books:

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1, third edition, Oxford University Press, 1997. ISBN 0194313492
2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2, third edition, Oxford University Press, 1997. ISBN 0194313506 58
3. Writing Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet., Oxford Supplementary Skills, Fourth Impression, 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
4. Reading Upper Intermediate Brain Tomlinson and Rod Ellis, Oxford Supplementary Skills, Third Impression, 1992. ISBN 0 19 453402 2

MATH-312 Calculus-I

Contents

Preliminaries: Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities.
Limits and Continuity: Limit of a function, left-hand and right-hand limits, continuity, continuous functions.
Derivatives and their Applications: Differentiable functions, differentiation of polynomial, rational and transcendental functions, derivatives.
Integration and Definite Integrals: Techniques of evaluating indefinite integrals, integration by substitution, integration by parts, change of variables in indefinite integrals.

Recommended Books:

1. Anton H, Bevens I, Davis S, Calculus: A New Horizon (8th edition), 2005, John Wiley, New York
2. Stewart J, Calculus (3rd edition), 1995, Brooks/Cole (suggested text)
3. Swokowski EW, Calculus and Analytic Geometry, 1983, PWS-Kent Company, Boston
4. Thomas GB, Finney AR, Calculus (11th edition), 2005, Addison-Wesley, Reading, Ma, USA

STAT-453 Linear Algebra

Contents

Preliminaries: Real-number system, complex numbers, introduction to sets, set operations, functions, types of functions.
Matrices: Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer's rule.
Quadratic Equations: Solution of quadratic equations, qualitative analysis of roots of a quadratic equations, equations reducible to quadratic equations, cube roots of unity, relation between roots and coefficients of quadratic equations.
Sequences and Series: Arithmetic progression, geometric progression, harmonic progression.
Binomial Theorem: Introduction to mathematical induction, binomial theorem with rational and irrational indices.
Trigonometry: Fundamentals of trigonometry, trigonometric identities.

Recommended Books:

1. Dolciani MP, Wooton W, Beckenback EF, Sharron S, Algebra 2 and Trigonometry, 1978, Houghton & Mifflin, Boston (suggested text)
2. Kaufmann JE, College Algebra and Trigonometry, 1987, PWS-Kent Company, Boston
3. Swokowski EW, Fundamentals of Algebra and Trigonometry (6^{th} edition), 1986, PWS-Kent Company, Boston

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STAT-352 Introduction to Probability Distributions

Contents

Discrete Random Variables, Probability Distribution, Mean and Variance of a discrete random variable. Bernoulli trials. Proerties, applications and f itting of Binomial, Poisson, Hypergeometric, Negative Binomial and Geometric distributions.

Continuous Random Variable, probability density function and its properties. Normal Distribution and its properties, Standard Normal Curve, Normal approximation to Binomial and Poisson distributions. **Pre-requisite:** STAT-101

Books Recommended

1. Spiegel, M.R., Schiller, J.L. and Sirinivasan, R.L. (2000) "Probability *and Statistics",* 2nd ed. Schaums Outlines Series. McGraw Hill. NY.

2. Clark, G.M. and Cooke, D. (1998), "A *Basic Course in Statistics"* 4th ed, Arnold, London.

3. * Walpole, R.E., Myers, R.H and Myers, S.L. (1998), "Probability *and Statistics for Engineers and Scientist"* 6th edition, Prentice Hall, NY.

4. Mclave, J.T., Benson, P.G. and Snitch, T. (2005) "Statistics *for Business & Economics"* 9th ed. Prentice Hall, New Jersey.

5. Weiss,N.A.(1997),"IntroductoryStatistics"4thed.Addison-Wesley Pub. Company, Inc.

6. Chaudhry, S.M.and Kamal, S. (1996), "Introduction *to Statistical Theory"* Parts I & II, 6th ed, Ilmi Kitab Khana, Lahore, Pakistan.

7. *** (Text Book)**

ENG-351 English II ***(Communication Skills)***

Contents:
Paragraph writing - Practice in writing a good, unified and coherent paragraph,
Essay writing - Introduction
CV and job application - Translation skills, Urdu to English
Study skills - Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension
Academic skills - Letter/memo writing, minutes of meetings, use of library and internet
Presentation skills - Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

Recommended Books:

1. Practical English Grammar by A.J. Thomson and A.V. Martinet, Exercises 2, third edition, Oxford University Press, 1986. ISBN 0 19 431350 6 59
2. Intermediate by Marie-Chrisitine Boutin, Suzanne Brinand and Francoise
3. Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
4. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
5. Reading Advanced Brian Tomlinson and Rod Ellis, Oxford Supplementary Skills, Third Impression, 1991. ISBN 0 19 453403 0
6. Reading and Study Skills by John Langan
7. Study Skills by Richard York.

STAT-431 Basic Statistical Inference

Contents

Distribution of sample mean and central limit theorem. Estimation: Point Estimation. Desirable Properties of a Good Estimator. Interval Estimation. Interval Estimation of population mean. Large and small sample confidence intervals for Population Mean.

Nature of Hypothesis Testing and Types of errors. Hypothesis Testing for Population Mean and variance. Inferences for Two Population Means. Large-sample inferences for Two Populations using Independent Samples. Inferences for the Mean of Two Normal Populations

using Independent Samples (variances are assumed Equal/Not Equal). Inference for Two Populations Mean using Paired Samples.

Inferences for Population Proportions. Confidence Intervals and hypothesis Testing for Population Proportion. Inferences for Two Populations Proportions using Independent Samples, Estimation of sample size.

Chi-Square Procedure. Chi-Square Goodness-of fit Test. Chi-Square Independence Tests.

Pre-Requisite- STAT-102

Books Recommended

1. Spiegel, M.R., Schiller, J.L. and Sirinivasan, R.L. (2000) "Probability *and Statistics",* 2nd ed. Schaums Outlines Series. McGraw Hill. NY.

2. Clark, G.M. and Cooke, D. (1998), "A *Basic Course in Statistics"* 4th ed, Arnold, London.

3. Mclave, J.T., Benson P.G. and Snitch, T. (2005) "Statistics *for Business & Economics"* 9th Prentice Hall New Jersey.

4. ***** Walpole, R.E., Myers, R.H. and Myers, S.L. (1998), "Probability *and Statistics for Engineers and Scientist"* 6th edition, Prentice Hall, NY.

5. Weiss, N.A. (1997), "Introductory *Statistics"* 4th ed. Addison- Wesley Pub. Company, Inc.

6. Chaudhry, S.M. and Kamal, S. (1996), "Introduction *to Statistical Theory"* Part I, II, 6th ed, Ilmi Kitab Khana, Lahore, Pakistan.

7. *** (Text Book)**

CS-433 Introduction to Computer Programming / Programming Fundamentals
Contents

Introduction to problem solving, Introduction to programming, role of compiler and linker, introduction to algorithms, basic data types and variables, input/output constructs, arithmetic, comparison and logical operators, conditional statements and execution flow for conditional statements, repetitive statements and execution flow for repetitive statements, lists and their memory organization, multi-dimensional lists, introduction to modular programming, function definition and calling, string and string operations, pointers/references, static and dynamic memory allocation, File I/O operations

Books Recommended

1. The C Programming Language, 2nd Edition by Brian W. Kernighan, Dennis M. Ritchi
2. Let Us C Fifth Edition Yashavant
3. C How to Program, 7th Edition by Paul Deitel & Harvey Deitel

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ENG-401 English III (Technical Writing and Presentation Skills)

Contents

Presentation skills: Essay writing Descriptive, narrative, discursive, argumentative

Academic writing: How to write a proposal for research paper/term paper How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing Progress report writing Note: Extensive reading is required for vocabulary building

Recommended Books

1. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3(particularly suitable for discursive, descriptive, argumentative and report writing).
2. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.
3. Patterns of College Writing (4thedition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.b)
4. The Mercury Reader. A Custom Publication. Compiled by Northern Illinois University. General Editors: Janice Neuleib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxingthe taste of engineering students).134

MGT-351: Principles of Marketing and Management

Contents

Understanding Marketing and Marketing Process, Marketing Strategy: Building strong customers relationship, Market Segmentation, Targeting and positioning for competitive advantage, Product and Services Marketing Strategies,New Product Development and Product Life Cycle Strategies, Developing pricing Strategies, Marketing channels and Supply Chain Managemen, Retailing and Wholesaling, Integrated Marketing Communication: Advertising and Public Relations

An Overview of Management, Function s of Management, Principles of ManagementNature of Management, Planning, Decision Making, Organizing, Communication, Staffing Directing I Direction, Leadership, Motivation, Controlling

Recomended Books

1. William J. Staton and Charles Furtrell, Fundamentals of Marketing
2. The Principles of Marketing by Phi lip Kotler and Gray Anus
3. PRINCIPLES OF MARKETING --- Michael J.Etzel, B1vce J.WalkerWilliam J.Stanton Stanton 1 1th Edition McGraw Hill-1997
4. PRINCIPLES OF MARKETING --- TI10111as C. Kimtear, Kem1eth L-Bem Hardt,4tb Edition Kathleem A.Krentler, Honper Collin College Publishers
5. Principles and Practice of Management 1998 Edition, Terry. Prentice Hall USA.
6. Practice of lvlanagement, 1997 Edition P.F. Duck Ker, Macmi llion, London.
7. Fundamentals of Management 2004 Edition,Prof. Fazli Wahid IBMS/CS Agricultural University Peshawar

STAT-451 Introduction to Regression Analysis and Experimental Design

Contents

Concepts of Regression and Correlation, Simple Linear regression, Inference regarding regression parameters, Linear correlation: simple, partial and multiple correlation. Inference regarding correlation coefficient. Coefficient of determination.

One-Way and Two-Way Analysis of Variance Design of Experiments, Basic Principles of Design of Experiments, Description, Layout and Analysis of Completely Randomized Design Randomized Complete Block Design and Latin Square Design. Multiple Comparisons (LSD and Duncan's test). Introduction to Non-Parametric Statistical Methods,

Pre-Requisite: STAT-101

Books Recommended

1. Clark, G. M. and Kempson, R. E. (1997), "Introduction *to the Design & Analysis of Experiment"* Arnold London.

2. ***** Walpole, P.E., Myers R.H., Myers S.L. (1998), "Probability *and Statistics for Engineers and Scientists",* 7th ed.Prentice Hall.

3. Weiss, N.A, (1997), "Introductory *Statistics"* 4th ed. Addison- Wesley Pub. Company, Inc.

4. Chaudhry, S.M., and Kamal, S., (1996), "Introduction *to Statistical Theory"* Part I, II, 6th ed, Ilmi Kitab Khana, Lahore, Pakistan.

5. *** (Text Book)**

STAT-452 Applied Statistics

Contents

Sampling: Need of sampling, Sample versus population, Random and non-random sampling, concepts of statistic and population parameter. Sampling techniques: Simple Random, Stratified and Systematic random sampling. Census and survey problem, farming of questionnaire. Sampling and Non-Sampling Errors.

Index numbers: construction and uses of index numbers, un-weighted index numbers (simple aggregative index, average of relative price index numbers). Weighted index numbers (Laspayers, Paaches and Fishers ideal index numbers). Consumer price index (CPI) and Sensitive Price Indicators.

Time Series Analysis: Components of time series and their isolation.

Vital Statistics: Meaning of vital statistics, registrations of Birth and death in Pakistan. Uses of vital statistics, short comings of vital statistics, rates and ratios (Sex ratio, child women ratio, birth and death ratio, population growth rate, classification of natal rates, death rates or mortality rates, crude death rate, specific death rate, infant mortality rate, case fatality rate, fertility rates, crude birth rate, specific birth rate, standardized death rate, reproduction rates, gross reproduction rate, net reproduction rate, morbidity or sickness rates, marriage rates, divorce rates etc. general; fertility rate, total fertility rate.)

Pre-Requisite: STAT-101

Books Recommended

1. Clark, G.M. and Cooke, D. (1998), "A *Basic Course in Statistics"* 4th ed, Arnold, London.

2. ***** Mclave, J.T. Benson, P.G. and Snitch, T. (2005) "Statistics *for Business & Economics"* 9th Prentice Hall New Jersey.

3. Walpole, P.E. Myers, R.H., Myers S.L. (1998), "Probability *and Statistics for Engineers and Scientists",* Prentice Hall.

4. Chaudhry, S.M. and S. Kamal, (1996), "Introduction *to Statistical Theory"* Part I, II, 6th Ed, IImi Kitab Khana, Lahore, Pakistan.

5. ***** Cochran, W.G. "Sampling *Techniques".3rd* Ed.

6. ***** Pollard, A.H.. Yousuf, F. and Pollard G.M. (1982), "Demographic *Techniques",* Pergamon Press, Sydney.

7. * **(Text Book)**

STAT-456: Numerical Methods

Contents

Computer arithmetic, approximations and errors; methods for the solution of nonlinear equations and their convergence: bisection method, regula falsi method, fixed point iteration method, Newton-Raphson method, secant method; error analysis for iterative methods. Interpolation and polynomial approximation: Lagrange interpolation, Newton's divided difference, forward-difference and backward-difference formulae, Hermite inter-polation. Numerical integration and error estimates: rectangular rule, trapezoidal rule, Simpson's one-three and three-eight rules. Numerical solution of systems of algebraic linear equations: Gauss-elimination method, Gauss-Jordan method; matrix inversion; LU-factorization; Doolittle's, Crount's, Cholesky's methods; Gauss-Seidel and Jacobi methods

Pre-requisite: STAT-453

Recommended Books:

8. Atkinson KE, An Introduction to Numerical Analysis (2nd edition), 1989, John Wiley, New York (suggested text)

9. Burden RL, Faires JD, Numerical Analysis (5th edition), 1993, PWS Publishing Company

10. Chapra SC, Canale RP, Numerical Methods for Engineers, 1988, McGraw Hill, New York

11. *** (Text Book)**

STAT-504 Statistical Packages

Contents

Introduction to Minitab, data manipulation in Minitab, graphical representation in Minitab, Qualitatively and Quantitative data presentation and analyzing data in Minitab, Programming in Minitab

Introduction of SPSS, data manipulation in SPSS, simple arithmetic in SPSS, SPSS function related to probability distributions, SPSS modules, simple graphing in SPSS.

Analysis using SPSS syntax programming. (Use of SPSS, Minitab, Matlab, Statistica is based upon the availability of Software)

Introduction to R Programming.

Pre-Requisite: STAT-201

Books Recommended

1. Ryan, Barbara F.; Joiner, Brian L. and Cryer, Jonathan D.(2005) MINITAB Handbook, 5th Edition, Duxbury Press, California.

2. Delwiche, Lora D. and Slaughter Susan J. (1998) The Little SAS Book : A Primer, Second Edition, SAS institute, North Carolina.

3. Norusis, Marija(2006) SPSS 14.0 Guide to Data Analysis, Prentice Hall, New Jersey.

4. SPSS (2006) SPSS 14.0 Base User's Guide, , Prentice Hall, New Jersey.

5. Marques de Sá, Joaquim P.(2003) Applied **Statistics using SPSS,** STATISTICA and MATLAB

STAT-501 Probability and Probability Distributions-I

Contents

Probability as a set function. Conditional probability and Bayes' theorem. Random variables, Distribution function, Probability mass function and probability density function. Joint and conditional distributions for two and more random variables. Marginal and conditional distributions, stochastic independence. Mathematical expectation and its properties Conditional expectation, variance and moments. Probability generating function.

Moment generating and characteristic functions and their properties. Relation between moments and cumulants. Probability distributions: Hypergeometric, Binomial, Multinomial, Negative Binomial, Geometric, Poisson, Normal and Lognormal distributions with moments and commulants.

Pre-Requisite: STAT-102

Books Recommended

1. Stirzaker, D. (1999). "Probability *and Random Variables".* Cambridge University Press, Cambridge.

2. Stuart, A. and Ord, J .K. *Kendall's'* (1998), "Advanced *Theory of Statistics",* Vol. I, Charles Griffin, London.

3. Hirai, A.S. (1998), "A *Course in Mathematical Statistics",* Ilmi Kutab Khana, Lahore.

4. Fridett, B. & Gray, L. (1997). "A *Modern Approach to Probability Theory"* Birkhallser, Boston.

5. Freund, J. E. (1997). "Mathematical *Statistics",* Prentice Hall, New Jersey 6th edition.

6. ***** Mood, A.M, Graybill, F.A. and Boss, D.C. (1997), "Introduction *to the Theory of Statistics",* McGraw Hill, New York.

7. Khan, M. K., (1996). "Probability *with Applications",* Maktiba Ilmi, Lahore.

8. ***** Hogg, R.M. and Craig, A.T. (1995), "Introduction *to Mathematical Statistics".* Prentice Hall, Engle wood Cliffs, New Jersey.

9. Haq, M. (1984). *Foundation of Probability and Statistics*, Tahir sons, Urdu Bazar, Karachi.

10. *** (Text Book)**

STAT-502 Sampling Techniques-I

Contents

Basic concepts, advantages of sampling methods, requirements of a good sample, bias, sampling and non-sampling errors. Steps and problems involved in planning and conduct of census and sample surveys. Selection and estimation procedures. Description and properties of simple random sampling. Sampling for proportions and percentages. Estimation of variances, standard errors and confidence limits. Sample size determination under different conditions. Description and properties of stratified random sampling. Formation of strata, Different methods of allocation of sample size. Systematic sampling. Ratio and regression estimates in simple and stratified random sampling.

Note: *Practicals of this course shall include visits of the students to various national statistical organizations and a report submitted to this effect.*

Pre-Requisite: STAT-203

Books Recommended

1. Raj, D. & Chandhok, P. (1998), "Sample *Survey Theory".* Narosa Publishing House, New Delhi.

2. Ferguson, T.S. (1996), "A *Course in large SampleTtheory*, Chapman & Hall, London.

3. Singh, R. and Singh N, (1996), "Elements *of Survey Sampling",* Kulwar Academic Publisher, Dodrecht.

4. Kish, L. (1992). *"Survey Sampling",* John Wiley, New York.

5. Sukhatme, P.V, Sukhatme, B., Sukhatme, S., and Asok, A. (1985), "Sampling *Theory of Survey with Application".* Iowa State University Press.

6. ***** Cochran, W.G. (1977), "Sampling *Techniques",* 3rd ed, John Wiley and Sons, New York.

7. Raj, D. (1971) "Design *of Sample Survey".* McGraw Hill, New York.

8. *** (Text Book)**

STAT-503 Regression Analysis

Contents

General linear model and its assumptions, Least squares estimators, MLE, Least squares estimators, tests of hypothesis, tests of significance of a single and complete regression, tests of significance of subset of coefficients. Significance tests and confidence intervals. Test of linearity of regression. Use of extraneous information in linear regression model. Residual analysis, Detection and study of outliers. Polynomial regression, orthogonal polynomial, orthogonal regression analysis. Specification of models.

Pre-Requisite: STAT-203 Books Recommended

1. ***Draper,** N.R. and Smith, H. (2004)." *Applied Regression Analysis",* John Wiley. New York.

2. Baltagi, B. H. (1999). "Econometrics", 2nd Edition, Springer Varlog.

3. Gujrati, D. (1998). "Econometrics", John Wiley, New York.

4. Wonnacott, T.H. and Wonnacott R.J. (1998). "Econometrics", John Wiley, New -York.

5. Johnston, J. and Di. Nardo, J., (1997). "Econometric *Method",* 4th Edition, McGraw Hill, New York.

6. Ryan, P. T. (1996) "Modern *Regression Methods",* John Wiley and sons Inc. New York.

7. Montgomery, D.C., and Peck E.A. (1992)."Introduction *to linear Regression Analysis",* 2nd Edition, John Wiley and sons Inc. New York.

8. Guttmann, I, (1980); "Linear *Models: An Introduction",* John Wiley, New York.

9. Koutsoyiannis, A. (1980), "Theory *of Econometrics",* Macmillan. N.Y .

10. Maddela, G.S. (1977). "Econometrics", McGraw Hill. New York.

11. Searle, S. R. (1971), "Linear *Models",* John Wiley, New York.

12. *** (Text Book)**

STAT-602 Design and Analysis of Experiments-I

Contents

Principles of Design of Experiments. Analysis of variance and its assumptions. Cochran theorem. Fixed, random and mixed effect models. Effect of violation of assumptions and transformations.

Completely Randomized, Randomized Complete Block, Latin square, Graeco-Latin square and cross-over designs. Missing observations. Relative efficiency of designs. Estimation of mean squares and their expectations. Multiple Comparisons.

Analysis of covariance in CR, RCB designs. Estimation of missing values in analysis of covariance.

Pre-Requisite: STAT-202 Books Recommended

1. Montgomery, D.C. (2000). "Design *and Analysis of Experiments",* John Wiley, New York.

2. Clarke, G.M., and Kempton, R.E. (1997), "Introduction *to the Design & Analysis of Experiments",* Edward Arnold.

3. Steel, Robert, G. D., Terrie James H., and Dickey David A. (1997). "Principles *and Procedures of Statistics: A Biometrical Approach"* 3rd Edition, McGraw Hill, New York.

4. Boniface, D.R. (1995). "Experiment *Design & Statistical Methods",* Chapman & Hall.

5. Myers, R.H. and Montgomery, D.C. (1995). "Response *Surface Methodology; Process & Product Optimization Using Design",* John Wiley.

6. Clarke, G.M. (1994). "Statistics *& Experimental Design".* Edward Arnold.

7. Harold, R. L (1992). "Analysis *of Variance in Experimental Design".* Springer Verlag:

8. Maxwell, S.E. and Delaney, H.D. (1990). "Designing *Experiments and Analysis of Data". A model comparison perspective.* Belment and Wadeson.

9. Mead, R. (1988). "The *Design of Experiments".* Cambridge University Press, Cambridge.

10. Das, M.N.and Geri, N.C, (1986). "Design *and Analysis of Experiments",* John Wiley, New York.

11. Gomez, K.A., and Gomez, A.A. (1984)."Statistical *Procedures for Agricultural Research",* 2nd Edition, John Wiley, New York.

12. Hicks, C.R. (1982). "Fundamental *Concepts in Design and Analysis of Experiments* Saunders

13. Cochran, W.G. and Cox, G.M. (1957). "Experimental *Design",* John Wiley, New York.

14. *** (Text Book)**

STAT-553 Non-Parametric Methods

Contents

Location estimates for single samples: The sign test, modified sign test, Wilcoxon signed rank test, confidence interval based on these tests. Runs test for randomness.

Distribution tests and rank transformation. Kolmogrov's test, Lilliefor's test and Shapiro-Wilks test for normality. Tests and estimation for two independent samples; the median test, Wilcoxon Mann – Whitney test. The Siegel – Turkey test, the squared rank test for variance, Smirnov test. Tests for paired samples. Kruskal – Wallis test, Friedman test, multiple comparison with the Friedman test, Cochran's test for binary responses. Spearman's rank correlation coefficient, Kendall's rank correlation coefficient. Theil's regression method.

Pre-Requisite: STAT-202,301

Books Recommended

1. Conover, W.J. (1999), *Practical Nonparametric Statistics,* 3rd Edition, John Wiley and Sons, New York.

2. Maritz, J.S. (1995). *Distribution-Free Statistical Methods.* Chapman & Hall London.

3. Gibbons, J.D. and Chakraborti, S.(1992), *Nonparametric Statistical Inference,* Marcel Decker, New York.

4. Sprint, P. (1989). *Applied Nonparametric Statistical Methods.* Chapman & Hall London.

5. Lehman, E.L. (1973), *Nonparametric Statistical Methods, based on Ranks,* Holden-Day San Francesco.

6. *** (Text Book)**

STAT-551 Probability and Probability Distributions-II

Contents

Probability Distributions: Uniform, Exponential, Gamma, Laplace, Rayleigh with moments and cumulates Distributions of functions of random variables; Chi-square, t and F distributions, their derivations and properties. Central limit and Chebyshev's theorems and other inequalities. Weak and Strong Laws and their applications. Order statistics. Distributions of rth and sth order statistics. Bivariate Normal distribution.

Pre-Requisite: STAT-301

Books Recommended

1. Stirzaker, D. (1999). "Probability *and Random Variables".* Cambridge University Press, Cambridge.

2. Stuart, A. and Ord, J .K. *Kendall's* (1998), *"Advanced Theory of Statistics",* Vol. I, Charles Griffin, London.

3. Hirai, A.S. (1998), "A *Course in Mathematical Statistics",* Ilmi Kutab Khana, Lahore.

4. Fridett, B. & Gray, L. (1997). "A *Modern Approach to Probability Theory"* Birkhallser, Boston.

5. ***** Freund, J. E. (1997). "Mathematical *Statistics",* Prentice Hall, New Jersey.

6. ***** Mood, A.M, Graybill, F.A. and Boss, D.C. (1997), "Introduction *to the Theory of Statistics",* McGraw Hill, New York.

7. Hogg, R.M. and Craig, A.T. (1995), "Introduction *to Mathematical Statistics".* Prentice Hall, Engle wood Cliffs, New Jersey.

8. Khan, M. K., (1996). "Probability *with Applications",* Maktiba Ilmi, Lahore.

9. Haq, M. (1984). "Foundation *of Probability and Statistics",* Tahir sons, Urdu Bazar, Karachi.

10. *** (Text Books)**

STAT-552 Sampling Techniques-II

Contents

Cluster Sampling, Sub sampling, PPS-Sampling. Double Sampling, Multistage and Multiphase sampling. Thomson Hurwitz estimator. Comparison of different sample designs. Sampling and non sampling errors and their sources. non-response, their sources and bias. Randomized response. Critical study of National sample surveys conducted in Pakistan: Census of Agriculture, Household Income and Expenditure Survey (HIES), Pakistan Demographic Survey (PDS) and National Population and Housing Census and Surveys (NPHCS).

Pre-Requisite: STAT-303 Books Recommended

1. Des Raj & Chandhok, P. (1998), "Sample *Survey Theory".* Narosa Publishing House, New Delhi.

2. Ferguson, T.S. (1996), "A *Course in Large Sample Theory",* Chapman & Hall, London.

3. Singh, R. and Singh N, (1996), "Elements *of Survey Sampling",* Kulwar, Dodrecht.

4. Kish, L. (1992), *"Survey Sampling",* John Wiley, New York.

5. Sukhatme, P.V, Sukhatme, B., Sukhatme, S., and Asok, A. (1985), "Sampling *Theory of Survey with Application".* Iowa State University Press.

6. ***** Cochran, W.G. (1977), "Sampling *Techniques",* John Wiley and Sons, 3rd ed, New York.

7. Des Raj, (1971), *Design of Sample Survey.* McGraw Hill, New York.

8. Various publications of FBS, ACO and PCO.

9. *** (Text Book)**

STAT-553 Statistical Methods

Contents

Applications of Binomial, Negative Binomial, Geometric, Hypergeometric, Poisson, Normal, Exponential, Chi-Square, t and F Distributions. Statistical Inference: Estimation of Parameters and Tests of Hypotheses, Simple and Composite Hypotheses. Type-I and Type-II Errors, Level of Significance and p-Values, Power of a test, Characteristic Function and O.C. Curve. Inference about Means, Proportions, Variances and Associated Power Curves, Determination of Sample Size. Analysis of Linear Regression Models, Testing of Hypotheses about Simple and Multiple Regression Coefficients, Simple Correlation, Multiple and Partial Correlations Up to three Variables, Concept of Outliers. Analysis of Categorized Data, Homogeneity of Variances, Bartlett Test. Partitioning of Chi-Square in a 2x2 Table, Fishers Exact Test, Log-Linear Models and their Applications. Non-Parametric Methods: The Sign Test. Wilcoxon Signed Rank Test, Mann-Whitney U Test, Runs test, Tests of Goodness of Fit, Tests of Randomness, Kruskal-Wallis Test, Friedman Test.

Books Recommended

1. Steel,R.G.D. Torrie, J.H. and Dickey, D.A. (1996). Principles and Procedures of Statistics, Latest Editions, McGraw Hill, New York.

2. Montgomery Douglas, C. and Peck Elizabeth A (1992), Introduction to Linear Regression Analysis, John Wiley and Sons, Inc. New York.

3. Dixon, W.J. and Massey, F.J. (1983). Introduction to Statistical Analysis, McGraw Hill, New York

4. Zar J.H. "Biostatistical Analysis" 4th Edition, John Wiley and Sons, New York2.Snedecor, G.W. & Cochran W.G. (1997). "Statistical Methods", Iowa State University Press.

5. Ott, R.L. (1993). "An Introduction toStatisticalMethods and Data Analysis", Latest Edition, Duxbury Press, Belmont, California

6. Daniels. H., (1988). "Applied Non-Parametric Statistics", John Wiley, New York5. Larson, H.J. (1983.), "Introduction to Probability Theory and StatisticalInference", John Wiley. New York.

STAT-555 Econometrics

Contents

Errors in Variables. Problems of autocorrelation, multicollinearity, heteroscedasticity and their solution. Ridge regression. Lagged variables. Dummy variables. System of simultaneous linear

equations, Identification-Estimation method, indirect and two-stage least squares methods, restricted least squares. Test of identifying restrictions. Estimation with stochastic regressor, generalized least squares estimators.

Pre-Requisite: STAT-307

Books Recommended

1. Draper, N.R. and Smith, H. (2004). "Applied *Regression Analysis",* John Wiley, New York.
2. Baltagi, B. H. (1999). "Econometrics", 2nd Edition, Springer Varlag.
3. Gujrati, D. (1998). "Econometrics", John Wiley, New York.
4. Wonnacot, T.H. and Wonnacot R.J. (1998). "Econometrics", John Wiley, New York.
5. ***** Johnston, J. and Di. Nardo, J., (1997). "Econometric *Method",* 4th Edition, McGraw Hill, New York.
6. Montgomery, D.C., and Peck E.A. (1992). "Introduction *to Linear Regression Analysis",* 2nd Edition, John Wiley and sons Inc. New York.
7. Guttmann, I. (1980); "Linear *Models: An Introduction",* John Wiley, New York.
8. Koutsoyiannis, A. (1980), "Theory *of Econometrics",* Macmillan.
9. Maddela, G.S. (1977). "Econometrics", McGraw Hill. New York.
10. Searle, S. R. (1971), "Linear *Models",* John Wiley, New York.
11. *** (Text Book)**

STAT-652 Design and Analysis of Experiments-II

Contents

Factorial Experiments: 2k, 3k series and mixed level factorial experiments and their analyses. Confounding in factorial experiments, Complete and partial confounding, Confounding in Fractional replications, Quasi-Latin square designs. Split- plot, split block, split-split plot, strip plot and nested designs. Missing observations in Split plot design.

Incomplete block designs: BIBD - Lattice designs, lattice square and Youden squares, PBIBD with recovery of intra-block information. Introduction of response surface methods: First and Second order designs. Central composite designs. Fitting of response surface models and estimation of optimum/maximum response.

Pre-Requisite: STAT-305

Books Recommended

1. ***** Montgomery, D.C. (2000). "Design *and Analysis of Experiments",* John Wiley, New York.

2. Clarke, G.M., and Kempton, R.E. (1997), "Introduction *to the Design & Analysis of Experiments",* Edward Arnold.

3. Steel, G. D., Terrie, and Dickey A. (1997). "Principles *and Procedures of Statistics: A Biometrical Approach"* 3rd Edition, McGraw Hill, New York.

4. Boniface, D.R. (1995). *Experimental Design & Statistical Methods,* Chapman & Hall.

5. Myers, R.H. and Montgomery, D.C. (1995). "Response *Surface Methodology; Process & Product Optimization Using Design",* John Wiley.

6. Clarke, G.M. (1994). "Statistics *& Experimental Design".* Edward Arnold.

7. Harold, R. L (1992). "Analysis *of Variance in Experimental Design".* Springer Verlag:

8. Maxwell, S.E. and Delaney, H.D. (1990). *Designing Experiments and Analysis of Data. A Model Comparison Perspective.* Belmont and Wadeson.

9. Mead, R. (1988). "The *Design of Experiments".* Cambridge University Press, Cambridge.

10. Das, M.N.and Giri, N.C, (1986). "Design *and Analysis of Experiments",* John Wiley, New York.

11. Gomez, K.A., and Gomez, A.A. (1984). *"Statistical Procedures for Agricultural Research",* 2nd Edition, John Wiley, New York.

12. Hicks, C.R. (1982). "Fundamental *Concepts in Design and Analysis of Experiments";* Saunders

13. Cochran, W.G. and Cox, G.M. (1957). "Experimental *Design",* John Wiley, New York. 14. *** (Text Book)**

STAT-554 Population Studies (Demography)

Contents

The population and housing census Registration of vital events. Demographic surveys. Components of population growth, composition of population and vital events. Types and sources of errors. General testing procedures. Testing the accuracy of age and sex data. Fertility and mortality measures. Total and general fertility rates. Estimation from incomplete Data. Construction of complete and abridged life tables. Different types of life tables. Graphs of Ix, qx and ex. Description and uses of life table columns. Stationary population models. Population estimates and projections, Inter-censual estimates, Population projections through various methods. Theory of demographic transition. Stable and stationary population models, their applications and uses. Malthusian and post Malthusian theories of growth. Consequences of world population growth & population explosion. State of Population in Pakistan.

Development of demographic profile in Pakistan. Recent demographic parameters. Current and future demographic activities in Pakistan.

Pre-Requisite: STAT-201 & 202

Books Recommended

1. *Jay Weinstein, Vijayan, K. Pillai, (2001) "Demography: The Science of Population". Allyn & Bacon.*
2. *Hind, A., (1998). "Demographic Method", Arnold.*
3. *United Nations (1998), "World Population Assessment", UNFPA; New York.*
4. *Govt. of Pakistan (1998), National, Provincial and District census reports and other supplementary reports with respect to 1998 census; PCO, Islamabad.*
5. *United Nations (1996), "Added years of Life in Asia", ESCAP; U.N., Thailand.*
6. *Palmore, J.A; Gardner, R.W. (1994), "Measuring Mortality Increase"; East West Centre, Honolulu.*
7. *Bogue, D.J. Arriagu, E.E., Anderson, D.L. (1993), "Readings in Population Research Methodology", Vol. I-VIII, United Nations Fund; Social Development Centre, Chicago.*
8. *Impagliazo, J. (1993), Deterministic Aspects of Mathematical Demography, Springer Verlag New York.*
9. *United Nations (1990), "World Population Monitoring 1989", UNFPA.*
10. *Rukanuddin A.R. and Farooqi, M.N.I.., (1988), "The State of Population in Pakistan – 1987", NIPS, Islamabad.*
11. *Keyfitz, N. (1983) "Applied Mathematical Demography", Springer Verlag N.Y.*
12. ** Pollard, A.H., Yousaf, F & Pollard, G.M. (1982), "Demographic Techniques", Pergamon Press, Sydney.*
13. *Pakistan Demographic Survey, Govt. of Pakistan, Federal Bureau of Statistics.*
14. *Publications of population census organizations.*
15. ** (Text Book)*

STAT-601 Statistical Inference-I

Contents

Estimation of Parameters. Properties of Estimators: unbiasedness, consistency, sufficiency, efficiency, completeness. Cramer-Rao inequality, Rao-Blackwell and Lehmann - Scheffe Theorems. Methods of Estimation: Moments, Maximum likelihood, least-squares, minimum

Chi- square and Baye **Pre-Requisite: STAT-302 Books Recommended**

1. Mood, A.M., Graybill, F.A. and Boss, D.C. (1997). "Introduction *to the Theory of Statistics".* McGraw Hill, New York.

2. ***** Hogg, R.V. and Craig, A.T. (1996). "Introduction *to Mathematical Statistics".* Prentice Hall, New Jersey.

3. Lindgren, B.W. (1998). "Statistical *Theory".* Chapman and Hall, New York.

4. Stuart, A. and Ord, J.K. (1998). *Kendall's' "Advanced Theory of Statistics" Vol. II.* Charles Griffin, London.

5. Zacks, S. (1973), "Parametric *Statistical Inference",* John Wiley, New York.

6. Rao, C.R., (1973). *"Linear Statistical Inference and its Applications",* John Wiley, New York.

7. ***** Bickel, P.J., and Docksum, K.A. (2001), Mathematical Statistics, Vol I, Prentice Hall, N.J., 2nd ed.

8. *** (Text Book)**

STAT-653 Applied Multivariate Analysis

Contents

Introduction to Multivariate Normal Distribution. Estimation of the mean vector and covariance matrix. Multivariate analysis of variance (MANOVA). Principal components analysis, Factor analysis, Discriminate analysis, Canonical Correlation Cluster analysis. Multidimensional scaling.

Pre-Requisite: STAT-302 Books Recommended

1. Anderson, T.W. (2003). "An *Introduction to Multivariate Statistical Analysis",* John Wiley, New York.

2. Afifi, A. A. and Clark Virginia (2000). "Computer *Aided Multivariate Analysis",* Lifetime learning publications, Belmont California.

3. Flurry B. (1997). "A *First Course in Multivariate Statistics",* Springer Valerg, New York.

4. Manly, B.F.J. (1994). "Multivariate *Statistical Methods,* A Primer" 2nd Edition, Chapman and Hall, London.

5. ***** Johnson, R.A. and Wincher, D.W. (1992). "Applied *Multivariate StatisticalAnalysis".* Prentice Hall. London.

6. ***** Morrison, F. (1990). "Multivariate *Statistical Methods",* McGraw Hill, New York.

7. Chatfield, C. and Collins, A.J. (1980). "Introduction *to Multivariate Analysis",* Chapman and Hall, London.

8. Mardia, K.V., Kent, J.T. and Bobby, J.M. (1979). "Multivariate *Analysis",Academic* Press, London.

9. Everett, B.J. (1974). "Cluster *Analysis",* McGraw Hill, New York.

10. *** (Text Book)**

STAT-603 Survey and Research Methods

Contents

Definition of Research, Types of Research, Selection of Problem, Search of References, Formation of Hypothesis and Procedure for its Testing, Research Methodology, Planning of Experiments to Test Hypothesis Objectivity, Principals of Experimental Design, Steps in Experimentation, Collection of Data, Data Analysis to Determine Functional Relationship Between Variables, Levels of Significance, Interpretation of Results, Components of Scientific Reports and Various Methods of Data Presentation, Preparation of Scientific Reports, Publication Procedures.

PRACTICAL:

Survey of Literature on a Given Topic, Collection of References from Various Sources

Including SD-ROM Data Base. Collection of Primary and Secondary Data, Arrangement of Primary and Secondary Data, Preparation of Scientific Report for Publication, if Possible

Pre-Requisite: STAT-304 Books Recommended

1. Andrew, C.O. and P.E. Hildebrand. (1993) "Applied Agricultural Research", Foundations and Methodology, Western Press.

2. Hashmi, N. (1989) "Style Manual of Technical Writings", USAID/NARC, Islamabad.

3. Gimbaled, J. and W.S. Acuter (1988) "MLA handbook for Writers of Research Papers", McGraw The Modern Language Association of America.

4. Little, T.M. and F.J. Hills (1978) "Agricultural Experimentation", John Wiley & Sons.

STAT-651 Statistical Inference-II

Contents

Interval Estimation: Pivotal and other methods of finding confidence interval, confidence interval in large samples, shortest confidence interval, optimum confidence interval. Bayes' Interval estimation. Tests of Hypotheses: Simple and composite hypotheses, critical regions. Neyman-Pearson Lemma, power functions, uniformly most powerful tests. Deriving tests of Hypothesis concerning parameters in normal, exponential, gamma and uniform distributions. Randomized Tests. Unbiased tests, Likelihood ratio tests and their asymptotic properties. Sequential Tests: SPRT and its properties, A.S.N. and O.C. functions.

Pre-Requisite: STAT-401

Books Recommended

1. Stuart, A and Ord, J.K. (1998). *Kendall's' "Advanced Theory of Statistics" Vol. II.* Charles Griffin, London.

2. Lindgren, B.W. (1998). "Statistical *Theory".* Chapman and Hall, New York.

3. ***** Mood, A.M. Gray Bill, F.A. and Boss, D.C. (1997). "Introduction *to the Theory of Statistics".* McGraw Hill, New York.

4. Lehman, E.L. (1997). "Testing *Statistical Hypotheses".* Springler - Volga, New York.

5. ***** Hogg, R.V. and Craig, A.T. (1996). "Introduction *to Mathematical Statistics".* Prentice Hall, New Jersey.

6. Zacks, S. (1973), "Parametric *Statistical Inference",* John Wiley, New York.

7. Rao, C.R., (1973). *"Linear Statistical Inference and its Applications",* John Wiley, New York.

8. *** (Text Book)**

STAT- PROJECT ELECTIVE COURSES

STAT-621 Operations Research

Contents

History and definition of O.R. Introduction to linear programming. Formulation of LP model. Graphical solution of two variables. Standard Form. Simplex method. Duality theory; Sensitivity Analysis, Primal and dual form. Gaussian elimination. Transportation Problem, Assignment problem. Introduction to CPM and PERT techniques. Queuing Models, Inventory

models, Dynamic programming and simulation models.

Books Recommended:

1. Taha, H.A. (1998). "Operations *Research".* Macmillan. London.
2. Hillier, F.S. and Lieberman G. J. (1996). "Introduction *to Operations Research",* Holden Day.
3. Gupta, P.K. & Hira, D.S. (1994). "Operations *Research".* S. Chand & Co., New Delhi.
4. Bazarra, N.M., Jarvis J.J. and Sherali, H.D. (1990) "Linear *Programming and Network Flows",* John Wiley & Sons, 2nd ed.
5. Ravindran, A., Philips, D.J and Sillerg, J.J. (1987). "Operations *Research: Principles and Practice"* John Wiley.
6. Bronson, R. (1983). "Operations *Research* – Schaums' Outline Series" – McGraw Hill.
7. *** (Text Book)**

STAT-622 Stochastic Processes

Contents

Introduction. Generating Functions. Laplace Transforms. Difference Equations. Differential - Difference Equations. Introduction to Stochastic Processes. The Random Walk in one and two

Dimensions. The Classical Gambler's Ruin Problem. Expected Duration of the Game.

Markov Chains: Definition. Higher Transition Probabilities. Classification of States and Chains. Markov processes with Discrete State Space. Poisson Process and its Generalization. Pure Birth and Death Processes. Markov Processes with Discrete State Space (Continuous Time Markov Chains). Markov Processes with Continuous State Space. Introduction to Brownian Motion. The Wiener Process. Diffusion Equations for the Wiener Process.

Books Recommended

1. Ross, S. (1996). "Stochastic *Process",* 2nd Edition, John Wiley, New York.
2. Feller, W. (1992). "An *Introduction to Probability Theory and its Applications",* John Wiley, New York.
3. Srinivasin, S.K. and Mehta, K.M. (1988). "Stochastic *Processes".* Tata McGraw Hill.
4. Karlin, S.A. and Taylor H.M. (1984). *"A first course in Stochastic Process",* Academic Press London.
5. Hole, P.G., Port, S. and Stone, C.L. (1984). "An *Introduction to Stochastic Process",* John Wiley, New York.
6. Cox, D.R.and Miller H.D. (1984). "The *Theory of Stochastic Processes",* Chapman and Hall, London.
7. Medhi, J. (1982), "Stochastic *Processes",* Wiley Eastern Ltd.
8. *** (Text Book)**

STAT-623 Reliability Analysis

Contents

Basic concepts of reliability. Structural reliability. Lifetime distributions (Failure models): Hazard rate; Gamma, Weibill, Gumball, Log-Normal and Inverse Gaussian Distribution.

Stochastic fatigue-rate models. Point and interval estimation. Fatigue-life model.

Testing reliability hypothesis. Monte-Carlo, distribution-free and Bayes' methods in reliability. System reliability; series and parallel systems. Failure models, (k-out-of-m) New-better-than used models. Inferences for these models. Accelerated life testing.

Books Recommended

1. Achintya Haldar, Sankaran Mahadevan (2000). *Reliability Assessment Using Stochastic Finite Element Analysis".*
2. Crowder, M.J. (1994). "Statistical *Analysis of Reliability Data".*
3. Lee, J. Bain, Bain Bain, (1991). "Statistical *Analysis of Reliability and Life-Testing Models".*
4. Gertsbakh, I.B. (1989). "Statistical *Reliability Theory".* Marcel Decker. New York.
5. ***** Lawless, J.F. (1982). "Statistical *Model and Methods for Lifetime Data".*
6. Gertsbakh, I.B. (1988). "Statistical *Reliability Theory".*
7. Mann, N.R., Scheefer, R.E. and Singapoor wel, N.D. (1974). *Methods for Statistical Analysis of Reliability,* John Wiley & Sons.
8. *** (Text Book)**

STAT-624 Time Series Analysis and Forecasting

Contents

Stochastic Process, Stationary Time-Series, Exponential smoothing techniques, auto-correlation and auto-covariance, estimates functions and standard error of the auto-correlation function (ACF) and PACF, Periodogram, spectral density functions, comparison with ACF, Linear stationary models: Auto regressive, Moving Average and mixed models, Non-stationary models, general ARIMA notation and models, minimum mean square forecasting. ARIMA Seasonal Models.

Books Recommended

1. Cox, D. R., Hinckley D.V. and Nielsen O.E.B. (1996). "Time *Series Models - In Econometrics, finances and other fields";* Chapman & Hall, London.

2. ***** Chatfield, C. (1996). "The *Analysis of Time Series: An Introduction",* Chapman and Hall, London.

3. Andy, P, West M. and Harrison, P. J. (1994). "Applied *Bayesian Forecasting and Time Series Analysis",* Chapman & Hall New York.

4. Brock well P.J. and Davis R.A. (1991). "Time *Series Theory and Methods",* Springer Verlag New York.

5. Harvey, A.C. (1990). "Forecasting *Structural Time Series Models and the Calamander",* Cambridge University Press, Cambridge.

6. Daggle, P.J. (1990), "Time *Series: A Biostatistical Introduction",* Clarendon Press, Oxford.

7. Bovas, A. and Johannes, L. (1983), "Statistical *Methods for Forecasting",* John Wiley. New York.

8. Priestley, M.B. (1981), "Spectral *Analysis and Time Series",* Academic Press, London.

9. ***** Box, G.E.P. and Jenkins, G.M. (1999). "Time *Series Analysis: Forecasting and Control",* San Francisco.

10. *** (Text Book)**

STAT-625 Decision Theory

Contents

The nature and concept of loss functions, parameters, decisions and sample spaces. Risk and average loss. Admissibility and the class of admissible decisions. Minimax principle and its application to simple decision problems, linear and quadratic losses and their uses in problems of estimation and testing hypotheses. Asymptotically minimax procedure. A prior distributions and conjugate priors. Bayes' decision procedure, admissibility of Bayes' and minimax procedures.

Books Recommended

1. Berger, J. O. (1985). "Statistical *Decision Theory & Bayesian Analysis",* Springer Verlag.

2. ***** Lindgren, B.W. (1971). "Elements *of Decision Theory,* Macmillan", New York.

3. Blackwell, D. and Graphic, M.A. (1966). "Theory *of Games and Statistical Decision",* John Wiley, New York.

4. *** (Text Book)**

STAT-626 Robust Methods

Contents

Introduction to Robustness. Objective function. M-estimator of location. E-estimator, R-estimator and W-estimator, Redesending M-estimator's The Breakdown point of Robust estimator Influence function. M-estimator for scale. Outliers and influential observations. Outliers in Regression analysis.

Books Recommended

1. Rousseau, P.J. and Leroy, A.M. (1987). "Robust *Regression and outlier detection",* John Wiley. New York.

2. Hamper, T.R. Brochette, E.M. Rousseau, P.J. and Satchel, W.A. (1986). "Robust *Statistics", "The approach Based on Influence functions",* John Wiley New York.

3. ***** Huber, P.J. (1981). "Robust *Statistics",* John Wiley, New York.

4. *** (Text Book)**

STAT-627 Official Statistics

Contents

Design and planning of a Statistical Investigation. Data collection- approach and operation; Role of sampling in generation of Statistics, Sampling plans and survey Designs. Sources of Errors, Types of Errors, methods of their control. Data processing, presentation, and publication of Statistics. Different modes of Data Dissemination. Official Statistics, Statistical systems and standards, Sources of official statistics, their role, working and publication. Role of Official Statistics, Official Publications. Setup of official organizations in Pakistan their role, working & publication, Statistics Division, Federal Bureau of Statistics, Agricultural Census Organization, Population Census Organization, Ministry of Food, Agriculture and Livestock; National Data Base and Registration Authority (NADRA). Provincial Bureaus of Statistics. Financial Statistics: Ministry of Finance, State Bank of Pakistan-Department of Statistics, their working, publications and responsibilities. Other Organization's Statistical output, National and International series, classification and standards.

Use of Statistics in administration and planning. Concepts and evaluation of GDP, GNP, NNP, Balance of Trade and payments. Measurement of Income Distribution, use of Index Numbers. and time series. Deflation and Inflation of series. National sample surveys and censuses conducted in Pakistan.

Assignment: Visit of major Statistical Organizations will be a part of the course. An assignment will have to be submitted on any topic given by the course incharge.

Books Recommended:

1. Kish, L. (1992). "Survey *Sampling",* John Wiley, New York.
2. Statistics Division, "Activity *Report" (1988-89).Government of Pakistan,* Islamabad.
3. Statistical Institute for Asia & Pacific SIAP (1984). "Training *of Trainers in Statistical Operations and Procedures"* Part-I, II UNDP, Tokyo.
4. Hansen M.H. (1980). "Progress *and Problems in Survey Methods and Theory". IIIustrated by the work of U.S. Bureau of the Census, U.S. Department of Commerce;* A Monograph.
5. Murthy, M.N. (1979). "Quality *of Data, Country Course on Sample Surveys",* Karachi.
6. Statistics Division (1979). "Retrospect, *Perspective and Prospect",* Islamabad.
7. State Bank of Pakistan (1966). "Deptt. *of Statistics-A Chronicle".*
8. Zarkovich S.S. (1966) "Quality *of Statistical Data, Food and Agricultural Organization",* The U.N. Rome.
9. NIPA (1962) "Administrative *uses of Statistics",* NIPA Res. Sr.No.2 Karachi.

10. Yates F. (1960), "Sampling *Methods for Census and Surveys",* Charles Griffin. FAO Year Books.

11. Various Publications of FBS, PCO, ACO, "State *bank of Pakistan, Ministry of Finance"* etc.

STAT-628 Survival Analysis

Contents

Special features of Survival data: Patient time and study time, Survival function and hazard function, Time dependent and censored survival data. Nonparametric procedures: Estimation of Survival function, hazard function, median and percentiles of Survival times. Confidence interval and comparison of group; stratified and log-rank tests for trend. Modeling of Survival data; hazard function modeling; its tests and confidence interval. The Waybill model for survival data. Exploratory data analysis and other models. Sample size requirement for survival study. Computer software for Survival analysis; any available software like SAS, BMDP, SPSS, GLIM, GENSTAT or S-plus.

Books Recommended

1. Lee, E.T. (1997). "Applied *Survival Analysis",* John Wiley and Sons, New York.

2. Muller, R.G. and Xian Zhou (1996). "Survival *Analysis with long- term Survivors",* John Wiley. New York.

3. Burkett, M. (1995). "Analyzing *Survival Data from Clinical Trials and Observational Studies";* John Wiley New York.

4. Parmer M.K.B. & Macklin D. (1995). "Survival *Analysis: A Practical Approach";* John Wiley New York.

5. Collett, D. (1994). "Modeling *Survival Data in Medical Research".* Chapman & Hall, London.

6. Lee, E.T. (1992). "Statistical *Methods for Survival Data Analysis";* John Wiley. N.Y.

7. Eland Johnson, R. C. and Johnson N. L. (1989), "Survival *Models & Data Analysis".* John Wiley N.Y.

8. Turkey, J. (1987). "Exploratory *Data Analysis",* John Wiley, New York.

9. Cox, DR. and Oakes, D. (1984). "Analysis *of Survival Data";* Chapman & Hall London.

10. *** (Text Book)**

STAT-629 Biostatistics

Contents

Definition of Biostatistics, viz-a-viz the type of variables and observations in biological, health and medical sciences, Uniqueness in terms of behaviour of variables their domain, and units; Categorical, numerical and censored data. Populations, Target populations and samples; Role of sampling in biostatistics, Size of samples of various types of studies, Proportions, rates and ratios; incidence, prevalence and odds. Distributional behaviour of biological variables (Binomial, Poisson and Normal), Role of transformation for analysis of biological variables. Probit and Logit transformations and their analysis, p values, its importance and role. Confidence Interval in simple and composite hypothesis testing.

Books Recommended

1. Zar, J. (2000). "Biostatistical *Analysis",* 5th Edition, John Wiley and Sons.

2. Shoukri, M. M. & Pause, C. A. (1998). "Statistical *Methods for Health Sciences".* 2nd Edition, CRC Press, Florida.

3. ***** Daniel, W.W. (1996). "Biostatistics: *A Foundation for the Health Sciences",* 6th Edition, John Wiley, New York.

4. Diggle, J. P., Liang, Kung-Yee and Zeger, S. L. (1996). "Analysis *of Longitudinal Data",* Clarendon Press, Oxford.

5. Dunn, G. and Everit, B. (1995). "Clinical *Biostatistics",* Edward Arnold, London.

6. ***** Rosner, B. (1994). "Fundamentals *of Biostatistics",* 4th Edition, Duxbury Press.

7. Zolman, J.F. (1993). "Biostatistics: *Experimental Design and Statistical Inference",* Oxford University Press, New York.

8. Lee, E.T. (1992). "Statistical *Methods for Survival Data Analysis",* 2nd Edition, John Wiley, New York.

9. *Harris, E. K. and Albert, A. (1991). "Survivorship Analysis for Clinical".*

10. *"Studies".* Marcel Decker, New York.

11. Altman, G. (1991). "Practical *Statistics for Medical Research".* Chapman & Hall,

London.

12. Lawless, J. F. (1982). *Statistical Models and Methods for Life Time Data.* John Wiley, New York.

13. *** (Text Book)**

STAT-630 Data Mining

Contents

Introduction to databases, including simple and relational databases; data warehouses. Review of classification methods from multivariate analysis; classification and decision trees. Clustering methods from both statistical and data mining viewpoints; vector quantization. Unsupervised learning from univariate and multivariate data; dimension reduction and feature selection. Supervised learning from moderate to high dimensional input spaces; artificial neural networks and extensions of regression models, regression trees. Association rules and prediction; applications to electronic commerce.

Books Recommended

1. Han, J. and Camber, M. (2000). Data Mining; "Concepts *and Techniques".* Morgan Gaufmann.

2. Benson and Smith, S.J. (1997). "Data *Warehousing, Data Mining',* and OLAP. McGraw-Hill.

3. Mitchell, T.M. (1997). *"Machine Learning".* McGraw-Hill.

4. Ripley, B.D. (1996). "Pattern *Recognition and Neural Networks".* Cambridge University Press.

5. Breiman, L. Friedman, J.H. Olshen, R.A. and Stone, C.J. (1984). "Classification *and Regression Trees"* Wadsworth and Brooks/Cole.

6. *** (Text Book)**

STAT-631 Actuarial Statistics-I

Contents

Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curate future lifetime, force of mortality.

Life table and its relation with survival function, examples, assumptions for fractional ages, some analytical laws of mortality, select and ultimate tables.

Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions evaluation for special mortality laws.

Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations.

Distribution of aggregate claims, compound Poisson distribution and its applications.

Books Recommended

1. Bowers, N.L. Gerber, H.U. Hickman, J.C. Jones, D.A. and Nesbitt, C.J. (1986). "Actuarial *Mathematics",* Society of Actuarial, Ithaca, Illinois, U.S.A. Second Edition (1997).

2. Neill, A. (1977). "Life *Contingencies",* Heineman.

3. Spurgeon, E.T. (1972), "Life *Contingencies",* Cambridge University Press.

STAT-632 Actuarial Statistics-II

Contents

Principles of compound interest: Nominal and effective rates of interest and discount, force of interest and discount, compound interest, accumulation factor, continuous compounding.

Life insurance: Insurance payable at the moment of death and at the end of the year of death-level benefit insurance, endowment insurance, deferred insurance and varying benefit insurance, recursions, commutation functions.

Life annuities: Single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, commutation functions, varying annuities, recursions, complete annuities-immediate and apportionable annuities-due.

Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportionable premiums, commutation functions, accumulation type benefits.

Payment premiums, apportionable premiums, commutation functions, accumulation type benefits.

Net premium reserves : Continuous and discrete net premium reserve, reserves on a semi-continuous basis, reserves based on true monthly premiums, reserves on an apportionable or discounted continuous basis, reserves at fractional durations, allocations of loss to policy years, recursive formulas and differential equations for reserves, commutation functions.

Some practical considerations: Premiums that include expenses-general expenses types of expenses, per policy expenses.

Claim amount distributions, approximating the individual model, stop-loss insurance.

Books Recommended

1. Bowers, N.L. Gerber, H.U. Hickman, J.C. Jones, D.A. and Nesbitt, C.J. (1986) "Actuarial *Mathematics",* Society of Actuaries, Ithaca, Illinois, U.S.A. Second Edition (1997).

2. Spurgeon, E.T. (1972). "Life *Contingencies",* Cambridge University Press.

3. Neill, A. (1977). "Life *Contingencies",* Heinemann.

STAT-633 Mathematical Modeling and Simulation

Contents

Monte Carlo methods: Different methods of generating random variables, generation of random numbers, acceptance and rejection techniques from various distributions. Comparison of algorithms to generate random variables. Generating random variables from failure rates.

Generation from multinomial distribution / Monte Carlo integration. Gibbs sampling and other techniques. Variance reduction techniques: importance sampling for integration, control variates and antithetic variables.

Books Recommended:

1. Ross, S.M.(2002). "Simulation" (Third Edition) (Academic).

2. Fishman, G.S. (1996). Monte Carlo: *"Concepts, Algorithms, and Applications",* (Springer).

3. Rubinstein, R.Y. (1981). "Simulation *and the Monte Carlo Method",* (Wiley).

4. Ripley, B.D. (1987) "Stochastic *Simulations"* (Wiley)

5. *** (Text Book)**

STAT-634 Categorical Data Analysis

Contents

Introduction, describing two way contingency tables, inference for two way contingency tables, models for binary response variables, Log linear models, fitting Log linear and Logit models, building and applying Log linear models, Log linear Logit models for ordinal variables, multinomial response models for matched pairs, analyzing repeated categorical response data, logistic regression models and their analysis.

Books Recommended

1. Agresti, A. (1990), "Categorical *Data Analysis",* John Wiley and Sons.

2. Bishop, Y.V.V., Fienberg, S.E. and Holland, P.W. (1975). "Discrete *Multivariate Analysis",* MA: MIT Press Cambridge.

3. Cox, D.R. and Snell, E.J.(1989). "The *Analysis of Binary Data",* Chapman and Hall, London.

4. David, W.H., Leweshow, S.L. (1989). "Applied *Logistic Regression".*

5. Mc Gullah, P. and Nelder, J.A. (1989). "Generalized *Linear Models",* 2nd ed. Chapman and Hall, London.

STAT-636 Bayesian Statistics

Contents

Prior information, Prior distributions, Methods of elicitation of prior distributions, Posterior distributions: The posterior means, medians (Bayes estimators under loss functions) and variances of univariate and bivariate posterior distributions, Noninformative priors: Methods of elicitation of noninformative priors, Bayesian Hypotheses Testing: Bayes factor; The highest density region; Posterior probability of the hypothesis.

Books Recommended

1. O.Hagan A. Kendall's Advanced Theory of Statistics (Vol.2B), Bayesian Inference, Cambridge, The University Press (1994).

2. Bernardo, J. M. & Smith, A.F.M., Bayesian Theory, John Wiley, New York (1994).

3. Lee, P.M. Bayesian Statistics, An Introduction, Oxford University Press, New York (1991).

4. Berger, J.O., Statistical Decision Theory and Bayesian Analysis (2nd Ed.), New York, Springer Verlag (1985).

5. Box, G.E. P & Tiao, G. C. Bayesian Inference in Statistical Analysis, Reading Addison-Wesley (1973).

STAT-637 Statistical Quality Management

Contents

Concept of quality control, total control and Total Quality Management (TQM) Statistical Methods in Quality Improvement. Statistical Process Control (SPC). Statistical Quality Control (SQC). Shewhart control charts: philosophy, construction, advantages. CUSUM and moving average control charts: Average Run Length (ARL); Fast Initial Response (FIR). ARL and FIR for X, R and S-charts.

Process capability analysis: Designed experiments. Process improvements using design of experiments. Taguchy Method. Orthogonal fractional factorial designs. Acceptance sampling for attributes and variables.

Acceptance sampling plans: Single, double, and multiple sampling plans with their O.C. curves, Military Standard 501 Sampling Plans. Introduction to ISO- 9000 and ISO-14000 series.

Pre-Requisite: STAT-301

Books Recommended

1. Montgomery, D.C. (2004). "Introduction *to Statistical Quality Control".* McGraw Hill, New York.

2. Miltag H. J. and Rinne H. (1993). "Statistical *Methods of Quality Assurance",* Chapman & Hall, London.

3. Nelson, W. (1990). "Accelerated *Testing".* John Wiley, New York.

4. Banks, J. (1989). "Principles *of Quality Control".* John Wiley, New York.

5. Ryan, T.P. (1989). "Statistical *Methods for Quality Improvement".* John Wiley, New York.

6. Juran, J.M. and Guyana, F.K. (1988). "Juan's *Quality Control Handbook".* McGraw Hill New York.

7. Feigenbaum, A.V. (1986). "Total *Quality Control".* McGraw Hill, New York.