UNIVERSITY OF CHITTAGONG

Faculty of Science

Syllabus of the Department of Statistics

For M.S. (Final) in Statistics

Session: 2013–2014 to 2014-2015

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Department of Statistics

UNIVERSITY OF CHITTAGONG

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FACULTY OF SCIENCE

UNIVERSITY OF CHITTAGONG

Session 2010–2011

UNIVERSITY OF CHITTAGONG

FACULTY OF SCIENCE

DEPARTMENT OF STATISTICS

Syllabus for M. S. (Final) Courses in Statistics

Session 2010–2011 to 2011-2012

The Degree of Master of Science will be awarded by the University of Chittagong under the provision of the ordained. The degree of Master of Science will be called M. S and shall spend one academic year. The results of the degree will be published in grading system. The course is divided into two groups. The general group (Group – A) and the thesis group (Group – B) . The examines shall take Examination either in the General Group and in the Thesis Group. The Thesis shall be offered subject to the approved of the Departmental Academic Committee. The examination shall be of 600 marks (6 Course unit: 24 Credits)

General Group: The examination shall consist of 6 theory course (12 credits). Three practical course of 150 mark (6 credits) each course consisting of Group A and Group B, spread over three days. Research study involving Project works/ field works of 50 mark (2 Credits) and Viva- Voce Examination of 50 marks (2 Credits) and sessional Marks of 50 (2 credits).

Thesis Group: Selection of students for thesis group will be made on the recondition of the Departmental Academic Committee.

The examination shall consist of six theory courses, Sessional examination, General Viva-Voce as General Group Students and a Thesis carrying 150 Marks plus Defense / Thesis Viva 50 Marks.

The breakdown of marks, units and credits are as follows:

General Group (Group – A)						
Category	Theory	Tutorial/ Sessional	Viva-Voce	Practical	Research involving Field Studies/ Project	Total
Course/Session	**6-course**	-	-	**3 - course**	-	-
Total Marks	300	50	50	150	50	600
Units	3	1/2	1/2	1 1/2	1/2	2
Credits	12	2	2	6	2	24

Thesis Group (Group – B)						
Category	Theory	Tutorial/ Sessional	Viva-Voce	Practical	Thesis writing and Thesis Defense	Total
Course/Session	6-courses	-	-	6-course	-	-
Total Marks	300	50	50	-	200	600
Units	3	1/2	1/2	-	2	6
Credits	12	2	2	-	8	24

The Paper –wise Title of Course (Both for General and Thesis Group), Marks, Course Unit, Credits and Duration of Examination are as follows:

Course M-Stat	Title of Paper	Full Marks	Unit	Credit	Duration of Exam / Hour
C o m p u l s o r y					
Stat- 501	Advanced Multivariate Analysis	50	0.5	2	3
Stat- 502	Statistical Inference	50	0.5	2	3
Stat- 503	Advanced Design & Analysis of Experiment	50	0.5	2	3
Stat- 504	Advanced Sampling Techniques	50	0.5	2	3
Total		200	2.0	8	-
O p t i o n a l : Any Two paper subject to Approval of the Academic Committee					
Stat- 505	Advanced Demography	50	0.5	2	3
Stat- 506	Industrial Statistics	50	0.5	2	3
Stat- 507	Advanced Bio- Statistics, Health & Epidemiology	50	0.5	2	3
Stat- 508	Advanced Econometrics	50	0.5	2	3
Stat- 509	Advanced Operation Research	50	0.5	2	3
Stat- 510	Probability and Stochastic Process	50	0.5	2	3
Stat- 511	Reliability Statistics and Modeling	50	0.5	2	3
Stat- 512	Environment Statistics	50	0.5	2	3
Practical (For General Group)					
Stat-13	Advanced Multivariate Analysis and Statistical Inference	50	0.5	2	3
Stat-14	Experimental Design and Sampling Techniques	50	0.5	2	3
Stat-15	(Two groups from two related Optional theory courses.)	50	0.5	2	3
Total		150	$1\frac{1}{2}$	6	9
Project		50			
For Thesis Group					
Thesis submission & Defense		200	2	4	-
Summary of Marks distribution					
Theory …….. ……		300	3	12	-
Pract. & Project /Thesis submission & Defense ….		200	2	8	
Sessional Examination ……		50	$\frac{1}{2}$	2	-
Viva-Voce (for General & Thesis Group)		50	$\frac{1}{2}$	2	-
Grand Total		600	6	24	-

Tutorial examination on theory courses shall be taken by the course teacher(s) during the progress of the course for internal evaluations. There shall be at least two tutorial examinations.

Stat – 501: Advanced Multivariate Analysis

Total Marks: 50 Time: 03 hours
Credit : 2 Number of Lectures: 30

Aspect of Multivariate Analysis—Application of Multivariate Techniques, Inference about a Mean Vector, Comparison of Several Multivariate Means, Paired Comparisons. A Repeated Measures Design, One-way MANOVA, Simultaneous Confidence intervals for Treatment Effects, Profile Analysis, Multivariate Linear Regression Models, Principal Component Analysis, Canonical Correlation Analysis, Multiple Classification Analysis, Clustering, Cluster Analysis, Generalized Linear Models, Path Analysis, Correspondence Analysis.

References:

1.	Johnson. R.A & Wichern, D.W	Applied Multivariate Statistical Analysis, Third Edition, Prentice –Hall, Inc.,Englewood, New Jersey, 1992
2.	Dillon & Goldstein	Multivariate Analysis
3.	Manly, B.F.S	Multivariate Statistical Methods-A Primer . Chapman & Hall, London, 1986
4.	Lawley & Maxwell	Factor Analysis as a Statistical Method.
5.	Everit, B.S.	Latent Variables Models.
6.	Press, S.J	Applied Multivariate Analysis
7.	Morrison, D.P	Multivariate Statistical Methods, McGraw-Hill, 1976.
8.	Kshiragar, A.M	Multivariate Analysis, Marcel Dekker

Stat – 502: Statistical Inference

(Theory of Inference)

Total Marks: 50 Time: 03 hours
Credit : 2 Number of Lectures: 30

Group-A: Estimation

Review of estimation theory. Sufficient statistic, Minimal sufficient statistic,Complete sufficient statistic,Ancillary Statistics, Jacknife and Boot Straping Technique, Fisher's consistency, Fisher's Information measure, The invariance Principle, Princeple of equivariance, Bhattachariyya system of Lower Bound, BAN, CAN and CUAN estimator,Estimation in large sample: Trimmed mean, L-estimator, M and R estimators.

Loss function: Symmetric and Asymmetric loss function, Risk function, Prior Distribution: Vague Priors, Conjugate prior, g-priors, Data based Priors,

Posterior Distribution, Baeys and minimax estimation with some fundamental theorems. Empirical Bays point estimation, Admissibility. Bayes interval estimation. Shrinkage estimators.

Decision Function, Minimax Decision function, Admissible decision function. Bays solution. Relation between decision theory and game theory.

Group B: Test of Hypotheses

Review of statistical test. Unbiased test, Generalised Neyman-Pearson lemma, similar region and Neyman-Structure, Similar region test, MPSR, UMPSR test, Invariant test. Asymptotic efficiency of a test.

Review of SPRT OC and ASN function, SPRT for three hypothesis, Sobel and Wald test, Armitage Method for composite hypothesis, Wald theory of weight function, Cox's Theorem, Sequential t-test, Sequential Chi square and T^2.
Asymptotic Relative Efficiency (ARE) MeNewar

Asymptotic Relative Efficiency (ARE) and Robustness of a non-parametric test, McNemar test in 2×2 contigency analysis, Cramer's Contingency Coefficient. ARE of Mann-Whitney test w.r.t one sample student t-test. Kruskal- Wallis and Friedman test.

References:

1.	Lehmann, E.L	Theory of Point Estimation , John Wiley and Sons. N.Y 1989
2.	Lehmann. E.L	Testing Statistical Hypothesis, 2nd Ed, Wiley. N.Y, 1959
3.	Rao. C.R (1984)	Linear Statistical Inference and its application, 2nd Ed. New Delhi, Wiley
4.	Gibbsons, J.D	Non parametric Statistical Inference, McGraw Hill, 1992
5.	S.James Press	Bayesian Statistics: Principles, Models & application, 1989
6.	Mood, AM, Graybill, F.A, Boyes, D.C	Introduction to the theory of Statistics, 3rd Ed, Mc Hill, International Book Co. New Delhi, 1983
7.	Keeping,E.S.	Introduction to Statistical Inference
8.	Casella. G and Berger, R.L	Statistical Inference. Duxbury Press, California.
9.	Ali, M.A.	Theory of Statistics, Vol-II

Stat – 503: Advanced Design & Analysis of Experiments

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Models: Detail study of random effect and mixed effect models. Variance compomets and their estimations in one-way and two-way classified data in random and mixed effect models. Procedure of analysis of variance.

Factorial experiments: Construction of confounded s^n factorials in blocks of size s^k. Analysis of variance in case of simultaneous confounded effects factorial experiments. Detail study of construction of balanced confounded asymmetrical factorial experiments. Analysis of variance of data in above confounded asymmetrical factorial experiments.

Incomplete Block Designs: Detail study of incomplete block designs, Balanced Incomplete Block Design (BIBD) and Symmetrical Balanced Incomplete Block Design (SBMBD). Construction of BIBD, SBIBD, Youden square design, Lattice design and Partially Balanced Incomplete Block Design (PBIBD), Orthogonal Latin square designs. Analysis of variance of BIBD with recovery of inter and intra-block information. Analysis of variance of PBIBD with associates. estimation of missing observations in split-plot design and BIBD and their variance components.
Concepts of Bioassays: Incomplete block design for Bio-assays Response surface designs with first and second order model fittings.

Weighing Designs: Chemical balance and spring balance weighing designs. Study of different properties. Analysis of variance in both Chemical balance and spring balance weighing design.

References:

1.	M.C. Charabarti	Mathematics of Design and Analysis of Experiments.
2.	K.S. Banerjec	Weighting Design.
3.	D. Raghararao	Construction and Combinational Problems in Design of Experiments
4.	D.D. Joshi	Linear Estimation & Design of Experiments.
5.	D.C. Montgonry	Design and Analysis of Experiments.
6.	P.W.M. John	Statistical Design and Analysis of Experiments-MacMillan
7.	Cochran & Cox	Experimental Design
8.	Das.M.N & Giri.N.C	Design and Analysis of Experiments.
9.	Yates	Factorial Experiments

Stat – 504: Advanced Sampling Techniques

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Cluster Sampling and Unequal Probability**:** Sampling of unequal size cluster with unequal Probability with replacement and without replacement – Sample selection procedure, related formula, estimator, and variances of the estimation; Application and usefulness of Probability Proportion to Size (PPS) selection procedure in various types of sampling; Some selective estimators based on sample selection (e.g . Des Raj's estimator, H-T. Estimator, Murthy's estimator, Hearthy- Cochran's estimator, Π PS sampling estimator etc) Relative efficiencies and Relative accuracies of the estimators. .

Review and Application of Multi- Stage Sampling: General methods along with variances and estimated variances. Optimum sampling and sub- sampling fractions, considering cost. Stratified Multi- stage sampling, Self- weighting techniques in multistage sampling.

Topics on Survey Errors**:** Overview of sampling and non-sampling errors. Bias and Variable errors. Non- Coverage, Incomplete frames, Missing values and their implifications. Non- response-types and its effect on accuracy of estimates. Techniques of adjustment (Call – back, Politz- saimon teachquies etc). Errors of measurement and its mathematical models.

Selected Topics in Survey Design**:** Review of steps in preparing a survey. Development of survey design plans for real life problems with special reference to design issues strategies and development plan (large scale small scale). The estimation of sample size of n, Familiarity with various large-scale national survey 's in Bangladesh.

References:

1.	Cochran. W.G .	Sampling Technique 4th Edition. Willey , N.Y.
2.	Sukhatme & Sukhatme	**F**AQ. Rome, 2nd Edition.
3.	Des Raj	Design of Survey , Tata MeGrars – Hill N.K.
4.	D.Raj	SamlingTheory**:** Tata McGrars - Hill, New Delhi.
5.	L**e**sstest, J.T	Khlo Beek.W.D–Non-Sampling Errors in Survey.
6.	Sigh. D. & F. H	Theory of Analysis of Sampling Survey Designs . Wiley Eastern Ltd. N. Delli
7.	A. Chowdhury & J.W.E.Vois	United Theory of Stacey of Survey Sampling North –Holland

Stat – 505: Advanced Demography

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Multiple and Single decrement life tables**,** Increment-decrement life tables, Multi-life functions Joint-life functions, Last survivor Status, General multi-life Status. Life table analysis of birth internals.

Indirect estimation of Fertility and adult morality reverse survival method, Preston and Coale method, Brass growth Balanced method own children method**.**

Study of some growth models- Exponential, Logistic and Quasi-stable models. Mathematical models on Fertility and human reproductive process.
Concept, elements of reproductive health, the dynamics of contraceptive use and their measures. Family planning programs in Bangladesh. Different types of fecundability. Births averted by contraception Probability of conceptions by day of the month.

Application of statistical tools**:** such as path analysis, multiple classification analysis, logistic model, hazards model and multinomial logistic model in demographic analysis.

References:

1. Keyfitz, N. (1977) Applied Mathematical Demography, Wiley & Sons.
2. Biswas, S. (1988) Stochastic Processes in Demography and Applications. Wiley Eastern Ltd. India
3. Bogue, D.J. (1969) Principles of Demography, Wiley & Sons. NW.
4. Chiang, C.L. (1968) Introduction to Stochastic Processes in Biostatistics. Wiley & Sons
5. Hooker, P.H. & Cook (1955) Life and Other Contingencies. Vol 1 & 2. Cambridge Univ. Press.
6. Johnson RCE & Johnson (1980) Survival Models and Data Analysis. Wiley NI. & Sons. NW.
7. Jordan. C.W. (1967) Life Contingencies. Society of Actuaries. Chicago. USA.
8. Feyfitz N (1968) Intriduction the Mathematies of Population. Addision-Wesly publishing Company, California.
9. Shylock, H.J.S. Siegel and Associates (1976) The Methods and Materials of Demography: Conded., New York, Academic Press.
10. UN Publications Manual IV and Manual X
11. UNFPA (1993). Population Research Methodology, Vols. 1-8 Chicago.

Illinois. and other UNFPA publications.
12. UNO (1983) Indirect Technique Demographic Estimation. Population Studies No.81
13. UNO Reading in Population research Methodology, Vol.1 to 6.

Stat – 506 : Industrial Statistics

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Basic ideas of manufacturing process. Application of Statistical tools in manufacturing sectors. Meaning and nature of Production Function. Productivity curves.

Quality Control: Basic Principles of Quality Control, Common Control Charts; Control Charts based on runs; O.C curves, Continuing test procedure and related concepts.

Classical sampling inspections by attributes and by variables; Sampling versus screening ; Producers and consumers risks; Single, Double and Multiple sampling plans; O.C. and ASN function of the plans. Dodge's and Roming sampling inspection table. Dodge's and Wald's Sampling plan for continuous productions. Unbiased estimates of fraction defective in case of curtailed inspections; use of some inefficient statistics in industrial inspections.

Sequential sampling, Notion of sequential testing. Sequential probability ratio tests , Derivations of O.C. and ASN functions of the test ; Certainty of the eventual termination of the test; Efficiency and optimum character of the test. Fundamental identity of sequential analysis. Sequential test on mean and variance of normal and on mean of exponential population. Use of range in sequential analysis.

Elements of large sample sequential estimation. Sequential confidence variance, Frequency justification of sequential tests.

Input-Output Analysis- Basic Concepts . Main features of analysis, Leontif input output statistics model, Dynamic model, Closed model, Hawkins Symon Conditions of Feasibility of solution.

References:

1. S.P.Singh : Econometrics.
2. Jhingan M.L : Advanced Economic theory.
3. Chaing, A : Fundamental Methods of Mathematical Economics.
4. Good and Bowker : Sample inspection by Variances.
5. Freeman, Freman : Sample Inspections.

6. Wald, A : Sequential Analysis.
7. Cowden, D. J. : Statistical Methods in Quality Control.
8. Mukhi, H.R. (2001) : Industrial Managements, ,Sataya Prakashan,New Delhi

Stat – 507: Advanced Bio-Statistics, Health & Epidemiology

Total Marks: 50 Time: 03 hours
Credit: 2 Number of Lectures: 30

Review**:** Basic concepts of lifetime distribution, Censoring Survival distribution, parametric regression models, Logistic regression model, Cox proportional hazards models.

Analysis of multivariate failure time data and cause specific hazards model, Various multistage hazards models, Accelerated failure time model, Generalized linear model (GLM), Generalized mixed model, Generalized estimating equations (GEE), Quasi likelihood and estimating functions, Modeling

Non-Parametric Methods (Two Samples and K-Samples): Kolmogrov-Smivnov Test, Mental-Haenszal Test, Gehan Test, Log-Rank Test, Wald Test, Score Test.
Transformation: Logit, Probit, Cumulative Log-log.

Markov Chain Model: Bernoulli Trials with Markov Dependence, Correlated Bernoulli Trials, Stationary Markov Chain, Markov Chain Model with Serially Dependent Observations, Markov Models for Covariate Dependence of Binary Sequences, Estimation and Test of Parameters, Test of Markov.

References:

1. D. R. Cox and D. Oakes, 1988 Analysis of Survival data. Chapman and Hall – London
2. J. F. Lawless, 1982 Statistical Model & Methods for Lifetime Data- N. Y.
3. J. D. Ralbfleisch & R. L. prentice 1982 The Statistical Analysis of Failure Time Data Wiley N.Y .
4. D. G Klei baun, 1996 Survival Analysis, Springer- N.Y.
5. D. G Klei baun, 1994 Logistic Regression. Springer Verlag.N.Y.
6. E. Harris & A. Albert, 1991 Survivalship Analysis for Clinical Studies Marcel. Decker, . N.Y.
7. D.V. Hinkley & E.J. Snell, 1991 Statistical Theory & Modeling, Chapman & Hall – London .
8. D.G. Hosmer & S.S. Lemeshow 1989 Applied Logistic Regression,Wiley- N.Y.
9. Breslow, N.E. & Day, N,E 1980 Statistical Methods is Cancer Research- The Analysis Case Control Studies, IARC,. LYON
10. Cox, D.R. & Snell.W., 1989 Analysis of Binary Data, 2nd ed. Chapman & Hall – London
11. Dobson A.J. 1990 An Introduction to Generalized Linear Models 2nd ed, Chapman & Hall- London.

12. MeCullaghp & Nelson, J.A. 1989 — Generalized Linear Models 2nd ed., Chapman & Hall, London.

13. Nelson, W. 1982 — Applied Life Data Analysis Wiley. N.Y

14. T.R.Fleming & D.P. Harrington1991 — Counting Processes & Survival Analysis, Wiley. N.Y.

15. P.K. Anderson, Berhan R.D. Gill & N. Keiding 1995 — Statistical Models Based on Counting Processes, Springer- N.Y.

16. N.G. Beeker 1987 — Analysis of Infectious Disease Data,Chapman & Hall- London

Stat – 508: Applications OF Econometrics

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

ML, GLS and IV estimators: Properties of ML estimators, likelihood ratio, Wald and Langrange's multiplier tests, ML estimation with non-spherical disturbances, GLS, IV estimator and its special cases

Distributed Lag models: Infinite lag distributions, SEASONALITY IN DISTRIBUTED LAG MODELS, Shiller's method and ridge regression, Form-free lags.

Generalized method of moments (GMM): The method of moment, OLS as moment problem, IV as moment problem, GMM estimator and its distribution.

Panel Data: Sources and types, random effect model and fixed effect model, Uu-Hausman Test, Fixed effects in the general model.

Robust regression : Concept, M-estimatos, L-estimators and W-estimators for robust regression, Bounded-influence regression,

Vector autoregressive (VAR) model: A simple VAr, two and three variable VAR, Higher order Var, Estimation of VARS, testing order of VAR, Granger causality test, impulse response function and Vector error correction models. Seemingly unrelated regression (SUR) model.

Autoregressive conditional heteroscedastic (ARCH) model: Basic concepts, ARCH9q) and GARCH(p,q) models, Estimation, testing for ARCH and GARCH effects.

References:

1. Johnston J and DiNardo J — Econometric methods (4th edition), McGraw Hill Componies inc.

2.	Peterson K	An introduction to applied econometrics-A time series approach Polgrave
3.	Maddala G S:	Econometrics, McGraw Hill International Editions
4.	Griffiths, W.E.et al:	Learning and Practicing Econometrics, John Wiley & Sons, Inc. New York
5.	Enders, W.:	Applied Econometric Time Series, John Wiley & Sons, Inc., New York
6.	Findley, D.F.	Applied Time Series Vol. 1& II, Academic press, N.Y.
7.	Hamilton, J.D.	Time Series Analysis, Princeton University Press, N.J, N.Y.

Stat – 509: Advanced Operations Research

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Review **:** Basic concepts of operations research, Sensitivity analysis in linear Programming Problems.

Non-linear Programming**:** NLPP and Its applications, Definition of Global Minimum. Difficulties introduced for nonlinearity. Direction vector Gradient function, Convex and concave functions and relevant theorems. Kuhn-Tucker necessary & sufficient condition for maximization.

Unconstrained Optimization-Necessary condition for the optimality of an unconstrained function, Davison Fletcher Powell method of Minimization, Newton's method, Optimal quotient method.

Quadratic Programming**:** wolf's and Bales method of solving QPP and related theorem.

Separable Programming**:** Linearization of a non-linear function and its separation by separable programming technique.

Network Models CPM, PERT Goal Programming, Inventory Models, Probabilistic Dynamic Program, Probalistic Inventory Models, classical optimization theory

References :

1.	Vajda,S	The theory of games and linear Programming
2.	Hadley, G	Linear Programming (Addison Wisley)
3.	Gauss	Linear Programming (McGraw-Hill)
4.	Garvin, W.W	Introduction to linear Programming. McGraw-Hill book Co. N.Y. 1910.
5.	Arrow, K.J.L Hurwicz and H. Uzawa.	Studies in linear programming Stadford University Press 1958
6.		
7.		

8. TAHA, Hamdj Operations Research An Intro-duction. (7th Ed)

Stat – 510 : Probability & Stochastic Process

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Measure Theory**:** Borel Field, Probability Measure, Probability Space, Kolmogrov and Von Mises Approachto Probability.

Convergence Theorems**:** Dominated Convergence Theorem, Monotone Convergence Theorem, Fatou's Lemma, Borel Cantelli Lemma, Inversion Theorem and its applications.

Markovian and Non Markovian Process, Markov Process with Discrete and continuous State Spaces.

Continuous Stochastic Process: General Theory, Winer Process, Point Process, Stationary Process.

Renewal Process**:** Distribution of number of renewals, Different types of renewal Processes.

Branching Process**:** Age dependent Branching Process, Branching Renewal Process. Multidimensional Branching Process.

Queuing Theory**:** Single Server Queues, Queues with many survers, Limiting Properties of queues, Equilibrium Theory.

References:

1. Chung, K.L — Markov Chains with Stationary transition Probabilities, 2nd edition, Springer Verlag
2. Perzon. E. — Stochastic Processes, Holden-Day,
3. Barlett, M.S — Introduction to Stochastic Procesess
4. Yag-lom — Stationary Random Processes
5. Gross, D & Harris, C.M — Fundamentals of Queuinq Theory, John Wiley, 1976
6. Jagers, P. — Branching Process with Biological Applications, John Wiley, 1975
7. Karlin, S. & Taylor, H.M — A first course on Stochastic processes, 2nd ed. Academic Press
8. Cinler, E — Introduction to Stochastic Procesess, Prantice-Hall, 1975
9. Bhat, B.R — Applied Stochastic Process,2nd edn.Wiley & Sons, N. Y.
10. Mehdi — stochastic Process, Wiley Eastern lt.
11. Srinivashan, S.K — Stochastic Point Process, Charles Griffin, London

Stat – 511: Reliability Statistics and Modeling

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Reliability and quality concepts and models for reliability data: Concepts of quality and reliability. Examples and features of reliability data. Strategy for data collection, modeling, and analysis of reliability data. Models for continuous failure-time processes. Models for discrete data from a continuous process. Quality assurance. Concept of total quality management (TQM), Cause-and-effect-diagrams. Failure modes and effect analysis (FMEA). Failure modes effect critically analysis (FMECA).

Reliability estimation: Non-parametric estimation and confidence intervals from complete, singly censored and multiply censored data. Simultaneous confidence bands. Uncertain censoring times. Quantities of interest in reliability applications. Maximum likelihood for location-scale and log-location-scale distributions. Confidence intervals for functions of parameters. Comparison of confidence interval procedures, Reliability prediction.

Probability plotting and choosing a failure-time distribution: Linearizing location-scale-based distributions, Graphical goodness of fit. Probability plots with specified shape parameters. Application of probability plotting. Weibull probability plot, model selection and validation.

Failure-time regression analysis: Failure-time regression models. Scale-accelerated failure-time model. Quadratic regression model. Checking model assumptions. Product comparison: an indicator-variable regression model. The proportional Hazards failure-time model and its applications in reliability.

Accelerated test models and analyzing Accelerated life test data: Accelerating variables, accelerating models. Guideline for the use of accelerating models. Non-parametric and graphical methods for presenting ans analyzing accelerated life test (ALT) data. Likelihood methods for analyzing right-censored data from an ALT. Suggestions for drawing conclusions from ALT data. Potential pitfalls of accelerated life testing.

References:

1. Bain, L.J. & Engelhardt,M(1991) — Statistical Analysis of Reliabllity and Life Resting Models, Theory & Methods. 2nd Edition, Marcel Dekker, NY
2. Balakrishnan, N. (1995) — Recent Advances in Life- Testing & Reliability, CRC Press, FL
3. Biswas,S (1988) — Stochastic Process in Demography & Applications, Wiley Eastern Ltd.
4. Kalbfleisch, J.D. & Prentice, R.L. (1980) — The Statistical Analysis of Failure Time Data, Wiley, NY.
5. Nelson, W.(1990) — Accelerated Testing: Statistical Models, Test Plans and Analysis, Wiley, NY
6. Meeker, W.Q. & Escobar, L.A.(1998) — Statistical Methods of Reliability data, Wiley, NY.

Stat – 512: Environment Statistics

Total Marks: 50 Time: 03 hours

Credit : 2 Number of Lectures: 30

Health Statistics Sources of health statistics. Meaning and concept. Biological variations. Health indicators classification. Morbidity and mortality. Health and diseases. Measurement of health status- health and nutrition. Diagnosis and prognosis statistical analysis. Sensitivity, specificity, predictivity, relative risk and odds ratio. System analysis for health care management. Health models. Epidemiological models. Health hazards.

Environmental Statistics Preliminaries concept**:** Scope of environmental statistics. Environmental phenomena-air quality, indoor air quality, water quality, concentrations in soils, plats and animals. Concentration in foods and human tissue. Ore deposits pollution-meaning of diffusion and dispersion of pollutants. Dilution of pollutants. Successes random dilution climatologically and meteorological issues-long range dependence and globally warming. Environmental factors affecting reservoir safety, rainfall-depth-duration-frequency curves. Dynamics of fish population, forestry. Probability models for environmental stress.

References:

1. Lal, J.R. (1999) Environmental Conservation
2. Joseph, L. Fleiss(1973) Statistical Methods for Rates and Proportions, Wiley, NY.
3. Armitage, P (1971) Statistical Methods in Medical Research, Blackwell, NY
4. Pathak, K.B., C.P. Prakasam, A.Pandey (2002) Bio-statistical Aspects of Health, B.R. Publishing Corporation, 3rd ed.
5. Schnelder, M.J. (2006) Introduction to Public Health, Gathersburg, Maryland.
6. Rao, V.V Biostatistics. Taypec
7. Spienelman,M. Introduction to Demography-north Holland (1968)

PRACTICAL (THREE COURSES FOR GENERAL GROUP)

STAT-513:PRACTICAL: Advanced Multivariate Analysis and Statistical Inference

Total Marks: 50 Time: 6 Hours Credit :2

Number of Lectures: 40 x 3 Class Hours

Group-I : Advanced Multivariate Analysis

Total Marks: 25 Time: 3 Hours Credit :1

Number of Lectures: 20 x 3 Class Hours

Fitting of linear and non linear models with multivariate data. Analysis of covariance structure. Analysis of data by principal components. Factor analysis. Canonical analysis. Path analysis. Logistic analysis. Classification and Grouping techniques of data by discrimination. Analysis of categorical data by different measures.

Group-II : Statistical Inference

Total Marks: 25 Time: 3 Hours Credit :1

Number of Lectures: 20 x 3 Class Hours

The bootstrap estimates of standard error, the Jacknife estimate of standard error, Bays and minimax estimators for different distribution for various types of loss function. Bayesian interval estimation. Estimation of trimmed mean, L-estimator, M- and R- estimator. Sequential t-test, sequential chi-square test and T^2 test. MC Neman test in 2X2 contingency, ARE of Mann Whitney test w. r. to one sample t-test. Kruskal-Wallis and Friedman test.

STAT-514: PRACTICAL: Design & Analysis of Experiments and Sampling Techniques

Total Marks: 50 Time: 6 Hours Credit :2

Number of Lectures: 40 x 3 Class Hours

Group-III : Design & Analysis of Experiments

Total Marks: 25 Time: 3 Hours Credit :1

Number of Lectures: 20 x 3 Class Hours

Intra and Inter –block analysis of variance of data in BIBD, SBIBD, Youden square design, lattice design. Estimation of missing observation in BIBD and its standard error as well as the standard error of the difference of two treatment means one having missing observation.

Analysis of variance of data in 2-stage, 3-stage Nested design. Analysis of variance of orthogonal and non-orthogonal data with 2 or more concomitant variable. Analysis of variance of data in response surface design having 1^{st} and 2^{nd} order. Analysis of variance of data in both Chemical balance and Spring balance weighing experiments.

Group-IV : Sampling Techniques

Total Marks: 25 Time: 3 Hours Credit :1
Number of Lectures: 20 x 3 Class Hours

Drawing samples from continuous populations. Multistage sampling with equal and unequal probability. Method of self-weighting.. Estimation of parameters and standard errors. Multiphase sampling. Estimation of non-response etc .Design of field schedule and construction of code plan.

STAT-515: PRACTICAL:(Two Groups from Two Related Optional Theory Courses)

Total Marks: 50 Time: 6 Hours Credit :2
Number of Lectures: 40 x 3 Class Hours

Group-V : Advanced Demography

Total Marks: 25 Time: 3 Hours Credit :1
Number of Lectures: 20 x 3 Class Hours

Sprague multipliers for interpolating demographic data. Smoothing of an age distribution. Construction of working life table and school life table.
Estimation of fertility and clinical mortality using data classified by duration of marriage. Estimation of adult mortality from information on the distribution of deaths by age. Estimation of fertility by reverse-survival method. Own children method of fertility estimation. Estimation of internal migration.
Fitting of some growth models-exponential, logistic and Malthusian models. Demographic analysis through logistic and hazards model.

Group-VI : Industrial Statistics

Total Marks: 25 Time: 3 Hours Credit :1
Number of Lectures: 20 x 3 Class Hours

Quality Control**:** Drawing of control charts for Mean. range , standard deviation, fraction defectives, number of defectives and number of defects per unit charts.. Designing single, double and multiple sampling and their OC'S, ASN curves and AOQ'S. Designing of sampling schemes based on variable and attributed inspection basis.
Sequential Analysis**:** SPRT test for binomial, Poisson and normal distribution. ASN and OC functions of the above probability distributions. SPRT test for single and double dichotomy.

Input Output Analysis**:** Construction of input output table. Computation of technology coefficient matrix. Determination of correct output levels for the industries and required primary inputs

Group-VII : Advanced Bio-Statistics, Health & Epidemiology

Total Marks: 25 Time: 3 Hours Credit :1

Number of Lectures: 20 x 3 Class Hours

Fitting**:** Logistic model. Cox model and other parametric regression model. Quasi-likelihood estimate. Markov-model. Log-normal test, Mantel-Heanzel test, Semirnov-Kolmogorov test etc. Using computer programming. Analyzing and visualizing epidemiological data set. S-Plus Programming.

Group-VIII : Advanced Econometrics

Total Marks: 25 Time: 3 Hours Credit :1

Number of Lectures: 20 x 3 Class Hours

(i) Estimation of Non-linear regression models.
(ii) Estimation of Time-series models for forecasting by B-J methodology
(iii) Estimation of VAR for forecasting
(iv) Monte Carlo methods to compute LS estimates (both linear ad non-linear)
(v) Monte Carlo for using Wald, LM and LR tests.
(vi) Estimation of regression models using Panel data.
(vii) Estimation of seemingly unrelated regression models.
(viii) Fitting regression models robustly.
(ix) Fitting Spline functions and varying parameter models..

Group-IX : Advanced Operations Research

Total Marks: 25 Time: 3 Hours Credit :1

Number of Lectures: 20 x 3 Class Hours

Sensitivity Analysis of LP solution; Network Problem. CPM, PERT analysis for scheduling activities. Bounded variables and Decomposition algorithm; Solution of Parametric LP. Goal programming problem; Dynamic programming problem. Inventory Models; Specialized Poisson Queue.

Group-X : Probability and Stochastic Process

Total Marks: 25 Time: 3 Hours Credit :1

Number of Lectures: 20 x 3 Class Hours

Classification of states and Markov chains. Statistical inference for Markov chains. Markov processes with discrete state space. Renewal process. Branching renewal process. Stochastic processes in queuing.

Academic Calendar:

Class Started On	*: July, 2012*
Class Closed On	*: February 15, 2013*
Expected Date of Exam	*: March 16, 20313*
Practical & Viva-Voce	*: Within 3/4 weeks after Theory Examination.*

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