

SEMESTER-I:: SYLLABUS
W.E.F.2006-2007 ACADEMIC YEAR
M. Sc.,(Previous) Statistics / M. Sc.,(Previous) Statistics (Quality Reliability & Operations
Research)

(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each
unit.)

PAPER- 1.1 PROBABILITY THEORY

UNIT –I

Classes of sets, fields, σ fields, minimal σ fields, sequence of sets, limit supremum and limit infimum of sequence of sets, measure, probability measure, properties of measure, axiomatic definition of probability, continuity theorem of probability, conditional probability, statistical independence of events, Borel-Cantelli lemma, probability on finite sample spaces, geometrical probability.

UNIT-II

Measurable functions, notion of random variable, distribution function, properties of distribution, vector of random variables, statistical independence, concepts of joint, marginal and conditional distributions, mathematical expectation, conditional expectation, characteristic function, its properties. Inversion formula, characteristic functions and moments. Moment inequalities – Markov, Schwartz, Jensen, Hilder, Minkowski, Kolmogorov's, Hajek-Renyi.

UNIT-III

Convergence of sequence of random variables-Types of convergence-in probability, almost sure, in mean square, in law- their interrelations. Laws of large numbers-weak laws: Chebychev's form of W.L.L.N., necessary and sufficient condition of W.L.L.N. Kintchine's form of W.L.L.N., Kolmogorov's S.L.L.N for i.i.d. random variables.

UNIT-IV

Central limit theorem for i.i.d random variables-Levy and Lindeberg form, CLT for independent random variables-Lindeberg and Feller condition (Statement only), Liapounov form of central limit theorem. Statements of results on asymptotic variances and covariances, distribution of sample moments, sample quantiles with simple examples in the respective situations.

References:

1. Modern Probability theory by B.R. Bhat, Wiley Eastern Limited.
2. An Introduction to Probability Theory and Mathematical statistics by V.K. Rohatgi, Wiley Eastern Limited.
3. An Outline of Statistical Theory-I, by A.M.GOON, M.K.Gupta and B.Dasgupta, the World Press Private Limited, Calcutta.
4. The Theory of Probability by B.V.Gnedenko, MIR Publishers, Moscow.

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PAPER- 1.2 :: DISTRIBUTION THEORY

UNIT-I

Notion of a random Variable - discrete and continuous types. Concepts of probability mass function and probability density function. Notions of joint, marginal and conditional distributions. Generating functions- probability generating function, moment generating function, cumulant generating function and characteristic function.

UNIT- II

Discrete distributions – Compound Binomial, Compound Poisson, multinomial , truncated Binomial, truncated Poisson distributions and their properties.

UNIT-III

Continuous distributions – Laplace, Weibull, logistic and Pareto distributions and their properties. Sampling distributions – Chi-square, t and f distributions and their properties.

UNIT-IV

Order Statistics – distribution function, probability density function (p.d.f.) of a single order statistic, joint p.d.f. of order statistics. Distribution of range with some applications in rectangular and exponential cases.

Books for study:

1. An Introduction to Probability theory and Mathematical Statistics – V.K. Rohatgi, John, Wiley
2. Discrete Distributions – N.L. Johnson and S.Kotz, John Wiley & Sons.
3. Continuous Univariate distributions, Vol.1 &2, _ N.L. Johnson & S. Kotz, John Wiley & Sons.
4. Mathematical Statistics – Parimal Mukopadhyay, New Central Book Agency, Calcutta .

Books for Reference:

1. Continuous Univariate Distribution Vol.1& 2 - N.L. Johnson & N. Balakrishnan, John Wiley,New York.
2. Linear Statistical Inference & Its applications – C.R.Rao, John Wiley,

Dr.K.R.

My documents/Semister-I Syllabus.

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PAPER-1.3 : ESTIMATION

UNIT – I

Distinction between joint distribution and likelihood function with examples from standard discrete and continuous models (such as Bernoulli, Poisson, Negative Binomial, Normal, exponential, Gamma, Pareto etc). Plotting Likelihood functions for these models upto 2 – parameters.

Information in data about the parameters as variation in likelihoods function. Concept of no information, sufficiency, Neyman-Factorizability criterion, likelihood equivalence, Minimal and complete sufficient statistics, existence and properties of sufficient statistics. Fisher information for one and several parameter models.

UNIT-II

Unbiasedness Vs. Minimum mean squared error estimations. MVUE, necessary and sufficient condition for existence of MVUE, Construction of MVUE based on Cramer-Rao lower bound, Rao – Blackwellization, Lehman-Scheffe methods. MVB Vs MVUE. Necessary and sufficient Condition for the existence of MVUE.

UNIT-III

Methods of estimation – moments, ML. Properties, linear. Estimation of Variance components – MINQUE (Minimum Norm Quadratic Unbiased Estimator) theory.

Consistent estimator and construction using moments, percentiles, MSE criterion. Asymptotic relative efficiency, error probabilities and their rates of convergence, Minimum sample required to attain given level of accuracy.

UNIT-IV

Can AND can ESTIMATORS AND PROPERTIES. Construction of CAN based on moments, percentiles, ML in one parameter case and extension to multi parameter exponential family. Examples of consistent but not asymptotically normal estimators.

Interval estimation, confidence level, construction of Intervals using Pivots, shortest expected length. UMA confidence interval Relationship in relation to testing.

Books for study:

1. An Introduction to probability theory and Mathematical Statistics by VK Rohatgi (1985) John Wiley.
2. An outline of Statistical Theory Vol-II by AM Goom, MK Gupta and B. Dsagupta (1980) World Press, Calcutta.
3. Linear Statistical Inference and its Application by C.R. Rao (1973) John Wiley

Books for Reference:

1. Theory of Point estimation by EL Lehman (1983) John Wiley
2. A first course in parametric Inference by B.K. Kale (1999) Narosa Publishing Co.,
3. Theory of Statistical Inference by S. Zacks (1971) John Wiley.

PROF. A.V.D.R

My documents/syllabus-I.

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PAPER- 1.4:: SAMPLING THOERY

UNIT-I

Allocation problem in stratified sampling, gain in precision due to stratification , estimation of sample size with continuous data, stratified sampling for proportions, populations with liner trend in systematic sampling, circular systematic sampling.

UNIT-II

Cluster sampling with equal and unequal cluster sizes, optimum cluster size for fixed cost. PPS sampling with and without replacements, procedures of selection of a sample, estimator of population total and its sampling variance in PPS with replacement, Horvitz-Thomson estimator and its variance.

UNIT-III

Two-stage sampling with equal number of second stage units, estimation of population mean, its variance and estimation of variance. Double sampling (two phase sasampling) for stratification, variance of the estimated mean, optimum allocation in double sampling. Concepts of multi-stage and multi-phase esampling.

UNIT-IV

Ratio estimation, bias of the ratio estimator, comparison of the ratio estimate with the mean per unit, conditions for optimum ratio estimates in sampling, ratio estimates in stratified sampling. Regression estimation, variance with pre-assigned and estimated value of regression coefficient, sample estimate of variance. Comparison with ratio estimate, regression estimates in stratified sampling.

Books for study:

1. Sampling Techniques by W. Cochran, John Wiley
2. Sampling Theory by Singh & Chaudhary.

Books for Reference:

1. Sampling Theory & Methods by M.N. Murthy.
2. Sampling Theory of Surveys with Applications: P.V. Sukhatme & B.V. Sukhatme.
3. Theory and Methods of Survey Sampling. Mukhopadhyay (1988).

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PAPER-1.5:: STATISTICAL COMPUTING WITH C

UNIT-I

Developing algorithms: Flowcharts, Flowcharts for standard statistical problems. Introduction to C, C fundamentals: C character set, identifiers and keywords, data types, constants and variables. Declaring variables, defining constants, arithmetic expressions. Input and output statements. Conditional statements, implementing loops. Some simple programs on well known preliminary statistical methods.

UNIT-II

Defining and manipulating arrays including multidimensional arrays. Logical expressions and more control statements: logical operators and expressions, *switch*, *break* and *continue* statements. Functions—library functions, defining and using functions, arrays in functions. Global , local and static variables..

UNIT-III

Recursion—Recursive functions, recursion vs. iteration, some recursive algorithms. Files in C—creating and storing data in a file, sequential files, unformatted files, text files.

UNIT-IV

Enumerated data type and stacks, structures, pointer data type and its applications. Linked lists —manipulating linearly linked lists, circular and doubly linked lists.

References:

1. Rajaraman, V. **Computer Programming in C**
2. Gottfried, Byron S. **Programming with C**, Schaum's Outline series
3. Kermighan B.W. and Ritchie, D.H. **The C programming language**, 2nd Ed., Prentice Hall

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PAPER-2-1:: STOCHASTIC PROCESS

UNIT-I

Introduction to stochastic Processes (sp's); Classification of sp's according to state space and time domain, countable-state Markov chains (mc's). Chapman-Kolmogrov equation; calculation of n-step transition probability and its limit. Classification of states.

UNIT-II

Markov processes with discrete state space, Poisson process, postulates of Poisson process, properties of Poisson process, Poisson process and related distributions – Interval Time – Further Interesting properties of Poisson process, Generalizations of Poisson process – Poisson process in Higher dimensions- Poisson cluster process – Pure birth process – Birth – Immigration process – Time dependent Poisson processes – Random variation of the parameter λ , Birth and Death Process – Birth and Death rates.

UNIT-III

Renewal processes in Discrete time, relation between $F(s)$ and $P(s)$, renewal interval, delayed recurrent event, renewal theory in discrete time, Renewal theorem.

Renewal process in continuous time – renewal Function and renewal density, renewal equation. Stopping time, Wald's equation. Elementary renewal theorem, Black well's and Smith's renewal theorem, central limit theorem for renewals.

UNIT-IV

Branching processes, properties of generating functions of branching processes – moments of X_n ; probability of extinction – asymptotic distribution of X_n ; Distribution of the total number of progeny.

References:

1. Medhi, J. (1982): Stochastic processes, Second Edition, New Age International (P) Ltd.
1. Karlin, S and Taylor, H.M. (1975): A First course in stochastic process-vol.I. Academic press.
2. Bhat, U.N. (1984); Elements of applied stochastic processes, John Wiley and sons.
3. Ross. (1995); Stochastic processes, John Wiley.

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PAPER- 2.2 : TESTING OF HYPOTHESIS

UNIT-I

Tests of hypotheses, concepts of critical region, critical function, two kinds of errors, power function, level of significance, MP and UMP tests, Neyman-Pearson lemma, Generalised N-P lemma, UMP tests for simple null hypothesis against one sided alternatives, and for one sided null against one sided alternative in one parameter exponential family, extension of these results to distributions with MLR property, non-existence of UMP test for simple null against two sided alternatives in one parameter exponential family.

UNIT-II

UMP unbiased tests and LMP tests. Similar regions, Neyman structure, Likelihood ratio test, properties of LR Test, asymptotic distribution of LR Test

UNIT-III

Chi-square and Kolmogorov Smirnov tests for goodness of fit, Bartlett's test for homogeneity of variances, chi-square test for homogeneity of correlation coefficients, F-test for homogeneity of regression coefficients, variance stabilizing transformation and large sample tests.

UNIT-IV

Notion of sequential tests, SRPT, Wald's fundamental identity, relation between the quantities A, B, alpha and beta, OC and ASN functions of SRPT, application to binomial, Poisson and normal distributions, efficiency of a sequential test.

Books for Study:

1. Advanced Theory of Statistics Vol.II by M.G. Kendall & a Stuart.
2. Introduction to Mathematical Statistics by R.V. Hogg & A.T. Craig.
3. Linear Statistical Inference and Applications by C.R. Rao.
4. Statistical Inference by H.C., Saxena & Surendran.
5. An outline of Statistical Theory Vol.2 by A.M. Goon and B. Das Gupta.
6. An Introduction to probability and Mathematical Statistics by V.K. Rohatgi.

Books for Reference:

1. Testing Statistical Hypotheses by E.L. Lehmann.
2. Mathematical Statistics by S.S. WILKS.
3. Nonparametric Inference by J.D. Gibbons.
4. Sequential Analysis by A. Wald.
5. Nonparametric Statistics by Sidney Siegal.

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PAPER-2-3::THEORY OF LINEAR ESTIMATION AND ANALYSIS OF VARIANCE

UNIT-I

Matrix algebra- Fundamental definitions, determinants, rank of a matrix, inverse of a matrix, orthogonal matrix, idempotent matrix, characteristic roots and vectors of a matrix, Cauley-Hamilton theorem, trace of a matrix, Statement of Cochran's theorem for quadratic forms.

UNIT-II

Theory of linear estimation, linear models, estimability of linear parametric function, best linear unbiased estimator, Gauss-Markov set-up, Gauss-Markov theorem,generalized linear model, generalized Gauss-Markov theorem (Atken's theorem).

UNIT-III

Decomposition of sum of squares in analysis of variance one way classification, two way classification with equal and unequal number of observations per cell. Multiple comparisons: Fisher's least significance difference test and Duncan's multiple range test, Fixed, random and mixed effect models.

UNIT-IV

Analysis of covariance of one way and two way classification, applications to standard designs- CRD, RBD, missing plot technique – general theory and applications to RBD and LSD.

References:

Rangaswamy, R, (1995), A text book of Agricultural Statistics., New Age International Publishers Limited.

Kemphorne, O, (1951)., The Design and Analysis of Experiments., Wiley Eastern Private Limited.

Rao,C.R.(1983)., Linear Statistical Inference and Its Applications., Wiley Eastern Ltd.

Joshi,D.D.(1987), Linear Estimation and Design of Experiments., Wiley Eastern Ltd.

Das, M.N. and Giri, N.C. (1986), Design and Analysis of Experiments,Wiley Eastern Ltd.

Raghavarao, D. (1987), Statistical Techniques in Agricultural and Biological Research., Oxford & IBH Publishing Company Private Limited.

Montgomery, D.C, (1976), Design and Analysis of Experiments., John Wiley & Sons.

Federer, W.T (1967), Experimental Design Theory and Application, Oxford & IBH Publishing Company.

Biswas, S. (1984). Topics in Algebra of Matrices, Academic Publication.

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PAPER-2.4: APPLIED REGRESSION ANALYSIS

UNIT-I

Simple Regression Analysis: The two-variable linear regression model along with assumptions; Least-Squares Estimators, properties of LS estimators, the least square estimator of σ^2 (Variance of disturbance term in the model), Interval estimation and testing hypothesis of the regression coefficients, the problem of prediction, extension of two-variable linear regression models log-linear models, semi-log models, Reciprocal models, logarithmic reciprocal model-Illustrative examples.

UNIT-II

Multiple regression analysis: The classical general linear model (GLM) and assumptions of the model, ordinary least squares (OLS) estimation, properties of OLS estimators (Gauss-Markov theorem). The correlation matrix, multiple correlation coefficient R. Inferences about regression model, problems of prediction. Linear restrictions-- restricted least squares. An illustrative example.

UNIT-III

Comparison of two regression equations-Chow test, testing the functional form of regression; choosing between linear and log-linear regression models, dummy variable regression models, the dummy variable alternative to the chow test, the use of dummy variables in seasonal analysis, the problem of multicollinearity; nature, consequences, detection, remedy; Ridge regression and principle component regression.

UNIT-IV

Violations of the assumptions of the classical model: Weighted least squares (WLS), generalized least squares (GLS), the problem of heteroscedasticity— nature, consequences, detection and remedies, the problem of serial(auto) correlation— nature, consequences, detection and remedies, illustrative examples.

Books for Study:

1. Gujarathi, DN (2003). **Basic Econometrics**, Fourth Edition, Tata McGraw Hill.
2. Johnston, J.(1984). **Econometric Methods**, 3rd Ed., McGraw Hill.
3. Johnston, J. and Dinardo, J.(1997): **Econometric methods**, Fourth edition, McGraw Hill

My documents/Semister-II syllabus

Dr. AVR

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PAPER-2-5:: MULTIVARIATE ANALYSIS

UNIT-I

The multivariate normal distribution: Multivariate normal density and its properties. Sampling from multivariate normal distribution and maximum likelihood estimation, sampling distributions of sample mean and sample covariance matrix.

UNIT-II

Inferences about multivariate normal population mean: Null distribution of Hotelling T^2 statistic. Application of T^2 statistic in tests of mean vector for one or more multivariate normal populations, simultaneous confidence intervals. Multivariate analysis of variances (MANOVA) for one way classification. The likelihood ratio principle.

UNIT-III

Analysis of covariance structure: Principle components analysis, dimension reduction, canonical variables and canonical correlation— definition, use, estimation and computation, Factor Analysis.

UNIT-IV

Classification and grouping techniques: Classification and discrimination procedures for discrimination between two multivariate normal populations, sample discriminant function, Fisher's discriminant function – separation of two populations. Classification with several multivariate normal populations. Fisher's method for discrimination among several populations.

References:

4. Anderson, T.W.(1983). **An Introduction to Multivariate Statistical Analysis**, Wiley Eastern.
2. Johnson, A. and Wichern, D.W.(2001) **Applied Multivariate Statistical Analysis**, 3rd Edition Prentice Hall and International.
3. Mardia, K.V. Multivariate Analysis

My documents/Semister-II syllabus
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SEMESTER-III STAT SYL
EMESTER-III::SYLLABUS

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PAPER – 3.1 :: STATISTICAL PROCESS CONTROL

UNIT-I

Concepts of quality, quality improvement, statistical process control, magnificent seven tools of SPC,OC and ARL of control charts, control charts for median, mid-range, standard deviation, coefficient of variation, individual measurements.

UNIT-II

Acceptance control chart, modified control limits for \bar{X} -chart, group control chart, sloping control chart, moving average chart, \bar{X} and R charts for short production runs.

UNIT-III

Cumulative sum (CUSUM) control chart, exponentially weighted moving average (EWMA) control chart, multivariate quality control-chi square control chart, Hotelling T^2 Control chart.

UNIT-IV

Process capability using probability plot and control chart, process capability indices, confidence intervals and tests of hypothesis relating to PCI, gauge and measurement system capability, Analysis of means(ANOM) \bar{X} and p charts.

Books for Study:

1. D.C. Montgomery: Introduction to Statistical Quality control, 3rd Edition, John Wiley & Sons
2. Wordsworth, H.M, Stephens, K.S. and Godfrey , A.B.: Modern Methods for Quality Control and Improvement, JohnWiley & Sons.
3. Nelson, P.R ., Wludyka , P.S. and Copeland, K.A.F. The Analysis of Means: A Graphical Method for Comparing Means, Rates, and Proportions. ASA- SIAM Series on Statistics and Applied Probability, Philadelphia(2005).
4. T. P .Ryan: Statistical Methods for Quality and Improvement. 2nd edition, John Wiley and Sons(2000).

SEMESTER-III::SYLLABUS

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PAPER – 3.2 ::COMPUTER PROGRAMMING WITH C++

UNIT-I

1. Introduction to computers and C++ programming
2. Control Structures
3. Functions
4. Arrays

UNIT-II

5. Pointers and Strings
6. Classes and Data Abstraction
7. Classes Part II

UNIT-III

- 8. Operator overloading**
9. Inheritance
10. Virtual Functions and Polymorphisim

UNIT-IV

11. C++ Stream Input/Output
12. Templates
13. Exception Handling
14. File Processing

Books for Study:

1. Deitel&Deitel, C++ How to program, third edition(Pearson)
(Chapter 1 through 14)

Books for Reference:

1. Tony gaddis, Starting out with C++, third Edition (Dreamtech Press)
2. E.Balagurwamy, Object Oriented Programming with C++, Second Edition, TMH

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SEMESTER-III::SYLLABUS

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PAPER – 3.3 :: OPERATIONS RESEARCH

UNIT-I

Definition and scope of Operations research: phases of Operations Research: L.P problems, Big – M method, Duality ,formulation of dual problem, Dual simplex method. Non – linear Programming – Kuhn Tucker conditions,

UNIT-II

Inventory control, models of inventory – purchase model with instantaneous replenishment and without shortages, Manufacturing model without shortages, Purchase model with nstantaneous Replenishment and with shortages. Manufacturing model with shortages, operation of inventory system, quantity discount.

UNIT-III

Queueing models , Steady – state solution of $M/M/1 / \infty /FCFS$, $M/E_k /1$, $E_k/M/1$ models and $M/G/1$ queue – length pollazek - khinchine result.

UNITV- IV

Sequencing, 2 machine n-job, 3 machine n-job and m machine n-job problems and graphic solution.

Books for Study:

1. Kanti Swarup, Gupta, P.K and Singh, M.M. (1985) Operations Research, Sultan Chand & Sons.
2. Panneerselvam, R. (2002) Operations Research, Prentice Hall of India (P) Ltd.,
3. S.D. Sharma, Operation Research, Kedar Nath Ram Nath & Co., Meerut.

Books for Reference:

1. Taha H.A (1982) Operational Research: An Introduction: Macmillan.
2. Philips D.T., Ravindran A, and Solberg J. Operations Research, Principles and Practice.
3. Hiller F.S and Lieberman G.J. (1962) Introduction to Operations Research; Holden Day.
4. Churchman C.W., Ackoff R.L. and Arnoff E.L. (1957). Introduction to Operations Research, John Wiley.

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PAPER –3.4 :: INDUSTRIAL EXPERIMENTATION

UNIT-I

Factorial Experiments – 2^2 , 2^3 ,..... 2^k , Factorial Experiments, Total and Partial confounding in 2^k factorial experiments, Resolution III, IV and V fractions of 2^k experiments.

UNIT-II

Construction and layouts of orthogonal array experiments and associated linear graphs to study some of the main effects and first order interactions of 2^k which need not be resolution III designs (designs known as Taguchi designs) with special cases of L - 8 and L – 16.

UNIT – III

3^2 , 3^3 full factorial designs, Total and partial confounding in 3^2 , 3^3 factorial experiments. Construction of orthogonal array experiments involving three level factors, with special cases of L – 9 and L – 18.

UNIT-IV

The Taguchi's Philosophy, loss functions, signal – to – noise ratio and performance measures. Analysis of means for variables data – one factor analysis and two factor analysis examples of experimental designs in quality and process improvement.

Books for Study:

1. Design and Analysis of Experiments, D.C. Montgomery, John Wiley and Sons (Asia) 5th edition, 2001.
2. Modern Methods for Quality Improvement, by Wadsworth, John Wiley and sons.
3. The quality engineering by Phillips Ross.

Books for Reference:

1. Quality through Design by J. Fox, McGraw-Hill Book Company, 1993.
2. Box, G.E.P., Hunter,J.S (1978) Statistics for Experimenters, New York; John Wiley.

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PAPER – 4.1 :: ACCEPTANCE SAMPLING PLANS

UNIT – I

Attribute Sampling Plans – single, double and sequential plans, Military Standard 105E, Dodge – Roming sampling plans.

UNIT – II

Acceptance sampling by variables, designing a variables Sampling plan with a specified OC curve, MIL STD414, sequential sampling by variable.

UNIT – III

Acceptance sampling procedures: Chain sampling, continuous sampling – CSP–1, CSP–2, CSP–3 and multi- level plans, MIL STD 1235b, skip lot sampling plans.

UNIT - IV

Tools and techniques of TQM, techniques for analyzing a quality process, SPC as a tool of quality management, Quality systems – ISO 9000 standards, QS-9000 standards, use of IS variable sampling inspection plans and tables, Notion of six – sigma and its uses.

Books of Study:

1. Introduction to Statistical Quality Control, Montgomery, D.C. John Wiley (Asia) 2001.
2. Modern Methods for Quality Improvement, Wadsworth, John Wiley and sons.
3. The Essence of TQM, John Bank, Printice - Hall of India Pvt Ltd (1998)
4. Statistics of Quality Control – sampling inspection and reliability by S. Biswas, New central book agency pvt Ltd (2003)

SEMESTER-IV QR&OR SYL

SEMESTER-IV::SYLLABUS

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PAPER- 4.2: STATISTICS IN TEXTILE TECHNOLOGY

UNIT – I

Process mapping, Error variation, material balancing statement, invisible loss percentage.

UNIT – II

Vendor development evaluation, non parametric analysis, process capability analysis, Design of Experiments (DOE), Failure Mode and Effect Analysis (FMEA), distributions of continuous variable, tolerance, C.V.percentage, ANOVA, sampling, 7QC tools,, distribution of discrete variable .

UNIT – III

6 σ ,QFD, GRR, Regression analysis, ISO 9001-MAI, ISO 14001-Aspect X Impact, scatter diagram.

UNIT – IV

Inventory control, primary&secondary data collection, compilation, relative probability estimate.

Books for Study::

- 1) Russell L.Ackoff-*Progress in Operations Research* (Vol I)-John Wiley & Sons (1966).
- 2) *American Cotton Handbook* (second addition) by Gilbert R.Merrill, Alfred R.Macormac.and Herbert R.Mallersberge.Textile book publishers, Inc., New York. (1949).
- 3) Jerry Banks-*Principles of Quality Control*-John Wiley & Sons, New York (1989)
- 4) Mikel Harry and Richard Schroedu-*Six Sigma*-Currency Publishers, New York (2000)
- 5) J.E.Booth-*Principles of Textile Testing*-Butterworths Publishers, London (1968).
- 6) Joseph M.Juran and A. Blanton Godfrey-*Juran's Quality Handbook* (fifth edition)-Mc Grew-Hill, New York (1999)
- 7) *Failure Mode and Effect Analysis (FMEA)-An Improvement Tool for Product Quality and Reliability*-Prof.R.Rajagopal, ISI, Coimbatore.
- 8) Charles t.Horngren-*Cost Accounting* (a managerial emphasis)(third edition)-Prentice-Hall of India, New Delhi (1972).
- 9) John Mortimer-*Statistical Process Control*.IFS Publications/Springer-Verlag (1988)
- 10) A.Breanley and D.R.Cox-*An Outline of Statistical Methods for Use in the Textile Industry* (third edition). Wool Industries Research Association, Torridon.

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PAPER – 4.3 :: OPERATIONS MANAGEMENT METHODS

UNIT-I

Integer programming-branch and bound algorithm , Gomory's cutting plane algorithm. Concept of goal programming, formulation of goal programming as extension of LP ,single and multiple goal models, solution of goal with equal priority.

UNIT-II

Games as decision problems, Two-Person Zero-sum games, Pure and mixed strategies ,normal and extensive forms, maximum criterion, Dominance, minimax theorem. Solutions of 2 X 2, 2X m, nx2games and 3x3 games (using simplex algorithm), Concept of equilibrium pairs.

UNIT-III

Queueing systems- steady state solution of M/M/1/N, M^X/M/1, M/M^Y/1 and M^X/G/1. Concept of Tandem Queues.

UNIT-IV

Replacement problems- replacement of items when the value of money changes/Does not changes, Group replacement. Project management- PERT and CPM , Probability of project completion.

Books for Study:

1. Taha. H.A. (1982). Operational Research; An Introduction: Macmillan.
2. Gross, D. and Harries, C.M (1974). Fundamentals of Queueing Theory; John Wiley.
3. Sharma. S.D. (1974). Operations Research.
4. Thomas, L.C (1984) Game, theory and applications. John Wiley.

Books for References:

1. Phillips D.T. Ravindran A and Salberg. J. Operations Research, Principles and practice. John Wiley.

SEMESTER-IV QR&OR SYL

SEMESTER-IV::SYLLABUS

W.E.F 2006-2007 ACADEMIC YEAR

M.Sc., (Final) Statistics (Quality, Reliability & Operations Research)

(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER – 4.4 ::Reliability

UNIT-I

Reliability concepts and measures- reliability function hazard rate, notions of CFR, IFR, DFR, bathtub shaped failure rate models, MTTF, IFRA, DFRA, models, NBO, NBUE classes of distributions, standard failure models – exponential, weibull, normal, lognormal distributions. Reliability data plotting technique for identification of underlying model. Non-parametric estimation for reliability.

UNIT – II

Component vs system reliability, series, parallel, k out of n system. Notion of redundancy, weakest link criterion. Markov formulation of 2 and 3 component systems, concept of load sharing, idealized 2-component stand by system, failures in stand by state, switching failures.

UNIT – III

Maintained systems, preventive maintainance, corrective maintainance, point and interval availability, un revealed failures, idealized, real periodic tests, maintainability.

UNIT-IV

Reliability of stress-strength system in standard probability model. Least square reliability growth models, concept of reliability test plan, exponential failure law for a reliability test plan. Use of the reliability test plan H108.

Books for study:

1. Reliability and life testing by S.K.Sinha, John wiley
2. Introduction to reliability Engineering by Lewis
3. Mathematical methods of reliability theory by Gnedenko, Belayev and Solovier, Mir Publishers, USSR.

Books for Reference:

1. Fundamentals of SQC by J.D.B Braverman, Reston Publishing Co.,
2. Reliability Engineering – A Probabilistic Approach by E.L. Shooman, McGraHill.

SEMESTER-IV QR&OR SYL

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W.E.F 2006-2007 ACADEMIC YEAR
M.Sc., (Final) Statistics

(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER – 4.1 ::ECONOMETRICS

UNIT-I

Econometric Modeling : Model Selection criteria, Types of specification errors, consequences of model specification errors, Tests of specification errors, Ramsey's RESET Test, LM test for adding variables, Instrumental variables, errors in variables, Model Selection Criteria

UNIT-I I

Univariate Time Series modeling, The Lag operator, ARMA Modeling, AR(1), AR(2), MA and ARMA processes, Tests of Stationarity ,Graphical Analysis, Autocorrelation Function(ACF) and correlogram, The unit root test.

UNIT-III

Qualitative Response Regression Models: Nature, Linear probability model (LPM), The LOGIT Model, The PROBIT model, The TOBIT model, Autoregressive and Distributed Lag models- Koyak, Stock adjustment and partial adjustment models, Estimation of autoregressive models.

UNIT-I V

Simultaneous- Equation Models : Some Illustrative Simultaneous systems, The Identification problem, order and Rank conditions of Identifiability, Simultaneous-Equation Estimation methods- Recursive models and OLS, Just Identified models and Indirect least squares and over identified models and 2 stage least squares(2LS) methods.

Books for Study:

1. Gujarathi, DN (2003): Basic Econometrics, Fourth Edition , Tata Mc Graw Hill
2. Johnston, J. and Dinardo , J. (1997) : Econometric Methods, Fourth Ed , Mc Graw Hill

REFERENCES:

1. Johnston, J. (1984): Econometric methods, Third edition, Mc Graw Hill.

SEMESTER-IV STAT SYL

SEMESTER-IV::SYLLABUS W.E.F 2006-2007 ACADEMIC YEAR M.Sc., (Final) Statistics

(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER – 4.2 :: ACTUARIAL STATISTICS

UNIT-I

Effective Rate of interest – Nominal rate of interest –Force of interest Effective rate of interest corresponding to Nominal rate of interest and Force of interest – Accumulation of 1 unit corresponding to the given rate of interest present value of 1 unit due at the end of n years corresponding to the given rate of interest, effective rate of discount – Nominal rate of discount – Force of interest varying continuou

UNIT-II

Definition of Annuity – Present value and Accumulation of an Immediate annuity –Annuity due – Present value and Accumulation of an Annuity-due-Present value and Accumulation of a Perpetuity and Perpetuity-due- Increasing and Decreasing Annuities. Annuities where payments are in A. P. Annuities where payments are made continuously.

UNIT-III

Analysis of Annuity payments – Loan instalment – Principal and interest portions of a typical loan instalment – General Expression for principal and interest portion – Purchase price of an annuity net of tax. Independent annual interest rates – Mean and Variance of the accumulation of a single investment, viz $E(S_n)$ and $V(S_n)$ – Mean and variance of the accumulation of a series of investments, viz $E(A_n)$ and $V(A_n)$ - Mean and Variance of a present value of unit due at the end of n years, viz $E(V_n)$ and $V(V_n)$ - Dependent annual interest rates and simple problems.

UNIT-IV

Net present value (NPV) – Intenal rate of return (IRR) – interpretation of NPV and IRR – Comparison of two investment projects – Discounted Payback Period – The effect of inflation on IRR – Money weighted rate of return (MWRR) – Time weighted rate of return (TWRR) – linked internal rate of return (LIRR).

Books for Study:

1. Compounded Interest and Annuities certain by D.W.A. Donald
2. Mathematics of Finance by Mccutcheon and Scott.
3. Gnana Deep Study Maeraials
4. Life Contingencies by A. Neile – Published by Heineman.

REFERENCES:

1. Actuarial mathematics by N.L. Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones and C.J. Nesbitt – Published by society of Acturarias, Ithaca, Illions, U.S.A. Second Edition (1997).
2. Life Contingencies, by Spurgeon – Cambridge University Press.

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W.E.F 2006-2007 ACADEMIC YEAR
M.Sc., (Final) Statistics

(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER – 4.3 :: STATISTICAL PATTERN RECOGNITION

UNIT-I

Pattern Recognition as a problem of testing. Error probability. Upper bounds on error probability. Other hypothesis tests including sequential test. Linear classifiers – Linear discriminant function for Minimum error , minimum MSE, Binary inputs, Piece-wise linear discriminant Functions and Desired output and MSE.

UNIT-II

Nonparametric decision making – Histograms, Kernel and Window estimators, Nearest neighbour classification techniques. Adaptive Decision boundaries and discriminant functions. Clustering – Hierarchical clustering and Partial clustering.

UNIT-III

Artificial neural networks – nets with and without hidden layers. Back-progation algorithm, Hopfield Nets. Image analysis – Scene seymentation and labelling, counting objects, Parimotor measurement, projections, Hogh transorms, least squares and Eigen vector line fitting, shape of regions and Morphological operations.

UNIT-IV

Feature selection and extraction – Distance measures, clustering transformations and feature ordering, clustering in feature selection , feature selection through entropy minimization. Binary feature selection – sequential and parallel algorithmis.

Books for Study:

1. Introduction to Statistical Pattern Recognition by K.Fukumaghar (1990). Academic Press.
2. Pattern Recognition and Image analysis by E.GOse, R. Johnson Baugh and S.Jost – PHI.
3. Pattern Recognition Principles by Julins T.Ton, Rafeak. C.Gon Zalez (1974) Addision – Wesley.

Books for References:

1. Pattern Recognition and Scene Analysis by R.O.Duda and P.E.Hart (1973) John Wiley.
2. Discriminant analysis and Statistical Pattern Recognition by G.J.Mc Lachlan (1992) John wiley.
3. Pattern Recognition and Neural Networks by B.B. Ripley (1996) Cambridge University Press.

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M.Sc., (Final) Statistics

(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER – 4.4 :: INVESTMENTS UNDER UNCERTAINTY

UNIT-I

Risk-Return Trade off, money market, Fixed income, equity, stocks and bonds, Treasury notes. Market indexes, Rates of interest, compound interest, inflation, Risk in a portfolio context, law of one price and arbitrage.

UNIT-II

Risk and risk aversion, mean variance analysis, allocation between risky and risk free portfolios. Diversification and portfolio risk, Markovitz Portfolio selection optimal port folios.

UNIT- III

Capital assets, pricing model (CAPM), passive strategy, risk premium, Index models and diversification, CAPM and Index model.

UNIT-IV

Call and put options, open strategies, option like instruments, option valuation, Binomial option pricing, Black-Scholes option valuation, uses of Black-Scholes formula. Futures markets, Mechanics and strategies, futures prices and expected spot prices.

Books for Study:

1. Bodie, Z., Kane, A, and Maecus, A.J. (1996), Investments Edition 4, Irwin. Chapters: 1,2,3,4,5,6,7,8,9,10,20,21,22.

Books for References:

1. Arrow, K.J. [1971], Essays in the theory of Risk Bearing, North Holland.
2. Hull John C. [1993], Options, Futures and Other Derivative Securities. 2nd Ed. Prentice Hall.
3. Punithavathy Pandian, Security Analysis and portfolio Management, Vikas Publishing House Pvt Ltd.

SEMESTER-III::SYLLABUS

W.E.F 2006-2007 ACADEMIC YEAR

M.Sc., (Final) Statistics

(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER-3.1:: DESIGN OF EXPERIMENTS

UNIT-I

General factorial experiments, factorial effects, best estimates and testing the significance of factorial effects, estimation of main effects, interaction and analysis of 2^n factorial experiments in general with particular reference to $n=2,3$. 3^2 and 3^3 factorial experiments. Total and partial confounding in case of 2^n (for $n=2,3$), 3^2 and 3^3 factorial designs

UNIT – II

Incomplete block designs; balanced incomplete block designs (BIBD), parametric relations, intra block analysis, simple methods of constructions of BIBD, resolvable and affine resolvable designs, partially balanced incomplete block designs (PBIBD) with two associate classes, parametric relations, intra block analysis.

UNIT – III

Youden square design, simple lattice design, split plot design, strip plot design and their analysis, Gracco latin square design.

UNIT – IV

Concept of response surface methodology (RSM), response surface designs, linear response surface designs, second order response surface designs, variance of estimated second order response surface, Rotatable designs; conditions for second order rotatable designs, construction of second order rotatable designs using central composite designs, balanced incomplete block designs.

Books for Study:

1. M.N.Das and N.C.Giri. (1986), Design and Analysis of Experiments.,Wiley Eastern Ltd.
2. Aloke Dey. (1986), Theory of Block Designs, Wiley Eastern Limited.
3. Oscar Kempthorne (1951)., The Design and Analysis of Experiments., Wiley Eastern Private Limited.
4. Montgomery, D.C, (1976)., Design and Analysis of Experiments., John Wiley & Sons.
5. D.D.Joshi. (1987), Linear Estimation and Design of Experiments., Wiley Eastern Ltd.
6. Walter T.Federer.(1967)., Experimental Design Theory and Application.,Oxford & IBH Publishing Company.

Books for References:

- 1 Raghavarao, D. (1971), Constructions and Combinatorial Problems in Design of Experiments., John Wiley & Sons, Inc.
2. W.G. Cochran, and G.M. Cox, (1957), Experimental Designs., A Wiley International Edition.
3. Box, G.E.P. and Draper, N.R.(1986), Empirical Model-Building and Response Surfaces, John Wiley & Sons.
4. R.H. Myers. (1976), Response Surface Methodology, Allyn and Bacon, Boston

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W.E.F 2006-2007 ACADEMIC YEAR

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(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER-3.2: STATISTICAL QUALITY CONTROL

UNIT-I

Statistical basis of the control charts, control charts for variables- development and use of \bar{X} , R charts, an interpretation operating characteristic function, average run length for \bar{X} chart, construction and operation of \bar{X} , s charts, charts for individual measurements. CUSUM chart, recommendations for CUSUM design, the V-mask procedure for monitoring the process mean.

UNIT- II

Lot by lot acceptance sampling plan for attributes-guidelines for using a sampling plan, singles, double and sequential sampling plans for attributes. Designing a single sampling with a specified OC curve. Sampling plans standards description and procedure of MIL STD-105E, elements of AOQC, LTPD plans of Dodge and Roaming.

UNIT-III

Acceptance sampling by variables, merits and demerits, types of available variable sampling plans, construction of a variable sampling plan with a specified OC curve, general description and use of MIL STD 414. Notion of a sequential sampling plan by variables.

UNIT-IV

Reliability characteristics- failure time distribution, failure probability, reliability, failure rate, notions of IFR, CFR, DFR models, MTTF in standard models like exponential, weibull. Notion of series and parallel system reliability in the case exponential model.

Books for Study:

1. Introduction to Statistical Quality Control by D.C.Montgomery, John Wiley.
2. Probability and Statistics for Engineers by Richard A. Johnson, Prentice Hall of India Private Ltd.
3. Reliability and life Testing by S.K. Sinha, John Wiley.

Books for Reference:

1. Modern methods for Quality Control and improvement by H.M. Wadsworth, K.Stephens and A. Blanton Godfrey, John wiley and sons.
2. Industrial Statistics and SQC, Durean

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(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER - 3 . 3 :: COMPUTER INTENSIVE STATISTICAL METHODS

UNIT-I

Introduction to simulation, various types of simulation. Uniform Random numbers properties, generation using linear congruential, combined linear congruential methods. Tests for randomness – Frequency test, Runs Test, Gap test, Poker test. Non-Uniform random number generation - Inverse transformation technique, convolution method and Acceptance – Rejection technique.

UNIT – II

Concept of circular distributions. Random number generation from standard circular distributions. Generation of Standard Non-Uniform random variables, choice of distributions – Addition and the Normal distribution, Multiplication and Lognormal, Memory less ness and exponential, Minimization and Weibull model, A mixed empirical and exponential, Extreme values and spacings.

UNIT – III

Applications to Queuing, Inventory, Networks and Risk analysis. Introduction to Special Purpose simulation languages – GPSS, SIMULA, GASP, SLAM, SIMSCRIPT. Choice of a Simulation language.

UNIT – IV

Variance – reduction methods – choosing an Input distribution, Common Random Numbers, Control and arithmetic variates, Stratified Sampling, Importance Sampling, Conditional Monte-Carlo methods. Gibbs Sampling. Boot strap and Jack knife methods.

Books for Study:

1. A Guide to Simulation (1983) by Paul Bratley, Bennett L. Fox, Linus E. Schrage – Springer Verlag.
2. Elements of Stochastic process Simulation (1984) by Byron S. Gottfried – PHI.
3. Discrete – Event System Simulation (1996) by Jerry Banks, John S. Carson, II Barry L. Nelson – PHI.

Books for Reference:

1. Monte – Carlo: Concepts, Algorithms and Applications (1996) by G.S. Fishman – Springer Verlag.
2. The Jack knife and the Bootstrap (1995) J. Shao and D.Tu – Springer verlag.
3. Tools for Statistical Inference (1996) by M.A. Tanner – Springer Verlag 3Ed.

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(4 Questions are to be set with one question each on Units I, II, III & IV with internal choice with in each unit.)

PAPER - 3 . 4 :: OPERATIONS RESEARCH

UNIT-I

Review of L.P.P as special situation of Operations Research problems – Simplex method, Big-M method, Two phase method, Duality, Formulation of Dual problem, Dual simplex method.

UNIT-II

Inventory control, models of inventory – purchase model with instantaneous replenishment and without shortages, Manufacturing model without shortages, Purchase model with instantaneous Replenishment and with shortages. Manufacturing model with shortages, Operation of inventory system, Quantity Discount.

UNIT-III

Queueing models , Steady – state solution of $M/M/1 / \infty / FCFS$, $M/E_k / 1$, $E_k/M/1$ models and $M/G/1$ queue – length pollazek - khinchine result.

UNIT-IV

Replacement and maintenance analysis – Types of maintenance, Types of replacement problems, Determination of economic life of an asset, Basics of interest formulae – Present – worth factor $(P/F, i, n)$, Equal payment series capital recovery factor $(A/P, i, n)$. Simple probabilistic model for items which completely fail.

Books for Study:

1. Kantiswarup, Gupta, P.G. and Man Mohan, Operations Research, Sultan Chand & Sons.
2. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co, Meerut.
3. Panneerselvam.R, Operations Research, Printice Hall of India, Pvt Ltd.
4. Philips D.T. Ravindran A and Sal berg J., Operations Research, Principles & practice, John Wiley.