STT 11 INDUSTRIAL STATISTICS

(Maximum no of periods: 60)

Unit I: Basic concepts of process monitoring and control. Review of control charts for attributes and variable data. O. C. and ARL of control charts. Cusum & V-masks charts.

Unit II: Concepts of AQL ,LTPD, AOQL average amount of inspection and ASN functions. Acceptance sampling plans for attributes inspection, single, double and sequential sampling plans and their properties. Continuous sampling plans of Dodge type and their properties.

Unit III: Capability indices Cp, Cp_k and Cp_m, estimation, confidence intervals and tests of hypothesis relating to capability indices for normally distributed characteristics.

Unit IV: Quality Systems: ISO 9000 standards, QS 9000 standards, concept of six sigma. Total Quality management. Taguchi Design.

Unit V: Elements of Reliability, definition and relationship between survival function, hazard function, distribution with DFR and IFR, series and parallel systems. Life testing experiments, stress–strength reliability and its estimation.

REFERENCES:

(1) Montgomery D.C. (1996) Introduction to Statistical Quality Control, Wiley.
(2) Wetherill G.B. (1977) Sampling Inspection & Quality Control, Halsted Press.
(3) Logothetis N. (1992) Managing Total Quality, Prentice Hall of India.
(4) Oakland J.S. (1989) Total Quality Management; Butterworth- Heinemann.
(5) Mittog H.J. and Rinne H. (1993) Statistical Methods of Quality Assurance.
(6) Guenther W.C (1981) Sampling Inspection in Statistical Quality Control Charter Grifits.
(7) Kotz S. (1993) Process capability indices, Chapman and Hall.
(8) Abraham Bovas (1998) Quality Improvement through statistical methods
(9) Birkhauser.
(10) Barlow R.E. And Proschan F. (1985) Statistical Theory of methods reliability and Life Testing ,Holt Rinehart and Winston.
(11) Lawless J.F. (1982) Statistical Models and methods of life Time Data, John Wiley.
(12) Bain L.J. And Engelhard (1991) Statistical Analysis of Reliability and Life Testing models Marcel Dekker.
(13) Nelson W. (1982) Applied Life Data Analysis, John Wiley.
(14) Zacks S. (1992) Introduction to reliability analysis Probability Models and statistical Methods, Springer-verlag.
(15) Mahajan M. (2004) Statistical Quality Control.

STT 12 STOCHASTIC PROCESSES

(Maximum no of periods: 60)

Unit I: Introduction to stochastic Processes (SP's) Classification of SP's according to State space & time domain. Markov chain, countable state Markov chain, calculation of n-step transition probability & its limit.

Unit II: Chapman-Kolmogorov equation, Stationary distribution, classification of states, criteria for various states, Ergodic theorem.

Unit III: Random walk & gambler's ruin problem, absorbing and reflecting barriers, probability of eventual absorption, expected duration of game, random walk in 2 & 3 dimension. First passage time distribution.

Unit IV: Discrete state space & continuous time Markov chain, Poisson process, properties of poisson process, pure birth, pure death, Birth and death process.

Unit V: Continuous state space, continuous time Markov chain, Wiener process, Wiener process as a limit of random walk, differential equation of Wiener process, first passage problem in Wiener process. Renewal and delayed renewal processes, related theorems, key renewal theorem (without proof) and its application. Galton-Watson Binaymi Branching process. Probability of ultimate extinction. Stationary Process: Weakly Stationary and strongly stationary processes

REFERENCES:

(1) Medhi, J. (1994) Stochastic Processes, Wiley Eastern.

(2) Bhat, B. R. (2000) Stochastic Models: Analysis and Applications, New Age International, India.

(3) Adke, S. R. and Manjunath, S. M. (1984) An Introduction to finite Markov Processes, Wiley Eastern.

(4) Parzen E. (1962) Stochastic Process, Holden-Pay.

(5) Karlin & Taylor, A. (1975) First Course in Stochastic Process, (Vol.1) Academic Press.

(6) Cinlar E.(1975) Introduction to Stochastic Process, Prentice Hall.

(7) Srinivas and Mehta (1976) Stochastic Processes - Tata McGraw Hill, New Delhi.

(8) Feller, W.(1968) Introduction to Probability and its Applications, (Vol.1) Wiley

Eastern.
(9) Harris, T.E. (1963). The Theory of Branching Processes, (Springer-Verlag).
(10) Hoel, P.G., Port, S. C. and Stone, C. J. (1972) Introduction to Stochastic Processes, Houghton Miffin & Co.
(11) Jagers, P. (1974) Branching Processes with Biological Applications, Wiley.
(12) Ross, S. (2005) Introduction to Probability Models, 6th Ed. Academic Press.
(13) Taylor and Karlin (1984) An Introduction to Stochastic Modeling, Aca. Press.

STT 13 AGRICULTURAL STATISTICS

(DESIGN OF EXPERIMENTS)

(Maximum no of periods: 60)

Unit I: Overview on CRD, RBD & LSD. Analysis of covariance(One way & Two way classification). Tests for comparing pairs of treatment means: Tukey's test, Fishers LSD test, Duncan's Multiple Range Test (DMRT), Newman- Keul's test, Dunnet test. Definition and analysis of split plot design, split-split plot design and Strip plot design.

Unit II: General factorial experiments, factorial effects, best estimates and testing the significance of factorial effects, study of 2^2, 2^3 , 2^4 and 2^k factorial experiments.

Unit III: Confounding in factorial experiments, complete and partial confounding, concept of generalized interaction. Fractional factorial designs.

Unit IV: Elementary parametric relations and analysis of BIBD. Definitions and parametric relations of PBIBD. Definition and analysis of Quasi-Latin square designs, Youden square design.

UNIT V: Designs for fitting response surface, Cross-over designs. Groups of experiments, Sampling in field experiments.

REFERENCES:

(1) Alok Dey (1986) Theory of Block Designs, Wiley Eastern.

(2) Das, M.N. and Giri, N. (1979) Design and Analysis of Experiments, Wiley.

(3) Joshi, D. D. (1987) Linear Estimation and Design of Experiments, John Wiley.

(4) Montgomery, D.C. (2005) Design & Analysis of Experiments, Wiley.

(5)Chakrabarti M. C. (1962) Mathematics of Design and Analysis of Experiments, Asia Pub. Hs.

(6) Cochran W.G. & Cox D.R.(1957) Experimental Designs, 2nd Ed., JohnWiley.

(7) Dean A. M. & Voss D. (1999) Design and Analysis of Experiments, Springer.

(8) Dey A. & Mukerjee R. (1999) Fractional Factorial Plans, John Wiley.

(9) Dey A. (1986) Theory of Block Designs, Wiley Eastern.

(10)John J.A. & Quenouille M.H. (1977) Experiments: Design and Analysis, Charles & Griffin.

(11) Kempthorne, O. (1976) Design and Analysis of Experiments, John Wiley.

(12) Khuri A.I. & Cornell J.A. (1996) Response Surface Designs and Analysis. 2nd Ed., Marcel Dekker.

(13) Raghavarao D. (1971) Construction and Combinatorial Problems in Design of Experiments, John Wiley.

STT 14 **ECONOMETRICS**

(Maximum no of periods: 60)

Unit I: Nature of Econometrics. The General linear model (GLM) & its extensions. Ordinary least squares (OLS) estimation & prediction. Use of dummy variables and seasonal adjustment. Generalized least squares (GLS) estimation & prediction. Heteroscedastic distribution. Pure and mixed estimation.

Unit II: Auto-correlation, its consequence and tests, the BLUS procedure, Estimation & prediction, Multicollinearity problem, its implications & tools for handling the problem. Ridge regression.

Unit III: Linear regression with stochastic regressors, instrumental variable estimation. Errors in variables, Autoregressive linear regression. Distributed lag models, use of principal components, canonical and discriminant analysis in econometrics.

Unit IV: Simultaneous linear equations models. Identification problem. Restrictions on structural parameters - rank & order conditions.

Unit V: Estimation in simultaneous equations model, Recursive systems, 2 SLS Estimators Limited information estimators, k- class estimators, 3 SLS estimation, Full information maximum likelihood method, Prediction and simultaneous confidence intervals.

REFERENCES:

(1) Croxton F.E. & Cowden D.J. (1979) Applied General Statistics, Prentice Hall of India.
(2) Johnston J. (1984) Econometric Methods, McGraw Hill.
(3) Judge G.C., Hill R.C., Griffiths W.E., Lutkepohl H. & Lee T.C. (1988) Introduction to the Theory and Practice of Econometrics, 2nd Ed., John Wiley.
(4) Kmenta J. (1986) Elements of Econometrics, 2nd Ed., Uni. of Michigan Press.
(5) Koop G. (2007) Introduction to Econometrics, John Wiley.
(6) Maddala GS. (2001) Introduction to Econometrics, 3rd Ed., John Wiley.
(7) Pindyck R.S. & Rubinfeld D.L. (1998) Econometric Models and Economic Forecasts, 4th Ed., McGraw Hill.
(8) Verbeek M. (2008) A Guide to Modern Econometrics, 3rd Ed., John Wiley.
(9) Judge GG, Griffith WE, Hill RC, Lee CH & Lutkepohl H. (1985) The Theory and Practice of Econometrics. 2nd Ed. John Wiley.

(10) Koop G., Poirier D. & Tobias J. (2007) Bayesian Econometric Methods, Cambridge Univ. Press.
(11) Pindyck R.S. & Rubinfeld D.L. (1981) Econometric Models and Economic Forecasts, McGraw Hill.
(12) Kotsoyiannis A. (1985) Modern Micro-economics, Macmillan,. London.

(13) A. A. Walter (1971) An Introduction to Econometrics., Macmillan, London.
(14)Apte P. G.(1990) Text Book of Econometrics, Tata Mc-Graw Hill.
(15) Ramanathan, R. (1997) Introductory Econometrics with Applications, Harcourt Brace Jovanovich.
(16) Chow G.C. (1983), Econometrics, McGraw Hill, New York.
(17)Koutsoyiannis, A (1977), Theory of Econometrics, 2nd Ed. The MacMillan Press Ltd.Londan

STT 15 DECISION THEORY/TIME SERIES ANALYSIS

DECISION THEORY (A)
(Maximum no of periods: 60)

Unit I: Decision problem, loss function, risk function, randomized and non-randomized decision rule. Decision principles (Conditional Bayes, Frequentist). Testing and estimation problem as decision problems. Optimal decision rule.

Unit II: Concept of admissibility and completeness, Bayes rules, minimax decision rule. Admissibility of Bayes rules. Existence of Bayes decision rule.

Unit III: Definition of non-parametric test, advantages and disadvantages of non-parametric tests. Single sample problems. (i) Test of randomness (ii) Tests of goodness of fit : Empirical distribution function. Kolmogorov-Smirnov test, comparison of Chi-square and KS test. (iii) Problem of location: Sign test, Wilcoxon's signed rank test, Wilcoxon paired sample signed rank test.

Unit IV: Two Sample Problems: Different types of alternative, sign test, Wilcoxon two sample rank sum test, Wald-Wolfiwitz run test, Mann-Whitney-Wilcoxon test, median test. K-S two sample test.

Unit V: One sample U statistic, Kernel and symmetric Kernel, variance of U statistic, two sample U statistics, linear rank statistics and their distribution properties under null hypothesis.

REFERENCES:

1) Ferguson T. S. (1967) Mathematical Statistics, Academic Press, New York.

2) Fraser, D.A.J. (1957) Non-parametric methods in Statistics, John Wiley.

3) Gibben J.D.(1992) Non Parametric Statistical inference, Marcel Dekker, Inc., New York.

4) Goon A.M., Gupta M.K., Dasgupta : An Outline of Statistical Inference. The World Press Pvt. Ltd.

5) Berger, J.O. (1980) Statistical Decision Theory: Foundations, Concepts and Methods, Springer-Verlag.

6) Berger, J.O. (1985) Statistical Design Theory and Bayesian Analysis, 2nd ed., Springer-Verlag.

7) Gupta S. S. and Huang, D. (1981) Multiple Statistical Decision Theory, Springer-Verlag, New York.

TIME SERIES ANALYSIS (B)

(Maximum no of periods: 60)

UNIT I: Time-series as discrete parameter stochastic process. Auto covariance and autocorrelation functions and their properties.

UNIT II: Exploratory Time Series Analysis: Tests for trend and seasonally, Exponential and Moving average smoothing. Hot winters smoothing. Forecasting based on smoothing, adaptive smoothing.

UNIT III: Stationary processes: (i) moving average (MA), (ii) Auto Regressive (AR), (iii) ARMA and (iv) AR integrated MA (ARIMA) models, Box-Jenkins models. Discussion,(without proof) of estimation of mean, auto covariance and auto correlation functions under large sample theory.

UNIT IV: Choice of AR and MA periods, Estimation of ARIMA models parameters. Forecasting, Residual analysis and diagnostic checking.

UNIT V: Spectral analysis of weakly stationary process, Periodogram and Correlogram analysis. Spectral Decomposition of weakly AR process and representations as a one-sided MA process- necessary and sufficient conditions.

REFERENCES:

1) Anderson, T. W (1971) The Statistical Analysis of Time Series, Wiley, N.Y.

2) Box, G.E.P. and Jenkins, G.M. (1976) Time Series Analysis-Forecasting and Control, Hodlen-day, San Francisco.

3) Kendall, Sir Maurice and Ord. J. K. (1990) Time Series, 3rd Ed., Edward Arnold.

4) Montgomery, D. C. and Johnson, L. A. (1977) Forecasting and Time SeriesAnalysis, McGraw Hill.

5) Brockwell P.J. and Davis R.A. (1991) Time Series: Theory and Methods, 2nd Ed., Springer-Verlag.

6) Fuller W.A. (1976) Introduction to Statistical time series, John Wiley N.Y.

7) Priestley M.B. (1981) Spectral analysis and time Series Griffin London.

8) Kendall M.G. And Stuart A. (1996) The advanced theory of Statistics, Vol. 3, Charles Griffin London.

9) Bloomfield P (1976) Fourier analysis of Time series – an introduction, Wiley.

10) Granger C.W. J and Hatanks (1964) Spectral analysis of economic Time Series, Princeton University Press N.J.

11) Koopmens C.R. (1973) The Spectral analysis of time series, Academic presses.

12) Nelson C.R. (1973) Applied Time Series for managerial forecasting, Holden –day.

13) Findley D.F.(1981) Applied Time Series analysis, Academic Press.

14) Wethirll G.B. (1986) Regression analysis with applications, Chapman Hall.