Proposed Revised Syllabus for M.Sc. in Statistics (Choice Based Credit System) for semester III and semester IV: (To be implemented in the Department of Statistics, Shivaji University) (w.e. form 2014-2015)

Structure:

Semester III

There will be following compulsory Theory papers and Practical III.

MST-301: Asymptotic Inference
MST-302: Elementary Stochastic Processes
MST-303: Planning and Analysis of Industrial Experiments.
MST-316: Practical III

Elective Papers from which **Any Two** are to be chosen:

MST-321: Reliability Theory
MST-322: Regression Analysis
MST-323: Statistical Genetics
MST-324: Measure Theory
MST-325: Demography
MST-326: Medical Statistics
MST-327: Advanced Stochastic Processes
MST-328: Actuarial Statistics
MST-329: Dissertation

Semester IV:

Following theory paper, Practical IV and Project work will be compulsory:

MST-401: Optimization Techniques
MST-416: Practical IV and Project

Elective Papers from which **Any Four** are to be chosen:

MST-421: Discrete Data Analysis
MST-422: Survival Analysis
MST-423: Industrial Statistics
MST-424: Time Series Analysis
MST-425: Statistical Ecology
MST-426: Econometrics
MST-427: Advanced Multivariate Analysis
MST-428: Data Mining
MST-429: Decision Theory

Note:-

a) Syllabus for compulsory and some elective courses has been given. Depending on need and demand, syllabus for other elective courses listed or of new elective courses will be submitted for approval.

b) There shall be CIE pattern in which internal examination will be for 20 marks, while University examination will be for 80 marks. The nature of the question paper will be as per university norms. Internal examination will be based on midterm test.

c) Practical Paper:

MST 316: Practical III

1. There shall be 20 marks for day-to-day performance and journal.
2. **Examination (60):** Practical Examinations will be conducted in the middle of the term and at the end of the term. Each exam will be of 3 hrs. duration carrying 60 marks. There shall be 8 questions each of 12 marks, of which a student has to attempt any 5 questions. The average of these two tests will be considered as final score out of 60.
3. Practical VIVA will be for 20 marks.

MST-416: Practical IV and Project

1. There shall be 10 marks for day-to-day performance and journal.
2. **Examination (30):** Practical Examinations will be conducted in the middle of the term and at the end of the term. Each exam will be of 1.5 hrs. (90 Min.) duration carrying 30 marks. There shall be 5 questions each of 10 marks, of which a student has to attempt any 3 questions. The average of these two tests will be considered as final score out of 30.
3. Practical VIVA will be for 20 marks.
4. Project work carries 40 marks. Project work consists of collecting data and analyzing the data and preparing report. 20 marks are reserved for VIVA. The project work should be preferably based on field work. Project work report be submitted along with practical journal, which will be evaluated for 5 marks. The budgetary provision for industrial tour will be utilized to meet expenses towards field work.

Detailed Syllabi of papers:

MST 301: ASYMPTOTIC INFERENCE

Unit-1: Consistency of estimators, joint and marginal consistency, Weak and strong consistency, Invariance under continuous transformations, Asymptotic relative efficiency, Asymptotic Normality, CAN estimators; invariance of CAN property under non-vanishing differentiable transformation. Methods of obtaining consistent and CAN estimators. (12L+3T)

Unit-2: Super-efficient estimators BAN estimators: Cramer regularity conditions and asymptotic properties of the MLE (Cramer-Huzurbazar results) CAN and BAN estimation for multi-parameter exponential family and applications. (12L+3T)

Unit-3: Variance stabilizing transformations; their existence; their applications in obtaining large sample tests and estimators. Asymptotic Distribution of likelihood ratio test statistics, Wald test, Rao's Score test, Pearson Chi-square test for goodness of fit, Bartlett's test for homogeneity of variances. (12L+3T)

Unit-4: Asymptotic Confidence Intervals based on CAN estimators, based on VST, Performance evaluation (based on simulation) of asymptotic tests and confidence intervals. Asymptotic Confidence regions in multi-parameter families. (12 L +3 T)

References:

1) Kale B.K. (1999): A first course on parametric inference, Narosa Pub.
2) Zacks S. (1971): Theory of statistical inference, Wiley & Sons inc.
3) Rohatagi V.K. and Saleh A. K. Md. E.(2001) : Introduction to Probability Theory and Mathematical Statistics- John Wiley and sons Inc.
4) Ferguson, T.S. (1996): A Course in Large Sample Theory. Chapman and Hall
5) Lehmann E L (1999): Elements of Large Sample Theory, Springer.
6) DasGupta A. (2008): Asymptotic Theory of Statistics and Probability, Springer Texts in Statistics.

MST 302: ELEMENTARY STOCHASTIC PROCESSES.

Unit-1:a) Definition of stochastic process, classification of stochastic processes according to state space and time domain, finite dimensional distributions. Examples of various stochastic processes.

b) Definition of Markov chain. Examples of Markov chains, Formulation of Markov chain models initial distribution transition probability matrix, Chapman-Kolmogorov equation, calculation of n-step transition probabilities. (12L +3T)

Unit-2:a) Classification of states, irreducible Markov chain, period of the state, random walk and gambler's ruin problem, first entrance theorem, first passage time distribution.

b) Long-run distributions of Markov chain, relation with mean recurrence time, stationary distribution. (12L +3T)

Unit-3:a) Discrete state space continuous time Markov chain, Poisson process and related results. Birth and death processes and associated cases. M/M/1, M/M/S queuing models and related properties.

b) Renewal and delayed renewal processes, related theorems, key renewal theorem (Without proof) and its application. (12L +3T)

Unit-4: a) Galton-Watson Binaymi Branching process. probability of ultimate extinction. Distribution of population size, and association results.

b) Simulation of Markov Chain, Poisson process and branching process.

(12 L+ 3 T)

References

1. Medhi J. (1982): Stochastic Process, Wiley Eastern.
2. Karlin & Taylor: A First Course in Stochastic Process, Vol. -1, Academic Press.
3. Cinlar E.: Introduction to Stochastic Process, Prentice Hall.
4. Ross S.: Introduction to Probability Module.
5. William Feller: An Introduction to Probability Theory and Its Applications, Vol. 1, 3rd Edition.
6) Hoel P, Port S, Stone C: Introduction to Stochastic Processes. Waveland Pr Inc publisher

MST-303 PLANNING AND ANALYSIS OF INDUSTRIAL EXPERIMENTS

Unit-1: 2^n factorial Experiments: Concepts of main effects, interaction, their graphical representation, Analysis of Full 2^n replicated and unreplicated factorial designs. Concept of Confounding: Total and partial confounding, construction and analysis confounded design. (12L+3T)

Unit-2: 3^n factorial Experiments: Concepts of main effects, interaction, their graphical representation, linear and quadratic components, Analysis of Full 3^n replicated and unreplicated factorial designs. Confounding: construction and analysis confounded design. (12L+3T)

Unit-3: Fractional replication for symmetric factorials, concept of generator, defining contrasts, aliasing, resolution and minimum aberration, construction and analysis of 2^{n-k} and 3^{n-k} fractional designs, Central composite designs. (12L+3T)

Unit-4: a) Response surface experiments: linear and quadratic model, test for curvature, stationary point, central ridge systems, Rotatability, Multiple responses.

b) Taguchi methods: Concept of noise and control factors, inner and outer arrays, concept of loss function, S/N ratio, orthogonal arrays, linear graphs, interaction tables, ANOVA.

(12L+3T)

References:

1. Jeff Wu C.F., Hamada M.(2000) : Experiments : Planning, Analysis and parameter design optimization, John Wiley & Sons.
2. Phadke M.S. (1989) : Quality Engineering using Robust Design, Prentice-Hall
3. Montgomery D.C. (2001): Design and Analysis of Experiments 5th edition, Wiley New York.
4. Angela M Dean (1999): Design and Analysis of Experiments, Springer US.

MST-321 RELIABILITY THEORY

Unit-1: Structure function, dual of a structure, cuts and paths, components & systems, coherent systems, Pivotal decomposition, coherent modules, Modulardecomposition, Reliability concepts and measures, reliability of coherent systems, bounds on system reliability. Birnbaum's measure of structural importance, Associated random variables and their properties. (12L+3T)

Unit-2: Life time distributions, survival functions, hazard rate, cumulative hazard function, residual life time, survival function of residual life time, mean residual life time, Computation of these function for Common life time distributions: exponential, Weibull, Gamma, Makeham, Pareto, Rayleigh, log-normal, computation of failure rate function. (12L+3T)

Unit-3: Notion of ageing: IFR, DFR, IFRA, DFRA, DMRL, NBU, NWU, NBUE, NWUE classes, ageing properties of common life time distributions, closure properties under formation of coherent structures, convolutions and mixtures ofthese classes. Damage model, cumulative damage model, univariate shock models and life distributions arising from shock models, bivariate exponential distribution, bivariate shock models. (12L+3T)

Unit-4: Stochastic ordering: usual stochastic ordering, hazarad rate ordering,reverse hazard rate ordering, dispersive ordering, mean residual lifeordering and their implications. Availability, interval reliability, availability of a system with a single spare and a repair facility. (12L+3T)

References:

1) Barlow R.E. and Proschan F. (1975): Statistical Theory of Reliability & Life testing, Holt, Reinhart and Winston.

2) Lawless J.F.(1982): Statistical Models & Methods of Life Tome Data, John Wiley.

3) Miller R.C. (1981): Survival Analysis. John Wiley

4) Bain L.J (1978): Statistical Analysis of Reliability & Life Testing, Models, *Marcel Dekker.*

5) Martz H.F. and Waller R.A (1982): Bayesian Reliability Analysis*, John Wiley.*

MST 322: REGRESSION ANALYSIS.

Unit-1: Multiple regression model, Least squares estimate (LSE), Properties of LSE, Hypothesis testing, confidence and prediction intervals, General linear hypothesis testing. Dummy variables and their use in regression analysis. Residuals and their properties, residual diagnostics. Transformation of Variables: VST and Box-Cox power transformation. (12L+3T)

Unit-2: Variable Selection Procedures: R-square, adjusted R-square, Mallows'C_p, forward, backward selection methods, AIC, BIC. Multicollinearity: Consequences, detection and remedies, ridge regression. Autocorrelation: Causes, Consequences, detection: Durbin-Watson test, Estimation of parameters in presence of autocorrelation: Cochrane-Orkut method. (12L+3T)

Unit-3: Robust Regression: Influential observations, leverage, outliers, methods of detection of outliers and influential observations, estimation in the presence of outliers: M-estimator, Huber loss function, breakdown point, influence function, efficiency, Asymptotic distribution of M-estimator (Statement only), Mallows' class of estimators. (12L+3T)

Unit-4: Nonlinear regression models: Non linear least squares, Transformation to a linear model, Parameter estimation in a non linear system, Statistical inference in non linear regression. Polynomial models in one and two variables, orthogonal polynomials, smoothing splines: linear, quadratic, cubic, cubic-B.Non parametric regression: Kernel regression, locally weighted regression. (12L+3T)

References

1. Draper N.R. and Smith,H. (1998): Applied Regression Analysis.3rd ed Wiley
2. Wiesberg, S.(1985): Applied Linear Regression, Wiley.
3. Kutner, Neter, Nachtsheim and Wasserman (2003): Applied Linear Regression Models, 4th Edition, McGraw-Hill
4. Montgomery, D.C., Peck, E.A.,and Vining, G.(2012): Introduction to Linear Regression Analysis, 5^{th} Ed .Wiley

5. Cook R.D. &WiesbergS.(1982): Residuals and Influence in Regression. Chap. and Hall.
6. Birkes, D and Dodge, Y. (1993). Alternative methods of regression, John Wiley & Sons;
7. Huber, P. J. and Ronchetti, E. M (2011) Robust Statistics, Wiley, 2nd Edition.
8. Seber, G. A., Wild, C. J. (2003). Non linear Regression, Wiley.
9. Hardle, W. Applied nonparametric regression. http://www.globalsepri.org/UploadPhotos/2008912164043348.pdf
10. Takezawa, K. (2005), Introduction to nonparametric regression, Wiley-Interscience.

MST -326 CLINICAL TRIALS

Unit-1: a) Introduction to clinical trials: the need and ethics of clinical trials, bias and random error in clinical studies, conduct of clinical trials, overview of Phase I-IV trials, multi-center trials.

b) Data management: data definitions, case report forms, database design, data collection systems for good clinical practice. **(12L+3T)**

Unit-2: Design of clinical trials: parallel vs. cross-over designs, cross-sectional vs. Longitudinal designs, review of factorial designs, objectives and endpoints of clinical trials, design of Phase I trials, design of single-stage and multi-stage Phase II trials, design and monitoring of Phase III trials with sequential stopping, design of bioequivalence trials. **(16L+4T)**

Unit-3: Reporting and analysis: analysis of categorical outcomes from Phase I - III trials, analysis of survival data from clinical trials. **(12L+3T)**

Unit-4: a) Surrogate endpoints: selection and design of trials with surrogate endpoints, analysis of surrogate endpoint data.

b) Meta-analysis of clinical trials. **(8L+2T)**

References:

1. S. Piantadosi (1997). Clinical Trials: A Methodologic Perspective, Wiley and Sons.
2. C. Jennison and B. W. Turnbull (1999): Group Sequential Methods with Applications to Clinical Trials, CRC Press.
3. L. M. Friedman, C. Furburg, D. L. Demets (1998). Fundamentals of Clinical Trials,Springer Verlag.
4. J. L. Fleiss (1989). The Design and Analysis of Clinical Experiments. Wiley and Sons.

MST 316- PRACTICAL –III

1. Construction of Consistent/CAN Estimators
2. Confidence interval based on CAN and VST.
3. Realization from a Markov Chain.
4. Classification of t.p.m and computation of n-step probability matrix.
5. Classification of State: Computations of absorption probabilities.
6. Stationary distribution and recurrence times.
7. Realization from discrete state space Markov Processes and related estimation.
8. Analysis of full replicated unconfounded 2^n and 3^2 factorial experiments.
9. Analysis of single replicated 2^n and 3^2 factorial experiments.
10. Analysis of confounded 2^n and 3^2 factorial experiments: total and partial confounding.
11. Analysis of fractional factorial 2^{n-k} and 3^{n-k} factorial experiments.
12. Analysis of response surface 1^{st} and 2^{nd} order experiments.

13-20. four practicals each on the optional courses.

MST 401: OPTIMIZATION TECHNIQUES

Unit-1: a) Linear programming problem (LPP): Theorems related to the development of Simplex algorithm, theorems related to a basic feasible solution ; Reduction of a feasible solution to a basic feasible solution, Improvement of a basic feasible solution, Existence of unbounded solution, Optimality conditions and other related theorems (statements only), Examples based on these theorems.

b) Artificial variable technique: Two phase method, redundancy (12L+3T)

Unit-2: a) Concept of Duality, related theorems, complementary slackness property and development of dual simplex algorithm.

b) Sensitivity Analysis: Changes in the cost vector, requirement vector and non basic activity vector; addition of new variables and addition of new constraints. (12L+3T)

Unit-3: a) Theory of games: two person zero sum games, minimax and maximin principles, Saddle point, mixed strategies; rules of dominance, solution of 2 x 2 game by algebraic method, Graphical method, Reduction of the game problem as LPP, Minimax and Maximin theorem .

b) Dynamic Programming: The Recursion Equation Approach, Computational Procedure, Characteristics of Dynamic Programming, Solution of L.P.P. by Dynamic Programming.

(12L+3T)

Unit-4: a) Integer Linear Programming Problem (ILPP): The concept of cutting plane, cutting plane method for all ILPP and mixed ILLP, Branch and Bound method.

b) Quadratic programming: Kuhn-Tucker conditions, methods due to Beale, Wolfe.

(12L+3T)

References:

1) Hadley G.(1969): Linear Programming ,*Addison Wesley*
2) Taha H. A.(1971): Operation Research An Introduction- *Macmillan N.Y.*

3) Kanti Swaroop & Gupta M. M.(1985): Operations Research, *Sultan Chand &*
P.Gupta & D.S.Hira(2010): Operation Research, *Sultan Chand & Co.ltd.*
5) J.K.Sharma. (2003): Operation Research Theory and Applications. *Macmillan,*

MST 421: DISCRETE DATA ANALYSIS

Unit-1: Log linear model for two and three dimensional contingency tables: Interpretation of parameters, comparison with ANOVA and regression. ML estimation of parameters, likelihood ratio tests for various hypotheses including independence marginal and conditional independence, partial association, models with quantitative levels. Collapsibility Theorem. (12L+3T)

Unit-2: Generalized linear models: concept of generalized linear model, Link function, ML estimation, Quasi-likelihood estimation, large sample tests about parameters, goodness of fit, analysis of deviance. Residual analysis, types of residuals: raw, Pearson, deviance, Anscombe, quantile; residual plots. Variable selection: AIC and BIC.

(12L+3T)

Unit-3: Logistic regression: logit, probit and cloglog model for dichotomous data with single and multiple explanatory variables, ML estimation, large sample tests about parameters. Hosmer-Lemeshow test, ROC curve. Multilevel logistic regression, Logistic regression for Nominal response: Baseline Category model and ordinal response: Proportional odds model. (12L+3T)

Unit-4: Poisson regression: ML and Quasi-likelihood estimation of parameters, testing significance of coefficients, goodness of fit, power family of link functions, over dispersion: Types, causes and remedies. Negative Binomial regression: NB-2 model.

(12L+3T)

References:

1) Yuvonne M. Bishop, Stephen E. Fienberg, Paul W. Holland (1975): Discrete Multivariate Analysis: Theory and Practice
2) Hosmer D.W. and Lemeshow S. (2000): Applied Logistic regression, 2nd ED. Wiley New York.
3) Agesti A. (1990) : Categorical Data Analysis. Wiley , New York.

4) R.Christensen (1997) Log-Linear Models And Logistic Regression, Springer. New York.
5) Hilbe, J. (2011): Negative Binomial regression, Cambridge University, Press, 2nd Edition.

MST 422 SURVIVAL ANALYSES

Unit-1: Concept of censoring, various types of censoring, type-I, type-II, random censoring, progressive censoring. Writing likelihood function under all these censoring schemes, estimation and testing of parameters under above types of censoring.

(12L+3T)

Unit-2: a) Estimation of survival function: Actuarial Estimator, Kaplan Meir product limit estimator, properties: self-consistency and MLE, redistribution to the right algorithm.

b) Concept of TTT Transform and its applications. Test for exponentiality against alternatives IFRA, NBU and NBUE. (12L+3T)

Unit-3: a) Two-sample problem: Gehen test, Log rank test, Mantel Haenszel test.

b) Competing risk models, parametric and nonparametric inference for this model.

(12L+3T)

Unit-4: a) Semi parametric regression for failure rate – Cox's proportional hazards model with one and several covariates, related estimation and test procedures.

b) Introduction to accelerated time models: Linear rank tests, Least squares, Miller, Buckley-James and kaul-SusaraVan-ryzin estimators. (12L+3T)

References:

1. Barlow R. E. & Proschann F. (1965): Mathematical Theory of Reliability, John Wiley & Sons, Inc.
2. Lawless J. F.(1982): Statistical Models and Methods of Failure Time Data, John Wiley.

3. Miller R. G.(1981): Survival Analysis, John Wiley and Sons.
4. Bain L. O.(1978): Statistical Analysis of Reliability and Life Testing Models, Marcel Dekker,
5. Nelson W. (1982): Applied Life Data Analysis, Jhon Wiley and Sons Inc

MST 423: STATISTICAL PROCESS CONTROL

Unit-1. Basic concept of quality control, process control and product control, seven SPC tools flowchart. Histogram, Check sheet, Ishikawa diagram, Pareto chart, Defect concentration diagram, control chart. Deming's PDCA cycle for continuous improvements and its applications. Control charts for measurements and attributes **X-**Bar, R, S, p, np charts with subgrouping, (12L+3T)

Unit-2: CUSUM chart, tabular form and V-mask, use of these charts for process control. Moving average and exponentially weighted moving average charts. Nonparametric Control Charts. Multivariate control charts for measurements data. Hotelling T^2 control charts. (12L+3T)

Unit-3: Process capability Cp, Cpk and Cpm. Determining process capability with **X-**Bar chart. Estimation of process capability. Introduction to Six-Sigma Methodology. DMAIC cycle & case studies. (12L+3T)

Unit-4: Sampling Inspection plans for attribute inspection : Single, double & sequential sampling plans and their properties. Dodge and Roming characterization by OC curve. Sampling inspection plans by variables for one or two sided specifications. Simulation of X -bar and R control charts, (12L+3T)

References:

1. Guenther W.C (1981) : Sampling Inspection in Statistical Quality Control Charter Grifits.
2. Montgomery D.C. (2009) Introduction to Statistical Quality Control, John Wiley & Sons inc.
3. Kotz S. (1993): Process capability indices. Chapman and Hall.

4. Abraham Bovas(1998) Quality Improvement through statistical methods. Birkhauser.

MST-424 TIME SERIES ANALYSIS

Unit-1: Time series as a discrete parameter stochastic process, Auto - Covariance, Auto-correlation functions and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing. (12 L + 3 T)

Unit-2: Wold representation of linear stationary processes, detailed study of the linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average models. Concept of Causality, invertibility, computation of π -weights and ψ- weights, computation of ACVF and ACF. Partial auto covariance function. Autoregressive Integrated Moving Average models. (12 L + 3 T)

Unit-3: Estimation of ARMA models: Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARMA Processes, Discussion (without proof) of estimation of mean, Auto-covariance and auto-correlation function under large samples theory, Residual analysis and diagnostic checking. Forecasting using ARIMA models. (12 L + 3 T)

Unit-4: a) Analysis of seasonal models: parsimonious models for seasonal time series, SARIMA models, forecasting, identification, estimation and diagnosis methods for seasonal time series.

b) Introduction to ARCH and GARCH models. (12L + 3T)

References:

Text Books:

1. Box, G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting & Control, Holden-Day.

2. Brockwell, P.J and Davis R.A. (1987) Time Series: Theory and Methods, Springer-

3. Tsay R. S. Analysis of Financial Time Series, 3rd Ed. (Wil. Ser. in Prob. and Statistics)

Reference Books:

1. Kendall, M.G. (1978) Time Series, Charler Graffin

2.. Chatfield, C. (2004) The Analysis of Time Series - An Introduction, Sixth edition, Chapman and Hall.

MST 428: DATA MINING

Unit-1: Data preparation for knowledge discovery: Data understanding and data cleaning tools, Data transformation, Data Discretization, Data Visualization, Imbalanced data, Data Mining Process: CRISP and SEEMA; Concept of training data, testing data and validation of model. (12L+3T)

Unit-2: Supervised Learning techniques: Problem of classification, classification techniques: knearest neighbor, decision tree, Naïve Bayesian, Classification based on logistic regression. (12L+3T)

Unit-3: ANN and SVM: Artificial Neutral Network (ANN): Introduction to ANN, types of activation function, McCulloch-Pitts AN model, single layer network, multilayer feed forward network model, training methods, ANN &regression models.

Convexity and optimization: Convexity, unconstrained and constrained optimization, KKT conditions.

Support vector machine: Introduction to support vector machine, loss functions, soft margin, optimization hyperplane, support vector classification, support vector regression, linear programming support vector machine for classification and regression.

(12L+3T)

Unit-4: Unsupervised learning: Clustering: Density based methods and grid based methods. Market Basket Analysis, Association rules and prediction, Apriori Algorithm, data attributes, applications to electronic commerce. (12L+3T)

References

1. Berson and Smith S.J. (1997) : Data warehousing, Data Mining, and OLAP, McGraw-Hill.
2. Breiman J.H Friedman, R.A. Olshen and stone C.J. (1984) : Classification

and Regression Trees, Wadsworth and Brooks / Cole.
3. Han, J. and Kamber, M. and Pei, J. (2012) : Data Mining: Concepts and Techniques. MorganGaufmann.
4. Mitchell T.M. (1997) : Machine Learning , McGraw-Hill.
5. Ripley B.D. (1996) : Pattern Recognition and Neural Networks. Cambridge University Press.
6. Vapnik V.N. The nature of Statistical learning theory, Springer.
7. Cristianini N. and Shawe-Taylor J. An Introduction to support vectormachines.
8. Data set source: http://www.ICS.uci.edu/~mlearn/MLRepository.html
9. Mehrika, K., Mohan, C., and Ranka (1997) Elements of Artificial neural networks. Penram international.
10. Hastie T, Tibshirani R, Friedmant J, (2009): The elements of statistical Learning, Springer.

MST 416- PRACTICAL –IV

1. Solution to LPP using simplex method.
2. Revised Simplex method and Dual Simplex Method.
3. Game Theory.
4. Quadratic programming
5. Integer programming.
6. Dynamic Programming

7-14 Two Practicals each on the Four Optional papers.