COURSES TAUGHT

ESO 209: PROBABILITY AND STATISTICS Prereq. MTH-101

L-T-P-D-[C]
3-1-0-0-[4]

Probability - Axiomatic Definition, Properties, Conditional Probability, Bayes Rule and Independence of Events; Random Variables, Distribution Function, Probability Mass and Density Functions, Expectation, Moments, Moment Generating Function, Chebyshev's Inequality; Special Distributions, like, Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, Poisson, Uniform, Exponential, Gamma, Normal; Joint Distributions, Marginal and Conditional Distributions, Independence of Random Variables, Covariance, Correlation; Functions of Random Variables, Weak Law of Large Numbers, P. Levy's Central Limit Theorem (i.i.d. finite variance case), Normal and Poisson approximations to Binomial.
Statistics - Introduction: Population, Sample, Parameters; Point Estimation: Method of Moments, MLE, Unbiasedness, Consistency, Comparing two Estimators (Relative MSE); Confidence Interval Estimation for Mean, Difference of means, Variance, Proportions, Sample size problem; Testing of Hypotheses: N-P Lemma, examples of MP and UMP tests, p-value, Likelihood Ratio Test, Tests for Means, Variance, Two Sample Problems, Test for Proportions, Relation between Confidence Intervals and Tests of Hypotheses, Chi-square Goodness of Fit Tests, Contingency Tables, SPRT; Regression Problem: Scatter Diagram, Simple Linear Regression, Least Squares Estimation, Tests for Slope and Correlation, Prediction Problem, Graphical Residual Analysis, Q-Q Plot to Test for Normality of Residuals, Multiple Regression; Analysis of Variance: Completely Randomized Design and Randomized Block Design; Quality Control: Shewart Control Charts and Cusum Charts.

MTH 415: MATRIX THEORY & LINEAR ESTIMATION
Prereq. ESO 209, #

L-T-P-D-[C]
3-1-0-0-[4]

Review of finite dimensional vector spaces (Null space and nullity), Linear dependence and independence, Matrix algebra, Rank of a Matrix, Inverse of a non-singular matrix, Hermite canonical forms, Generalised inverses, Moore-Penrose inverse, solution of linear equations,

Projection and orthogonal projection matrices, Idempotent matrices, Real quadratic forms, reduction of pair of real symmetric matrices, Singular value decomposition, extrema of a quadratic forms, Vector and matrix differentiation. Least squares theory and Gauss-Markoff theorem, Cochran's theorem and distribution of quadratic forms, test of single linear hypothesis and more than one hypothesis, ANOVA table, Confidence interval and regions, Power of F-test, Multiple comparisons and simultaneous confidence intervals.

MTH 416: REGRESSION ANALYSIS Prereq. MTH 415/ ESO 209, #

L-T-P-D-[C]
3-1-0-0-[4]

Simple and multiple linear regression, Polynomial regression and orthogonal polynomials, Test of significance and confidence intervals for parameters, Residuals and their analysis for test of departure from the assumptions such as fitness of model, normality, homogeneity of variances, detection of outliers, Influential observations, Power transformation of dependent and independent variables, Problem of multicollinearity, ridge regression and principal component regression, subset selection of explanatory variables, Mallow's Cp statistic. Nonlinear regression, different methods for estimation (Least squares and Maximum likelihood), Asymptotic properties of estimators, Generalised Linear Models (GLIM), Analysis of binary and grouped data using logistic and log-linear models.

MTH 513: ANALYSIS OF VARIANCE Prereq. MTH 416

L-T-P-D-[C]
3-1-0-0-[4]

Analysis of Completely Randomized Design, Randomized Block Design, Latin Squares Design; Split plot, 2^n and 3^n Factorials with Total and Partial Confounding, 2-way Non-orthogonal Experiment, BIBD, PBIBD; Analysis of Covariance, Missing Plot Techniques; First and second order Response Surface Designs.

MTH 516: NON-PARAMETRIC INFERENCE Prereq. ESO 209, #

L-T-P-D-[C]
3-1-0-0-[4]

Order statistics, Run tests, Goodness of fit tests, rank order statistics, sign test and signed rank test. general two-sample problems, Mann-Whitney test, Linear rank tests for location and scale problem, k-sample problem, Measures of association, Power and asymptotic relative efficiency, Concepts of Jack-knifing, Bootstrap methods.

MTH676: ECONOMETRICS Prereq. MTH 416, #

L-T-P-D-[C]
3-0-0-0-[4]

Brief review of topics in Multiple Linear Regression Analysis; Econometric tests on Heteroscedasticity and Autocorrelation; Restricted Regression; Errors in Variables; Functional Form and Structural Change; Stochastic Regressors; Instrumental Variable (IV) Estimation; Large Sample properties of Least Square and IV estimators; Panel Data Models; Systems of Regression Equations – Seemingly Unrelated Regression Equations (SURE) and Multivariate Multiple Linear Regression; Simultaneous Equation Models – Structural and Reduced forms, Rank and Order conditions for Identifiability; Indirect Least Squares, 2-stage Least Squares and Limited Information Maximum Likelihood methods of estimation; k-class estimators and Full Information Maximum Likelihood Estimation; Models with lagged variables – Autoregressive Distributed Lag (ARDL) Models and Vector-Autoregressive (VAR) Models; Topics in Econometric Time Series Models – Autoregressive and Generalized Autoregressive Conditionally Heteroscedastic (ARCG & GARCH) Models, Unit Root, Co-integration and Granger Causality

MTH 682: ORDER STATISTICS Prereq. #

L-T-P-D-[C]
3-0-0-0-[4]

Basic Distribution Theory, Moments of Order Statistics including Recurrence Relations, Bounds and Approximations, Estimation of Parameters, Life testing, Short cut Procedures, Treatment of Outliers, Asymptotic Theory of Extremes.

MTH 755: STATISTICAL INFERENCE Prereq. None

L-T-P-D-[C]
3-0-0-0-[4]

Population and samples, Parametric and nonparametric models, Exponential and location-scale families, Sufficiency and minimal sufficiency, Complete statistics, Unbiased and UMVU estimation, Asymptotically unbiased estimators, Method of moments, Bayes estimators, Invariance, Minimaxity and admissibility, The method of maximum likelihood, Asymptotically efficient estimation, Variance estimation, The jacknife, The bootstrap, The NP lemma, MLR, UMP tests for one and two sided hypotheses, Unbiased and similarity, UMPU tests in exponential families, Invariance and UMPI tests, LR tests, Asymptotic tests based on likelihoods, Chi-square tests, Bayes tests, Pivotal quantities, Inverting acceptance regions of tests, The Bayesian confidence interval, Prediction sets, Length of confidence intervals, UMA and UMAU confidence sets, Invariant confidence sets.

#: Consent of the Instructor