Centre for International Trade and Development

School of International Studies

Course (MA/PhD): MA level

Course Title: Introduction to Statistics and Econometrics

Course Code: IE 408

Course Type: Core

Course Teacher: Prof. Mandira Sarma

Credits: 4

Contact Hours: 4 hours per week

Course Objectives:

- To provide a theoretical foundation on Mathematical Statistics and Econometrics
- To equip students with empirical skills

Learning Outcomes: Upon completion of this course, students will be able to

- Understand other areas of economics that apply statistical concepts
- Develop statistical skills to conduct empirical work
- Opt for advanced courses in Econometrics

Evaluation: Mid-term and end term examinations, graded assignments and project work.

Course Content

1. **Probability and Random Variables**:
    a. Definitions and axioms of probability, probability set functions; random variables and probability distributions,
    b. transformation of random variables,
    c. moments and moment generating function;
    d. Well-known probability distributions - Binomial, Poisson, Geometric, Uniform, exponential, Normal etc.
    e. Bivariate and Multivariate random vectors and associated probability concepts, Transformation of variable technique for bi-variate case, Distribution of functions of random variables, Chi-square, t-, F distributions, multivariate normal distribution
2. **Asymptotic Theory:** Convergence in Probability, Convergence in Distribution, Weak Law of Large Numbers, Central Limit Theorem.
3. **Statistical Inference:**
    a. Sampling and associated concepts, Concept of sampling distribution;
    b. Estimation - Unbiasedness, asymptotic unbiasedness, consistency, and efficiency of estimators.

c. Method of Moments, Method of maximum likelihood and properties of MLE estimators;
d. Testing of hypotheses, errors of first and second kind, power of the test, Neyman Pearson Theorem, likelihood ratio test.

4. **Linear Regression Analysis**
   a. Simple Linear Regression - Method of least squares, properties of OLS estimators and goodness of fit. Gauss Markov Theorem.
   b. Multiple Linear Regression Analysis: General case (k-explanatory variables); examples with k=2 & 3; multiple correlation coefficient coefficient and goodness of fit. Problem of multicollinearity.
   c. Inference in the Multiple Regression Model: Hypothesis testing for significance of a subset of coefficients; and overall significance.
   d. Generalized Least Squares and Feasible Least Squares: Violation of assumption on spherical errors (problems of autocorrelation and heteroscedasticity), GLS and FGLS. Tests to detect autocorrelation and heteroskedasticity. Problem of autocorrelation in lagged dependent variable models.

Readings

Robert Hogg, Joseph W. McKean and Allen T. Craig: *Introduction to Mathematical Statistics* (8th edition, 2005), Pearson Education

John A. Rice: *Mathematical Statistics and Data Analysis* (3rd Edition, 2007), Cengage Learning.

Robert Hogg and Eliot Tanis: *Probability and Statistical Inference* (7th edition, 2006)

James Stock and R.W. Watson: *Introduction to Econometrics* (International edition 2007)

Jeffrey Wooldridge: *Introductory Econometrics: A Modern Approach* (2006).

Additional reading list will be provided in class as and when required.