

STA-HC- 6016**Design of Experiments**

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

13.1 Theory13.1.1 Unit 1: *Design of Experiments*: (Lectures: 25)

Role, historical perspective, terminology, experimental error, basic principles, uniformity trials, choice of size and shape of plots and blocks.

Basic designs: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) – layout, model and statistical analysis, relative efficiency, analysis with missing observations, Greco Latin Square Design.

13.1.2 Unit 2: *Design of Experiments*: (Lectures: 15)

Split Plot Design, Strip Plot Design, Incomplete Block Designs, Introduction to Balanced Incomplete Block Design (BIBD).

13.1.3 Unit 3: *Factorial Experiments*: (Lectures: 20)

Factorial experiments: advantages, notations and concepts, 2^2 , $2^3 \dots 2^n$ and 3^2 factorial experiments, design and analysis, Total and Partial confounding for 2^n ($n \leq 5$), idea of 3^2 experiment.

13.2 Practical/Lab**List of Practical**

1. Analysis of a CRD
2. Analysis of an RBD
3. Analysis of an LSD
4. Analysis of an RBD with one missing observation
5. Analysis of an LSD with one missing observation
6. Analysis of 2^2 and 2^3 factorial in CRD and RBD
7. Analysis of a completely confounded two level factorial design in 2 blocks
8. Analysis of a completely confounded two level factorial design in 4 blocks
9. Analysis of a partially confounded two level factorial design.

SUGGESTED READINGS:

1. Cochran, W.G. and Cox, G.M. (1959): *Experimental Design*. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): *Design and Analysis of Experiments*. Wiley Eastern Ltd.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): *Fundamentals of Statistics*. Vol. II, 8th Edn. World Press, Kolkata.
4. Kempthorne, O. (1965): *The Design and Analysis of Experiments*. John Wiley.
5. Montgomery, D. C. (2008): *Design and Analysis of Experiments*, John Wiley.

Multivariate Analysis and Nonparametric Methods

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

14.1 Theory

14.1.1 Unit 1: *Bivariate and Multivariate Distributions*: (Lectures: 20)

Bivariate Normal Distribution (BVN): p.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN.
Multivariate Data: Random Vector: Probability mass/density functions, Distribution function, Mean vector & Dispersion matrix, Marginal & Conditional distributions.

14.1.2 Unit 2: *Multivariate Normal Distributions*: (Lectures: 20)

Multivariate Normal distribution and its properties. Sampling distribution for mean vector and variance-covariance matrix. Multiple and partial correlation coefficient and their properties, Basic idea of Principal Component Analysis, Hotelling T^2 – concept and applications.

14.1.3 Unit 3: *Non-parametric Tests*: (Lectures: 20)

Nonparametric Tests: Introduction and Concept, Test for randomness based on total number of runs, Empirical distribution function, Kolmogorov Smirnov test for one sample, Sign tests- one sample and two samples, Wilcoxon-Mann-Whitney test, Kruskal-Wallis test.

14.2 Practical/Lab

List of Practical

1. Multiple Correlation
2. Partial Correlation
3. Bivariate Normal Distribution,
4. Multivariate Normal Distribution
5. Principal Components Analysis
6. Test for randomness based on total number of runs,
7. Kolmogorov Smirnov test for one sample.
8. Sign test: one sample, two samples, large samples.
9. Wilcoxon-Mann-Whitney U-test,
10. Kruskal-Wallis test.

SUGGESTED READING:

1. Anderson, T.W. (2003): *An Introduction to Multivariate Statistical Analysis*, 3rd Edn., John Wiley
2. Muirhead, R.J. (1982): *Aspects of Multivariate Statistical Theory*, John Wiley.
3. Kshirsagar, A.M. (1972) : *Multivariate Analysis*, 1st Edn. Marcel Dekker.
4. Johnson, R.A. and Wichern, D.W. (2007): *Applied Multivariate Analysis*, 6th Edn., Pearson & Prentice Hall.
5. Mukhopadhyay, P. : *Mathematical Statistics*.
6. Gibbons, J. D. and Chakraborty, S (2003): *Nonparametric Statistical Inference*. 4th Edition. Marcel Dekker, CRC.

STA-HE- 6016**Econometrics**

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

19.1 Theory**19.1.1 Unit 1: *Economic Models*: (Lectures: 15)**

Introduction: Objective behind building econometric models, nature of econometrics, model building, role of econometrics, linear models: two or more variables.

19.1.2 Unit 2: *Estimation*: (Lectures: 18)

Least square assumptions, estimation of regression parameters, tests of significance and confidence intervals.

19.1.3 Unit 3: *Regression*: (Lectures: 15)

Multiple Regression analysis, estimation and inference.

19.1.4 Unit 4: *Collinearity*: (Lectures: 12)

Violations of Least Square assumptions: multicollinearity, autocorrelation and heteroscedasticity.

SUGGESTED READING:

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition, McGraw Hill Companies.
2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.
3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited,
4. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

PRACTICAL /LAB WORK**List of Practical**

1. Problems based on estimation of General linear model
2. Testing of parameters of General linear model
3. Forecasting of General linear model
4. Problems concerning specification errors
5. Problems related to consequences of Multicollinearity
6. Diagnostics of Multicollinearity
7. Problems related to consequences of Autocorrelation (AR(I))
8. Diagnostics of Autocorrelation
9. Estimation of problems of General linear model under Autocorrelation

10. Problems related to consequences Heteroscedasticity
11. Diagnostics of Heteroscedasticity
12. Estimation of problems of General linear model under Heteroscedastic distance terms
13. Problems related to General linear model under (Aitken Estimation).

STA-HE- 6026

Demography and Vital Statistics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

20.1 Theory

20.1.1 Unit 1: *Population Theory*: (Lectures: 10)

Population Theories: Coverage and content errors in demographic data, use of balancing equations, Population composition, dependency ratio.

20.1.2 Unit 2: *Measurement of Mortality*: (Lectures: 15)

Introduction and sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates.

20.1.3 Unit 3: *Life Table*: (Lectures: 18)

Stationary and Stable population, Central Mortality Rates and Force of Mortality. Life (Mortality) Tables: Assumption, description.

20.1.4 Unit 4: *Measurement of Fertility*: (Lectures: 17)

Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR). Measurement of Population Growth: Crude rates of natural increase, Pearl's Vital Index, Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).

SUGGESTED READING:

1. Mukhopadhyay, P. (1999): Applied Statistics, Books and Allied (P) Ltd.
2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
3. Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
4. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
5. Keyfitz N., Beckman John A.: Demography through Problems S-Verlag New York.

STA-HE- 6046

Project Work

Total Lectures: 60 Credits: 6

Objective: The aim of the course is to initiate students to write and present a statistical report, under the supervision of a faculty, on some area of human interest. The project work will provide hands on training to the students to deal with data emanating from some real life situation and propel them to dwell on some theory or relate it to some theoretical concepts.