SEMESTER I

Course Title   **Introduction to Statistics**
Course Code: **STA-301**
Credit Hours: **4(3-1)**

THEORY:

Meanings of Statistics. Main branches of Statistics. Types of variables. Measurements scales. Statistical data collection. Organizing of data. Classification of data. Graph and charts: Stem and Leaf diagram, Box and Whisker plots. Graph based on frequency distribution: Histogram, Frequency polygon, Ogive, Pie-chart.

Measure of Central Tendency: Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean, their properties, merits and demerits. Quantiles, Empirical relation between mean, median and mode.

Measure of Dispersion: Absolute and Relative measure of dispersion, their properties, merits and demerits. Standardized variables, moments, Sheppard's correction, moments ratios, Kurtosis and Skewness.

Probability concepts, Addition and Multiplication rules, Bivariate frequency tables, joint and marginal probabilities, conditional probability and independence, Bayes'rule.

Books Recommended:
1. Spiegel, M.R. Schiller, J.L. and Sirinivasan, R.L. (2000) "*Probability and Statistics*", 2nd ed. Schaums Outlines Series. McGraw Hill. NY.
2. Wonnacott, T.H. and Wannacott, R.J (1990). Introductory Statistics. Jhon Wily & Sons. New York.
3. Walpole, R.E (2001). Introduction to Statistics. Macmillan Publishing Company.
4. Rauf, M (2001). Polymers Modern Statistics. Polymer Publication, Urdu Bazar, Lahore.
5. Chaudhary, SM and Kamal, S. (1996) "*Introduction to Statistical Theory*" Parts I & ii, 6th ed, Ilmi Kitab Khana, Lahore Pakistan.

Reference Books
1. Clark, G.M and Cooke, D. (1998), "*A Basic Course in Statistics*" 4th ed, Arnold, London.
2. Walpole, R.E., Myers, R.h and Myers, S.L. (1998), "*Probability and Statistics for Engineers and Scientists*" 6th Edition, Prentice Hall, NY.
3. Mclave, J.T., Benson, P.G. and Snitch, T. (2005) "*Statistics for Business & Economics*" 9th ed. Prentice Hall, New Jerssey
4. Weiss, N.A. (1997, *Introductory Statistics*" 4th ed. Addison-Wesley Pub. Company. Inc.

SEMESTER II

Course Title	**Introduction to Random Variables & Probably Distribution**
Course Code:	**STA-302**
Credit Hours:	**4(3-1)**

THEORY:

Random variable. Discrete random variable, probability distribution of discrete random variable and its properties. Distribution function and its properties. Mean and variance of discrete random variable. Properties and applications of following discrete probability distributions: Uniform Distribution, Bernoulli Distribution, Binomial Distribution, Poisson Distribution, Hypergeometric Distribution, Geometric distribution, Negative binomial distribution

Continuous random variable, probability density function with its properties. Distribution function of continuous random variable with its properties.

Application, properties* of following continuous distributions like, Normal distribution, Exponential distribution, Gamma distribution, Beta distribution, Normal approximation to Binomial and Poisson distributions.

   Concept of following sampling distributions
   - t-distribution
   - Chi-Square distribution
   - F-distribution

Properties includes mean, variance, moments, moment generating function (if possible),

Books Recommended:
1. Spiegel, M.R. Schiller, J.L. and Sirinivasan, R.L. (2000) "*Probability and Statistics*", 2ⁿᵈ ed. Schaums Outlines Series. McGraw Hill. NY.
2. Walpole, R.E (2001). Introduction to Statistics. Macmillan Publishing Company.
3. Rauf, M (2001). Polymers Modern Statistics. Polymer Publication, Urdu Bazar, Lahore.
4. Chaudhary, SM and Kamal, S. (1996) "Introduction to Statistical Theory" Parts I & ii, 6ᵗʰ ed, Ilmi Kitab Khana, Lahore Pakistan.

Reference Books:
1. Clark, G.M and Cooke, D. (1998), "*A Basic Course in Statistics*" 4ᵗʰ ed, Arnold, London.
2. Walpole, R.E., Myers, R.h and Myers, S.L. (1998), "*Probability and Statistics for Engineers and Scientists*" 6ᵗʰ Edition, Prentice Hall, NY
3. Mclave, J.T., Benson, P.G. and Snitch, T. (2005) "*Statistics for Business & Economics*" 9ᵗʰ ed. Prentice Hall, New Jerssey
4. Weiss, N.A. (1997, *Introductory Statistics*" 4ᵗʰ ed. Addison-Wesley Pub. Company. Inc. Chaudhary, SM and Kamal, S. (1996) "*Introduction to Statistical Theory*" Parts I & ii, 6ᵗʰ ed, Ilmi Kitab Khana, Lahore Pakistan.

SEMESTER II

Course Title	**Applied Statistics**
Course Code:	**STA-304**
Credit Hours:	**4(3-1)**

THEORY:

Index Number: Construction and application of index number. Simple and composite Index number. Fixed based and chain base method. Unweighted and weighted index number. Theoretical tests for index number.(Time Reversal Tests, Factor Reversal Test, Circular Test). Consumer price Index Number and Sensitive Price Index Number. Determination of Purchasing Power of Money, Real Wages, Inflation Rate on the basis of index number. Limitation of Index Number.

Time Series Analysis: Time Series Data, Components of Time Series, Measurements of Systematic components of time series (Measurement of Secular Trend, Seasonal Variation, Cyclical Fluctuation). Detrending, Deseasonalization of data, Forecasting and Prediction.

Vital Statistics: Meaning of Vital Statistics, registration of births and deaths in Pakistan. Uses of Vital statistics, Short comings of vital statistics, rates and ratio (Sex ratio, child ratio, birth and death ratio, population growth rate, classification of natal rates, death rates or mortality rates, crude death rate, infant mortality rate, specific death rate, case fatality rate, fertility rate, crude birth rate, specific birth rate, standardized death rate, reproduction rate, gross reproduction rate. Net reproduction rate, morbidity or sickness rate, marriage rate, divorce rate, etc. general fertility rate, total fertility rate.)

Books Recommended

- Walpole, R.E (2001). Introduction to Statistics. Macmillan Publishing Company.
- Rauf, M (2001). Polymers Modern Statistics. Polymer Publication, Urdu Bazar, Lahore.
- Clark, G.M and Cooke, D. (1998). A Basic Course in Statistics, 4th Edition. Arnold, London.
- Walpole, P.E., Myers, R.H and Myers, S.L. (1998). Probability and Statistics for Engineers and Scientists, 6th Edition. Prentice Hall.
- Mclave, J.T., Benson, P.G. and Snitch, T. (2005). Statistics for Business and Economics, 9th Edition. Prentice Hall, New Jerssey
- Pollard, A.H., Yousaf, F. and Pollard, G.M. (1982). Demographic Techniques. Pergamon Press, Sydeny.

SEMESTER III

Course Title   Basic Statistical |Inference
Course Code: STA-401
Credit Hours: 4(3-1)

THEORY:

Basic definition, Objective, advantages and disadvantages of sampling, types of sampling (concepts). Sampling distribution of mean, difference between two mean, variances, proportion, difference between two proportions. Central limit theorem.

Point estimation and its properties. Point estimate for population* mean, difference between two population means, proportion and difference between two population proportion, population variance. Interval estimation. Confidence interval and its interpretation. Confidence interval for population mean, difference between two population means, proportion and difference between two population proportions, population variance. One sided confidence interval. Determination of sample size for Estimating population mean and proportion.

Basic definitions in hypothesis testing, types of error, power of test, construction and interpretation of OC curve. Hypothesis testing for single Normal population mean, proportion and variance. Hypothesis testing for difference between two normal populations' means, proportions and ratio of two populations' variances.

Testing the hypothesis for equality of several normal population variances (test for homogeneity). Chi-Square independence test, Goodness of fit test.

Books Recommended:
1. Spiegel, M.R. Schiller, J.L. and Sirinivasan, R.L. (2000) *"Probability and Statistics"*, 2nd ed. Schaums Outlines Series. McGraw Hill. NY.
2. Wonnacott, T.H and Wannacott, R.J (1990). Introductory Statistics. Jhon Wily & Sons. New York.
3. Walpole, R.E (2001). Introduction to Statistics. Macmillan Publishing Company.
4. Rauf, M (2001). Polymers Modern Statistics. Polymer Publication, Urdu Bazar, Lahore.
5. Chaudhary, SM and Kamal, S. (1996) *"Introduction to Statistical Theory"* Parts I & ii, 6th ed, Ilmi Kitab Khana, Lahore Pakistan.

Reference Books:

1. Clark, G.M and Cooke, D. (1998), *"A Basic Course in Statistics"* 4th ed, Arnold, London.
2. Walpole, R.E., Myers, R.h and Myers, S.L. (1998), *"Probability and Statistics for Engineers and Scientists"* 6th Edition, Prentice Hall, NY
3. Mclave, J.T., Benson, P.G. and Snitch, T. (2005) *"Statistics for Business & Economics"* 9th ed. Prentice Hall, New Jerssey
4. Weiss, N.A. (1997, *Introductory Statistics"* 4th ed. Addison-Wesley Pub. Company. Inc.

SEMESTER III

Course Title   **Statistics and Society**
Course Code: **STA-403**
Credit Hours: **3(3-0)**

THEORY:

Statistical ideas and their relevance to public policy, business, humanities, and the social, health, and physical sciences; focus on critical approach to statistical evidence, quantitative or formal reasoning. How numbers are deployed in social settings, and how they are used in sociology to construct and challenge our understanding of the social world. Introduces students of quantification in modern societies, familiarization with the main instruments for the collection of quantitative data, and providing an overview of the methods used to treat such data in contemporary sociology. Descriptive and explanatory methods, and the vision of the social world implicitly associated with each of the methods we encounter. Basic descriptive skills of quantitative data analysis, notably how to download large data sets, how to manipulate variables and how to present statistical information in tabular and graphical form. Uses and misuses of Statistics in society.

References:

- **Wasserman**, L. (2004). All of Statistics, A Concise Course in Statistical Inference, *Springer Texts in Statistics.*
- Chava, F. N. , Anna L. G. (2018). Social Statistics for a Diverse Society 8th Edition, SAGE Publications Inc.
- Dani, B. Z., Katie, M., Joan, G. (2017) International Handbook of Research in Statistics Education, Springer

SEMESTER IV

Course Title	**Introduction to Regression Analysis of ANOVA and ANCOVA**
Course Code:	**STA-402**
Credit Hours:	**4(3-1)**

THEORY:

Concept of regression analysis, scatter diagram, Simple linear regression, its model and assumptions. Inference regarding the parameters of simple linear regression. Mutiple linear regression, Inference regarding the parameter of multiple linear regression. Fitting of non-linear regression. Standard error of estimate. Coefficient of determination and its interpretation.

Correlation and causation. Correlation coefficient, its properties and interpretation. Multiple and partial correlation coefficient and its interpretation. Inference regarding the correlation coefficient, multiple correlation coefficient and partial correlation coefficient.

Analysis of Variance, One Way Analysis of Variance, Two way Analysis of Variance, Partitioning of Total SS and degree of freedom in One Way and Two Way Analysis of Variance. Multiple Comparisons tests. Analysis of Covariance.

Books Recommended:

1. Wonnacott, T.H and Wannacott, R.J (1990). Introductory Statistics. Jhon Wily & Sons. New York.
2. Walpole, R.E (2001). Introduction to Statistics. Macmillan Publishing Company
3. Rauf, M (2001). Polymers Modern Statistics. Polymer Publication, Urdu Bazar, Lahore.
4. Chaudhary, SM and Kamal, S. (1996) "*Introduction to Statistical Theory*" Parts I & ii, 6th ed, Ilmi Kitab Khana, Lahore Pakistan.

Reference Books:

5. Clark GM and Kampson, RE (1997), " *Introduction to Design and Analysis of Exepriment*" Arnold London.
6. Walpole, R.E., Myers, R.h and Myers, S.L. (1998), "*Probability and Statistics for Engineers and Scientists*" 7th Edition, Prentice Hall.
7. Weiss, NA (1997) "*Introductory Statistics*" 4th ed. Addison Wesley Pub. Company, Inc.

SEMESTER IV

Course Title   **Statistical Software-I**
Course Code: **STA-406**
Credit Hours: **3(0-3)**

Statistical Data analysis using MS Excel, Minitab

SEMESTER V

Course Title   **Probability and probability Distributions-I**
Course Code: **STA-501**
Credit Hours: **4(4-0)**

THEORY:

Probability set function. Kolomogrov's axioms. Conditional probability. Total probability and bayes theorem. Statistical Independence. Random variable. Probability functions. Probability density function and distribution function. Mathematical expectations. Moment generation function, cumulant generating function and characteristic function. Factorial moment. Joint density function. Conditional and marginal function and expectation. Uniqueness theorem. Inversion theorem. Chebyshev's inequality. Laws of large numbers. Central Limit Theorem.

Discrete uniform, Bernoulli, hyper geometric, Poisson, Negative Binomial, Multinomial. Distribution and their properties. Relationship among distribution

Continuous uniform, Normal, Negative exponential, gamma, beta, lognormal, weibull, Rayleigh, Pareto, double exponential and Cauchy Distribution. Applications of distributions and their properties. Relationship among distributions.

Books Recommended
1.   Mood, A.M, Graybill, F.A and Boss, D.C.(1997). *Introduction to the Theory* of *Statistics,* MacGraw Hill, New York.
2.   Hogg, R.M. and Craig, A.T. (1995), *Introduction to Mathematical Statistics.* Prentice Hall, Engle wood Cliffs, New Jersey.

Reference Books

1. Stirzaker, D. (1999). *Probability and Random Variables.* Cambridge University Press, Cambridge.

2. Stuart, A. and Ord; J.K. (1998), *Kendalls' Advanced Theory of Statistics.* Vol. I, Charles Griffin, London.

3. Freund, J. E. (1997)., *Mathematical Statistics,* Prentice Hall, New Jersey.

SEMESTER V

Course Title	**Sampling Techniques-I**
Course Code:	**STA-503**
Credit Hours:	**3(3-0)**

THEORY:

Basic Concepts, Requirement of a good Sample, Sampling and Non-Sampling Errors, Bias and its effects, Steps and Problems involved in planning and conduct of census and sample surveys. Probability and Non-Probability Sampling. Non-Probability Sampling Techniques, Quota Sampling, Judgment Sampling etc. Application and Limitations of Non-Probability Sampling Methods.
Probability sampling, Simple Random Sampling, Estimation of population mean, Total, Proportion, variance and standard error of estimates. Confidence limits.Sample Size Determination under different Conditions.
Supplementary Information: Stratification, Construction of Strata, Stratified random sampling. Different Method of allocation of Sample size. Sampling Variance (of stratified mean and stratified proportion) under various Allocation Methods, Gain in Precession in Stratified sampling as Compare to Simple Random Sampling. Essentials of Questionnaires Building.

Books Recommended

1.   Cochran, W.G.(1996). *Sampling Techniques,* John Wiley and Sons, New York.
2.   Kish, L. (1992). *Survey Sampling,* John VYiley, New York.

Reference Books

1.   Ferguson, T.S. (l996), *A course in large sample theory*, Chapman & Hall, London.
2.   Sukhatme, P.V, Sukhatme, B., Sukhatme, S., and Asok, A. (1985). *Sampling Theory* of S*urvey with Application.* lowa State University Press.
3.   Des Raj, *Design of Sample Survey.* McGraw Hill, New York.
         Singh, R. and Singh N, (1996), *Elements of Survey Sampling,* Kulwar, Dodrecht

SEMESTER V

Course Title   **Statistical Methods**
Course Code: **STA-505**
Credit Hours: **4(4-0)**

THEORY:

Applications of Binomial, Negative Binomial, Geometric, Hypergeometric, Poisson, Normal, Exponential, Chi-Square, t and F Distributions. Statistical Inference: Estimation of Parameters and Tests of Hypotheses, Simple and Composite Hypotheses. Type-I and Type-II Errors, Level of Significance and p-Values, Power of a test, Characteristic Function and O.C. Curve. Inference about Means, Proportions, Variances and Associated Power Curves, Determination of Sample Size.

Analysis of Linear Regression Models, Testing of Hypotheses about Simple and Multiple Regression Coefficients, Simple Correlation, Multiple and Partial Correlations Upto three Variables, Concept of Outliers.

Analysis of Categorized Data, Homogeneity of Variances, Bartlett Test. Partitioning of Chi-Square in a 2x2 Table, Fishers Exact Test, Log-Linear Models and their Applications.

Non-Parametric Methods: The Sign Test. Wilcoxon Signed Rank Test, Mann-Whitney U Test, Runs test, Tests of Goodness of Fit, Tests of Randomness, Kruskal-Wallis Test, Friedman Test.

Books Recommended

1.   Steel, R.G.D. Torrie, J.H. and Dickey, D.A. (1996). *Principles and Procedures of Statistics, Latest Editions,* McGraw Hill, New York.
2.   Montgomery Douglas, C. and Peck Elizabeth A (1992), *Introduction* to *Linear Regression Analysis,* John Wiley and Sons, Inc. New York.
3.   Dixon, W.J. and Massey, F.J. (1983). *Introduction to Statistical Analysis,* McGraw Hill, New York.

Reference Books

1.   Zar J.H. *"Biostatistical Analysis"* 4th Edition, John Wiley and Sons, New York

2.   Snedecor, G.W. & Cochran W.G. (1997). *"Statistical Methods", I*owa State University Press.

3.   Ott, R.L. (1993). *"An Introduction to Statistical Methods and Data Analysis",* Latest Edition, Duxbury Press, Belmont, California

4.   Daniels. H., (1988). *"Applied Non-Parametric Statistics",* John Wiley, New York

5.   Larson, H.J. (1983.), *"Introduction to Probability Theory and Statistical   Inference",* John Wiley. New York.

SEMESTER V

Course Title   **Operations Research**
Course Code: **STA-507**
Credit Hours: **3(3-0)**

THEORY:

Overview: history and definition of O.R. Introduction to linear programming. Formulation of LP model. Matrix Form, Canonical Form, Standard Form. Duality theory; Primal and dual form. Graphical solution of two variables. Row operations, Gaussian elimination. Simplex method. Network programming, Transportation, assignment and shortest path problems.

Integer programming: Gomoray's cutting plane method, Branch and Bound method, Introduction to CPM and PERT techniques. Inventory control models. ABC analysis and selective inventory management. Queuing Models.

Books Recommended

1.   Taha, H.A. (1998). *Operations Research*. Mac Millan, London.
2.   Brownson, R. (1983). *Operations Research* - Schaums' Outline Series - McGraw Hill.

Reference Books

1. Hillier, F.S. and Lieberman G. J. (1996): *Introduction to Operation' Research*, Holden Day.
2. Gupta, P.K. & Hira, D.S.(1994). *Operations Research.* S. Chand & Co., New Delhi.

SEMESTER V

Course Title	**Population Studies**
Course Code:	**STA-509**
Credit Hours:	**3(3-0)**

THEORY:

Sources of Demographic Data: The Population Census Registration of Vital Events. Housing & Demographic Surveys. Components of Population Growth, Composition of Population and Vital Events. Testing the Accuracy of Demographic Data. Types and Sources of Errors. General Testing Procedures. Testing the Accuracy of Age and Sex Data.

Basic Demographic Measures: Fertility And Mortality Measures. Mortality Rates. Total and General Fertility Rates.

Life Tables: Construction of Complete and Abridged Life Tables. Different Types of Life Tables. Graphs of Lx, qx And dx. Description and Uses of Life Table Columns. Stationary Population Models. Population Estimates and Projections, Inter-Censal Estimates, Population Projections through Various Methods.

Population Models: Theory of Demographic Transition. Consequences of World Population Growth & Population Explosion.

State of Population In Pakistan. Development of Demographic Profile In Pakistan. Recent Demographic Parameters. Current and Future Demographic Activities in Pakistan.

Books Recommended
1.   Hind, A., (1998). *Demographic Method,* Arriold.
2.   Pollard, A.H., Yousaf, F & Pollard, G.M. (1982), *Demographic Techniques,* Pergamon Press, Sydney.

Reference Books
1.   Govt. of Pakistan (1998), *National, Provincial and District* census reports *and other supplementary* reports with respect to *1998 census;* PCO, Islamabad.

2.   Palmore, J.A; Gardner , R.W. (1994), *Measuring* Mortality *Increase;* East West Centre, Honolulu.

3.   Bogue, D.J; Arriagu, E.E. Anderton D.L. (1993), *Readings in Population* Research *Methodology, Vol. I-VIIIl,* United Nations Fund; Social Development Centre, Chicago.

4.   Impagliazo J. (1993), *Deterministic Aspects* of *Mathematical Demography,* Springler Verlag, New York.

5.   Rukanuddin AR. and Farooqi, M.N.I.., (1988), *The State of Population in Pakistan - 1987,* NIPS, Islamabad.

6.   Keyfitz N. (1983), *Applied Mathematical Demography,* Spnngler Venag N.Y.

7.   United Nations (1996), *Added years of Life in Asia*. ESCAP; U.N., Thailand.

8.   United Nations (1998), *World Population Assessment*, UNFPA: New York.

SEMESTER VI

Course Title **Probability and Probability Distributions-II**
Course Code: STA-502
Credit Hours: 4(4-0)

THEORY:

Transformation of variables of continuous and discrete types. Expectations of functions of random variables. Sum, Product and quotient of random variables. Cumulative distributions function and moment generation function techniques. Derivation of x^2, t and F-distributions and their properties. Cochran,s theorem. Distributions of sample mean and variance and their properties.
Bivariate distributions. Marginal and conditional distribution. Statistical independence. Conditional expectation and variance. Bivariate normal distribution and its properties. Variance of linear function of random variables.

Multivariate normal distribution. Its mean vector, covariance matrix and moment generating function j. Marginal and conditional distributions Distribution of quadratic forms in normally distributed random variable. Moments of quadratic forms.
Distribution of rth order statistics. Marginal density function of $Y_{(1)}$, Marginal density function of $Y_{(n)}$. Distribution of i-th and j-th order statistics. Joint density function of Y(1) and Y(n). Distribution of sample range, sample mid range. Moments of these order statistics and their properties. Sample Cumulative Distribution function.

RECOMMENDED BOOKS:

1. Evans, M., Hastings, N. and Peacock, B. (2000). Statistical Distributions. Willey Interscience.
2. Hogg, R.M. and Craig, A.T. (1995), Introduction to Mathematical Statistics Prentice Hall, Engle wood Cliffs, New Jersey.
3. Hirai, A.S. (1998), A course in Mathematical Statistics, Ilmi Kutab Khana, Lahore.
4. Mood, A.M, Graybill, F.A and Boss, D.C. (1997). Introduction to the Theory of Statistics, MacGraw Hill, New York.
5. Nitis, M. (2000). Probability and Statistical inference. Marcel Dekker, USA.
6. Rohatgi, V.K. and Saleh, E. (2008). An introduction to Probability & Statistics John Willey & Sons (Asia) Pte. Ltd.
7. Ross, S.M. (2002). Introduction to probability Models, Academic Press.

SEMESTER VI

Course Title   **Sampling Techniques-II**
Course Code: **STA-504**
Credit Hours: **3(3-0)**

THEORY:

Ratio Estimates in Simple and Stratified Random Sampling. Linear Regression Estimates and Their Variances in Simple and Stratified Sampling, Bias of Ratio and Regression Estimates
The Variance and Estimated Variance for Ratio and Regression Estimates, Construction of Confidence Limits, Comparison of Simple Ratio and Regression Estimates, Combined Ratio and Separate Ratio Estimates.
Systematic Sampling, Sampling Variance of Estimate of Mean and Total, Comparison of Systematic Simple Random and Stratified Sampling for Linear Trend Population, Stratified Systematic Sampling in two Dimensions, One Stage Cluster Sampling, Sub-Sampling with Units of Equal and Unequal Sizes.
Critical Study of National Sample Surveys conducted in Pakistan: Census of Agriculture, Household Income and Expenditure Survey (HIES), Pakistan Demographic Survey (PDS) and National Population and Housing Census and Surveys (NPHCS)

Books Recommended

1.   Cochran, W.G.(1996). *Sampling Techniques,* John Wiley and Sons, New York.

2.   Kish, L. (1992). *Survey Sampling,* John VYiley, New York.

Reference Books

1.   Ferguson, T.S. (l996), *A course in large sample theory*, Chapman & Hall, London.

2.   Sukhatme, P.V, Sukhatme, B., Sukhatme, S., and Asok, A. (1985). *Sampling Theory* of *Survey with Application.* lowa State University Press.

3.   Des Raj, *Design of Sample Survey.* McGraw Hill, New York.

      Singh, R. and Singh N, (1996), *Elements of Survey Sampling,* Kulwar, Dodrecht

SEMESTER VI

Course Title	**Design and Analysis of Experiments-I**
Course Code:	**STA-506**
Credit Hours:	**4(4-0)**

THEORY:

Principals of Design of Experiments. Analysis of Variance and its Assumptions, Models: Fixed, Random and Mixed Effects Models. Analysis of Fixed Effects Models, Decomposition of Total Sum of Squares, Expected Values of Mean Squares. Model Adequacy Checking. Violation of the Assumptions and Transformations, Statement of Cochran's Theorem, Multiple Comparison Tests: Fisher's LSD Test, Duncan's Multiple Range Test (DMRT), Tuky's W-Honestly Significant Difference (HSD) Test, Scheffe's Test. Contrasts, Orthogonal Contrast, Testing of Hypotheses Involving Contrasts (Single Degree of Freedom Comparison), Scheffe's Method for comparing all

Contrasts, Confidence Intervals

Basic Experimental Designs (Completely Randomized, Randomized Complete Block, Latin Square), Graeco-Latin Square. Cross-Over Designs. Layouts and Analysis. Missing Observations. Relative Efficiency of Designs. Analysis of Covariance with One Concomitant Variable For CR, RCB And LS Designs. Estimation of Missing Values by Analysis of Covariance.

Books Recommended

1.   Montgomery D.C. (2000). *Design and Analysis* of *Experiments,* John Wiley, New York.

   2. Steel, Rebert, G.D., Torrie James H., and Dickey David A. (1997). *Principles and Procedures of Statistics*: *A Biometrical Approach*: Third Edition. McGraw Hill, New York.

Reference Books

1.   Kempthorne, O. and Mann, K.H. , Introduction to Experimental Design, , John Wiley & Sons.

2.   Boniface, D.R. (1995). *Experiment Design & Statistical Methods,* Chapman & Hall.

3.   Myres, R.H. and Montgomery, D.C. (1995). *Response Surface Methodology; Process & product Optimization using design,* John Wiley.

4.   Clarke, G.M. (1994). *Statistics & Experimental Design.,* Edward Arnold.

5.   Harold, R. L. (1992) Analysis of Variance in Experimental Design. Springer Verlag:

6.   Maxwell, S.E. and Delaney, H.D.(1990). Designing Experiments and Analysis of Data. A model comparison perspective. Belment and Wadeson

SEMESTER VI

Course Title   Statistical Quality Control
Course Code: STA-508
Credit Hours: 3(3-0)

THEORY:

Concept of quality control; total control; Total Quality Management (TQM). Statistical Methods in Quality Improvement. Statistical Process Control (SPC). Statistical Quality Control (SQC).
Shewhart control charts: philosophy, construction, advantages. CUSUM and moving average control chart: Average Run Length (ARL); Fast Initial Response (FIR). ARL and FIR for X, R and S-charts. Process capability analysis: Designed experiments. Process improvements using design of experiments. Orthogonal fractional factorial designs. Acceptance sampling for attributes and variables.
Acceptance sampling plans: Single, double, and multiple sampling plans with their O.C. curves, Military Standard 105 Sampling Plans. Introduction to ISO-9000 and ISO-14000 series.
Basic concepts of reliability: Structural reliability. Lifetime distributions (Failure models): Hazard rate; Gamma, Weibull, Gumbel, Log-Normal and Inverse Gaussian. Stochastic fatigue-rate models; point and interval estimation.

Books Recommended

1.   Montgomery, D.C. (1998); *Introduction to Statistical Quality Control.* MacGraw Hill, New York.

Reference Books

1.   Miltag H.J. and Rinne H. (1993), *Statistical Methods of Quality Assurance,* Chapman & Hall, London.

2.   Nelson, W. (1990); *Accelerated Testing.* John Wiley, New York.

3.   Gertsbakh, I.B. (1989); *Statistical Reliability Theory.* Marcel Dekker, New York.

4.   Banks, J. (1989); *Principles of quality Control.* John Wiley, New York.

5.   Ryan, T.P. (1989); *Statistical Methods for Quality Improvement.* John Wiley, New York.
6.   Juran, J.M. and Grayana, F.K. (1988). '*Juran's Quality Control Handbook'*. McGraw Hill New York.

7.   Feigenbaum A.V. (1986). *Total Quality Control.* McGraw Hill, New York.

8.   Lawless, J.F. (1982); *Statistical Models and Methods for Lifetime Data.* John Wiley, New York.

SEMESTER VI

Course Title	**Survey Research Methods**
Course Code:	**STA-510**
Credit Hours:	**3(3-0)**

Aims and objectives:

To introduce the applications and properties of different probability distributions as well as to create a relationship among various distributions.

THEORY:

The Nature of Social Survey, Preliminary Study, The main Planning Problems, Pre-Test and pilot Survey, The Coverage of the Surveys, Methods of Collecting the Information; Documentary Soruces, Observation, Mail Questionnaires, Interviewing. Construction of Questionnaires; General principals of design, Question content, Question wording, open and pre-coded Questions, Question order. Scaling methods; Types of scales, rating scales, Thurstone scales, Likert Scales, Guttman Scales.Editing, Coding, Tabulation, Report Writing.

Sample Survey Project:

Conducting a small scale survey and preparing a comprehensive report.

Books Recommended

1. Abrams, M. A. (1951). Social Surveys and Social Actions, Heimemann, London.
2. Backstrom, C. H. and Hursh, G.D. (1963). Survey research,. North-western University Press, Evanston, III
3. C.A. Moser and G.Kalton. (1971), Survey Methods in Social Investigation, Ashgate, England.

SEMESTER VII

Course Title	**Econometrics-I**
Course Code:	**STA-601**
Credit Hours:	**4(4-0)**

THEORY:

Introduction and Basic Concepts; Nature of Econometrics, Simple Linear Regression and Least Square Estimators, Properties of Linear Regression and Least Square Estimators, Inference in the Least Square Model, Equivalence of Three Test of Regression Coefficients i.e. Regression, ANOVA & Correlation. Tests of Equality of Regression Coefficients and Intercepts of the Simple Linear Regression, Prediction in the Least Square Model.

Linear Regression Models: General Linear Model, Assumptions of the Linear Model, Ordinary Least Squares Estimators, Properties of Least Squares Estimators, Partition of the total Sum of Square & Degrees of Freedom, Properties of the Residual, Prediction in General Linear Regression Model, Significance Tests and Confidence Intervals, Tests of Single and Set of Regression Coefficients. Least Square Estimators for Partition Matrix, Use of Extraneous Information in General Linear Regression Model, Tests of Significance of Subset of Coefficients, Exact Linear Restrictions, Extraneous Unbiased Restricted Estimator for Partition Matrix

Detection and Study of Outliers, Orthogonal Polynomials, Stepwise Regression, PC Regression. Specification of Models, Introduction to Models with Binary Response Variables, Generalized Linear Models, Generalized Additive Models.

Books Recommended

1.   Gujrati. D. (1998). *Econometrics,* John Wiley, New York.

2.   Johnston, J. and Di. Nardo, J., (1997). *Econometric Method,* Latest Edition, McGraw Hill, New York.

Reference Books

1.   Baltagi, B. H. (1999). Econometrics, Latest Edition, Springler Varlog.

2.   Draper, N.R. and Smith, H. (1998). *Applied regression analysis,* John Wiley, New York.

3.   Wonnacot, T.H. and Wonnacot R.J. (1981). *Econometrics,* John Wiley, New York.

4.   Guttman, I. (1980); *Linear Models: An Introduction,* John Wiley, New York.

5.   Koutsoyiannis, A. (1980), *Theory of Econometrics,* MacMillan.

SEMESTER VII

Course Title   **Design and Analysis of Experiments-II**
Course Code: **STA-603**
Credit Hours: **4(4-0)**

THEORY:

Factorial Experiments: 2^k, 3^k Series and Mixed Level Factorial Experiments and Their Analyses. Advantages and Disadvantages of Factorial Experiments $P \times Q$ Factorial In Randomized Complete Design.

Confounding in Factorial Experiments: Complete and Partial Confounding. Confounding in Fractional Replications, Split-Plot, Split Block and Nested Design. Missing Observations in Split-Plot Design.

Incomplete Block Designs: Balance Incomplete Block Design BIBD-Lattice Designs, Lattice Square and Youden Squares. Partially Balance Incomplete Block Design PBIBD with Recovery of Intra-Block Information. Generalized Lattices, Introduction of Response Surface Methodology: First and 2nd Order Designs, Central Composite Designs, Fitting of Response Surface Models and Estimation of Optimum/Maximum Response.

Books Recommended

1.   Montgomery D.C. (2000). *Design and Analysis* of *Experiments,* John Wiley, New York.

2.   Steel, Rebert, G.D., Torrie James H., and Dickey David A. (1997). *Principles and Procedures of Statistics*: *A Biometrical Approach*: Third Edition. McGraw Hill, New York.

Reference Books

1.   Mead, R. (1988). *The Design of Experiments.* Cambridge University Press, Cambridge.

2.   Dad, M.N. and Giri, N.C, (1986). *Design and Analysis* or *Experiments.* John Wiley: New k.

3.   Steel, Rebert, G.D., Torrie James H., and Dickey David A. (1997). *Principles and Procedures of Statistics*: *A Biometrical Approach*: Third Edition. McGraw Hill, New York.

4.   Gomez, K.A., and Gomez, A.A. (1984). *Statistical Procedures for Agricultural Research,* Latest Edition, John Wiley, New York.

5.   Hicks, C.R. (1982) *Fundamental Concepts in Design and Analysis of Experiments;* Saunders.

6.   Cochran, W.G. and Cox, G.M. (1957). *Experimental Design,* John Wiley, New York.

SEMESTER VII

Course Title   **Multivariate Analysis-I**
Course Code: **STA-605**
Credit Hours: **3(3-0)**

THEORY:

Matrix Algebra. Introduction to Multivariate Analysis, Linear compound and linear combinations, Eigen values and eigen vectors.

Multivariate normal distribution, Its mean vector, covariance matrix , Moment generating function marginal distribution and conditional distribution, Estimation of mean vector and covariance matrix, Wishart distribution and their properties,

Hotelling's T^2 distribution and its application. Multivariate analysis of Variance (MANOVA).

Books Recommended

1.   Johnson, R.A. and Wichern, D.W. (1992). *Applied Multivariate   Statistical Analysis.* Prentice Hall, London.

2.   Morrison, D. F. (1990) *Multivariate Statistical Methods,* McGraw Hill, NewYork.

3.   Mardia, K.V., Kent, J.T. and Bibby, J.M. (1979) *Multivariate Analysis,* Academic Press, London.

Reference Books

1. Afifi, A. A. and Clark Virginia (4984). *Computer Aided Multivariate Analysis,* Lifetime learning publications. Belmont California.

2. Anderson, T.W. (1984). An *Introduction to Multivariate Statistical Analysis,* John Wilery, New York.

3. Chatfield, C. and Collins, A.J. (1980) *Introduction to Multivariate Analysis,* Chapman and Hall, London.

4. Everitt, B.J.(1974). *Cluster Analysis,* MacGraw Hill, New York.

5. Flury B. (1997) *A First Course in Multivariate* Statistics, Springler Valerg, New York.

6. Manly, B.F.J. (1994). *Multivariate Statistical Methods,* A Primer Latest Edition, Chapman and Hall, London.

SEMESTER VII

Course Title   Statistical Inference-I
Course Code: STA-607
Credit Hours: 3(3-0)

THEORY:

Properties of Estimators: Unbiasedness, Consistency, Sufficiency, Efficiency, Completeness. Cramer-Rao Inequality, Rao-Blackwell Theorem, and Lehman- Scheffe Theorem. Methods of Estimation of Parameters: Moments, Maximum likelihood, Least-squares, Minimum Chi-square, Bayesian method, Lyod's Method.

Recommended Books:

1. Mood, A.M., Graybill, F.A. and Boss D.C. (1997). *Introduction to the Theory of Statistics.* McGraw Hill, New York.

2. Hogg, R.V. and Craig, AT (1996). *Introduction to Mathematical Statistics.* Prentice Hall, New Jersey.

Reference Books

1. Levy, P.S. and Lemeshow, S. (1999). *Sampling of Populations: Methods and Applications,* Latest Edition, John Wiley, New York.

2. Lindgren, B.W. (1998). *Statistical Theory.* Chapman and Hall, New York.

3. Lehmann, E.L. (1997) *Testing Statistical Hypotheses.* Springler-Valag, New York.

4. Zacks, S. (1978), *Parametric Statistical Inference,* John Wiley, New York.

5. Lehmann, E.L. (1983) *Theory of Point Estimation.* John Wiley, New York.

6. Rao, C.R. (1973). *Linear Statistical Inference and its Applications,.* John Wiley, New York.

7. Stuart, A. and Ord. J.K. (1998). *Kendalls' Advanced Theory of Statistics* Vol. II. Charles Griffen, London.

SEMESTER VII

Course Title   **Statistical Software-II**
Course Code: **STA-609**
Credit Hours: **3(0-3)**

Statistical Data Analysis using any software; SPSS, or STATISTICA or SAS, Matlab

SEMESTER VII

Course Title   **Seminar**
Course Code: **STA-629**
Credit Hours: **1(0-1)**

A special problem given by supervisor.

SEMESTER VIII

Course Title   **Econometrics-II**
Course Code: **STA-602**
Credit Hours: **4(4-0)**

THEORY:

Errors In Variables, Problems of Autocorrelation; The Nature of the Problem, OLS Estimation in the Presence of Autocorrelation, The BLUE Estimator in the Presence of Autocorrelation, Consequences of Using OLS Estimation in Presence of Autocorrelation, Its Detection & Remedial Measures. Multicollinearity: It's Nature & the Estimation in the Presence of Multicollinearity, Consequences of Multicollinearity, Detection of Multicollinearity & its Remedial Measures.
Heteroscedasticity; its Nature & The OLS Estimation in the Presence Of Heteroscedasticity, Consequences of Using OLS in the Presence of Heteroscedasticity, Detection of Heteroscedasticity, Its Remedial Measures.
       Ridge Regression, Lagged Variables, Dummy Variables, System of Simultaneous Linear Equations, Identification-Estimation Method: Least Variance Ratio, Two-Stage, Three-Stage and Restricted Least Squares. Test of Identifying Restrictions, Problems of Income and Wealth Distributions.

Books Recommended

1.   Gujrati. D. (1998). *Econometrics,* John Wiley, New York.

2.   Johnston, J. and Di. Nardo, J., (1997). *Econometric Method,* Latest Edition, McGraw Hill, New York.

Reference Books

1.   Maddala, G.S. (1977). Econometrics, McGraw Hill. New York.

2.   Searle, S.R.(1971) *Linear Models,* John Wiley, New York.

3.   Montgomery, D.C., and Peck E.A. (1992). *Introduction to linear Regression Analysis,* Latest Edition. John Wiley and sons Inc. New York.

4.   A Re-issue of Statistical Methods for Research Workers, The Design of Experiments and Statistical Methods and Scientific Inference, Edited by J. H Bennett, with a forward by F. Yates.

SEMESTER V

Course Title   **Statistical Software-III**
Course Code: **STA-608**
Credit Hours: **3(0-3)**

Data Analysis and Statistical Programing using R Language

SEMESTER VIII

Course Title   **Multivariate Analysis-II**
Course Code: **STA-606**
Credit Hours: **3(3-0)**

THEORY:

Principal Component Analysis; Derivation of Principal Components, Principal Components From Covariance Matrix and Correlation matrix. Advantages and Disadvantages of Principal Component Analysis. Factor Analysis; Estimating the Factor Loading and Error Variance, Factor Rotation. Method of Estimation.
Discriminant Analysis; Discrimination Rules, Classification, Calculation of Misclassification Probabilities. Canonical Correlation; Derivation of Canonical Correlations and Canonical Variables, Identifying the Canonical Variables. Cluster Analysis. Multidimensional Scalling

Books Recommended

1.   Johnson, R.A. and Wichern, D.W. (1992). *Applied Multivariate Statistical Analysis.* Prentice Hall, London.

2.   Morrison, D. F. (1990) *Multivariate Statistical Methods,* McGraw Hill, NewYork.

3.   Mardia, K.V., Kent, J.T. and Bibby, J.M. (1979) *Multivariate Analysis,* Academic Press, London.

Reference Books

1.   Afifi, A. A. and Clark Virginia (4984). *Computer Aided Multivariate Analysis,* Lifetime learning publications. Belmont California.

2.   Anderson, T.W. (1984). An *Introduction to Multivariate Statistical Analysis,* John Wilery, New York.

3.   Chatfield, C. and Collins, A.J. (1980) *Introduction to Multivariate Analysis,* Chapman and Hall, London.

4.   Everitt, B.J.(1974). *Cluster Analysis,* MacGraw Hill, New York.

5.   Flury B. (1997) *A First Course in Multivariate* Statistics, Springler Valerg, New York.

6.   Manly, B.F.J. (1994). *Multivariate Statistical Methods,* A Primer Latest Edition, Chapman and Hall, London.

SEMESTER VIII

Course Title   **Statistical Inference-II**
Course Code: **STA-604**
Credit Hours: **3(3-0)**

THEORY:

Interval Estimation: Pivotal and other methods of finding confidence interval, confidence interval in large samples, shortest confidence interval, optimum confidence interval. Bayes Interval estimation.

Tests of Hypotheses: Simple and composite hypotheses, critical regions, Neyman-Pearson Lemma, power functions, uniformly most powerful tests. Deriving tests of hypothesis concerning parameters in normal, exponential, gamma and uniform distributions. Randomized Tests, Unbiased tests, Likelihood ratio tests and their asymptotic properties. Generalized likelihood-ratio tests.

Sequential Analysis: Introduction to sequential tests, Average sample number and Operating Characteristic functions.

Noncentral Distributions: The derivation of Chi-square, t and F and their applications.

Recommended Books:

1. Mood, A.M. Graybill, F.A. and Boss D.C. (1997). *Introduction to the Theory of Statistics.* McGraw Hill, New York.
2. Hogg. R.V. and Craig, AT (1996). *Introduction to Mathematical Statistics.* Prentice Hall, New Jersey.

Reference Books

1. Levy, P.S. and Lemeshow, S. (1999). *Sampling of Populations: Methods and Applications,* Latest Edition, John Wiley, New York.
2. Lindgren, B.W. (1998). *Statistical Theory.* Chapman and Hall, New York.
3. Lehmann, E.L. (1997) *Testing Statistical Hypotheses.* Springler-Valag, New York.
4. Zacks, S. (1978), *Parametric Statistical Inference,* John Wiley, New York.
5. Lehmann, E.L.(1983) *Theory of Point Estimation.* John Wiley, New York.
6. Rao, C.R., (1973). *Linear Statistical Inference and its Applications,.* John Wiley, New York.
7. Stuart, A and Ord J.K. (1998). *Kendalls' Advanced Theory of Statistics* Vol. II. Charles Griffen, London.

➤   **ANY ONE FROM THE FOLLOWING OPTIONS**

SEMESTER VIII

Course Title   **Research Report**
Course Code: **STA-630**
Credit Hours: **4(0-4)**

OR

SEMESTER VIII

Course Title   **Analysis of Time Series and forecasting**
Course Code: **STA-610**
Credit Hours: **4(4-0)**

Stochastic Process, Stationary Time Series, Exponential Smoothing Techniques, Auto-Correlation and auto-covariance, estimates functions and standard error of the auto-correlation functions and PACF, Period gram, Correlogram, spectral density functions, comparison with ACF , Linear stationary models, autoregressive, moving average and mixed models, Non-stationary models, general ARIMA notations and models, minimum mean square forecasting, ARIMA Seasonal Models.

Books Recommended:
1. Chatfield, C. (1996). "The Analysis of Time Series: An Introduction", Chapman and Hall, London.

2. Box, G.E.P. and Jenkins, G.M (1999). "Time Series Analysis: Forcasting and Control", San Francisco.

Reference Books:
1. Cox, D. R., Hinckley D.V. and Nielsen O.E.B. (1996). "Time Series Models- In Econometrics, finance and other fields", Chapman & Hall London.

2. Andy, P, West M. and Harrison, P. J. (1994) "Applied Bayesian Forecasting and Time Series Analysis ", Chapman & Hall New York.

3. Harvey, A.C. (1990). "Forecasting Structual Time Series Models and the Calamander", Cambridge University Press, Cambrige.

4. Daggle, P.J. (1990), "Time Series: A Biostatistics Introduction", Clarendon Press, Oxford.

5. Bovas, A. and Johannes, L. (1983), "Statistical Methods for Forcasting", John Wiley. New York. 6. Priestley, M.B. (1981), "Spectral Analysis and Time Series", Academic Press, London

OR

SEMESTER VIII

Course Title	Categorical Data Analysis
Course Code:	**STA-612**
Credit Hours:	**4(4-0)**

Introduction, describing two-way contingency tables, inference for two-way contingency tables, models for binary response variables, Log linear models, Fitting log linear and logit models, building and applying log linear models, log linear logit models for ordinal variables, multinomial response models for matched pairs, analyzing repeated categorical response data, logistic regression models and their analysis

Books Recommended:
1. Agresti, A. (1990), "*Categorical Data Analysis*", John Wiley and Sons.
2. Cox, D.R. and Snell, E.j. (1989). " *The Analysis of Binary Data*", Chapman and Hall, London.

Reference Books:
1. Bishop, Y.V.V., Fienberg, S.E. and Holland, P.W. (1975). "*Discrete Multivariate Analysis*", MA: MIT Press Cambridge.
2. David, W.H., Leweshow, S.L. (1989). " *Applied Logistic Regression*".
3. Mc Gullah, P. and Nelder, J.A. (1989). "*Generalized Linear Models*", 2ⁿᵈ ed. Chapman and Hall, London.

OR

SEMESTER VIII

Course Title	Non Parametric Methods
Course Code:	**STA-618**
Credit Hours:	**4(4-0)**

The Binomial Test and Estimation of p, The Quantile Test and Estimation of the p-th quantile. Location estimates for single samples: The sign test, modified sign test, Wilcoxon signed rank test, confidence interval based on these tests, Runs test for randomness.

Distribution test and rank transformation. Kolmogrov's test, Lilliefer's test and Shapiro-Wilks test for normality, Tests and estimation for two independent samples; the median test, Wilcoxon Mann-whitney test, The Siegal-Turkey test, the squared rank test for Variance, Smirnov test, Tests for Paired samples, Kruskal-Wallis test, Friedman test, Multiple comparison with the Friedman test, Cochran's test for binary responses. Spearman's rank correlation coefficient, Kendall's rank correlation coefficient. Theil's regression method.

Recommended Books

- Conover, W.J. (1999), Practical Nonparametric Statistics, 3rd Edition. John Wiley and Sons, New York.
- Gibbons, L.D. and Chakraborti, S. (1992). Nonparametric Statistical Inference. Marcel Decker, New York.
- Hollander, M. and Wolfe, A.D. (2013).Nonparametric Statistics Methods, 3rd Edition. John Wiley and Sons, New York.
- Maritz, J.S. (1995). Distribution-Free Statistical Methods. Chapman & Hall London.

Sprent, P. and Smeeton, C.N. (2007). Applied Nonparametric Statistical Methods, 4th Edition. Chapman & Hall London.

OR

SEMESTER VIII

Course Title	Survival Data Analysis
Course Code:	**STA-614**
Credit Hours:	**4(4-0)**

Special features of Survival data: Patient time and study time, Survival function and hazard function, Time dependent and censored survival data. Nonparametric procedures: Estimation of Survival function, hazard function, median and percentiles of Survival times. Confidence interval and comparison of groups; stratified and log-rank tests for trend. Modeling of Survival data; hazard function modeling; its tests and confidence interval. The Weibul model for survival data. Exploratory data analysis and other models. Sample size requirement for survival study. Computer software for survival analysis; any available software like SPSS, S-plus, SAS, STATA.

Recommended Books:

1. Lee, E.T. (1997). "*Applied Survival Analysis*", John Wiley and Sons, New York.
2. Parmer M.K.B. & Macklin D. (1995). "*Survival Analysis: A Practical Approach*", John Wiley New York.
3. Lee, E.T. (1992). "*Statistical Methods for Survival Data Analysis*", John Wiley. N.Y.

Reference Books:

1. Muller, R.G. and Xian Zhou (1996). "*Survival Analysis with long-term Survivors*", John Wiely. New York
2. Brkett, M. (1995). "*Analyzing Survival Data from Clinical Trials and Observational Studies*", John Wiley New York.
3. Collett, D. (1994). "*Modeling Survival Data in Medical Research*", Chapman & Hall, London.
4. Eland Johnson, R.C and Johnson N.L. (1989). "*Survival Models & Data Analysis*", John Wiley N.Y.
5. Turkey, J. (1987). "*Exploratory Data Analysis*", Johm Wiley, New York.
6. Cox, DR. and Oakes, D. (1984). " *Analysis of Survival Data*", Chapman & Hall London

SEMESTER VIII

Course Title   **Bayesian Statistics**
Course Code: **STA-616**
Credit Hours: **4(4-0)**

THEORY:

What is Bayesian, Prior information, Prior distributions, Posterior distribution, and Different Loss functions: squared error loss function, absolute loss function, etc. Different prior distributions: informative prior, non-informative prior, Bayes estimators under loss functions, mean and variances of uni-variate and bivariate posterior distributions, predictive prior and posterior distribution, Bayesian hypothesis testing: Bayes factor, the highest density region; posterior probability of the hypothesis.

RECOMMENDED BOOKS:

1. Bernardo, J. M & Smith, A.F.M, Bayesian Theory, John Wiley, New York. (1994).
2. Lee, P. M. Bayesian Statistics, An Introduction, Oxford University Press New York (1991).
3. O. Hagan A. Kendall's Advanced Theory of Statistics (Vol 2B), Bayesian Inference, Cambridge, The University Press (1994).