Affiliated 7 Colleges Under Dhaka University  
Subject: Statistics  
Syllabus for 4-Years BS (Honors)  
Starting Session: 2017-2018 (DU Admission)

Syllabus for 3rd Year and 4th Year BS (Honors)

Third Year Syllabus (Structure):

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stat H-301</td>
<td>Test of Hypothesis</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-302</td>
<td>Sampling Techniques</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-303</td>
<td>Regression Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-304</td>
<td>Epidemiology</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-305</td>
<td>Industrial Statistics and Operations Research</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-306</td>
<td>Demography</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-307</td>
<td>Simulation</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-308</td>
<td>Lab-VI: Introduction to SPSS</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-309</td>
<td>Lab-VII: Regression Analysis &amp; Test of Hypothesis (Using R/SPSS)</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-310</td>
<td>Lab-VIII: Demography and Industrial Statistics (Using R/SPSS)</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-311</td>
<td>Viva Voce</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>34</strong></td>
</tr>
</tbody>
</table>
Third Year Detailed Syllabus:

Stat H-301: Test of Hypothesis  4 Credits

Preliminaries of tests: Hypothesis, simple and composite hypotheses, null and alternative hypotheses, concept of test of significance, procedures of a test, errors in testing hypothesis, level of significance, power of a test, one-tailed and two-tailed tests, p-value.

Common tests of hypothesis: Testing the significance of single mean, single variance, single proportion, difference of two means and proportions, ratio of two variances, simple correlation coefficient and regression coefficient for single and double sample. Paired t-test. Testing the homogeneity of several population means, variances and proportions. Statement about p-values for these tests.

Association of attributes: Association & disassociation, Measure of association, Contingency tables, General test of independence in an r x c contingency table. Fisher’s exact test for a 2x2 contingency table. Test of goodness of fit.

Evaluation of tests: Power function, best critical region, most powerful test, unbiased test, Neyman-Pearson lemma, uniformly most powerful test, Monotone likelihood ratio test, a decision theoretic view of hypothesis testing.

Likelihood Ratio Test: Introduction and distribution of likelihood ratio, properties, tests for single, double and several means, variances, regression and correlation coefficients.

Sequential Probability Ratio Test: Introduction, SPRT, Determination of constants, operating characteristic function, Average sample number, graphical procedure, Truncation of SPRT.

Non-Parametric Tests: Concepts of Non-Parametric tests, useful Non-Parametric tests like sign test, Rank test, Run test, Signed rank test, Median test, Kolmogorov-Smirnov test of Goodness of fit, Kruskal Wallis test, Cochran’s test, Stratified Rank Sum test, Friedman test and Spearman Rank Correlation test.

Text

References

চেয়ারম্যান
পরিসংখ্যান বিভাগ
চাকা বিশ্ববিদ্যালয়
Simple random sampling: Estimates of population characteristics and standard errors. Sampling for proportions, randomization theory results for simple random sampling, a model for simple random sampling situations where a simple random sample is appropriate.

Systematic Sampling: Estimation of population characteristics, systematic sampling in some special populations.

Stratified Sampling: Definition and basic ideas, theory of stratified sampling, allocating observations to strata, defining strata, a model for stratified sampling, post-stratification, stratified versus quota sampling.

Ratio & Regression estimation: Use of auxiliary data in ratio estimation, regression estimation, regression models, design implications of regression models, comparison of ratio and regression estimation method.

Cluster sampling: Notation for cluster sampling, one-stage cluster sampling, designing a cluster sample, models for cluster sampling. Comparison with simple random sampling and systematic sampling. Determination of optimum cluster size. Stratified cluster sampling.


Sampling of unequal clusters with unequal probability without replacement --different selection methods: Brewer's, Durbin's, Sampford's, PPS systematic, Raj's, Murthy's and Rao-Hartley-Cochran methods of selection. Detailed study on the related formulae, estimates, variances, estimates of variances for these methods.

Sample size: Concepts of sample size estimation. Determination of sample size for estimating mean and proportions. Design effect, sample size for comparison of two means or proportions.

Text
Lohr, S.L., (2005), Sampling Design and Analysis, Brooks/Cole

References
2. Islam, M.N., (2008), An Introduction to Sampling Methods, Book World
4. Kish, L., (1965), Survey Sampling, wiley
Fitting a straight line by Least Squares: Linear relationship between two variables, linear regression: fitting a straight line by least squares, the analysis of variance, confidence intervals and tests for $\beta_0$ and $\beta_1$, test for significance of regression.

Checking the straight line fit: Lack of fit and pure error, testing homogeneity of pure error, examining residuals: the basic plots, non-normality checks of residuals, checks for time effects, non-constant variance, need for transformation and curvature, other residual plots.

Simple Linear Regression in Matrix Notation: Fitting a straight line in matrix terms, Singularity: what happens in regression to make $X'X$ singular? The analysis of variance in matrix terms, the variances and covariance of $b_0$ and $b_1$ from matrix calculation, variance of $\hat{y}$ using the matrix development, summary of matrix approach to fitting a straight line (nonsingular case).

Multiple Linear Regression: Model fitting, least squares properties, confidence interval versus regions.

Extra Sums of squares and Tests: The “extra sum of squares” principle, partial and sequential F tests.

More on checking fitted models: The hat matrix $H$ and the various types of residuals, Cook’s statistics.

Multiple regression- special topics: Generalized least squares and weighted least squares: examples, restricted least squares, inverse regression (multiple predictor case).

Transformation of independent variables: Polynomial regression fitting, splines.

Transformation of the response variable: Introduction and preliminary remarks, power family of transformations on the response, Box-Cox method, transformations chosen to stabilize variance.

Indicator/Dummy variable: Indicator variables versus regression on allocated codes, dummy variables to separate blocks of data with different intercepts same model, interaction terms involving dummy variables, dummy variables for segmented models.

Selecting the “Best” regression equation: All possible regressions and “best subset” regression, stepwise regression, backward elimination, significance levels for selection procedures.

Ridge regression: Introduction, basic form of ridge regression, circumstances when ridge regression is absolutely the correct way to proceed, use of ridge regression in model selection.

Orthogonal polynomials: Introduction, model fitting, properties.

Text

References:

Stat H-304: Epidemiology

Epidemiologic Concepts: Definition and Scope of Epidemiology, Key Issues in Epidemiology; Health and Disease; Sources of Data on Community Health, Vital Statistics and Morbidity Data; Descriptive Epidemiology: Person, Place, Time: Analytic Epidemiology: Causality.
Types of Epidemiologic Research: Experimental (Laboratory, Clinical Trial, and Community Intervention), Quasi Experimental (Clinical/Laboratory, Program/Policy), Observational Studies: design options in observational studies — methods of observations; typology of observational study designs (Cohort, Case-Control, and Cross-sectional Studies).

Measures of Disease Frequency: Incidence and Prevalence; Basic measures of Incidence and Prevalence, Mortality Measures, Age, Period and Cohort Effects.

Measures of Association: Ratio Measures and Difference Measures (Relative Risk, Odds Ratio; Risk Difference etc.), Comparison of Proportions from Different Samples, Standard Error of Estimators, Test of Hypotheses.

Measures of Potential Impact: Etiologic Fractions, Prevented Fractions.


Validity: Validity and Precision, Direction of Bias, Sources of Bias, Selection Bias, Information Bias, Misclassification Bias.

Stratified Analysis: Test for Overall Association, Mantel-Haenszel Estimator and Test, Confounding, Criteria and Test for Confounding (Single Factor Confounding).

Matching: Definition of Matching, Types of Matching Schemes, R-to-1 Matching, Comparison of m Matched Samples, McNemar Test.


Text

References
Greenberg, R.S. et. al.

Stat H-305: Industrial Statistics and Operations Research 4 Credits

Industrial Statistics:

**Operations Research:**

**Linear Programming:** Introductions: Formulations of linear programming problems. Graphical Solutions of two variables problems. Principal theorems of Linear Programming, Simplex Method, Revised Simplex Method, Dual Simplex Method, Two-phase Method, Big-M Method.

**Game Theory:** Pure, Mixed and Optimal Strategy, Two-person zero sum game, Relationship between two-person zero sum game and linear programming symmetric games.

**Integer Linear Programming:** Formulation of Integer Linear Programming Problem by cutting plane and branch and Bound methods, Solution of mixed integer, Integer programming problem by cutting plane method.

**Inventory Models:** Deterministic Models. Single Item Static Model. Single Item Static Model with Price Breaks, Multiple Item Static Model with Storage Limitation.

**Transportation Problem:** Basic feasible solution of transportation problem, Optimality test, Degeneracy, Variations and Least time transportation problem, Trans-Shipement problem, Assignment problem.

**Network Models:** Scope and definition, Minimal spanning tree algorithm, Shortest-Route problem, Maximal flow model.

**Text**


**References**

Basic Concepts: Population studies and demography, scope of demography, population and demographic variables

Sources of demographic data: Primary and secondary sources. Vital registration, Survey and Census.

Demographic rates and ratios: Concepts of rates, ratios, proportions and probability. Crude rates & refined rate, Age-Sex composition, population pyramid, cohort and Lexis diagram.

Population change: Concept of population change, population growth, measurement of population growth.

Fertility and reproduction: Concept of fertility, reproduction, fecundity, fecundability, sterility. Measurements of fertility and reproduction, cohort fertility, parity progression ratio, differentials of fertility.


Marriage: Concept of marriage, estimation of mean and median age at marriage, estimation of singulate mean age at marriage, Coale’s indices ($I_g, I_r$ and $I_m$), their relationships and contributions to fertility differentials.


Texts
1. Shryock, H.S., J.S. et al., The methods and Material of demography.
2. Andrew Hinde, Demography methods.

References
1. Spiegelman, Introduction to Demography.
6. United Nations: Manuals I to XI.
8. Pressat, R., World Book in Demography (Latest ED.), Nethuen, London.
Introductory Examples of Simulation, Estimation, and Graphics: Simulating random samples from finite populations, Coverage probabilities of binomial confidence intervals

Generators: Introductory comments on random numbers, Linear congruential generators, Validating desirable properties of a generator, Transformations of uniform random variables

Generating random samples: Transformations involving normal random variables using Box-Muller method, Marsaglia method, Direct method, Indirect method, Accept/Reject algorithm, Generating data from different distributions such as Binomial, Poisson, Exponential, Gamma, Beta etc.

Monte Carlo methods: Buffon’s needle experiment, Monte Carlo integration and limit theorems, Law of Large Numbers, Central Limit Theorem

Variance reduction techniques: Antithetic sampling, Stratified sampling, Importance sampling and Control variates methods

Screening Tests: Prevalence, Sensitivity, and Specificity, Estimation of Prevalence, Predictive values, Bayes’ theorem for events

Metropolis algorithm: The Metropolis algorithm, Mathematical formulation and Hastings’s generalization, Some special algorithms such as Random-walk Metropolis, Metropolized independence sampler, Configurational bias Monte Carlo.


Text

References

Stat H-308: Lab VI: Introduction to SPSS

Introduction to SPSS: Meaning, Application and Background of SPSS; Reading the Data set: Reading SPSS Data, Reading Data from Spreadsheet formats, Reading Data from Simple Data base formats, Reading Data other Statistical Programs, e.g. STATA, SAS, etc; Defining the Variable: Variable type, Variable name, Variable formats, Variable Lables, Value Labels; Transformation Expressions: Numeric Expressions, Arithmetic Operations, Numeric Functions, Arithmetic Functions, Statistical Functions, Random Variable and Distribution Functions, Missing Values in Numeric
Expressions, Logical Expressions, Logical Functions, Relational Operators, NOT Logical Operator, AND and OR Logical Operators, Other Functions; Working with Data and Time: Data and Time formats, Arithmetic operations with data and time variables, Data and Time functions; Working with Commands: Introduction, Syntax Diagrams, Command Specification, Running Commands, Subcommands, Keywords, Delimiters, Command Order; Different commands in SPSS: Get, Save Out file, Split Files, Sort Cases, Add Files, Match Files, Import, Compute, Recode, If, Select If, Do If, End If, List, Aggregate, Sample selection.

Texts:

Stat H-309 Lab VII: Regression Analysis & Test of Hypothesis (Using R/SPSS) 2 Credits


Test of Hypothesis:
Common test of hypothesis: Testing the significance of single mean, single variance, single proportion, difference of two means and proportions, ratio of two variances, simple correlation coefficient and regression coefficient for single and double sample. Paired t-test. Testing the homogeneity of several population means, variances and proportions. General test of independence in an r × c contingency table. Fisher’s exact test for a 2 × 2 contingency table. Test of goodness of fit. Non-Parametric tests, Sign test, Rank test, Run test, Median test, Kolmogorov-Smirnov test.

Stat H-310: Lab VIII: Demography and Industrial Statistics (Using R/SPSS) 2 Credits

Demography: Age-sex composition, population payramid, population growth rate, calculation of various rates and ratios of fertility, mortality, nuptiality, migration, standardization.of rates and ratios. Construction of life tables, etc.

Industrial Statistics: Construction of control charts (variable and attribute). Natural tolerance and specification. Limits Acceptances sampling, Derivation of sampling plans (single and double) OC curves & ANS curves.

Stat H-312 Viva- voce 2 Credits
4th Year Syllabus (Structure):

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stat H-401</td>
<td>Multivariate Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-402</td>
<td>Time Series Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-403</td>
<td>Design and Analysis of Experiment</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-404</td>
<td>Econometrics</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-405</td>
<td>Biostatistics</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-406</td>
<td>Stochastic Process</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-407</td>
<td>Research Methodology</td>
<td>4</td>
</tr>
<tr>
<td>Stat H-408</td>
<td>Categorical Data Analysis</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-409</td>
<td>Lab-IX: Multivariate Analysis and Experimental Design (Using R/SPSS)</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-410</td>
<td>Lab-X: Biostatistics and Econometrics (Using R/SPSS)</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-411</td>
<td>Lab-XI: Time Series Analysis and Categorical Data Analysis (Using R/SPSS)</td>
<td>2</td>
</tr>
<tr>
<td>Stat H-412</td>
<td>Viva voce</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>36</td>
</tr>
</tbody>
</table>
4th Year Detailed Syllabus:

Stat H-401: Multivariate Analysis 4 Credits

Introduction: Concept of multivariate data, applications of multivariate techniques.

Multivariate distributions: Multinomial distribution with properties, Frequency $\chi^2$-distribution, Multivariate normal distribution (MND) with properties, derivation of multiple and partial correlation coefficients, estimation of parameters, Wishart distribution, Hotelling $T^2$ distribution and Mahalanobis $D^2$ their properties, Generalized variance and its distribution.

Distribution of quadratic forms: Quadratic forms and their central and non-central distributions. Expectations and variances and co-variances of quadratic forms. Independence of two or more quadratic forms.

Inference about a Mean Vector: Introduction, the plausibility of $\mu_0$ as a value for a normal population mean, Likelihood ratio tests, confidence regions and simultaneous comparisons of component means, large sample inferences about a population mean vector, inferences about mean vectors when some observations are missing.

Comparisons of Several Multivariate Means: Introduction, paired comparison and a repeated measures design, comparing mean vectors from two populations, comparing several multivariate population means (One-Way MANOVA), simultaneous confidence intervals for treatments effects, two-way multivariate analysis of variance, profile analysis, repeated measures designs and growth curves.

Multivariate Linear Regression Models: Introduction, the classical linear regression model, least squares estimation, inferences about the regression model, inferences from the estimated regression function, model checking, multivariate multiple regression.

Texts

References

Fundamental concepts: The autocovariance and autocorrelation function (ACF), the partial autocorrelation function (PACF), sample mean, sample autocovariance, sample ACF, sample PACF, moving average (MA) and autoregressive (AR) representation of time series processes, linear difference equation.

Stationary time series models: Autoregressive processes: 1st order autoregressive AR(1) process, 2nd order autoregressive AR(2) process, the general p-th order autoregressive AR(p) process.

Moving average processes: 1st order moving average MA(1) process, 2nd order moving average MA(2) process, the general q-th order moving average MA(q) process.

The dual relationship between AR(p) and MA(q) processes.

The general autoregressive moving average ARMA(p,q) process, the ARMA(1,1) process.

Nonstationary time series models: Nonstationarity in the mean: Deterministic trend models, Stochastic trend models and differencing.

Autoregressive integrated moving average (ARIMA) models: The general ARIMA model, the random walk model, the ARIMA(0,1,1) or IMA(1,1) model.

Nonstationarity in the variance and the autocovariance: Variance and autocovariance of the ARIMA models, Variance stabilizing transformations.

Forecasting: Minimum mean square error (MSE) forecasts: Minimum MSE forecasts for ARMA models, Minimum MSE forecasts for ARIMA models.

Computation of forecasts, The ARIMA forecast as a weighted average of previous observations, updating forecasts, eventual forecast functions.

Model identification: Steps for model identification.


Seasonal time series models: Traditional methods (Regression method, Moving average method) Seasonal ARIMA models.

Testing for a unit root: Testing for a unit root in the AR(1) model, testing for a unit root in a more general model, testing for a unit root in seasonal time series models.

Text Book:

Time Series Analysis- Univariate and Multivariate Methods (2nd Edition)
William W.S. Wei, Pearson Education Inc.

Reference books:

George E.P. Box, Gwilym M. Jenkins & Gregory C. Reinsel, Wiley

Time Series Analysis and Its Applications With R Examples (3rd Edition)
Robert H. Shumway and David S. Stoffer, Springer

Time Series Analysis With Applications in R (2nd Edition) Jonathan D. Cryer and Kung-Sik Chan, Springer
Stat H-403: Design and Analysis of Experiment 4 Credits

Basic concepts of ANOVA: Definition of ANOVA, importance and uses, basic assumptions of ANOVA, related concepts of experimental design & sample design, experimental error & sample error, etc.

ANOVA Techniques: Single-factor ANOVA, Double-factor ANOVA, Triple-factor ANOVA, etc. Partitioning of Total SS, D.F., Justification ANOVA-F test, ANOVA Table, Least Significance Difference (LSD), Grouping of treatments etc.

Basic concepts of Experiments and designing: Experiment and its types. Steps involved in experiment, Designing of experiments, Its purposes, Basic principles of experimental designs, their purposes, Fisher’s diagram, etc.

Experimental Units: Definition, different types: agricultural plots, block, examples in other areas, Reasons of blocking, Uniformity trials and fertility control mapping, Choice of size and shape of plots and blocks, Smith’s variance law and other field plot techniques.

Experimental error and sampling error, Sources of experimental error and controlling measures.

Basic Experimental designs: Completely randomised design (CRD), Randomised block design (RBD) Latin square design (LSD), Gracco LSD. Multiple LSD, Nested design (ND), etc. Their definitions and layouts, relative merits, demerits, orthogonality and relative efficiency, etc.

Multiple Comparison: Grouping of treatments, necessity, different methods: Fisher’s least significant method, Duncan’s multiple range test, Student-Newmen-Keul’s test, Tukey’s test, Scheffe’s method, etc.

Missing plot techniques: Orthogonality and Non-orthogonality problems, effects of missing values in basic designs, methods of estimation for missing values, and their standard error, LS method, Iterative method etc. Adjustment in analysis procedures, Comparison of pair treatments in missing plots etc.

Factorial Experiments: Basic ideas of variety trials, factorial experiment, Bio-assays, etc. Linear contrasts, orthogonal contrasts different factorial experiments: 2^k,etc. simple-effects, main-effects & interactions and analysis procedures: Contrast method, Yates algorithm, Confounding in factorial experiments: Definitions, necessity, different types of confounding and their analysis, Asymmetric factorial experiments 2x3, 2x4, 3x4,etc.

Analysis of Covariance (ANCOVA): Concomitant variables, examples, definition of ANOVA with one concomitant variable in different basic designs: Their linear models, estimation of parameters, analysis procedures, related tests, etc.

Other Designs: (i) Non-orthogonal designs (unequal cases) (ii) Split-plot designs (iii) Switch-over designs (iv) Carry-over designs.

Texts

References
2. Kempthorne, Design and Analysis of Experiments, Wiley, N.Y.

Stat H-404: Econometrics  
4 Credits

**Concepts**: meaning, definition, scope and role of econometrics, difference with mathematical economics and economic statistics, nature and scope of data for econometric analysis.

**Measures of Model Adequacy**: Residual analysis, Outlier analysis and choice of regressors.

**Model Misspecification**: Basic concepts and consequences, Omitted variables, Irrelevant variables and Measurement errors.

**Regression with Qualitative dependent variable**: Introduction to linear probability model. Logit, Probit and Tobit model.

**Generalized least squares (GLS)**: Spherical and nonspherical disturbances, sources of nonspherical disturbances and problems associated with these, OLS estimators under nonspherical disturbances and their properties, the Generalized Least-Squares estimator.

**Multicollinearity**: Basic concepts, reasons, consequences, detection and remedial measures.

**Autocorrelation**: Basic concepts, reasons, consequences, detection and remedial measures.

**Heteroscedasticity**: Basic concepts, reasons, consequences, detection and remedial measures.

**Simultaneous equation models**: Basic concepts; endogenous, exogenous and predetermined variables, structural model and reduced-form model; simultaneous equation bias, inconsistency of OLS estimators.

Estimation of simultaneous equation models: method of indirect least-squares (ILS) and two-stage least-squares (2SLS).

**Identification**: Concept of identification and methods of identification.

**Nonlinear Regression Models**: Estimation of linear and nonlinear regression models, different approaches to estimating nonlinear regression models, properties of nonlinear regression, The Cobb-Douglas and CES production function, estimation of Cobb-Douglas production function.

**Dummy variable regression models**: Basic concepts, ANOVA models, caution in the use of dummy variables, ANOVA models with two qualitative variables, regression with a combination of quantitative and qualitative regressors. The ANCOVA models, testing the structural stability of regression model and comparing two regression by dummy variable, comparison with chow test, use of dummy variables.

**Time Series Econometrics**: Basic concepts, Cointegration and Error Correction Mechanism, Spurious regression, The Unit Root Test, The Dickey-Fuller Test, The Augmented Dickey-Fuller Test, Forecasting approaches in econometrics (In detail).

Text
Gujarati, D.N., *Basic Econometrics*.
References
2. Dhrymes, P.J, Econometrics, Springer-Verlag, N.Y.
5. Griffiths, J., The Theory and Practice of Econometrics, Wiley & Sons, N.Y.

Stat H-405: Biostatistics

Biostatistics, Survival Analysis, Survival Data, Examples of Survival Data.


Incomplete Data: Censoring, Left and Right Censoring, Type I (Progressive Type I, Generalized Type I etc.), Type II Censoring, Progressive Type II Censoring, Random Censoring, Construction of Likelihood Functions under Different censoring Schemes.

Parametric Methods: Estimation and Tests (for small and large samples) under Different Censoring schemes for Important Lifetime Distributions, Confidence Intervals, Delta Method, Estimation, Test, and Confidence Interval for Survival Function, Hazard Function, Quantile


Comparison of Survival Curves: Comparison of Two Groups: Log-rank (Mantel-Haenszel) Test; Other Tests Comparing Two Groups, Comparison of More than Two Groups.


Text:

Reference:


**Stat H-406: Stochastic Process**

2 Credits


**Queuing Process:** Concepts, components of Queuing process, Queuing model, Single server queues, Equilibrium theory, limiting properties of queues, related mathematical problems.

**Texts**


**References**


Research and methods: Meaning of research, concepts of methods and methodologies, Categories of research-- pure research, applied research, descriptive, exploratory, causal and explanatory research, qualitative and quantitative research; conceptualization, operationalization

Research process: Stages in a research process, selection of research problem, review of literature, objectives of the study, research question and research hypothesis

Research design: Types of design -- case studies, trend and panel studies, experimental design, non-experimental design, cross-sectional and quasi-experimental design, etc., stages of a research design, criteria of selecting a design


Questionnaire and its construction.

Sampling design and sample size determination.

Data collection methods and techniques: Primary and secondary sources of data, concepts of Big data, different methods to collect quantitative data: mail-questionnaire, personal interview, telephone interview, principles of interviewing.

Qualitative data collection: observations, key informants interview, in-depth interview, focus group discussion (FGD), rapid appraisal technique (RAT), Delphi technique, data quality check.

Research proposal: Formulation of research proposal and report writing, oral presentation, citation, copyright, plagiarism. Evaluation of social programs, SWOT analysis.

Proposal Writing and Project Report:
Students will be divided into groups. Students of each group will do one research project together. However, each student has to present the project. Each group will be supervised by a teacher. Preparing a proposal for project, such as, selecting a topic, determining sample size, use of primary/secondary/simulated data, data processing and analysis, writing the report. Assessment will be based on presentation and the report. Evaluation of the presentation will be done by the examination committee and evaluation of the report will be done by examiners.

Note: Project Report will carry 25% Marks instead of in-course examination.

Texts:
2. Akanda, M. A. Salam, Research Methodology A complete Direction for Learners, Latest Ed.,
Akanda & Sons Publications.

References
1. Frankfort, J., Research Methodology.
3. Krisaaswami and Raaganatham, Methodology of research in social sciences.
4. Das, A. Social survey and research.
5. Sufian, A.J.M., Methods and techniques of social research.
StatH-408 Categorical Data Analysis  

Introduction of Contingency tables and chi-square test, McNemar's and Gart's test for 2×2 tables, Contingency tables with more than one degree of freedom, Combining information from several 2×2 table, r×c contingency tables, Isolation of sources of association in r×c tables, Measures of association for contingency tables, Partitioning the degrees of freedom in contingency table, Combining and comparing results from different investigation, Relative measure of association: Lambda measure, Gamma measure and Somer's D-measure. Multidimensional tables: Analysis and test of hypothesis of 3-dimensional table, Stratified analysis, Confounding and interaction, Mantel-Haenszel test. Log-linear models: Fitting Log-linear models and estimating parameters, Contingency table with ordered categories.

Text
Everitt, B.S., The Analysis of Contingency Tables, John Willey, N.Y.

Reference:

1. Haberman, Analysis of Frequency Data, University of Chicago.

Stat H-409: Lab-IX: Multivariate Analysis and Experimental Design (Using R/SPSS)  

Multivariable Analysis: Drawing samples from univariate and multivariate distributions. Inference of mean vector and variance-covariance matrix of multivariate population, Comparison of several multivariate means, Drawing power curves for different hypotheses. Experimental Design: Missing plots techniques, Relative efficiency, Split plot designs, Covariance Analysis, analysis of 2^n factorial experiments. Confounding, Different designs with more than one observation per cell. Analysis of nested designs, Covariance analysis, Analysis of different advanced designs.

Stat H-410: Lab-X: Biostatistics and Econometrics (Using R/SPSS)  

**Econometrics:** Test on model adequacy, fitting of regression, estimation of parameters in the regression model, detection of multicollinearity, autocorrelation, heteroscedasticity, remedial measures of multicollinearity, autocorrelation, heteroscedasticity, LPM, logit model, probit model.

**Stat H-411: Lab-XI: Time Series Analysis and Categorical Data Analysis (Using R/SPSS)** 2 Credits

**Time Series:** Determination of components of time data, periodogram analysis, Correlogram analysis, Demand analysis, Fitting of production Functions, Forecasting by fitted functions, Confidence intervals for predicted values.

**Categorical Data Analysis:** Contingency tables and chi-square test, McNemar’s and Gart’s test, Relative measure of association: Lamda measure, Gamma measure and Somer’s D-measure. Confounding and interaction, Mantel-Haenszel test.

**Stat H-412: Viva-Voce**

2 Credits