

**DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH**

**Course Structure
Under Choice Based Credit System
B.A. /B.Sc. (Honours) (Statistics)
Three Years**

Semester I

Paper	Code	Title	MARKS	CREDIT
Paper-I	STB151	Descriptive Statistics	30+70	4
Lab. I	STB1P1	Lab. Course – Descriptive Statistics	40+60	2

Semester II

Paper	Code	Title	MARKS	CREDIT
Paper-I	STB251	Probability and Probability Distributions	30+70	4
Lab. I	STB2P1	Lab. Course – Probability	40+60	2

Semester III

Paper	Code	Title	MARKS	CREDIT
Paper-I	STB351	Sampling Distributions	30+70	4
Lab. I	STB3P1	Lab. Course – Sampling Distributions	40+60	2

Semester IV

Paper	Code	Title	MARKS	CREDIT
Paper-I	STB451	Survey Sampling & Indian Official Statistics	30+70	4
	STB491	Introduction Statistical Method (Open Elective)	30+70	2
Lab. I	STB4P1	Lab. Course – Survey Sampling & Indian Official Statistics	40+60	2

Semester V

Paper	Code	Title	MARKS	CREDIT
Paper-I	STB551	Statistical Inference	30+70	4
Paper-II	STB552	Linear Models	30+70	4
Paper-III	STB553	Operations Research	30+70	4
Paper-IV	STB554	Demography and Vital Statistics	30+70	4
Paper-V	STB555	Statistical Data Analysis Using R	30+70	2
Lab. I	STB5P1	Lab.- I (Linear Models & Demography & Vit.)	40+60	2
Lab. II	STB5P2	Lab.- II (O.R.)	40+60	2
Lab. III	STB5P3	Lab.- III (Stat. Data Anal. Using R)	40+60	2
Open Elective	STB591	Introduction to Statistical Methods	40+60	2

Semester VI

Paper	Code	Title	MARKS	CREDIT
Paper-I	STB651	Econometrics	30+70	4
Paper-II	STB652	Statistical Computing Using C/C++ Programming	30+70	4
Paper-III	STB653	Statistical Quality Control	30+70	4
Paper-IV	STB654	Design of Experiments	30+70	4
Project	STB6S1	Project	30+70	4
Lab. I	STB6P1	Lab. - I (Eco. & Design of Exp.)	40+60	2
Lab. II	STB6P2	Lab. - II (Stat. Comp. Using C/C++Prog.)	40+60	2

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc.(Honours) (Statistics)
I Semester
Course Code- STB151
Descriptive Statistics

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of descriptive statistics including graphics.

Course outcome: On successful completion of this course the students will be able to

- Describe the basic measures of statistics including measures of location, dispersion and linear regression.
- Interprets summery features of data.

Syllabus

UNIT I

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement- nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.

UNIT II

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.

UNIT III

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

UNIT IV

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

Suggested Reading:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A./B.Sc.(Honours) (Statistics)
I Semester
Course Code - STB1P1
Lab. Course – Descriptive Statistics

Credit: 2

Max Marks: 40+60 =100

List of Practical

1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.
6. Fitting of polynomials, exponential curves.
7. Karl Pearson correlation coefficient.
8. Correlation coefficient for a bivariate frequency distribution.
9. Lines of regression, angle between lines and estimated values of variables.
10. Spearman rank correlation with and without ties.
11. Partial and multiple correlations.
12. Planes of regression and variances of residuals for given simple correlations.
13. Planes of regression and variances of residuals for raw data.
14. To calculate price and quantity index numbers using simple and weighted average of price relatives.
15. To calculate the Chain Base index numbers.
16. To calculate consumer price index number.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
II Semester
Course Code-STB251
Probability and Probability Distributions

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of probability and probability distributions.

Course outcomes: On successful completion of this course the students will be able to

- Describe the discrete and continuous probability distributions.
- Interpret the shape of probability distributions.

Syllabus

UNIT I

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

UNIT II

Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations.

Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables.

UNIT III

Mathematical Expectation and Generating Functions: Expectation of single and bivariate random variables and its properties. Moments and Cumulants, moment generating function, cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications. Conditional expectations.

UNIT IV

Standard probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases.

Suggested Reading:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc.(Honours) (Statistics)
II Semester
Course Code-STB2P1
Lab. Course - Probability

Credit: 2

Max Marks: 40+60 =100

List of Practical

1. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$
2. Fitting of binomial distributions for n and p given
3. Fitting of binomial distributions computing mean and variance
4. Fitting of Poisson distributions for given value of λ
5. Fitting of Poisson distributions after computing mean
6. Fitting of negative binomial distribution
7. Fitting of suitable distribution
8. Application problems based on binomial distribution
9. Application problems based on Poisson distribution
10. Application problems based on negative binomial distribution
11. Problems based on area property of normal distribution
12. To find the ordinate for a given area for normal distribution
13. Application based problems using normal distribution
14. Fitting of normal distribution when parameters are given
15. Fitting of normal distribution when parameters are not given

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY
B.A/B.Sc. Honours (Statistics)
III Semester
Sampling Distributions
Course Code - STB351

Credit 4

Max. Marks 30+70 =100

Course objectives: To introduce the basic notion of distribution of a statistic.

Course outcomes: On successful completion of this course the students will be able to

- Describe the sampling distributions of various statistics like Z, t, χ^2 , F
- Interpret law of large numbers and central limit theorem.

Syllabus

UNIT I

Limit laws: convergence in probability, convergence in distribution and their inter relations, Chebyshev's inequality, W.L.L.N. and their applications, De-Moivre Laplace theorem, Central Limit Theorem (C.L.T.) for i.i.d. variates, applications of C.L.T.

Order Statistics: Introduction, distribution of the r th order statistic, smallest and largest order statistics. Joint distribution of r th and s th order statistics.

UNIT II

Definitions of random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of sample mean, standard errors of sample mean, sample variance and sample proportion. Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Large sample tests, use of CLT for testing single proportion, difference of two proportions, single mean, difference of two means by classical and p -value approaches.

UNIT III

Exact sampling distribution: Definition and derivation of p.d.f. of χ^2 with n degrees of freedom (d.f.) using m.g.f., nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., cumulant generating function, mode, additive property and limiting form of χ^2 distribution. Tests of significance based on χ^2 distribution.

UNIT IV

Exact sampling distributions: Student's t -distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution.

Snedecore's F -distribution: Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Distribution of $1/F(n_1, n_2)$. Relationship between t , F and χ^2 distributions. Test of significance based on t and F distributions.

Suggested Reading:

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): *An Outline of Statistical Theory*, Vol. I, 4th Edn. World Press, Kolkata.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): *An Introduction to Probability and Statistics*. 2nd Edn. (Reprint) John Wiley and Sons.
3. Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*. Pearson Education.
4. Johnson, R.A. and Bhattacharya, G.K. (2001): *Statistics-Principles and Methods*, 4th Edn. John Wiley and Sons.
5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): *Introduction to the Theory of Statistics*, 3rd Edn. (Reprint). Tata McGraw-Hill Pub. Co. Ltd.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY
B.A/B.Sc. Honours (Statistics)
III Semester
Course Title – Lab. Course – Sampling Distributions
Course Code - STB3P1

Credit 2

Max. Marks 40+60 =100

PRACTICAL/LAB. WORK:

List of Practical

1. Testing of significance for single proportion and difference of two proportions
2. Testing of significance for single mean and difference of two means and paired tests.
3. Testing of significance for difference of two standard deviations.
4. Exact Sample Tests based on Chi-Square Distribution.
5. Testing if the population variance has a specific value and its confidence intervals.
6. Testing of goodness of fit.
7. Testing of independence of attributes.
8. Testing based on 2 x 2 contingency table without and with Yates' corrections.
9. Testing of significance of an observed sample correlation coefficient.
10. Testing of equality of two population variances

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY
B.A. /B. Sc. Honours (Statistics)
IV Semester
Course Code – STB451
Survey Sampling & Indian Official Statistics

Credit 4

Max. Marks 30+70 =100

Course objectives: To introduce the basic elements of sample surveys and Indian official statistical system.

Course outcomes: On successful completion of this course the students will be able to

- Describe the various methods of sample selection.
- Apply the sample survey methodology in real life applications
- Demonstrate the understanding of Indian official statistical system

Syllabus

UNIT I

Concept of sample and population, complete enumeration versus sampling, sampling and non-sampling errors, requirements of a good sample, simple random sampling with and without replacement, estimates of population mean, total and proportion, variances of these estimates, and estimates of these variances and sample size determination.

UNIT II

Stratified random sampling, estimates of population mean and total, variances of these estimates, proportional and optimum allocations and their comparison with SRS. Systematic Sampling, estimates of population mean and total, variances of these estimates.

UNIT III

Ratio and regression methods of estimation, estimates of population mean and total (for SRS of large size), variances of these estimates and estimates of these variances, variances in terms of correlation coefficient between X and Y for regression method and their comparison with SRS.

UNIT IV

Present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Principal publications containing data on the topics such as population, industry and finance. Various official agencies responsible for data collection and their main functions.

Recommended Books (Text and Reference)

1. Goon A.M., Gupta M.K.Dasgupta B (2001):Fundamentals of Statistics (Vol.2), Word Press
2. Murthy M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta
3. Des Raj and Chandhok P.(1998): Sample Survey Theory, Narosa Publishing House.
4. Cochran W.G (1984):Sampling Techniques(3rd Ed.), Wiley Eastern
5. Mukhopadhyay P.(1998): Theory and Methods of Survey Sampling, Prentice Hall
6. Sampat S.(2001) Sampling Theory and Methods, Narosa Publishing House
7. Guide to current Indian Official Statistics, Central Statistical Organization , GOI,New Delhi.
8. Saluja,M.P.(1972):Indian official statistical systems, Statistical Pub. Society, Calcutta

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY

B. Sc. Honours (Statistics)

IV Semester

Course Code – STB4P1

Lab. Course – Survey Sampling & Indian Official Statistics

Credit 2

Max. Marks 40+60=100

List of Practical

1. Drawing a simple random sample of different sizes from the population
2. Obtaining an estimate of the population mean under SRS
3. Finding an estimate of Variance of the population under SRS
4. Preparation of different strata and stratum in Stratified sampling
5. the estimate of the population mean under Stratified sampling using Neyman allocation
6. Obtaining an estimate of the population variance mean under Stratified sampling using Neyman allocation
7. Calculating an estimate of the population mean under Stratified sampling using Proportional allocation
8. Finding an estimate of the population variance under Stratified sampling using Proportional allocation
9. Obtaining an estimate of the Variance of the population under Stratified sampling
10. Finding an estimate of the population mean under Systematic Sampling
11. Calculating an estimate of the population variance under Systematic Sampling
12. Obtaining an estimate of the population mean under Ratio and regression method of sampling
13. Calculating an estimate of the population variance under Ratio and regression methods of sampling.
14. Preparation/understanding of Zero schedules and Questionnaires used in Official Statistics by MOSPI

**DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
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B.A. /B.Sc. (Honours) (Statistics)

IV Semester

Course Code – STB491

Introduction to Statistical Methods

An open elective course

To be offered to the students of B.A./B.Sc.(Honours) of Faculty of Science, who do not have Statistics as a main or as a subsidiary subject in their graduation.

Credit: 2

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of statistical analysis.

Course outcomes: On successful completion of this course the students will be able to

- Describe the techniques of statistical data analysis.
- Apply various statistical tests in the real life applications.

Syllabus

UNIT I

Concept of primary and secondary data, methods of collection of data, types of data: qualitative and quantitative data, discrete and continuous data, different types of scales: nominal and ordinal, ratio and interval, classification and tabulation of data, diagrammatic representation of data: bar diagrams, histogram, frequency polygon, frequency curve and ogive.

Unit II

Central tendency: mean, median, mode, quartiles, box plot, Dispersion: range, mean deviation, standard deviation, coefficient of variation, elementary probability, random variables, standard probability distributions: Bernoulli, binomial, Poisson, and normal.

Unit III

Bivariate data, scatter diagram, coefficient of correlation, regression lines and regression coefficients, principle of least square and fitting of polynomials and exponential curves.

Unit IV

Testing of hypothesis: Z-test, t-test, F-test, Chi-square test for goodness of fit, Introduction to analysis of variance.

Books Recommended:

1. Sharma, J. K. (2013): Business Statistics, 3rd Edition, Pearson Education.
2. Snedecor, G. W. and Cochran, W. G. (1989): Statistical Methods, 8th Edition, Wiley.
3. Freund, J. E. and Perles, B. M. (2006): Modern Elementary Statistics, 12th Edition, Pearson Higher Education.
4. R. Lyman Ott and Michael Longnecker (2001): An Introduction to Statistical Methods and Data Analysis, 5th Edition, Thomson Learning, Inc.
5. Siegel, A. F. and Morgan, C. J. (1995): Statistics and Data Analysis: An Introduction, 2nd Edition, John Wiley & Sons, Inc. New York.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
V Semester
Course Code – STB551
Statistical Inference

Credit: 4

Max Marks: 30+70 =100

Course objectives: To Introduce the basic elements of statistical inference

Course outcomes: On successful completion of this course the students will be able to

- Describe the methods of estimation and hypothesis testing.
- Apply these methods in real life applications.

Syllabus

UNIT I

Estimation: Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell and Lehmann-Scheffe theorems and their applications. Cramer-Rao inequality and MVB estimators(statement and applications).

UNIT II

Methods of Estimation: Method of moments, method of maximum likelihood estimation, method of minimum Chi-square, basic idea of Baye's estimators.

UNIT III

Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests (without proof).

UNIT IV

Sequential Analysis: Sequential probability ratio test (SPRT) for simple vs simple hypotheses. Fundamental relations among α , β , A and B, determination of A and B in practice. Wald's fundamental identity and the derivation of operating characteristics (OC) and average sample number (ASN) functions, examples based on normal, Poisson, binomial and exponential distributions.

Suggested Reading:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
4. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
5. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.
6. Mood A.M, Graybill F.A. and Boes D.C,: Introduction to the Theory of Statistics, McGraw Hill.
7. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
V Semester
Course Code – STB552
Linear Models

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of linear models.

Course outcomes: On successful completion of this course the students will be able to

- Describe the sample and multiple regression models.
- Apply these results in design of experiments and econometrics.

Syllabus

UNIT I

Gauss-Markov set-up: Theory of linear estimation, Estimability of linear parametric functions, Method of least squares, Gauss-Markov theorem, Estimation of error variance.

UNIT II

Regression analysis: Simple regression analysis, Estimation and hypothesis testing in case of simple and multiple regression models, Concept of model matrix and its use in estimation.

UNIT III

Analysis of variance: Definitions of fixed, random and mixed effect models, analysis of variance and covariance in one-way classified data for fixed effect models, analysis of variance and covariance in two-way classified data with one observation per cell for fixed effect models

UNIT IV

Model checking: Prediction from a fitted model, Violation of usual assumptions concerning normality, Homoscedasticity and collinearity, Diagnostics using quantile-quantile plots

Suggested Readings:

1. Weisberg, S. (2005). Applied Linear Regression (Third edition). Wiley.
2. Wu, C. F. J. And Hamada, M. (2009). Experiments, Analysis, and Parameter Design Optimization (Second edition), John Wiley.
3. Renchner, A. C. And Schaalje, G. B. (2008). Linear Models in Statistics (Second edition), John Wiley and Sons.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honors) V Semester (Statistics)
Course Code – STB553
Operations Research

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of Operations Research

Course outcomes: On successful completion of this course the students will be able to

- Understand the fundamentals of Operations Research.
- Apply the results of transportation problems, game theory, sequencing problems, etc in the real life applications.

Syllabus

UNIT I

Introduction to Operations Research, phases of O.R., model building, various types of O.R. problems. Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of an L.P.P. Convex sets and convex functions, Extreme point theorems, Simplex method for solving L.P.P., Artificial variable techniques-Charne's Big M and Two-Phase Methods, Special cases of L.P.P. Concept and applications of Duality in L.P.P. and Rules of forming dual.

UNIT II

Transportation Problem:, Mathematical Formulation, Initial solution by North West corner rule, Least Cost Method and Vogel's Approximation Method (VAM), MODI's method for testing optimality, special cases of transportation problem. Assignment problem: Hungarian method to find optimal assignment, special cases of assignment problem.

UNIT III

Game theory: Rectangular game, pure and mixed strategies, minimax-maximin principle, solution to rectangular game using graphical method, dominance and modified dominance property to reduce the game matrix and solution to rectangular game with mixed strategy. Equivalence between game theory and LPP.

UNIT IV

Sequencing Problems: The sequencing Problems with n -jobs and two machines, Optimal sequencing algorithm, Problems with n -jobs and three machines. Problems with n -jobs and m -machines. Networking: Shortest route and minimal spanning tree problem.

Suggested Reading:

1. Taha, H. A. (2009): Operations Research: An Introduction, Prentice Hall of India.
2. A.Ravindaran, Don T. Philips and J.J.Soleberg (2007): Operations Research: Principles and Practice, 2nd ed., Wiley.
3. Kanti Swarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
4. Hadley, G: (2002): Linear Programming, Narosa Publications
5. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research-Concepts and cases, 9th Edition, Tata McGraw Hill

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
V Semester
Course Code – STB554
Demography & Vital Statistics

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of demography and vital statistics.

Course outcomes: On successful completion of this course the students will be able to

- Understand the fundamental of demographic data.
- Interpret the demographic estimators in population studies and other related areas.

Syllabus

UNIT I

Population Theories: Coverage and content errors in demographic data, use of balancing equations and Chandrasekharan-Deming formula to check completeness of registration data. Adjustment of age data, use of Myer and UN indices, Population composition, dependency ratio..

UNIT II

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.

UNIT III

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

UNIT IV

Abridged Life Tables; Concept and construction of abridged life tables by Reed-Merrell method, Greville's method and King's Method. 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.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
V Semester
Course Code – STB555
Statistical Data Analysis Using R

Credit: 2

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of R-language and its applications.

Course outcomes: On successful completion of this course the students will be able to

- Describe the various concepts of R-language.
- Interpret the functions related to data analysis.

Syllabus

UNIT I

Learn how to load data, plot a graph viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart, ogives with graphical summaries of data

UNIT II

Generate automated reports giving detailed descriptive statistics, correlation and lines of regression.

UNIT III

Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.

UNIT IV

Simple analysis and create and manage statistical analysis projects, import data, code editing, Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.

Suggested Reading:

1. Gardener, M (2012) Beginning R: The Statistical Programming Language, Wiley Publications.
2. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York

**DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A./B.Sc.(Honours) (Statistics)
V Semester
Course Code – STB5P1
Lab. I (Linear Models & Demography & Vit.)**

Credit: 2

Max Marks: 40+60 = 100

Practical Based on the Courses:

STB552

STB554

**DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH**

**B.A. /B.Sc. (Honours) (Statistics)
V Semester
Course Code – STB5P2
Lab. II (O.R.)**

Credit: 2

Max Marks: 40+60 = 100

Practical Based on the Courses:

STB553

**DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
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**B.A. /B.Sc. (Honours) (Statistics)
V Semester
Course Code – STB5P3
Lab. III (Stat. Data Analysis Using R)**

Credit: 2

Max Marks: 40+60 = 100

Practical Based on the Courses:

STB555

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH

B.A. /B.Sc. (Honours) (Statistics)
VI Semester
Course Code – STB651
Econometrics

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of econometric data and its modelling.

Course outcomes: On successful completion of this course the students will be able to

- Describe the various econometric data and models
- Interpret the estimates in econometric models applied in various field of applications.

Syllabus

UNIT I

Introduction: Objective behind building econometric models, nature of econometrics, role of econometrics. General linear econometric model (GLM), Estimation, Disturbance Term.

UNIT II

Multicollinearity: Introduction and concepts, detection of multicollinearity, consequences, tests and solutions for multicollinearity, specification error.

UNIT III

Generalized least squares estimation, Aitken estimators. Autocorrelation: concept, consequences of autocorrelated disturbances, detection and solution of autocorrelation.

UNIT IV

Heteroscedastic disturbances: Concepts and efficiency of Aitken estimator with OLS estimator under heteroscedasticity. Consequences of heteroscedasticity. Tests and solutions of heteroscedasticity. Autoregressive and Lag models, Dummy variables.

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

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
VI Semester
Course Code – STB652
Statistical Computing Using C/C++ Programming

Credit: 4

Max Marks: 30+70 =100

Course objective: To introduce the basic elements statistical computing using C/C++ programming.

Course outcomes: On successful completion of this course the students will be able to

- Describe computer Programs in C/C++ related to statistical data analysis
- Write computer programs in C/C++ related to statistical data analysis.

Syllabus

UNIT I

History and importance of C/C++. Components, basic structure programming, character set, C/C++ tokens, Keywords and Identifiers and execution of a C/C++ program. Data types: Basic data types, Enumerated data types, derived data types. Constants and variables: declaration and assignment of variables, Symbolic Constants, overflow and underflow of data.

Operators and Expressions: Arithmetic, relational, logical, assignment, increment/decrement, operators, precedence of operators in arithmetic, relational and logical expression. Implicit and explicit type conversions in expressions, library functions. Managing input and output operations: reading and printing formatted and unformatted data.

UNIT II

Decision making and branching - if...else, nesting of if...else, else if ladder, switch, conditional (?) operator. Looping in C/C++: for, nested for, while, do...while, jumps in and out of loops. Arrays: Declaration and initialization of one-dim and two-dim arrays. Character arrays and strings: Declaring and initializing string variables, reading and writing strings from Terminal (using scanf and printf only).

UNIT III

User- defined functions: A multi-function program using user-defined functions, definition of functions, return values and their types, function prototypes and calls. Category of Functions : no arguments and no return values, arguments but no return values , arguments with return values, no arguments but returns a value, functions that return multiple values. Recursion function. Passing arrays to functions, Storage class of Variables.

UNIT IV

Pointers: Declaration and initialization of pointer variables, accessing the address of a variable, accessing a variable through its pointer, pointer expressions, pointer increments/decrement and scale factor. Pointers and arrays, arrays of pointers, pointers as function arguments, functions returning pointers Structure: Definition and declaring, initialization, accessing structure members, copying and comparison of structure variables, array of structures, structure pointers. Dynamic memory allocation functions :malloc, calloc and free. Pre processors: Macro substitution, macro with argument File inclusion in C/C++: Defining and opening a file (only r, w and a modes), closing a file,I/O operations on files-fscanf and fprintf functions.

Suggested Reading:

1. Kernighan, B.W. and Ritchie, D. (1988): C Programming Language, 2ndEdition,Prentice Hall.
2. Balagurusamy, E. (2011): Programming in ANSI C, 6th Edition, Tata McGraw Hill.
3. Gottfried, B.S. (1998): Schaum's Outlines: Programming with C, 2nd Edition, Tata McGraw Hill

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
VI Semester
Course Code – STB653
Statistical Quality Control

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic elements of statistical quality control.

Course outcomes: On successful completion of this course the students will be able to

- Describe the various charts in SQC
- Interpretation of these charts in real life situations.

Syllabus

UNIT I

Quality: Definition, dimensions of quality, historical perspective of quality control and improvements starting from World War II, historical perspective of Quality Gurus and Quality Hall of Fame. Quality system and standards: Introduction to ISO quality standards, Quality registration. Statistical Process Control - Seven tools of SPC, chance and assignable Causes of quality variation. Statistical Control Charts- Construction and Statistical basis of 3- σ Control charts, Rational Sub-grouping.

UNIT II

Control charts for variables: X-bar & R-chart, X-bar & s-chart. Control charts for attributes: np-chart, p-chart, c-chart and u-chart. Comparison between control charts for variables and control charts for attributes. Analysis of patterns on control chart, estimation of process capability.

UNIT III

Acceptance sampling plan: Principle of acceptance sampling plans. Single and Double sampling plan their OC, AQL, LTPD, AOQ, AOQL, ASN, ATI functions with graphical interpretation, use and interpretation of Dodge and Romig's sampling inspection plan tables.

UNIT IV

Introduction to Six-Sigma: Overview of Six Sigma, Lean Manufacturing and Total Quality Management (TQM). Organizational Structure and Six Sigma training plans- Selection Criteria for Six-Sigma roles and training plans. Voice of customers (VOC): Importance and VOC data collection. Critical to Quality (CTQ). Introduction to DMAIC using one case study: Define Phase, Measure Phase, Analyse Phase, Improve Phase and Control Phase.

Suggested Reading:

1. Montgomery, D. C. (2009): Introduction to Statistical Quality Control, 6th Edition, Wiley India Pvt. Ltd.
2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
3. Mukhopadhyay, P (2011): Applied Statistics, 2nd edition revised reprint, Books and Allied(P) Ltd.
4. Montgomery, D. C. and Runger, G.C. (2008): Applied Statistics and Probability for Engineers, 3rd Edition reprint, Wiley India Pvt. Ltd.
5. Ehrlich, B. Harris (2002): Transactional Six Sigma and Lean Servicing, 2nd Edition, St. Lucie Press.
6. Hoyle, David (1995): ISO Quality Systems Handbook, 2nd Edition, Butterworth Heinemann Publication.

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
VI Semester
Course Code – STB654
Design of Experiments

Credit: 4

Max Marks: 30+70 =100

Course objectives: To introduce the basic and advanced elements of design of experiments.

Course outcomes: On successful completion of this course the students will be able to

- Describe the basic designs like CRD, RBD, Latin square and factorial, in confounding and fractional factorials.
- Apply these designs in various fields of applications.

Syllabus

UNIT I

Experimental designs: Role, historical perspective, terminology, experimental error, basic principles, uniformity trials, fertility contour maps, 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.

UNIT II

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 2^2 ($n \leq 5$), 3^2 and 3^2 . Factorial experiments in a single replicate.

UNIT III

Fractional factorial experiments: Construction of one-half and one-quarter fractions of 2^n ($n \leq 5$) factorial experiments, Alias structure, Resolution of a design.

UNIT IV

Incomplete Block Designs: Balanced Incomplete Block Design (BIBD) – parameters, relationships among its parameters, incidence matrix and its properties, Symmetric BIBD, Resolvable BIBD, Affine Resolvable BIBD, Intra Block analysis, complimentary BIBD, Residual BIBD, Dual BIBD, Derived BIBD.

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, 8thEdn. 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.
6. Casella G. (2008): Statistical Design, Springer

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
VI Semester
Course Code – STB6P1
Lab. I (Econometrics & Design of Expt.)

Credit: 2

Max Marks: 40+60 = 100

Practical Based on the Courses:

STB65

STB654

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
VI Semester
Course Code – STB6P2
Lab. II (Stat. Comp. Using C/C++Prog.)

Credit: 2

Max Marks: 30+70 = 100

Practical Based on the Courses:

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH
ALIGARH MUSLIM UNIVERSITY ALIGARH
B.A. /B.Sc. (Honours) (Statistics)
VI Semester
Course Code – STB6S1
Project

Credit: 4

Max Marks: 40+60 =100

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. For instance designing and conducting a sample survey and presenting a survey report.