

DEPARTMENT OF STATISTICS
MODERN COLLEGE, IMPHAL EAST (MANIPUR)
Programme Offered: B.A/B. Sc. Statistics (Elective & Honours):

Program Outcome:

After completing this undergraduate course in Statistics students will be able to understand basic theoretical and applied principles of statistics needed to enter the job force or further higher studies. Students will be able to communicate key statistical concepts to non-statisticians. Statistics teaches people to use a limited sample to make intelligent and accurate conclusions about a greater population. The use of tables, graphs, and charts play a vital role in presenting the data being used to draw these conclusions. Statisticians help to design data collection plans, analyze data appropriately and interpret and draw conclusions from those analyses. The central objective of the undergraduate major in Statistics is to equip students with consequently requisite quantitative skills that they can employ and build on in flexible ways. Students can use statistics in various fields such as business, industry, agriculture, government, private, computer science, scientific, health sciences & other disciplines. After completing the study in statistics, students can also apply for the Civil Services, Indian Statistical Services & Indian Economic Services exams and other public sectors etc.

Students develop analytical thinking and good communication skills during classroom teaching (through projects/presentation/practical etc) and also as they participate in various activities both at departmental as well as college level. Programme specific outcomes and course outcomes offered by the department are stated and displayed on the website of the college. Hard Copy of the syllabus is available in the department for ready reference to the teachers and students. The students are also made aware of the Programme and course outcomes at the beginning of the program and at the start of each semester.

Program Specific Outcome:

PSO-1: Excel in creating the basic concepts of statistics which include the major areas of probability theory, probability distributions, distribution theory, statistical inference, survey sampling, designs of experiments, applied statistics, mathematical methods, non- parametric inference and operations research etc.

PSO-2: Practical exercises carried out during these semesters enable students to analyze and interpret data and also to draw valid conclusions. This will enable students to face real time applications.

PSO-3: Apply the concepts of statistics, Operations Research, Probability theory, Time Series, Designs of Experiment, Survey sampling, etc. in real life problems.

PSO-4: Understand the applications of statistics concept in other disciplines such as mathematics, physics, economics, life sciences, etc.

PSO-5: Provides a platform for pursuing higher studies leading to Post Graduate or Doctorate degrees.

Course Outcome:

STA: 101 Descriptive Statistics (DS: 111), Measures of central tendency (MSC: 112), Measures of Dispersion (MD: 113), Moments (M: 114), Skewness and Kurtosis (SK: 115), Probability (P: 116) Theory+ Practical

***After completing this course, the students should have developed a clear understanding of:**

CO-1: Concepts of Statistics and its definition. Importance of Statistics and its scope in different fields like Industry, Biological sciences, Medical sciences, Economics, Social Sciences, Agriculture, Information technology, Education and Psychology etc.

CO-2: Concepts of statistical population and sample, variables and attributes.

CO-3: Classification and tabulation of data. Different types of data. Diagrammatical and Graphical presentation of data.

CO-4: Measures of central tendency, Dispersion, Skewness and Kurtosis, Moments and their use in studying various characteristics of data

CO-5: Concept of Random experiment, Sample space (for finite), events, algebra of events using Venn diagram. Definition of probability, Use the basic probability rules including addition and multiplicative laws, conditional probability and Bayes theorem.

STA: 202 Random variables, Mathematical Expectations and Generating Functions (RVMEGF (1):221), (RVMEGF (1):222) (Theory + Practical)

***On completion of the course, students should have achieved the following:**

CO-1: Knowledge on random variables. Distinguish between discrete and continuous random variables. Probability mass function and probability density function. Mathematical expectation of a random variable. Conditional expectation and variance.

CO-2: Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient. Concept of Principle of least squares for curve fitting and regression lines.

CO-3: Concept of Limit theorems.

CO-4: Concept of finite difference, Interpolation and Extrapolation, derivation of forward and backward operators, shift operator, difference table. Newton Gregory Forward and Backward Interpolation formula for arguments at equal intervals. Newton's Divided Differences Interpolation formula and Lagrange's Interpolation formula for arguments at unequal intervals. Numerical Integration, the general quadrature formula, trapezoidal rule, Simpson's one- third and three- eight formula.

STA: 303 Discrete Probability Distribution (DPD: 331), Continuous Probability Distribution (CPD: 332), Theory of estimation – 1 (TE (1): 333), Sample survey- 1(SS9!): 334), Theory of Attributes (TA: 335), Demography (D: 336).

*** After completing the course students should have developed clear understanding of:**

CO-1: Discrete and continuous distributions and identify their characteristics. Students will be able to identify the type of statistical situation to which different distributions can be applied. Use the different distributions in solving statistical problems.

CO-2: Gain knowledge in the concepts of Theory of estimation and distinguish various types of estimation. Know the properties of estimators and construction of point and interval estimators, Criteria of a good estimator, Methods of point estimation, Maximum likelihood estimation etc.

CO-3: Understand basic concepts of Statistical population and sample, Difference between census and survey sampling, basic principles in sampling, Simple random sampling, systematic sampling, stratified sampling etc.

CO-4: Have a good understanding about the Attributes: classification, notion of manifold classification, dichotomy, class frequency, negative and positive class frequency, quanta class frequency, ultimate class frequency, relationship among different class frequencies (up to three attributes), Consistency of data (up to 3 attributes), condition of consistency of data,

concepts of independence and association of two attributes, Yule's coefficient of association (Q).

CO-5: Understand the basic concepts of vital statistics, deficiencies of census and registration system. Measurement of Mortality rates – CDR, ASDR, and STDR. Complete life table fertility rates and their measurements. Have a basic idea about Logistic curve.

STA: 404 Sampling distribution -1 (SD (1):441), Testing of hypothesis-1 (TH (1): 442), (TH (2): 443), Time series – 1 (TS (1):444), ANOVA & Design of Experiments-1 (ADE (1): 445), Index Numbers (IN: 446)

*** After completing the course students should have Gain the knowledge of:**

CO-1: Sampling distribution theory and their applications in statistical inference.

CO-2: Understand the concept of statistical hypothesis, process of hypothesis testing and its significance. Concept of test of significance, assumption and their validity Distinguish various test used in sampling theory. Use the different test in solving statistical problems. Gain the knowledge about the application of t-distribution, F- distribution, chi-square distribution, Fisher's Z- transformation etc.

CO-3: Know about the importance of time series, the different models, measurement of trend by using different methods.

CO-4: Acquire knowledge about analysis of variance – estimation of parameters by the method of least square with special reference to one and two-way classification with m observations per cell under fixed, random and mixed effects model. Understand the concept of basic principles of design of experiment and statistical analysis of CRD and RBD (with one observation per cell)

CO-5: Acquire knowledge on Index numbers and their applications. Have a clear understanding about the different indices, criteria of a good index, cost of living index number and calculate indices from given data.

STA: 505 Set theory and Measure (STM: 551), Basic Mathematics (BM: 552), Determinant and Matrices (DM: 553), Computer Programming-1 (CP (I): 554), Computer Programming-II (CP (2):555)

*** At the end of the course students should have developed clear understanding of:**

CO-1: Set, types of set, operations on sets and their properties, Intervals- open, closed, half-open, half-closed. Countable and uncountable sets, open and closed sets, compact set and

their properties. Concept about the field of sets, sigma-field and their properties. Measure, measure space, elementary properties of measure.

CO-2: Students will have the knowledge of basic properties of the Convergence of sequence, Cauchy criterion, Infinite series: Cauchy criterion for convergence, geometric series, convergence test of positive term series by different test. Alternative series: test of convergence (Leibnitz test), concept of absolute convergence, conditional convergence, Lagrange's method of determining multiplier, Mean Value theorem of differential calculus' Riemann integrability, Infinite and improper integral (concept only), Gamma and Beta function and their elementary properties.

CO-3: Learn about the knowledge of determinant and Matrices and their properties and different types of matrices.

CO-4: Acquire about computer and its generation, uses types of computers, Internet, Concept of windows, desktop, creation of files and folder etc, integral parts, Uses of M.S. Excel sheet for drawing charts, calculation etc.

CO- 5: Studied about how the statement functions, subroutines and other function work. programming with FORTRAN 77.

STA: 506 Normal and Bivariate Probability Distribution (NBPD: 561), Theory of Estimation- II (TE (2):562), Design of Experiments- II (DE (2):563), Correlation and Curve fitting (CCF: 564), Sampling Distribution- II (SD (2): 565)

***After completion of this course student will be able to:**

CO-1: Learn about Normal distribution and its derivation as a limiting case of binomial distribution, joint prob. Mass and density functions, joint, marginal and conditional distributions. Bivariate normal distribution and finding of marginal and conditional mean and variance etc.

CO-2: Acquire knowledge about the Minimum variance estimator, calculate and interpret confidence intervals for maximum likelihood parameter estimates.

CO-3: Gain knowledge about the Latin square Design (LSD), its analysis, CD of comparing treatment means, Missing plot technique, one missing observation for CRD, RBD, LSD. Factorial experiments with two and three levels. Complete and partial confounding. Analysis of covariance. Concept of Split plot technique applied in RBD, description of strip plot arrangement in RBD etc.

CO-4: Learn about the Multiple and partial correlation, calculate and interpret the correlation between two variables, determine whether the correlation is significant, the

process of constructing a mathematical function, Orthogonal polynomial and its derivation etc.

CO-5: Know about the Derivation of t, F, Chi square distribution, its curve and properties. Explain about the calculating the sample variance and unbiased estimator, how is that related to this topic of sample proportion etc.

STA: 608 Statistical Inference- II (SI (2): 681), Statistical Quality Control (SQC: 682), Time Series- II (TS (2): 683), Sample Survey- II (SS (2): 684, National Income & Demand and Supply Analysis (NIDSA: 685).

*** On completion of the course, students should have achieved the following:**

CO-1: The motion of parametric model and point estimation. Demonstrate the plausibility of pre-specified ideas about the parameters of the model by examining the area of hypothesis testing, Order Statistics and its derivation. Non-parametric statistical tests.

CO-2: Understand the concepts of Statistical Quality Control, Control charts for variables and attributes. Know about the different types of control charts for variables and attributes and their construction. Process and Product Control, Producer's and consumer's risk, Acceptance sampling plans etc.

CO-3: Understand the concepts of measuring seasonal variation by using different methods, Measurement of cyclic movements by the method of residual approach, Spencer's 15- point and 21- point formula and their importance in determining trend.

CO-4: Survey Sampling provides the tolls/ techniques for selecting a sample of elements from a target population keeping in mind the objectives and nature of population. Most of the research work is done through Sample Survey. Principles of survey sampling and main steps involved in selecting a sample. Simple random sampling, Stratified random sampling, Systematic sampling (linear), Ratio and Regression method of estimation Cluster sampling (equal cluster size) Concepts of sub sampling, non-sampling errors: source and type, non-Sampling bias, non-response errors etc.

CO-5: Knowledge about the national income by (i) Marshall (ii) Pigou (iii) Fisher, different concept of national income GNP, NNP, method of estimation, demand analysis. Law of demand and supply. Price elasticity of demand, Types of data required for estimation of elasticity – family budget and time series, Engel's law and Engel's curve, Pareto distribution, Lorenz curve etc.

STA: 609 Finite difference and Numerical Analysis- II (FDNA (2): 691), Finite difference and Numerical analysis- III (FNDA (3):692), Operation research (OR: 693), Psychological and Educational Statistics (PES: 694), Indian Official Statistics (IOS: 695)

***Upon successful completion of this course students will have knowledge of:**

CO-1: Inverse interpolation, method of approximation, reversion of series method, Weddle's rule, central difference formula, Gauss formulae, Sterling's and Bassel's formulae etc.

CO-2: Derivations of finite difference interpolation formulae such as Laplace-Everett, Newton's Cots, Euler-Maclaurin's Summation and Sterling's formula for factorial n, Difference equation with constant coefficient (homogenous, non-homogenous equations only)

CO-3: Origin, development and importance of OR, Models of OR, Elements and formulation of LPP, Solution of LPP by different methods, Concept and formulation of dual problem.

CO-4: Ability to evaluate and apply statistical and measurement, Principles to their area of interest.

CO-5: Indian Official Statistical system. The different methods of collection of official statistics and their reliability. Principal publications and the various official agencies responsible for data collection and their main functions.

Semester V
Statistics (Pass)
Paper – V (Theory) / STA – P501

At the end of the course students should have developed clear understanding of:

Unit I: Basic Mathematics

Set, types of set, operations on sets and their properties, Intervals- open, closed, half-open, half-closed. Countable and uncountable sets, open and closed sets, compact set and their properties. Concept about the field of sets, sigma-field and their properties. Measure, measure space, elementary properties of measure.

Students will have the knowledge of basic properties of the Convergence of sequence, Cauchy criterion, Infinite series: Cauchy criterion for convergence, geometric series, convergence test of positive term series by different test. Alternative series: test of convergence (Leibnitz test), concept of absolute convergence, conditional convergence, Lagrange's method of determining multiplier, Mean Value theorem of differential calculus' Riemann integrability, Infinite and improper integral (concept only), Gamma and Beta function and their elementary properties.

Unit II: Computer Programming

Acquire about computer and its generation, uses types of computers, Internet, Concept of windows, desktop, creation of files and folder etc, integral parts, Uses of M.S. Excel sheet for drawing charts, calculation etc.

Unit III: Normal Probability Distribution

Learn about Normal distribution and its derivation as a limiting case of binomial distribution, joint prob. Mass and density functions, joint, marginal and conditional distributions. Bivariate normal distribution and finding of marginal and conditional mean and variance etc.

Unit IV: Theory of Estimation

Acquire knowledge about the Minimum variance estimator, calculate and interpret confidence intervals for maximum likelihood parameter estimates.

Unit V: Design of Experiments

Gain knowledge about the Latin square Design (LSD), its analysis, CD of comparing treatment means, Missing plot technique, one missing observation for CRD, RBD, LSD.

Factorial experiments with two and three levels. Complete and partial confounding. Analysis of covariance. Concept of Split plot technique applied in RBD, description of strip plot arrangement in RBD etc.

Unit VI: Sample Survey

Survey Sampling provides the tools/ techniques for selecting a sample of elements from a target population keeping in mind the objectives and nature of population. Most of the research work is done through Sample Survey. Principles of survey sampling and main steps involved in selecting a sample. Simple random sampling, Stratified random sampling, Systematic sampling (linear), Ratio and Regression method of estimation Cluster sampling (equal cluster size) Concepts of sub sampling, non-sampling errors: source and type, non-Sampling bias, non-response errors etc.

Semester V
Statistics (Pass)
Paper – V (Theory) / STA – P601

On completion of the course, students should have achieved the following:

Unit I: Sampling Distribution

Know about the Derivation of t, F, Chi square distribution, its curve and properties. Explain about the calculating the sample variance and unbiased estimator, how is that related to this topic of sample proportion etc.

Unit II: Statistical Quality Control

Understand the concepts of Statistical Quality Control, Control charts for variables and attributes. Know about the different types of control charts for variables and attributes and their construction. Process and Product Control, Producer's and consumer's risk, Acceptance sampling plans etc.

Unit III: Correlation

Learn about the Multiple and partial correlation, calculate and interpret the correlation between two variables, determine whether the correlation is significant, the process of constructing a mathematical function, Orthogonal polynomial and its derivation etc.

Unit IV: Operation Research

Origin, development and importance of OR, Models of OR, Elements and formulation of LPP, Solution of LPP by different methods, Concept and formulation of dual problem.

Unit V: Psychological and Educational Statistics

Ability to evaluate and apply statistical and measurement, Principles to their area of interest.

Unit VI: Indian Official Statistics

Indian Official Statistical system. The different methods of collection of official statistics and their reliability. Principal publications and the various official agencies responsible for data collection and their main functions.