NATIONAL UNIVERSITY

BANGLADESH

First Year Syllabus
Department of Statistics

Four-Year B.Sc. (Honours) Program
Effective from the Session: 2024–2025

Mission

To promote "Progress for Everyone" by fostering transformative education, conducting pioneering research, and encouraging meaningful collaboration with individuals, communities, and partners both in Bangladesh and around the world.

Vision

We expect that the hundredth anniversary of the National University, our commitment to "Progress for Everyone" will be evident in all areas of our operations and stakeholder engagements.

We leverage our core strength in education, research, and community engagement to address pressing global issues and foster sustainable development.

By 2042, National University aims to strengthen its positions as Bangladesh's top academic institution and rank among the world's leading universities. Our focus will be on expanding expertise building strategic partnerships, and increasing our global influence. Our services will be measured by the achievements of the individuals and communities we serve.

Name of the Program: B.Sc. (Honours) in Statistics

Program Educational Objectives (PEOs)

PEO 1: To produce graduates with strong theoretical and practical knowledge of Statistics according to the requirements of contemporary market demand.

PEO 2: To develop graduates capable of performing interdisciplinary and collaborative research and demonstrate technical competence in the field of statistics.

PEO 3: To develop graduates who can help to deliver adequate, relevant and timely statistics to facilitate research, planning and decision making program for the government and the community for achieving Sustainable Development Goals (SDGs) of Bangladesh.

PEO 4: To produce graduates with strong leadership, teamwork, communication skills and ethical and moral values that will help them in their professional lives.

Program Learning Outcomes (PLOs)

At the time of graduation, B.Sc. (Honours) in Statistics students will have achieved the ability to:

PLO 1: Statistical Knowledge: Understand and use basic to advanced statistics, and apply this acquired knowledge to solve real-life, academic, and professional problems.

PLO 2: Problem-Solving Ability: Recognize, formulate, and solve statistical problems using logic, formulas, and statistical techniques; and draw accurate conclusions in both pure and applied statistics.

PLO 3: Designing Solutions: Design and conduct scientific research to solve the problems that meet the specified needs of human welfare, public health and safety, and environmental considerations for sustainable living.

PLO 4: Research Skills: Collect, analyze, and interpret relevant data using statistical methods; perform calculations, draw graphs, and present results confidently with logical conclusions.

PLO 5: Use of Modern Tools: Understand the statistical tools and techniques that are available in Mathematics, Economics, Bioinformatics, Computer Program, and so on.

PLO 6: Health and Society: Apply statistical knowledge to practical activities, societal functions, public health, and overall development.

PLO 7: Career and Academic Readiness: Demonstrate readiness for careers in data management, research institution, teaching, government and nongovernment organizations , and qualify for admission to advanced studies in statistics and related fields such as engineering, medical sciences, economics, and education.

PLO 8: Ethics and Responsibility: Develop strong moral and ethical principles and apply them to professional work for the betterment of society.

PLO 9: Teamwork and Leadership: Communicate effectively, work as a team and demonstrate high leadership qualities for handling any problems on professional settings.

PLO 10: Communication Skills: Share statistical ideas clearly through writing, speaking, and presenting. Be able to write reports, give presentations, and explain concepts.

PLO 11: Project and Time Management: Plan and manage time, tasks, and projects well. Use statistics in real situations while working alone or in a team.

PLO 12: Lifelong Learning: Keep learning new statistical knowledge, tools, and skills beyond graduation for personal and professional growth in an ever-evolving technological world.

Mapping PEO with PLO

	PEO-1	**PEO-2**	**PEO-3**	**PEO-4**
PLO-1	√	√		
PLO-2	√	√		
PLO-3		√	√	
PLO-4		√	√	
PLO-5		√	√	
PLO-6		√	√	
PLO-7				√
PLO-8				√
PLO-9			√	
PLO-10			√	
PLO-11				√
PLO-12				√

First Year Courses and Marks Distribution

FIRST YEAR

Course Code	Course Title	Marks	Credits
213601	Introduction to Statistics	100	4
213603	Elementary Probability	100	4
213605	Linear Algebra	100	4
213606	Lab 1: Introduction to Statistics	50	2
213608	Lab 2: Elementary Probability and Linear Algebra	50	2
213709	Foundations of Mathematics	100	4
213711	Calculus I	50	2
212209	Principles of Economics	100	4
212211	Bangladesh Agricultural Economics	50	2
219901	History of Bangladesh: Language, Culture and Identity	100	4
219903	Information and Communication Technology	75	3
219904	Lab: Information and Communication Technology	25	1
	Total =	900	36

Detailed Syllabus

Course Code	213601	Marks:100	Credits: 4	Class Hours: 60
Course Title:	Introduction to Statistics			

Course Objectives To be able to understand the nature, characteristics, scope, application and abuse of statistics. To make familiar with data, nature of data, how to process and condense the data, sources of data and graphical presentation of data, and to apply appropriate statistical tools and techniques to analyze the data.

Course Learning Outcomes (CLOs)

After going through the course, students will be able to learn the following

CLO1	Understand the nature, characteristics, scope, application and abuse of statistics, and sources of data.
CLO2	Grasp the knowledge of variables, measurement scales, classification and tabulation of data and also the knowledge of frequency distribution.
CLO3	Comprehend the detail graphical presentation of data,
CLO4	Understand different characteristics of statistical data such as measures of location, dispersion, moments, skewness, kurtosis and their properties.
CLO5	Understand the relationship between variables such as simple correlation, rank correlation, correlation ratio, simple regression analysis. standard error of estimators of regression coefficients & their properties and fitting of regression lines.
CLO6	Grasp the knowledge of the theory of attributes.

Mapping of CLOs with PLOs

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO10	PLO11	PLO12
CLO1	√	√						√				
CLO2	√	√										

CLO3	√	√								√		
CLO4	√	√	√			√			√			
CLO5	√	√	√	√	√	√	√		√		√	
CLO6	√	√										√

Course Contents

Topic	Teaching Learning Strategy	CLOs
Statistics - Its Definition and Scope: History of statistics, its definition, nature and characteristics, Methods of statistics, Scope and application of statistics, Abuse of statistics, Primary and secondary sources of data.	Lecture, Assignment	CLO1
Processing of Data: Variables & its types, Measurement scales, Attributes, Classification, Characteristic and basis of classification, Array formation. Tabulation, Different types of tables, Frequency distribution.	Lecture, Assignment	CLO2
Presentation of Data: Graphical presentation of data, Details of different types of graphs and charts with their relative merits and demerits, Exploratory data analysis: Stem-and-leaf plot using the right number of stems.	Lecture, Group Discussion, Assignment	CLO3
Characteristics of Statistical Data: Measures of location, Dispersion, Moments, Related theorems with their proofs, Skewness, Kurtosis and their properties. Box-and-Whisper plots.	Lecture, Group Discussion, Workshop and Assignment	CLO4
Relationship between Variables: Bivariate data, Scattered diagram, Simple correlation, Rank correlation, Correlation ratio, Simple regression analysis. Standard	Lecture, Group Discussion, and Assignment	CLO5

error of estimators of regression coefficients & their properties. Fitting of regression lines.		
Theory of Attributes: Notations, Order of classes and class frequencies, Relation between class frequencies, Consistency of data, Independence of attributes, Association of attributes, Yule's coefficient of association.	Lecture, Group Discussion, Workshop and Assignment	CLO6

List of Books

Gupta, S.C., & Kapoor, V.K. (1994). *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons.

Hoel, P.G. (1991). *Introduction to Mathematical Statistics, 5th Edition*. Wiley and Sons

Islam, M.N. (2015). *An introduction to Statistics and Probability (4th ed.).* Mullick & Brothers.

Jalil, M. A., & Ferdous, R. (1999). *Basic statistics: Methods and Applications*, Robi Publications.

Mostafa, M.G. (1989). *Method of Statistics (4th ed.).*Karim press and Publications.

Shil, R.N., & Debnuth, S.C. (2016). *An introduction to the theory of Statistics*. Star Publications.

Simpson, G., & Kafka, F. (1960). *Basic Statistics.* Oxford & ibh Publishing Co.

Weiss, N. A., & Weiss, C. A. (2012). *Introductory statistics*. Pearson Education.

Course Code	**213603**	**Marks:100**	**Credits: 4**	**Class Hours: 60**
Course Title:	**Elementary Probability**			

Course Objectives To make familiar with the concepts of sets, and acquaint students with necessary skills for solving probability related problems using appropriate laws. To understand the notions of random variables. To develop ability to find probability distribution of random variables and of their functions. To introduce operators like generating functions, expectation, etc. for studying the characteristics of distributions. To provide basic probability distributions with possible areas of applications.

Course Learning Outcomes (CLOs)

After going through the course, students will be able to learn the following

CLO1	Able to understand basic concepts of set theory.
CLO2	Grasp the knowledge of experiments and related concepts.
CLO3	Comprehend different approaches to defining probability and useful laws of probability to solve problems.
CLO4	Understand the concept of random variables in discrete and continuous cases with derive the distribution functions (Joint, marginal and conditional) for both cases.
CLO5	Understand the knowledge of moments and generating functions.
CLO6	Grasp the knowledge of some fundamental probability distributions.

Mapping of CLOs with PLOs

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO10	PLO11	PLO12
CLO1	√	√						√				
CLO2	√	√							√	√	√	
CLO3	√	√										
CLO4	√	√			√		√					
CLO5	√	√	√	√								
CLO6	√	√				√						√

Course Contents

Topic	Teaching Learning Strategy	CLOs
Set theory: Sets, type of sets with their operations and applications.	Lecture, Assignment	**CLO1**
Experiments and Related Concepts: Random experiment, Sample space, Event space, Union and intersection of events, Different types of events.	Lecture, Assignment	**CLO2**

Multiplication rule, Permutation & Combination.		
Basic Concepts of Probability: Meaning of probability, Scope of probability, Different approaches of defining probability. Theorem on total probability, Conditional probability, Theorems on multiplicative law of probability. Bayes' theorem and its uses & importance in statistics.	Lecture, Group Discussion, Assignment	**CLO3**
Random Variable: Discrete and continuous random variables, probability mass function, probability density function. Function of random variable and its probability distribution, joint distribution, marginal and conditional distribution, independence of random variables, mathematical expectation, expectations of sum and products of random variables, conditional expectation and conditional variance.	Lecture, Group Discussion, Workshop and Assignment	**CLO4**
Moments and Generating Functions: Moments and moment generating functions, Characteristics function, Cumulants and cumulant generating functions, Relationship between moments and cumulants. Chebyshev inequalities, Law of large number, Central limit theorem.	Lecture, Group Discussion, and Assignment	**CLO5**
Fundamental Probability Distributions: Detail study of Bernoulli, Binomial, Poisson, Negative Binomial, Geometric, Rectangular and Exponential distribution.	Lecture, Group Discussion, Workshop and Assignment	**CLO6**

List of Books

Chung, K. L. (2006). *Elementary Probability Theory with Stochastic Process, 4th ed.,* Springer - Verlag, N.Y.

Feller, W. (2008). *An introduction to probability theory and its applications (Vol. 2).* John Wiley & Sons.

Hoq, S. (1996). *Probability: An Introduction.* Halima Begum.

Islam, M.N. (2015). *An introduction to Statistics and Probability (4th Ed.).* Mullick & Brothers, Dhaka.

Lipschutz, S., and J. Schiller (2011). *Introduction to Probability and Statistics*. McGraw-Hill, N.Y.

Roy, M. K., & Roy, D. C. (2014). *Fundamentals of Probability & Probability Distributions*. Romax Publications

Shil, R.N., & Debnath, S. C. (2016). *An introduction to the theory of Statistics*. Star Publications.

Course Code	**213605**	**Marks:100**	**Credits: 4**	**Class Hours: 60**
Course Title:	**Linear Algebra**			

Course Objectives To be able to apply properties of real vector spaces and subspaces, including linear independence and dependence. To perform matrix algebra, determinants, and their properties. To find eigenvalues and eigenvectors and use them in applications.

Course Learning Outcomes (CLOs)

After going through the course, students will be able to learn the following

CLO1	Able to understand basic concept of vector and vector set, Gram-Schmidt Orthogonalisation process, subset and superset of vectors, related theorems.
CLO2	Understand and apply properties of real vector spaces and subspaces.
CLO3	Perform matrix algebra, determinants, and understand their properties. Also able to find elementary transformation of matrices, ranks, trace of a matrix, orthogonal matrices, and idempotent matrices.
CLO4	Solve systems of linear equations.
CLO5	Find quadratic forms, canonical forms, eigenvalues and eigenvectors and apply them in various scenarios.

Mapping of CLOs with PLOs

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO10	PLO11	PLO12
CLO1	√	√						√				
CLO2	√	√										
CLO3	√	√		√	√					√		
CLO4	√	√	√	√	√	√			√			√
CLO5	√	√	√			√	√		√		√	

Course Contents

Topic	Teaching Learning Strategy	CLOs
Vector and Vector Set: Definition of a vector, different types of vectors, length and angle between two vectors, operation with vectors, vector set, linearly dependent and independent set of vectors, Sweep-out method, Orthogonal vectors, Normalization, Gram-Schmidt Orthogonalisation process, subset and superset of vectors, related theorems.	Lecture, Assignment	CLO1
Vector spaces: Spanning set of vectors, vector spaces and sub-spaces, their geometric interpretation, rank and basis of vector spaces and sub-spaces, related theorems.	Lecture, Assignment	CLO2
Determinants and Matrices: Matrix and vector, square matrix and determinants, product of determinants, different types of determinants, Evaluation of n×n determinants & their properties and uses in statistics. Various types of matrices, matrix operations, properties of such operations, rank and elementary transformation of matrices, related theorems of ranks, trace of a matrix, its properties with proofs. The usual inverse of matrices and their uses in statistics. Generalized inverses & Kronecker product of	Lecture, Group Discussion, Assignment	CLO3

matrices and their properties and uses. Orthogonal matrices, idempotent matrices, patterned matrices and their properties. Vector & matrix differentiations and their application in statistics.		
System of Linear Equations: Homogeneous and non-homogeneous types of linear equations, consistent and inconsistent, unique solutions.	Lecture, Group Discussion, Workshop and Assignment	CLO4
Quadratic Forms: Definition with examples, classification of quadratic forms, latent roots and latent vectors of matrices, canonical forms, related theorems of eigen values, eigen vectors and quadratic forms.	Lecture, Group Discussion, and Assignment	CLO5

List of Books

Anton, H., and Rorres. C., (2005). *Elementary Linear Algebra (4th edition)*, Wiley.

Ali, M. I. (1984). *Matrices and Linear Transformation*. Science corner, Dhaka.

Hadley, G. (1993). *Linear Algebra*, Narosa, New Delhi.

Lipschutz, S. & Lipson, M.L. (1981). *Linear Algebra* (Schaum's Outline Series). McGraw-Hill.

Rahman, A. (2015). *College Linear Algebra*. Nahar Book Depot & Publications, Dhaka.

Rao, C. R., & Mitra, S. K. (1971). *Generalized Inverses of Matrices and its Applications*, John Wiley & Sons Inc., N.Y.

Santirarayan. (2007). *A Textbook of Matrices*. S. Chand & Company Ltd., New Delhi, India.

Course Code	**213606**	**Marks:50**	**Credits: 2**	**Class Hours: 30**
Course Title	**Lab 1: Introduction to Statistics**			

Condensation and tabulation of data. Formation of a frequency distribution from both qualitative and quantitative data. Construction of a bivariate table. Graphical representation of data. Measures of location and dispersion, Calculation of moments, Measures of skewness and kurtosis. Simple correlation coefficient and fitting of regression lines. Computation of the rank correlation coefficient.

Course Code	213608	Marks:50	Credits: 2	Class Hours: 30
Course Title:	Lab 2: Elementary Probability and Linear Algebra			

Elementary Probability: Real-life based probability calculation. Fitting of Binomial, Poisson, and Geometric distributions. Probability calculation based on Rectangular and Exponential distributions.

Linear Algebra: Rank basis, dimension & orthogonal vectors by the Gram-Schmidt orthogonalization process, orthonormal vectors, linear dependence and independence of vectors, etc. Rank of a matrix, transpose, Determinant inversion, Trace, Solutions of simultaneous equations, quadratic form. Latent roots and latent vectors of the matrix.

Course Code	213709	Marks: 100	Credits: 4	Class Hours: 60
Course Title:	Foundations of Mathematics			

Course Objectives

To give students a clear understanding of essential mathematical concepts and techniques, preparing them for advanced courses in mathematics and allied disciplines.

Course Learning Outcomes (CLOs)

After completing this course, students will be able to

CLO1	Define and explain basic concepts of relations, functions, and their graphs.
CLO2	Demonstrate understanding of real and complex numbers and apply their properties in problem-solving.
CLO3	Solve polynomial and related equations using appropriate methods.
CLO4	Apply formulas of algebraic and geometric series to compute sums and related results.
CLO5	Use the principles of two- and three-dimensional geometry to solve basic geometrical problems.
CLO6	Explain the basic concepts of vector space and apply them to simple problems.
CLO7	Represent and manipulate vectors in two and three dimensions to solve problems in mathematics and other fields.

Mapping of CLOs with PLOs

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO10	PLO11	PLO12
CLO1	√	√						√				
CLO2	√	√										
CLO3	√	√		√	√					√		
CLO4	√	√	√	√	√	√			√			√
CLO5	√	√	√			√	√		√		√	
CLO6			√	√	√	√						
CLO7	√	√					√	√				√

Course Contents

Topic	Teaching Learning Strategy	CLOs
Relations and Functions: Relations; Order relation; Equivalence relations; Functions; Images and inverse images of sets; Injective, surjective, and bijective functions; Inverse functions.	• Whiteboard-based lecture • Assignment • Short presentations by students	CLO1
Real Number System: Field and order properties; Prime numbers; Natural numbers; Integers and rational numbers; Absolute value and its properties; Basic inequalities (including inequalities of means and powers); Inequalities of Cauchy, Chebyshev, Weierstrass.	• Whiteboard-based lecture • Assignment	CLO2
Complex Number System: Field of Complex numbers; De Moivre's theorem and its applications.	• Whiteboard-based lecture • Assignment	CLO2
Matrices and Determinants: Notion of matrix; Algebra of matrices; Different types of matrices; Invertible matrices; Determinant function; Properties of determinants; Minors, Cofactors, expansion, and evaluation of determinants. Elementary row and column operations and row-reduced echelon matrices, Invertible matrices, Diagonal, triangular, and Symmetric matrices.	• Whiteboard-based lecture • Assignment	CLO3
System of Linear Equations: Linear equations; System	• Whiteboard-based lecture	CLO3

of linear equations (homogeneous and non-homogeneous) and their solutions using different methods. Gaussian elimination, Application of matrices and determinants for solving systems of linear equations, Applications of systems of equations in real-life problems.	• Assignment	
Summation of Finite Series: Arithmetic and geometric series; Method of difference; Successive differences; Summation of trigonometric series.	• Whiteboard-based lecture • Assignment	CLO4
Theory of Equations: Relations between roots and coefficients; Symmetric functions of roots; Sum of the powers of roots; Synthetic division; Descartes' rule of signs; Multiplicity of roots; Transformation of equation.	• Whiteboard-based lecture • Assignment	CLO3
Two-dimensional Geometry: Transformation of coordinates, Pair of straight lines (homogeneous second-degree equations, General second-degree equations representing pair of straight lines, angle between pair of straight lines, Bisectors of angle between pair of straight lines), General equations of second degree (reduction to standard forms, Identifications, Properties and tracing of conics).	• Whiteboard-based lecture • Assignment	CLO5
Three-dimensional Geometry: Three-dimensional coordinates, Distance, Direction cosines and direction ratios, Planes and straight lines.	• Whiteboard-based lecture • Assignment	CLO5
Vector Geometry: Vectors in plane and space; Algebra of vectors; Rectangular components; Scalar and Vector products; Coplanar vectors; Scalar triple product and vector triple product; Applications of vectors to geometry (vector equations of straight lines and planes, areas and volumes).	• Whiteboard-based lecture • Assignment	CLO6 CLO7
Vector Spaces: Euclidean *n*-space, Real vector spaces, Subspaces, Linear combination of vectors, Linear dependence of vectors, Basis and dimension, Linear transformations, Matrix representation of linear transformation, Kernel and image, Eigenvalues and Eigenvectors.	• Whiteboard-based lecture • Assignment	CLO6 CLO7

List of Books

Anton, H., & Rorres, C. (2013). *Elementary linear algebra with applications* (11th ed.). Wiley.

Barnard, S., & Child, J. M. (1997). *Higher algebra* (6th ed.). Cambridge University Press.

Hall, H. S., & Knight, S. R. (1992). *Higher algebra* (7th ed.). Macmillan.

Hadley, G., (1993). *Linear Algebra*, Narosa, New Delhi.

Lipschutz, S. (1997). *Schaum's outline of set theory and related topics* (Schaum's Outline Series). McGraw-Hill

Mohammad, K. (2010). *Analytic geometry and vector analysis*. Dhaka: Ideal Library.

Rahman, A. (2015). *College Linear Algebra.* Nahar Book Depot & Publications, Dhaka.

Rahman, M. A. (2015). *Basic algebra*. Dhaka: Nahar Book Depot and Publications.

Spiegel, M. R. (1974). *Vector analysis* (Schaum's Outline Series). McGraw-Hill.

Course Code	**213711**	**Marks: 50**	**Credits: 2**	**Class Hours: 30**
Course Title:	**Calculus I**			

Course Objectives To develop the basic ideas of functions and their graphs. To learning the basic properties of limit and continuity and analyzing them both mathematically and graphically. Also to understand the ideas and applications in solving real-life-oriented problems of differentiation and integration.

Course Learning Outcomes (CLOs)

After completing this course, students will be able to

CLO1	Identify and graph various types of functions, including polynomial, rational, exponential, logarithmic, trigonometric, and hyperbolic functions, and describe their key properties.
CLO2	Explain the concepts of limits and continuity, and apply relevant theorems to compute limits.
CLO3	Apply techniques of differentiation, including rules and theorems (e.g., Leibniz's rule), to solve problems related to rates of change and approximations in mathematical and real-life contexts.
CLO4	Analyze functions using derivative-based tools, such as the Mean Value Theorem, to determine maximum and minimum values, and concavity, to solve optimization and curve analysis problems.
CLO5	Apply techniques of integration (definite and indefinite) and related theorems to solve problems involving area, volume, arc length, and surface area.

CLO6	Apply approximation techniques using Taylor polynomials and series to estimate function values and analyze convergence.
CLO7	Evaluate series expansions and perform differentiation and integration of series to solve complex calculus problems.

Mapping of CLOs with PLOs

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO10	PLO11	PLO12
CLO1	√	√						√				
CLO2	√	√										
CLO3	√	√		√	√					√		
CLO4	√	√	√	√	√	√			√			√
CLO5	√	√	√			√	√		√		√	
CLO6			√	√	√	√						
CLO7	√	√					√	√				√

Course Contents

Topic	Teaching Learning Strategy	CLOs
Functions and Their Graphs: Polynomial and rational functions; logarithmic and exponential functions; trigonometric functions and their inverses; hyperbolic functions and their inverses; combinations of such functions.	• Whiteboard-based lecture • Assignment	CLO1
Limit and Continuity: Definitions and basic theorems on limit and continuity; Limit at infinity and infinite limits; Computation of limits.	• Whiteboard-based lecture • Assignment	CLO2
Differentiation: Tangent lines and rates of change; Definition of derivative; One-sided derivatives; Rules of differentiation; Successive differentiation; Leibnitz's theorem; Related rates; Linear approximations and differentials.	• Whiteboard-based lecture • Assignment • Tutorial	CLO3

Applications of Differentiation: Mean value theorem; Maximum and minimum values of functions; Concavity and points of inflection; Optimization problems.	• Whiteboard-based lecture • Assignment	CLO4
Integration: Antiderivatives and indefinite integrals; Techniques of integration; Definite integration using antiderivatives; Fundamental theorems of calculus; Basic properties of integration; Integration by reduction.	• Whiteboard-based lecture • Assignment	CLO5
Applications of Integration: Arc length; Plane areas; Surfaces of revolution; Volumes of solids of revolution; Volumes by cylindrical shells; Volumes by cross sections.	• Whiteboard-based lecture • Assignment	CLO5
Approximation and Series: Taylor polynomials and series; Convergence of series; Taylor's series; Taylor's theorem and remainders; Differentiation and integration of series.	• Whiteboard-based lecture • Assignment	CLO6 CLO7

List of Books

Anton, H., Bivens, I. C., & Davis, S. (2016). *Calculus: Early transcendentals* (11th ed.). Wiley.

Das, B. C., & Mukherjee, B. N. (1938). *Integral calculus*. Kolkata: U. N. Dhur & Sons Pvt. Ltd.

Das, B. C., & Mukherjee, B. N. (1949). *Differential calculus*. Kolkata: U. N. Dhur & Sons Pvt. Ltd.

Matin, M. A., & Chakraboty, B. (1994). *Differential calculus*. Dhaka: Standard Publications.

Mohammad, K., Bhattacharjee, P. K., & Latif, M. A. (1968). *Differential calculus* (1st ed.). Chittagong: S. Tripaty.

Mohammad, K., & Bhattacharjee, P. K. (1987). *Integral calculus* (6th ed.). Chittagong: H. Bhattacharjee.

Stewart, J. (2015). *Calculus: Early transcendentals* (8th ed.). Cengage Learning.

Swokowski, E. W. (1988). *Calculus with analytic geometry* (6th ed.). Brooks/Cole.

Thomas, G. B., & Finney, R. L. (1996). *Calculus and analytic geometry* (9th ed.). Addison-Wesley.

Course Code	212209	Marks:100	Credits: 4	Class Hours: 60
Course Title:	Principles of Economics			

Course Objectives This course provides students with fundamental economic principles covering microeconomic and macroeconomic concepts, including supply and demand analysis, consumer behavior, production theory, market structures (perfect competition and monopoly), national income accounting, international trade, money and inflation, and government finance. Students will develop analytical skills to understand economic decision-making at individual, firm, and national levels, while examining contemporary economic issues and Bangladesh's economic context.

Course Learning Outcomes (CLOs)

CLOs	Learning Outcome
CLO1	Explain core economic concepts including scarcity, opportunity cost, and production possibilities
CLO2	Analyze market forces using supply-demand models and elasticity concepts
CLO3	Apply utility theory to explain consumer choice and calculate consumer surplus
CLO4	Differentiate between short-run and long-run production costs and analyze production functions
CLO5	Compare market structures (perfect competition vs monopoly) and their equilibrium outcomes
CLO6	Calculate key macroeconomic indicators (GDP, GNP) and explain national income accounting
CLO7	Evaluate arguments for free trade vs protectionism using comparative advantage theory
CLO8	Distinguish between economic growth and development, identifying measurement challenges
CLO9	Explain monetary concepts (money supply measures, inflation) and their economic impacts
CLO10	Analyze government budgets, tax systems, and fiscal policy implications

Course Contents

Topic	Teaching Learning Method	CLOs
1. Fundamentals of Economics: Definition, Nature and Scope of Economics, Scarcity of Resources, Various forms of Economic Organization, Three Fundamental Problems of Economics, Production Possibility Frontier, Opportunity Cost, Efficiency and Equity, Informal Economics,	Lecture and Assignment	CLO1
2. Supply and Demand: Demand and Quantity Demanded, Determinants of Quantity Demanded, Demand Schedule, Demand Curve, Supply and stock, Quantity Supplied, Determinants of Supply, Supply Schedule, Supply Curve, Equilibrium of Supply and Demand, Movement along the Supply and Demand Curve and Shift of Supply and Demand Curve and Its Effects on Equilibrium Price and Quantity. Elasticity of Supply and Demand; Determinants of Elasticity of Demand, Cross Elasticity of Demand.	Lecture, Group Discussion, Problem Solving and Assignment	CLO2, CLO5
3. The Theory of Consumer Behavior: Cardinal and Ordinal Utility Analyses, Total and Marginal Utility; Law of Diminishing Marginal Utility, Equi-Marginal Utility; Consumer Surplus.	Lecture, Problem Solving, Tutorial and Assignment	CLO3
4. Production and Cost: Production Function and Technology; Production with One Variable Input; Production with Two Variable Inputs; Returns to Scale; Costs in the Short-run; Costs in the Long-run, LAC, SAC, LMC, SMC.	Lecture, Group Discussion and Tutorial	CLO4
5. Market Analysis: **i) Perfect Competition:** Definition of Market, Characteristics of Perfect Competition; Average and Marginal Revenue; Short-run equilibrium of a competitive firm Long run Equilibrium under Perfectly Competitive Market, Causes of Disequilibrium Condition.	Lecture, Problem Solving, Group Discussion and Assignment	CLO2, CLO5

ii) Monopoly: Characteristics of Monopoly Market, Average and Marginal Revenue; Supply Curve of the Monopolist; Equilibrium Position of a Monopolist. Compare between Perfect Competitive Market and Monopoly Market.		
6. Overview of Macro Economics: Objective and Instruments of Macroeconomics, Methods of National Income Accounting, Gross Domestic Product (GDP), Problem of Double Counting, Net Domestic Product, Gross National Product (GNP), From GDP to Disposable Income.	Lecture, Practical Example and Assignment	CLO6
7. International Trade: Domestic Vs. International Trade-Balance of Trade Vs. Balance of Payment-Trend of Changes in International Trade of Bangladesh. Free Trade Vs. Protection, Absolute Advantage Theory, Comparative Advantage Theory.	Lecture, Group Discussion and Assignment	CLO7
8. Growth and Development: Economic Development and Economic Growth, Measurement of Economic Development, Obstacles to Economic Development, Contemporary Concept of Development.	Lecture, Group Discussion, and Assignment	CLO8
9. Money: Definition and Functions of Money-Importance of Money in Modern Economy-Different Concepts of Money (M1, M2, M3)-Value of Money. Concept, Causes and Effects of Inflation and Deflation.	Lecture, Group Discussion, and Assignment	CLO9
10. Government Revenue and Expenditure: Difference between Public Sector and Private Sector finance, Different Sources of Govt. Revenues, Taxation and Different Kinds of Taxes, Direct and Indirect Taxation, Definition of Revenue Budget, Development Budget, Revenue Budget Vs. Development Budget, Surplus, Deficit and Balanced Budget.	Lecture, Group Discussion, Practical Example and Assignment	CLO10

List of Books

Case, K. E., & Fair, R. C. (2020). *Principles of economics* (13th ed.). Pearson.

Mankiw, N. G. (2021). *Principles of economics* (9th ed.). Cengage Learning.

Parkin, M. (2022). *Economics* (13th ed.). Pearson.

Samuelson, P. A., & Nordhaus, W. D. (2021). *Economics* (20th ed.). McGraw-Hill.

Course Code	**212211**	**Marks: 50**	**Credits: 2**	**Class Hours: 30**
Course Title:	**Bangladesh Agricultural Economics**			

Course Objectives This course aims to provide graduate students with a comprehensive insight of agricultural economics in the context of Bangladesh, covering fundamental concepts, the structure of traditional and modern agriculture, and the sector's contributions to economic development through product, factor, and market linkages. It examines different farming systems (subsistence, commercial, cooperative, and sharecropping), agricultural finance mechanisms, land reform policies, and marketing systems, including challenges such as market imperfections. Additionally, the course critically evaluates government interventions like price support and input subsidies, equipping students with analytical skills to assess agricultural policies and their socio-economic impacts, ultimately preparing them for careers in agricultural policy, rural development, and agribusiness.

Course Learning Outcomes

Upon successful completion of this course, students will be able to learn the following

CLOs	**Learning Outcome**
CLO1	Define and explain the fundamental concepts of agricultural economics, including its subject matter and justification as a specialized field of study.
CLO2	Analyze the structural characteristics of traditional agriculture and evaluate development processes within traditional farming systems.
CLO3	Assess agriculture's contributions to economic development through product, factor, and market dimensions, and examine the impact of agricultural mechanization.
CLO4	Differentiate between various farming systems (commercial, cooperative, collective,

	sharecropping, subsistence, capitalist) and analyze their socio-economic implications.
CLO5	Evaluate the importance of agricultural finance, compare institutional and non-institutional credit sources, and analyze rural money markets considering gestation periods for different crops.
CLO6	Examine land reform concepts, objectives, and implementation challenges, and conduct comparative policy analysis of land reforms in Bangladesh.
CLO7	Analyze agricultural marketing systems, market imperfections, and value chain management while developing strategies to reduce producer-consumer gaps.
CLO8	Critically assess government interventions (price supports, subsidies, sustainability policies) and evaluate their effectiveness in Bangladesh's agricultural sector.
CLO9	Synthesize course knowledge to formulate policy recommendations for enhancing agricultural productivity, marketing efficiency, and rural development.
CLO10	Apply theoretical concepts to analyze real-world agricultural economic challenges through case studies and research projects.

Mapping of CLOs with PLOs

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO10	PLO11	PLO12
CLO1	√	√						√				
CLO2	√	√										
CLO3	√	√								√		
CLO4	√	√	√			√			√			
CLO5	√	√	√	√	√	√	√		√		√	
CLO6	√	√										√
CLO7	√	√						√	√			
CLO8	√	√						√	√			
CLO9	√	√										
CLO10	√	√				√	√					

Course Contents

Topic	Teaching Learning Strategy	CLOs
1. Introduction: Definition of Agricultural Economics, subject matter of agriculture economics, need for a separate study.	Knowledge Sharing and Lecture	CLO1
2. Structure and Characteristics of Traditional Agriculture: Basic features of traditional agriculture, development in traditional agriculture.	Lecture, Group Discussion, Assignment	CLO2
3. Contribution of Agriculture to Economic Development: Product contribution; factor contribution, market contribution and their relative importance; Importance of agriculture for industrial development; role of mechanization of agriculture mode of production.	Lecture, Field Work and Assignment	CLO3, CLO9
4. Types of Farming: Commercial, cooperative and collective farming; share cropping, subsistence farming Vs. Capitalist farming;	Lecture, Group Discussion	CLO4, CLO9
5. Agricultural Finance: Importance of agricultural credit, sources of agricultural credit, institutional and non-institutional; functions of rural money markets: proper management of financing considering gestation gaps for different variety of agriculture product.	Lecture, Field Work, Problem Solving and Assignment	CLO5, CLO9
6. Land Reform: Definition, objectives of land reform, features of past and modern land reform, difficulties of implementing land reform; tenancy arrangement practices and prospect in rural economy; comparative analyses of land reform policies in Bangladesh.	Lecture, Group Discussion and Assignment	CLO6, CLO10
7. Marketing: Role of agricultural marketing, marketing functions and market structure, market intelligence, imperfections of agricultural marketing in Bangladesh and	Lecture, Problem Solving, Group Discussion and	CLO7, CLO9, CLO10

LDCs; Value chain in agriculture sector; proper management of value chain and the strategies of gap manage between peasant and consumer.	Assignment	
8. Role of Government: Rationale for government intervention in agriculture, protections of farmer's income, price support and input subsidy, price policy in agriculture sector in Bangladesh; government role for sustainability issues in rural Bangladesh.	Lecture, Group Discussion, Field Work and Assignment	CLO8, CLO10

List of Books

Barkat, A., Zaman, S., & Raihan, S. (2001). *Political economy of khas land in Bangladesh*. Association for Land Reform and Development (ALRD).

Ghatak, S., & Ingersent, K. (1984). *Agriculture and economic development*. Wheatsheaf Books.

Hill, B., & Ingersent, K. (1982). *Economic analysis of agriculture* (2nd ed.). Heinemann Educational.

Mellor, J. W. (1966). *The economics of agricultural development*. Cornell University Press.

Southworth, H. M., & Johnston, B. F. (Eds.). (1967). *Agricultural development and economic growth*. Cornell University Press.

Course Code	**219901**	**Marks:100**	**Credits: 4**	**Class Hours: 60**
Course Title:	**History of Bangladesh: Language, Culture and Identity**			

Course Objective

This course is designed to help undergraduate students from diverse academic backgrounds develop a comprehensive and nuanced understanding of the historical development of Bangladesh, with a particular focus on its language, culture, and identity. By critically examining a variety of historical events, socio-political movements, and cultural shifts from ancient times to the contemporary period, students will have the opportunity to trace the evolution of the Bengali nation. The course aims to foster informed citizenship through an exploration of the Liberation War, identity formation processes, cultural heritage, the lives and contributions of key political

figures, and the roles of ethnic minorities. Ultimately, the objective is to equip learners with the intellectual tools necessary to contextualize current national debates and to recognize the role of youth and globalization in shaping the future of Bangladesh.

Course Learning Outcomes

At the end of the course, learners will be able to:

CLO 1: Recall key historical events, dates, movements, personalities, and cultural developments that contributed to the emergence of Bangladesh from the pre-colonial period to the present day.

CLO 2: Demonstrate an understanding of the socio-political, linguistic, and cultural influences that shaped Bengali identity and nationalism, emphasizing the Language Movement, Liberation War, and subsequent democratic uprisings.

CLO 3: Apply their historical and cultural understanding to interpret contemporary national issues and debates relating to identity, political reform, and cultural transformation in Bangladesh.

CLO 4: Analyze how historical events, political ideologies, and social changes are interconnected in shaping the current socio-political landscape of Bangladesh, with a particular emphasis on the roles of movements, minorities, and the youth.

Course Contents

Course contents	Teaching Learning Strategy	CLOs
1. Pre-colonial Era • Life and Culture of the People in Ancient Bengal • Bengal Under Muslim Rulers: Society, Culture, and Religion • Role of the Sufis in Preaching Islam and Impacts of • Sufism in the Bengali Society • Bengali Society and Culture in the Writings of Foreigners	Interactive lectures	CLO 1-2
2. Colonial Era (18th and 19th Century) • The Battle of Plassey (1757)and the Beginning of British Colonialism • Bengal Renaissance	Interactive lectures, reading, and assignments	CLO 1-2

• Reforms in Hindu Society • New Forms in Bengali Literature and Culture • The Muslim Response to Western Education		
3. Colonial Era (First Half of the 20th Century) • Partition of Bengal (1905) • Hindu-Muslim Disagreements • Formation of the All India Muslim League (AIML) • Muslim Shahitya Samaj • Buddhir Mukti Andolan: The Urge for Rational Thinking in Bengali Muslim Society • Growth of Religion-based Identity • Politics of Hindutva and the Two-Nation Theory • Spread of Communalism in Society • The Partition of India and Bengal	Interactive lectures and group discussions	CLO 2-3
4. Post-Partition Era(1947-1971) • Language Movement • Political, Economic, and Cultural Aspects • Growth of Vernacular Nationalism • Cultural Activism	Interactive lectures and group discussion	CLO 2-3
5. Changing Bengali Identity • The Evolution of Bengali Identity in the Context of Language, Culture, and Religion • From Ancient Times to the Present • The Role of the Bengali Language in Shaping Identity • The Language Movement of 1952 and Its Long-term Impact on National • Consciousness • The Influence of Religion on Bengali Identity • The Impact of Socio-political Movements on Identity Formation • The Liberation War of 1971 • Contemporary Debates on Bengali Identity • The Role of Youth in Redefining Identity • The Influence of Globalization	Interactive lectures and thematic assignments	CLO 2-3
6. Liberation Movement of 1971 and Mass Uprising till 2024 • The Political and Economic Exploitation of East Pakistan by West Pakistan • Six (6) Points Movement, Uprising of 1969 • The 1970 General Elections • The Non-Cooperation Movement and the Declaration of Independence • The Role of AK Fazlul Haque, Huseyn Shaheed Suhrawardy, Maulana Bhashani, Sheikh Mujibur Rahman and Ziaur Rahman	Interactive lectures, group discussions, and thematic assignments	CLO 1 CLO 3-4

• The Liberation War of 1971 • Genocide and Resistance • The Role of the Mukti Bahini • Post-independence Challenges • Nation-building • Political Instability • Mass Uprisings and Democratic Movements • The Anti-Autocracy Movement of the 1980s • The 1990s Movement for Democracy and Afterwards • The 2024 Movements for Political and Social Reforms		
7. History of Other Ethnic Groups • The Indigenous Communities of Bangladesh • Historical Presence • Cultural Practices • Land Rights and Cultural Assimilation • Contributions and Sacrifices • Political Representation of Ethnic Minorities	Interactive lectures and group discussions	CLO 4
8. Cultural Heritage and Modern Transformations • The Evolution of Bengali Culture • From Ancient Traditions to Modern Expressions • The Role of Literature, Music, and Art in Shaping Bengali Identity • Contributions of Rabindranath Tagore, Kazi Nazrul Islam, and Other Cultural Icons • The Impact of Globalization on Bengali Culture • The Revival of Traditional Arts • The Role of Youth in Cultural Innovation Urbanization • Environmental Changes • The Commodification of Culture	Interactive lectures, documentary screening, and thematic assignments	CLO 1-4

List of Books

Ahmed, M. (1979). *Bangladesh: The constitutional quest for autonomy*. The University Press Limited.

Ahmed, R. (1981). *The Bengal Muslims 1871-1906: A quest for identity*. Oxford University Press.

Alavi, H. (1972). *The state in post-colonial societies: Pakistan and Bangladesh.* In K. Gough & 11. P. Sharma (Eds.), Imperialism and revolution in South Asia (pp. 145-178). New York, NY: Monthly Review Press.

Bernier, F. (2023). *Travels in the Mogul Empire: A.D. 1656-1668.* Chennai: Atlantic Publishers.

Bleie, T. (2005). *Tribal peoples, nationalism, and the human rights challenge.* The Adivasis of Bangladesh. University Press Limited.

Bosc, S. (2011). *Dead reckoning Memories of the 1971 Bangladesh war*. Hurst & Company.

Eaton, R. M. (1996). *The rise of Islam and the Bengal frontier. 1204-1760.* Berkeley: University of California Press.

Gilmour, D. (2019), *The British in India: Three centuries of ambition and experience*. London. Penguin.

Habib, L. (1982). *Cambridge economic history of India. Cambridge.* Cambridge University Press.

Halim, S., Amanullah, A. S. M., & Nasir, R. 1. (2024). *Society and sociology in Bangladesh*: *A South Asian perspective.* The University Press Limited.

Hashmi, T. (2021). *Fifty Years of Bangladesh, 1971-2021 Crises of Culture, Development, Governance and Identity.* Switzerland: Palgrave Macmillan.

Huq, M. E. (1975). *History of Sufism in Bengal. Dhaka.* Bangladesh Asiatic Society

Husain, 1. (2014). *Karl Marx on India.* New Delhi: Tulika Books.

Jahan, R. (1972). *Pakistan: Failure in national integration.* Columbia University Press.

Maniruzzaman, T. (1988*). The Bangladesh revolution and its aftermath* (2nd ed.). Dhaka: University Press Limited. (Original work published 19801

Mascarenhas, A. (1986). *Bangladesh: A legacy of blood. London:* Hodder and Stoughton.

Rashid, H. O. (2015). *The foreshadowing of Bangladesh: Bengal Muslim League and Muslim politics* (3rd ed.). Dhaka: University Press Limited.

Roy, A. (1984). *The Islamic syncretistic tradition in Bengal. Princeton.* NJ: Princeton University Press.

Sen, A. (2006). *Identity and violence: The illusion of destiny.* W. W. Norton & Company.

Umar, B. (2022). *The Emergency of Bangladesh: A History of East Pakistan.* Dhaka: Bangla Gobeshona.

Course Code	219903	Marks:75	Credits: 3	Class Hours: 45
Course Title	Information and Communication Technology			

Course Objectives

The main objective of the course is to develop students' understanding and skills in using, managing, and applying technology to solve problems and enhance various aspects of life and work. Key areas of focus include understanding ICT systems, software, hardware, networks, and their applications.

Course Learning Outcomes

The student will be able to

CLO 1	Explain foundational ICT concepts, including the information processing cycle.
CLO 2	Operate standard computer hardware and software systems effectively.
CLO 3	Use office productivity tools (Word, Excel, PowerPoint) for academic and professional tasks.
CLO 4	Apply safe internet practices and use internet tools for communication and information retrieval.
CLO 5	Understand and explain the concepts of Data Analytics, Artificial Intelligence (AI), and Machine Learning (ML)

Unit	Specific Objectives	Content	Teaching and Learning Approach
Unit 1: Introduction to Information and Communications Technology (ICT) and Computer System	The student will be able to: • Explain the concept of ICT and its related terminologies. • Describe the information processing cycle. • Analyze the impact of ICT on educational, social and economic development. • Identify career opportunities in ICT education.	Definition of ICT, basic concepts and terminologies. Data, Information Application of ICT, Advantages and Disadvantages of ICT, Impact of ICT Career opportunities in ICT education	Classroom Lectures

	• Differentiate among the classes of computers and the usages of them. • Identify the vital components of the Systems Unit.	Information Processing Cycle. Classification of Computers The Vital Components of the Systems Unit.	
Unit 2: Computer Hardware and Software	The student will be able to: • Describe the categories of Computer Hardware. • Describe the commonly used Input and Output devices • Identify the main processing devices, storage devices and media. Identify the main communication devices. • Identify types of Software packages. • Distinguish between an Operating System and Application software. • Identify different types, examples and uses of Operating Systems and Application software • Distinguish between Open Source and Proprietary Software.	Categories of Computer Hardware: Input devices, Processing devices, Output devices, Storage devices Communication devices, Main Processing Devices: The Processor, Control Unit and Arithmetic and Logic Unit Software Packages, Operating Systems, Types and uses of Operating Systems, Types and uses Application Software: Educational software, Games software, Graphics software Browsers: Internet explorer, Google chrome, Mozilla Firefox, Opera, Internet explorer, Mozilla Firefox; Proprietary and Open Source Software	Classroom lectures and Lab
Unit 3: Introduction to Word Processing Application	• The student will be able to: • Identify Word Processing packages. • Create and save a document using the Word Processor. • Format a Word document using formatting tools.	Word Processing Packages and Their Uses Creating a Document Using a Word Processor Saving a Document Using the 'Save As' command Editing a Word Document	Classroom Lectures, Lab, and Hands-on Practice

	Demonstrate the ability to perform collaborative editing. • Insert tables in a Word Processing document. • Insert symbols and pictures in Word Processing documents. • Use layout techniques in document creation. • Inserting headers and footers. • Print documents using the various print options.	Using Common Editing Tools: Copy/cut, paste, Undo and redo, find, replace, clipboard Creating a Document with More Sub-Headings and Paragraphs Text correction, Wrapping options, Text orientation Formatting and saving a Word document using the formatting tools: font (style, size, color, etc.), bold, underline, italic, superscript, subscript, shadow, strikeout, font color Paragraph Editing: alignment, bullet & numbering, indent, line spacing, table border Collaborative Editing: Using the highlighting option to track changes in a document, accepting or rejecting changes Insert: Adding text comments, Inserting Tables in a Word Document and inserting Symbols and Pictures in a Word Document. Header, footer, page number, drop cap, word art Page Design: watermark, page border Layout: Page setup/print	

Unit 4: Spreadsheet Application	• The student will be able to: • Identify Spreadsheet Packages. • Explain the importance of the Spreadsheet application in data management. • Explain related concepts and terminologies in the Spreadsheet. • Identify features in the Spreadsheet application window. • Create and save a Workbook. • Construct and insert simple formulae and functions. • Format the worksheet using formatting tools. • Printing a worksheet.	Spreadsheet Packages, e.g. Excel Importance of Spreadsheet application in Data Management, Related Concepts and Terminologies (e.g., cell(s), rows, columns, worksheet, workbook) Features in the Spreadsheet Window Tool Bars: formatting bar, standard bar, formulae bar Types of Data and Their Uses (e.g., number, date, text, currency), Creating and Saving a Workbook, Constructing and Inserting Simple Formulae and Functions Formatting Worksheet Using Formatting Tools Draw a Graph/chart Editing and Printing Worksheet	Classroom Lectures, Lab and Hands-on Practice
Unit 5: Presentation Application	• The student will be able to: • State the importance of the Presentation application. • Identify the commonly used features of a Presentation application while prepare a presentation. • Create and save presentations using a template, Add new slide(s). Edit text ,	Presentation Applications Packages, Devices used for Presenting, Importance of Presentation Application, Principles for Designing Presentations, Terminologies in Presentation Application (eg, Slide Layout, Slide transitions,	Classroom Lectures, Lab and Hands-on Practice

	Format text, Insert objects, images and pictures , Run slide show, Apply transition, animation effects to slides • Select the print option for printing. • Prepare a presentation on a selected topic and present it.	Slide show, etc.), Identification of Commonly Used Features of Presentation Application Window: Toolbars, Different presentation view modes Prepare a Presentation: Adding elements and formatting slides, slide Show, slide transition, animation Effects Selection of Print Option: Entire presentation, Specific slides, Handouts, Notes pages, outline view of slides, and Number of copies	
Unit 6: Privacy and Security	The student will be able to: • Understand the basics of digital security • Use some security tools. • Understanding digital ethics.	Introduction to Information Security, cybercrime, DoS and DDoS Attack, Key Management, Digital Signature and Certifications, privacy, Data Security, Vulnerability, Threat and Risk, Malware, Social Engineering, Hacking, Plagiarism, Fishing, Software Piracy, Worms and Viruses, Spam, Adware, Malware, Spyware, Antivirus Software Ethics in the digital world	Classroom Lectures, Lab and Hands-on Practice

Unit 7: Using The Internet to Communicate and Accessing Information	• The student will be able to: • Explain basic concepts, requirements, and terminologies of the Internet • Apply the rules and regulations in the use of the internet. • Using email • Use the internet social network to communicate. • Use Uniform Resource Locators (URLs) to access Information. Use search engines to access information • Upload files to virtual drives and work on it.	Internet, Intranet, Extranet, IP Address, Masking, MAC Address, Internet Services, OSI Reference Model, TCP/IP protocol stack, IPv4, IPv6, subnet Masking, MAC Address, Internet Services, Network Configuration and Troubleshooting, Wi-Fi, Broadband, Email Usage. Rules and Regulations in the Use of the Internet: Spam- Unsolicited Emails, People's Privacy, Intellectual Property Rights, etc. E-mail: Creating an Email Account, Sending, Accessing Email Messages, Attaching Documents to Email Messages, Using the Internet: Social Networks to Communicate, Uniform Resource Locators (URLs) to Access Information, Using Search Engines, Downloading Information from the Internet. Transferring Information from the Internet to a Different Application Intellectual Property Rights, ICT Policy, Software Piracy etc. Using Cloud Space:	Classroom Lectures, Lab and Hands-on Practice

		Google Drive, Google Workspace, OneDrive, Dropbox, etc.	
Unit8: Emerging Technologies: Data analytics, Artificial intelligence, Machine learning	• Define Data Analytics, Artificial Intelligence (AI), and Machine Learning (ML). • Understand how data is collected, processed, and used for decision-making. • Recognize the role of AI and ML in everyday life. • Explain basic differences between AI and ML. • Discuss benefits and challenges of these technologies. • Recognize current trends and career opportunities in these fields.	Introduction to Data Analytics: What is Data? Types of Data, Basic Steps in Data Analytics, Simple Tools; Artificial Intelligence (AI): Making Machines Capable of Performing Tasks that Require Human-Like Thinking. Common Examples: Voice Assistants, Facial Recognition, GPS Route Suggestions, Chatbots.; AI Capabilities: Understanding Language, Recognizing Patterns, Making Decisions; Machine Learning (ML): Define Machine Learning (ML), How It Works, Classification and Examples; Relationship Between Data Analytics, AI, and ML Benefits & Challenges of Data Analytics, AI, and ML. Future Trends & Career Paths	Classroom Lectures, Lab and Hands-on Practice

List of Books

Norton, P. (2008). *Introduction to computers* (9th ed.). The McGraw-Hill.

Comer, D. E. (2018). *The internet book: Everything you need to know about computer networking and how the internet works* (5th ed.). Chapman and Hall/CRC Press.

Lambert, J., & Frye, C. (2015). *Microsoft Office 2016 step by step*. Microsoft Press.

Hassan, N. A., & Hijazi, R. (2017). *Digital privacy and security using Windows: A practical guide*. Apress.

Maheshwari, A. (2024). *Data analytics made accessible*. Jay Cobb.

Russell, S. J., & Norvig, P. (2020). *Artificial intelligence: A modern approach* (4th ed.). Pearson.

Alpaydin, E. (2020). *Introduction to machine learning* (4th ed.). MIT Press.

Course Code	**219904**	**Marks: 25**	**Credits: 1**	**Class Hours: 15**
Course Title	**Lab: Information and Communication Technology**			

Course Objectives

The main objective of the course is to teach the students' understanding and skills in using, and applying technology to solve problems and enhance various aspects of life and work. It includes assembling hardware, installing software, preparing PPT slides, and producing Word and Excel documents.

Course Learning Outcomes

CLO 1	Learn assembling hardware
CLO 2	Prepare, edit and print word documents and excel
CLO 3	Prepare power point presentation.
CLO 4	Access information from e-mail
CLO 5	Installation of anti-virus software
CLO 6	Data collection, Prediction using AI, ML, Data Analytics

List of Experiments

CLO Addressed	**Unit**	**Experiments**	**Teaching Learning Approach**
CLO1	1-4	• Assemble different hardware • Install different software • Operate the computer - Drive, folder and file management • Maintenance	Lab and Hands-on Practice

CLO 2	3	**Word** • Prepare a Word document on a specific topic (e.g, routine, question paper, CV, reports, applications) • Formatting the document (Alignment, table, border, watermark, etc.), e.g., newspaper article, academic report, or documentation used in daily life, book, poster • Print documents with different paper and printers	Lab and Hands-on Practice
CLO 2	4	• **Excel** • Prepare a grade sheet • Prepare a family expenditure • Prepare a business expenditure report • Prepare payroll management, with a report • Create graphs on the given data • Print Excel files	Lab and Hands-on Practice
CLO 3	5	**Power point** • Prepare an academic presentation on a specific topic. • Formatting the slides & using different tools. • Apply animation and transition • Print PPT files in different modes: Hand note, Slides shorter, outline	Lab and Hands-on Practice
CLO4	6	• Install antivirus software, e.g., Norton Antivirus, McAfee, Kaspersky, Avast.	Lab and Hands-on Practice
CLO5	7	• Use of email • Access information from the internet, use a search engine. • Use of virtual drive for collaboration • Google Meet, Zoom	Lab and Hands-on Practice
CLO6	8	• Data Collection and Visualization • Simple Prediction Using Trendlines	Lab and Hands-on Practice

List of books

Comer, D. E. (2018). *The internet book: Everything you need to know about computer networking and how the internet works* (5th ed.). Chapman and Hall/CRC Press.

Lambert, J., & Frye, C. (2015). *Microsoft Office 2016 step by step*. Microsoft Press.

National University

Statistics
(for other subjects)
Effective from the Session: 2024–2025

FIRST YEAR

Course Code	Course Title	Marks	Credits
213607	**Fundamentals of Statistics**	**100**	**4**
213610	**Lab 1: Fundamentals of Statistics**	**50**	**2**

Detailed Syllabus

Course Code	213607	Marks: 100	Credits: 4	Class Hours: 60
Course Title:	**Fundamentals of Statistics**			

Course Objectives

To be able to understand the nature, characteristics, scope, application and abuse of statistics. To make familiar with data, nature of data, how to process and condense the data, sources of data and graphical presentation of data, and to apply appropriate statistical tools and techniques to analyze the data. To acquaint students with the necessary skills for solving probability-related problems using appropriate laws. To provide knowledge on time series and statistical indices.

Course Learning Outcomes (CLOs)

CLO1	Understand the nature, characteristics, scope, application, and abuse of statistics. Knowledge of sources of data and how to process, condense, and present data. Understand different characteristics of statistical data such as measures of location, dispersion, moments, skewness, kurtosis and their properties.
CLO2	Understand the relationship between variables, such as simple correlation, rank correlation, correlation ratio, simple regression analysis, standard error of estimators of regression coefficients & their properties and fitting of regression lines.

CLO3	Comprehend different approaches of defining probability and useful laws of probability to solve problems. Also learn some commonly used probability distributions.
CLO4	Gain knowledge about meaning and application of statistical indices.
CLO5	Identify the pattern and trends and isolate the influencing factors of the time series data for future planning and control.
CLO6	Understand the concept of numerical methods, including interpolation and use of numerical methods in application to real problems.

Mapping of CLOs with PLOs

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO10	PLO11	PLO12
CLO1	√	√						√	√	√		√
CLO2	√	√	√	√	√	√	√		√			
CLO3	√	√			√							
CLO4	√	√				√	√					
CLO5	√	√				√				√	√	
CLO6	√	√				√						√

Course Contents

Topic	Teaching Learning Strategy	CLOs
Descriptive Statistics: Statistics–Its nature and some important uses, Qualitative and quantitative data, Classification, Tabulation and frequency distribution, Graphical representation of data, Measures of location, Measures of Dispersion, Skewness and Kurtosis, Mathematical relationship among different measures of location, dispersion, Skewness and kurtosis.	Lecture, Assignment	CLO1

Bivariate Data: Correlation coefficient, Correlation analysis, The purpose and uses of regression analysis, Simple regression and methods of least squares and estimation of parameters, Correlation ratio, Rank correlation, Partial and multiple correlation.	Lecture, Assignment	CLO2
Elementary Probability: Meaning of Probability, Classical and empirical definitions of Probability, Axiomatic approach of defining probability, Event, Sample space and simple problems on probability, Addition rule, Conditional probability, Multiplication rule and Bayes theorems, The concept of a random variables, Probability function and probability density function, Joint probability function. Marginal and conditional distributions, Statistical independence, Expected value and related theorems, Moment generating function, Common probability distributions, Binomial, Poisson and Normal.	Lecture, Group Discussion, Assignment	CLO3
Index Number: Concept of an index number and problems in the construction of index number, Types of indices (Price, Quantity, Value and cost of living indices) and their uses, Tests for index numbers.	Lecture, Group Discussion, Workshop and Assignment	CLO4
Time Series analysis: Elements of time-series analysis, Measurement of trend by moving average, By least square method, Trend curve, Determination of seasonal indices, Cyclical movements.	Lecture, Group Discussion, and Assignment	CLO5
Numerical Mathematics: Differences of a polynomial, Finite difference operator, Difference table, Newton's formula and starling's central difference formula, Inverse interpolation, Numerical integration.	Lecture, Group Discussion, Workshop and Assignment	CLO6

List of Books

Gupta, S.C. & Kapoor, V.K. (1994). Fundamentals of *Applied Statistics*. Sultan Chand & Sons.

Hoel, P.G. *Introduction to Statistics, 4th Edition*. Wiley and Sons

Islam, M.N. (2015). *An introduction to Statistics and Probability (4th ed.).* Mullick & Brothers, Dhaka.

Jalil, M. A. & Ferdous, R. (1999). *Basic statistics: Methods and Applications*, Robi Publications.

Mostafa, M.G. (1989). *Method of Statistics (4th ed.).* Karim press and Publications.

Shil, R.N & Debnath, S.C. (2016). *An introduction to the theory of Statistics*. Star Publications.

Simpson, G., & Kafka, F. *Basic Statistics.* Oxford Ibh Publishing Co.

Weiss, N. A., & Weiss, C. A. (2012). *Introductory statistics*. Pearson Education.

Course Code	**213610**	**Marks: 50**	**Credits: 2**	**Class Hours: 30**
Course Title	**Lab 1: Fundamentals of Statistics**			

Data condensation and tabulation. Formation of a frequency distribution from both qualitative and quantitative data. Construction of a bivariate table. Graphical representation of data. Measures of location and dispersion, Calculation of moments, Measures of skewness and kurtosis. Simple correlation coefficient and fitting of regression lines. Computation of the rank correlation coefficient. Fitting of Binomial, Normal, and Poisson distributions, Finding trend values and seasonal variation from time series data by different methods, Calculation of Index numbers and test of index number, Use of Newton's forward and backward formula, Solution of numerical integration.