

The University of Burdwan



Syllabus for 3-Year Degree/ 4-Year Honours
in Statistics under Curriculum and Credit
Framework for Under-graduate Program
(CCFUP) as per NEP, 2020 with effect from
2023-24

Semester wise & Course Wise Credit Distribution Structure under CCFUP as per NEP, 2020

Semester	Course Type	Name of The Course	Credit	Lecture	Tutorial	Practical/Viva Voce	Full Marks	Distribution of Marks		
								Theory	Practical/ Viva-Voce	Internal Assessment
I	Major/DS Course (Core) Code: STAT1011	Descriptive Statistics and Elementary Probability	4	3		1	75	40	20	15
	Minor Course Code: STAT1021	Descriptive Statistics and Elementary Probability	4	3		1	75	40	20	15
	Multi/ Interdisciplinary Code: STAT1031	Elementary Statistics	3	2	1	0	50	40	0	10
	Ability Enhancement Course (AEC) [L ₁ -1, MIL] Code: AEC1041	Arabic/ Bengali/ Hindi/ Sanskrit/ Santali/ Urdu or EquvInt. Course from SWAYAM/ Any other UGC-recognized platform	2	2	0	0	50	40	0	10
	Skill Enhancement Course (SEC) Code: STAT1051	Numerical Analysis	3	2	1	0	50	40	0	10
	Common Value Added (CVA) Course Code: CVA1061	Environmental Science/ Education	4	3	0	1	100	60	20	20

Semester	Course Type	Name of The Course	Credit	Lecture	Tutorial	Practical /Viva Voce	Full Marks	Distribution of Marks		
								Theory	Practical /Viva-Voce	Internal Assessment
II	Major/DS Course (Core) Code: STAT2012	Probability Distribution – I	4	3		1	75	40	20	15
	Minor Course Code: STAT2022	Probability Distribution – I	4	3		1	75	40	20	15
	Multi/ Interdisciplinary Code: STAT2032	Statistics for National Development – An Introduction	3	2	1	0	50	40	0	10
	Ability Enhancement Course (AEC) [L ₂ -1] Code: AEC2041	English or EquvInt. Course from SWAYAM / Any other UGC-recognized platform	2	2	0	0	50	40	0	10
	Skill Enhancement Course (SEC) Code: STAT2052	Research Methodology	3	2	1	0	50	40	0	10
	Common Value Added (CVA) Course Code: CVA2061	Understanding India/ Digital & Technological Solutions/ Health & Wellness, Yoga Education, Sports & Fitness	4	3	0	1	100	60	20	20
Skill based vocational course (addl. 4 Cr) during summer term for 8 weeks, who will exit the program after securing 40 Cr.										
For UG certificate 40 cr + additional 4 cr (work based vocational course) = 44 cr. Students are allowed to reenter within 3 years and complete the program within stipulated max. period of 7 years										
	Total		20				400			

Detailed Syllabus

Semester – I

(MAJOR)

Course Code: STAT 1011

Credit: 4 Full Marks: 75

Descriptive Statistics and Elementary Probability

Course Objective: The following are the course objectives of the major course STAT 1011 (Descriptive Statistics and Elementary Probability)

1. It gives the introductions of basic statistics to the students.
2. It focuses the application of basic statistics to the different real situations of daily life and our different activities in the society.
3. It introduces the chance of different activities in the real life and real society.

Theory

Credit: 3 Full Marks: 40

Statistics: Definition and scope, concepts of statistical population and sample

Data: quantitative and qualitative (5L)

Scales of measurement: nominal, ordinal, interval and ratio. Frequency distribution

Presentation: textual, tabular and graphical, including histogram and ogives.

Measures of Central Tendency: Mean, Median, Mode. (5L)

Measures of Dispersion: range, mean deviation, standard deviation, coefficient of variation, Gini's Coefficient, Lorenz Curve. Moments, skewness and kurtosis, Quantiles and measures based on them. Box Plot, Outlier, Detection, Quantile-Quantile Plot. (15L)

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. (20L)

Reference Books

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002): Fundamentals of Statistics, Vol. I& II, 8th Edn. The World Press, Kolkata.
- Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
- 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.
- Tukey, J.W. (1977): Exploratory Data Analysis, Addison-Wesley Publishing Co.
- Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley.
- Freedman, D., Pisani, R. and Purves, R. (2014): Statistics, 4th Edition, W. W. Norton & Company.

Descriptive Statistics and Elementary Probability Lab (Prac)

Practical

Credit: 1 Full Marks: 20

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. Box Plot and Q-Q Plot.
7. Application problems based on Classical Definition of Probability.
8. Application problems based on Bayes Theorem.

Course Outcome: The following are the course outcomes of the major course

STAT 1011 (Descriptive Statistics and Elementary Probability):

1. Students will be acquainted with the meaning, application and necessary of the subject Statistics based on the topics Statistics, Data, Measurement etc.
2. They will be able to apply Statistics in the different activities in the real life and in the society based on the topics Central tendency and dispersion.
3. They can predict the situations of different events through the elementary probability.

(MINOR)

Course Code: STAT 1021

Credit: 4 Full Marks: 75

Descriptive Statistics and Elementary Probability

Course Objective: The following are the course objectives of the minor course STAT 1021 (Descriptive Statistics and Elementary Probability)

1. It gives the introductions of basic statistics to the students.
2. It focuses the application of basic statistics to the different real situations of daily life and our different activities in the society.
3. It introduces the chance of different activities in the real life and real society.

Theory

Credit: 3 Full Marks: 40

Statistics: Definition and scope, concepts of statistical population and sample

Data: quantitative and qualitative (5L)

Scales of measurement: nominal, ordinal, interval and ratio. Frequency distribution

Presentation: textual, tabular and graphical, including histogram and ogives.

Measures of Central Tendency: Mean, Median, Mode. (5L)

Measures of Dispersion: range, mean deviation, standard deviation, coefficient of variation, Gini's Coefficient, Lorenz Curve. Moments, skewness and kurtosis, Quantiles and measures based on them. Box Plot, Outlier, Detection, Quantile-Quantile Plot. (15L)

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. (20L)

Reference Books

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002): Fundamentals of Statistics, Vol. I& II, 8th Edn. The World Press, Kolkata.
- Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
- 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.
- Tukey, J.W. (1977): Exploratory Data Analysis, Addison-Wesley Publishing Co.
- Agresti, A. (2010): Analysis of Ordinal Categorical Data, 2nd Edition, Wiley.
- Freedman, D., Pisani, R. and Purves, R. (2014): Statistics, 4th Edition, W. W. Norton & Company.

Descriptive Statistics and Elementary Probability Lab (Prac)

Practical

Credit: 1 Full Marks: 20

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. Box Plot and Q-Q Plot.
7. Application problems based on Classical Definition of Probability.
8. Application problems based on Bayes Theorem.

Course Outcome: The following are the course outcomes of the minor course

STAT 1021 (Descriptive Statistics and Elementary Probability):

1. Students will be acquainted with the meaning, application and necessary of the subject Statistics based on the topics Statistics, Data, Measurement etc.
2. They will be able to apply Statistics in the different activities in the real life and in the society based on the topics Central tendency and dispersion.
3. They can predict the situations of different events through the elementary probability.

(Multi/Interdisciplinary)

Course Code: STAT 1031

Credit: 3 Full Marks: 50

Elementary Statistics

Course Objective: The following are the course objectives of the Multi/Interdisciplinary course STAT 1031 (Elementary Statistics)

1. It gives the introductions of basic statistics to the students.
2. It focuses the application of basic statistics to the different real situations of daily life and our different activities in the society.
3. It introduces the chance of different activities in the real life and real society.

Theory

Credit: 2

Full Marks: 40

Introduction: 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. Frequency distribution, Presentation: tabular and graphic, including histogram and ogives. (6L)

Measures of Central Tendency: mathematical and positional.

Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis. (6L)

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

curves.

(5L)

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency. (3L)

Reference Books

- Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
- Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
- Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rdEdn. (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
- Goon A.M., Gupta M.K. and Dasgupta B.: Basic Statistics. The World Press, Kolkata.
- Chakraborty, Arnab (2016): Probability and Statistics. Sarat Book House.

Course Outcome: The following are the course outcomes of the Multi/Inter disciplinary course STAT 1031 (Elementary Statistics):

1. Students will be acquainted with the meaning, application and necessary of the subject Statistics based on the topics Statistics, Data, Measurement etc.
2. They will be able to apply Statistics in the different activities in the real life and in the society based on the topics Central tendency and dispersion.
3. They can predict the situations of different events through the elementary probability.

(SEC)

Course Code: STAT 1051

Credit: 3 Full Marks: 50

Numerical Analysis

Course Objective: The following are the course objectives of the SEC course STAT 1051 (Numerical Analysis):

1. It gives the ideas to compute approximate values in the different real situation where there are no exact equations for computing the interested values.
2. It helps the students to estimate the unknown values in any complex situations based on a derived equation on the basis of the data in hand.

Theory

Credit: 2 Full Marks: 40

Approximation of numbers and functions, Absolute and Relative errors.

Interpolation: Polynomial approximation, Difference Table, Newton's Forward and Backward interpolation formulae and Lagrange's general interpolation formula, Error terms.

Numerical differentiation and its applications. (10L)

Numerical Integration: Trapezoidal and Simpson's 1/3 rules.

Numerical solution of equations: method of false position, method of fixed point iteration and Newton-

Raphson method in one unknown, Conditions of convergence, rates of convergence. (10L)

Reference Books

- Scarborough J.B. (1958) : Numerical Mathematical Analysis, Oxford Univ. Press
- Atkinson K. (1985) : Elementary Numerical Analysis
- Sastry S.S. (1998) : Introductory Methods of Numerical Analysis
- Hildebrand F.B. (1974) : Introduction to Numerical Analysis, Tata McGraw-Hill

Course Outcome: The following are the course outcomes of the SEC course STAT 1051 (Numerical Analysis):

1. Based on a real data set, students will be acquainted to estimate any value which is not available in the data set.
2. Students can predict the any interested values of the real fact based on the observations in hand.

Semester – II

(MAJOR)

Course Code: STAT 2012

Credit: 4 Full Marks: 75

Probability Distribution – I

Course Objective: The following are the course objectives of the major course STAT 2012 (Probability Distribution – I):

1. It focuses on the random variables, their distributions and properties.
2. It presents many basic probability theories to understand the real events in the society.
3. It gives basic knowledge to undergo the higher courses.

Theory

Credit: 3 Full Marks: 40

Random variables: discrete random variables, p.m.f. and c.d.f., statement of properties of c.d.f, illustrations and properties of random variables. (8L)

Standard discrete probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform. (10L)

Continuous random variables, p.d.f. and c.d.f., illustrations and properties, univariate transformations with illustrations.

Mathematical Expectation: One Dimensional random variable and their properties. Probability generating function. Moments. Moment generating function.

Probability Inequalities: Markov & Chebyshev. (12L)

Standard continuous probability distributions: uniform, normal, exponential, Cauchy, beta, gamma, lognormal, logistic, double exponential and Pareto along with their properties and limiting/approximation cases. (15L)

Reference Books

- Chung, K.L. (1983): Elementary Probability Theory with Stochastic Process, Springer / Narosa.
- Feller, W. (1968): An Introduction to Probability Theory & its Applications, John Wiley.
- Goon, A.M., Gupta, M.K.& Dasgupta, B. (1994): An Outline of Statistical Theory (Vol-1), World Press.
- Parzen, E. (1972): Modern Probability Theory and its Applications, John Wiley .
- Uspensky, J.V. (1937): Introduction to Mathematical Probability, McGraw Hill.
- Cacoullous, T. (1973): Exercises in Probability. Narosa.
- Rahman, N.A. (1983): Practical Exercises in Probability and Statistics, Griffen.
- Ross, S. (2002): A First Course in Probability, Prentice Hall.

Probability Distribution - I Lab (Prac)

Practical

Credit: 1 Full Marks: 20

List of Practical

1. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$.
2. Fitting of binomial distributions for given n and p .
3. Fitting of binomial distributions after 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. Application problems based on binomial distribution.
8. Application problems based on Poisson distribution.
9. Application problems based on negative binomial distribution.
10. Problems based on area property of normal distribution.
11. To find the ordinate for a given area for normal distribution.
12. Application based problems using normal distribution.

Course Outcome: The following are the course outcomes of the major course STAT 2012 (Probability Distribution - I):

1. Students will be acquainted about different kind of random variables in the real society based on the topic Random variables.
2. Students will be acquainted with the nature and variability of different random variables based on the topics: Standard discrete and continuous random variables distribution.
3. Student can undergo higher courses through the knowledge of mathematical expectations, probability inequality etc.

(MINOR)

Course Code: STAT 2022

Credit: 4 Full Marks: 75

Probability Distribution – I

Course Objective: The following are the course objectives of the minor course STAT 2022 (Probability Distribution – I):

1. It focuses on the random variables, their distributions and properties.
2. It presents many basic probability theories to understand the real events in the society.
3. It gives basic knowledge to undergo the higher courses.

Theory

Credit: 3 Full Marks: 40

Random variables: discrete random variables, p.m.f. and c.d.f., statement of properties of c.d.f, illustrations and properties of random variables. (8L)

Standard discrete probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform. (10L)

Continuous random variables, p.d.f. and c.d.f., illustrations and properties, univariate transformations with illustrations.

Mathematical Expectation: One Dimensional random variable and their properties. Probability generating function. Moments. Moment generating function.

Probability Inequalities: Markov & Chebyshev. (12L)

Standard continuous probability distributions: uniform, normal, exponential, Cauchy, beta, gamma, lognormal, logistic, double exponential and Pareto along with their properties and limiting/approximation cases. (15L)

Reference Books

- Chung, K.L. (1983): Elementary Probability Theory with Stochastic Process, Springer / Narosa.
- Feller, W. (1968): An Introduction to Probability Theory & its Applications, John Wiley.
- Goon, A.M., Gupta, M.K.& Dasgupta, B. (1994): An Outline of Statistical Theory (Vol-1), World Press.
- Parzen, E. (1972): Modern Probability Theory and its Applications, John Wiley .
- Uspensky, J.V. (1937): Introduction to Mathematical Probability, McGraw Hill.
- Cacoulios, T. (1973): Exercises in Probability. Narosa.
- Rahman, N.A. (1983): Practical Exercises in Probability and Statistics, Griffen.
- Ross, S. (2002): A First Course in Probability, Prentice Hall.

Probability Distribution - I Lab (Prac)

Practical

Credit: 1 Full Marks: 20

List of Practical

1. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$.
2. Fitting of binomial distributions for given n and p .
3. Fitting of binomial distributions after 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. Application problems based on binomial distribution.
8. Application problems based on Poisson distribution.
9. Application problems based on negative binomial distribution.
10. Problems based on area property of normal distribution.

11. To find the ordinate for a given area for normal distribution.

12. Application based problems using normal distribution.

Course Outcome: The following are the course outcomes of the minor course STAT 2022 (Probability Distribution - I):

1. Students will be acquainted about different kind of random variables in the real society based on the topic Random variables.
2. Students will be acquainted with the nature and variability of different random variables based on the topics: Standard discrete and continuous random variables distribution.
3. Student can undergo higher courses through the knowledge of mathematical expectations, probability inequality etc.

(Multi/Interdisciplinary)

Course Code: STAT 2032

Credit: 3 Full Marks: 50

Statistics for National Development – An Introduction

Course Objective: The following are the course objectives of the Multi/Interdisciplinary course STAT 2032 (Statistics for National Development – An Introduction):

1. It focuses on the different data sources which are used in the society, ruling the government and social researchers.
2. It gives the ideas of different data sources along with their applications in the different field of the society.

Theory

Credit: 2 Full Marks: 40

An outline of present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), Registered General Office and National Statistical Commission. Government of India's Principal publications containing data on the topics such as Agriculture, price, population, industry, finance and employment. (10L)

Consumer price Index, Wholesale price index number and index of industrial production.

National Income: Basic idea and a brief description of income, expenditure and production approaches. (10L)

Reference Books

- Goon A.M., Gupta M.K. and Dasgupta B. (2008): Fundamentals of Statistics (Vol.2), World Press.
- Guide to current Indian Official Statistics, Central Statistical Office, GOI, and New Delhi.
- <http://mospi.nic.in/>

Course Outcome: The following are the course outcomes of the Multi/Inter disciplinary course STAT 2032 (Statistics for National Development – An Introduction):

1. Students will be acquainted with the different sources of the data sets which are related in the different fields in the society based on the topics: different data sources, registers, published books by the government.
2. Students will be able to study about the society based on the data sets obtained from the different registered sources.

(SEC)

Course Code: STAT 2052

Credit: 3 Full Marks: 50

Research Methodology

Course Objective: The following are the course objectives of the SEC course STAT 2052 (Research Methodology):

1. It gives ideas about research, types of research, research problems, research hypothesis, research frame and its limitations.
2. It gives the ideas about research data which may be experimental or environmental.
3. It presents the data collection method, basis analysis and interpretations.

Theory

Credit: 2 Full Marks: 40

What is Research? Role of Research in important areas. Characteristics of Scientific Method. Process of research: Stating Hypothesis or Research question, Concepts & Constructs, Units of analysis & characteristics of interest, Independent and Dependent variables, Extraneous or Confounding variables. Measurements and scales of Measurements. Types of research: Qualitative & Quantitative Research, Longitudinal Research, Survey & Experimental Research. (7L)

Survey Methodology and Data Collection, sampling frames and coverage error, non-response.

Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation. (5L)

Develop a questionnaire, collect survey data pertaining to a research problem (such as gender discriminations in private v/s government sector, unemployment rates, removal of subsidy, impact on service class v/s unorganized sectors), questions and answers in surveys, Internal & External validity, interpret the results and draw inferences. Formats and presentations of Reports – an overview. (12L)

Reference Books

- Kothari, C.R. (2009): Research Methodology: Methods and Techniques, 2nd Revised Edition reprint, New Age International Publishers.
- Kumar, R (2011): Research Methodology: A Step - by - Step Guide for Beginners, SAGE publications.

Course Outcome: The following are the course outcomes of the SEC course STAT 2052 (Research Methodology):

1. Students will be acquainted with different types of research and they will be interested in the different field of research based on the topics: Research, Research Method and Process, Research Problems and Hypothesis etc.
2. Students will be able to collect data for their own research using the proper questionnaire, suitable sampling method based on the course: Sample Survey.
3. Students will be able to analyze their collected data and interpret their research questions based on this topic.