

**The University of Burdwan**  
**B.Sc Honours in Statistics**  
**CBCS syllabus (effect from 2017-2018)**

**Semester- I**

**CC-1**

**Descriptive Statistics (Th)**

**4 Credits**

**Unit 1**

1. Statistics: Definition and scope, concepts of statistical population and sample.
2. Data: quantitative and qualitative,
3. Scales of measurement: nominal, ordinal, interval and ratio. Frequency distribution.
4. Presentation: tabular and graphical, including histogram and ogives.

(10L)

**Unit 2**

1. Measures of Central Tendency: Mean, Median, Mode.
2. 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.

(12L)

**Unit 3**

1. Bivariate data: Definition, scatter diagram, simple correlation, linear regression, principle of least squares.
2. Analysis of Categorical Data: Contingency table, association of attributes, odds ratio, Pearson's measure, Goodman- Kruskal's. Binary response and logistic regression. Spearman's Rank correlation.

(10L)

**Unit 4**

**Index Numbers:** Weighted means, price and quantity index numbers, choice of weights, Laspeyres' and Paasche's index numbers. Tests of index numbers and Fisher's ideal index number.

(8L)

**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 Lab (Prac)**

**2 Credits**

### **List of Practical**

**(10L)**

1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.
6. Fitting of quadratic and exponential function.
7. Karl Pearson correlation coefficient.
8. Correlation coefficient for a bivariate frequency distribution.
9. Lines of regression, angle between lines and estimated values of variables.
10. Spearman's rank correlation.
11. Box Plot and Q-Q Plot.
12. Calculation of price and quantity index numbers.

## **CC-2**

### **Probability and Probability Distributions-I (Th)**

**4 Credits**

#### **Unit 1**

**Probability:** Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic.

**(10L)**

#### **Unit 2**

Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

**(8L)**

#### **Unit 3**

1. 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.

2. Standard discrete probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform.

#### **Unit 4**

**Two dimensional random variables:** discrete type, joint, marginal and conditional p.m.f and c.d.f., statement of properties of c.d.f, independence of variables, trinomial distribution.

#### **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.
- Cacoullos, 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 and Probability Distributions-I Lab (Prac)**

**2 Credits**

### List of Practical

1. Application problems based on Classical Definition of Probability.
2. Application problems based on Bayes Theorem.
3. Fitting of binomial distributions for  $n$  and  $p = q = \frac{1}{2}$ .
4. Fitting of binomial distributions for given  $n$  and  $p$ .
5. Fitting of binomial distributions after computing mean and variance.
6. Fitting of Poisson distributions for given value of  $\lambda$ .
7. Fitting of Poisson distributions after computing mean.
8. Fitting of negative binomial distribution.
9. Fitting of suitable distribution.
10. Application problems based on binomial distribution.
11. Application problems based on Poisson distribution.
12. Application problems based on negative binomial distribution.

**Generic Elective**  
**(For the students of other Subject/ Discipline)**

**GE-1**

**Statistical Methods (Th)**

**4 Credits**

**Unit 1**

**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.

**Unit 2**

1. **Measures of Central Tendency:** mathematical and positional.
2. **Measures of Dispersion:** range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

**Unit 3**

**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.

**Unit 4**

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

**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.
- Goon A.M., Gupta M.K. and Dasgupta B. : Basic Statistics. The World Press, Kolkata.
- Chakraborty, Arnab (2016) : Probability and Statistics. Sarat Book House

**Statistical Methods Lab (Prac)**

**2 Credits**

**List of Practical**

1. Graphical representation of data
2. Problems based on measures of central tendency
3. Problems based on measures of dispersion
4. Problems based on combined mean and variance and coefficient of variation
5. Problems based on moments, skewness and kurtosis

6. Fitting of polynomials, exponential curves
7. Karl Pearson correlation coefficient
8. Partial and multiple correlations
9. Spearman rank correlation with and without ties.
10. Correlation coefficient for a bivariate frequency distribution
11. Lines of regression, angle between lines and estimated values of variables.
12. Checking consistency of data and finding association among attributes.

## Semester- II

**CC-3**

**Mathematical Analysis (Th)**

**6 Credits**

### Unit 1

Representation of real numbers as points on a line. Algebraic, Order and Completeness properties of  $\mathbb{R}$  (Concepts only). Bounded and unbounded sets, neighbourhood of a point, Supremum and infimum.

Functions, Countable, Uncountable sets and Uncountability of  $\mathbb{R}$ . Sequences and their convergence, monotonic sequences, bounded sequences, squeeze theorem Limits of some special sequences such as  $\frac{1}{n}, \left(\frac{1}{n}\right)^n, n^n, \dots$

Infinite series, positive termed series and their convergence, Comparison test, ratio test and root test. Absolute convergence of series, Leibnitz's test for the convergence of alternating series, Conditional convergence.

### Unit 2

Review of limit, continuity and differentiability. Indeterminate form, L' Hospital's rule. Rolle's and Lagrange's Mean Value theorems. Taylor's theorem with lagrange's form of remainder (without proof). Taylor's series expansions of  $\sin x, \cos x, e^x, (1+x)^n, \log(1+x)$ .

Maxima and Minima of Functions. Successive Differentiation.

### Unit 3

**Integral Calculus:** definite integral (definition). Statements of properties, Fundamental Theorem of Integral Calculus.

Improper Integral, Beta and Gamma functions: properties and relationship between them.

### Unit 4

Functions of two variables and Partial Derivatives. Maxima and Minima of such Functions. Constrained Maximization and minimization, use of Lagrange Multiplier. Double Integral (intuitive-graphical approach), change of order of integration, transformation of variables and Jacobians (statement of relevant theorems and their uses)

## CC-4

### Probability and Probability Distributions –II (Th)

4 Credits

#### Unit 1

Continuous random variables, p.d.f. and c.d.f., illustrations and properties, univariate transformations with illustrations. Two dimensional random variables: continuous type, joint, marginal and conditional, p.d.f., and c.d.f.. Independence of two variables.

#### Unit 2

**Mathematical Expectation (discrete and continuous):** Single & bivariate random variables and their properties. Probability generating function. Moments. Moment generating function. Correlation coefficient, Conditional expectation and variance.

**Probability Inequalities:** Markov & Chebyshev.

#### Unit 3

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

#### Unit 4

**Bivariate Normal Distribution (BVN):** p.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN.

#### Reference Books

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

2 Credits

1. Problems based on area property of normal distribution.
2. To find the ordinate for a given area for normal distribution.
3. Application based problems using normal distribution.
4. Fitting of normal distribution when parameters are given.
5. Fitting of normal distribution when parameters are not given.
6. Problems similar to those in 1 to 5 in cases of other continuous distributions.

**Generic Elective**  
**(For the students of other Subject/ Discipline)**

**GE-2**

**Introductory Probability (Th)**

**4 Credits**

**Unit 1**

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

**Unit 2**

**Random Variables:** Discrete and continuous random variables, p.m.f., p.d.f., c.d.f. Illustrations of random variables and its properties. Expectation, variance, moments and moment generating function.

**Unit 3**

Convergence in probability, almost sure convergence, Chebyshev's inequality, weak law of large numbers, De-Moivre Laplace and Lindeberg-Levy Central Limit Theorem (C.L.T).

**Unit 4**

**Standard probability distributions:** Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, beta, gamma.

**Reference Books**

- Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
- Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
- Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
- Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8<sup>th</sup> Edn. The World Press, Kolkata.
- Chakraborty, Arnab (2016): Probability and Statistics. Sarat Book House.
- Ross, S. (2002): A First Course in Probability, Prentice Hall.

**Introductory Probability Lab (Prac)**

**2 Credits**

**List of Practical**

1. Fitting of binomial distributions for  $n$  and  $p = q = \frac{1}{2}$  given
2. Fitting of binomial distributions for  $n$  and  $p$  given
3. Fitting of binomial distributions computing mean and variance
4. Fitting of Poisson distributions for given value of  $\lambda$
5. Fitting of Poisson distributions after computing mean
6. Application problems based on binomial distribution
7. Application problems based on Poisson distribution

8. Problems based on area property of normal distribution
9. To find the ordinate for a given area for normal distribution
10. Application based problems using normal distribution
11. Fitting of normal distribution when parameters are given
12. Fitting of normal distribution when parameters are not given



# The University of Burdwan



## Syllabus for B.Sc Honours in Statistics

Under semester with CBCS (effect from 2017-2018)

Paper Code	Paper Name	Credit	Marks
<b>Semester- I</b>			
CC-1 <i>(for Stat Hons)</i>	Descriptive Statistics (Th)	4	75
	Descriptive Statistics Lab (Prac)	2	
CC-2 <i>(for Stat Hons)</i>	Probability and Probability Distributions I (Th)	4	75
	Probability and Probability Distributions I Lab (Prac)	2	
GE-1	<i>(Any discipline other than Statistics)</i>	6	75
<b>Semester- II</b>			
CC-3 <i>(for Stat Hons)</i>	Mathematical Analysis (Th)	6	75
CC-4 <i>(for Stat Hons)</i>	Probability and Probability Distribution II (Th)	4	75
	Probability and Probability Distributions II Lab (Prac)	2	
GE-2	<i>(Any discipline other than Statistics)</i>	6	75

<b>Semester- III</b>			
CC-5 <i>(for Stat Hons)</i>	Linear Algebra and Numerical Analysis (Th)	6	75
CC-6 <i>(for Stat Hons)</i>	Demography and Vital Statistics (Th)	4	75
	Demography and Vital Statistics Lab (Prac)	2	
CC-7 <i>(for Stat Hons)</i>	Statistical Computing using C/C++ Programming (Th)	4	75
	Statistical Computing using C/C++ Programming Lab (Prac)	2	
SEC-1 <i>(for Stat Hons)</i>	Statistical Data Analysis using R  Or  Data Base Management System	2	50
GE-3	<i>(Any discipline other than Statistics)</i>	6	75
<b>Semester IV</b>			
CC-8 <i>(for Stat Hons)</i>	Survey Sampling and Indian Official Statistics (Th)	4	75
	Survey Sampling and Indian Official Statistics Lab (Prac)	2	
CC-9 <i>(for Stat Hons)</i>	Statistical Inference- I and Sampling Distribution (Th)	4	75
	Statistical Inference- I and Sampling Distribution Lab (Prac)	2	
CC-10 <i>(for Stat Hons)</i>	Time Series Analysis (Th)	4	75
	Time Series Analysis Lab (Prac)	2	

SEC-2 <i>(for Stat Hons)</i>	Research Methodology  OR Monte Carlo Method	2	50
GE-4	<i>(Any discipline other than Statistics)</i>	6	75
<b>Semester V</b>			
CC-11 <i>(for Stat Hons)</i>	Statistical Inference II Lab (Th)	4	75
	Statistical Inference II Lab (Prac)	2	
CC-12 <i>(for Stat Hons)</i>	Linear Models (Th)	4	75
	Linear Models Lab (Prac)	2	
DSE-1 <i>(for Stat Hons)</i>	Statistical Quality Control (Th)	4	75
	Statistical Quality Control Lab (Prac)	2	
	<b>OR</b>		
	Econometrics (Th)	4	
	Econometrics Lab (Prac)	2	
DSE-2 <i>(for Stat Hons)</i>	Operations Research (Th)	4	75
	Operations Research Lab (Prac)	2	
	<b>OR</b>		
	Financial Statistics (Th)	4	
	Financial Statistics Lab (Prac)	2	

<b>Semester VI</b>			
CC-13 <i>(for Stat Hons)</i>	Design of Experiments (Th)	4	75
	Design of Experiments Lab (Prac)	2	
CC-14 <i>(for Stat Hons)</i>	Multivariate Analysis and Nonparametric Methods (Th)	4	75
	Multivariate Analysis and Nonparametric Methods Lab (Prac)	2	
DSE-4 <i>(for Stat Hons)</i>	Survival Analysis (Th)	4	75
	Survival Analysis Lab (Prac)	2	
	<b>OR</b>		
	Stochastic Processes and Queuing Theory (Th)	4	
	Stochastic Processes and Queuing Theory Lab (Prac)	2	
DSE-5 <i>(for Stat Hons)</i>	Project Work	6	75
	<b>OR</b>		
	Actuarial Statistics (Th)	4	
	Actuarial Statistics Lab (Prac)	2	