

WEST BENGAL COUNCIL OF HIGHER SECONDARY EDUCATION
SYLLABUS FOR CLASSES XI AND XII
SUBJECT : STATISTICS (STAT)

COURSE OVERVIEW :

Nowadays , Statistics has become an indispensable subject in every sphere of life, specially in the fields of Engineering, Commerce, Industry, Agriculture, Bio-Technology , Education , Economics, Physical Science and Social Science.

Sincere attempt has been taken in including the topics in Class XI and Class XII, so that students are familiarized with the content and ideas of those topics.

This Higher Secondary Statistics Syllabus included all the topics covered by the leading boards of India in HS level. Utmost care has been taken in selecting and preparing the topics for both the classes. Most of the topics will help HS students in their All India Entrance Examinations and Entrance tests of the reputed Institutions. Not only that, the students who are willing to pursue their studies in basic sciences will also get immense help.

For some advance topics, only a few salient features have been discussed to give the students a brief idea.

CLASS - XI

SEMESTER – I

SUBJECT : STATISTICS (STAT)

FULL MARKS: 35

CONTACT HOURS: 60 Hours

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT 1	Introduction: Meaning of statistics, Nature of statistics, Importance of statistics, Relation with some allied subjects, Uses of statistics, Misuses of statistics	03	02
	Types of data: Primary and Secondary data, Quantitative data and Qualitative data, Discrete data and continuous data, Time series , Spatial series data and cross-sectional data, ordinal data and nominal data, Illustration with examples	06	04
UNIT 2	Collection of data: Questionnaire and its basic characteristics, Definition of Schedule and pilot survey, Designing a questionnaire and schedule, concept of outliers.	05	01
	Scrutiny of data: Checking internal consistency and detection of error in collection and in recording.	04	02
UNIT 3	Presentation of data: Textual representation, Tabular representation, Diagrammatic representation (line diagram, Multiple axes diagram and multiple line diagram), Bar diagram (Horizontal and vertical bar diagrams, multiple and divided bar diagrams), Pie diagram	09	04
UNIT 4	Frequency distribution, Cumulative frequency distribution and their graphical representation (Column diagram, Step diagram, ogive, Histogram, frequency curve of different types, Stem and leaf diagram)	09	05
UNIT 5	Official Statistics: Structure and activities of some organizations (NSSO, CSO, DGCSIR, Labour Borough, Agricultural Statistics, MOSPI)	04	03
UNIT 6	Concept of Central Tendency and its measures with properties including $AM \geq GM \geq HM$.	13	09
UNIT 7	Index No.: Definition of Index Number, Types of Index No.(Price Index, Quantity Index, Value Index), Construction of Price Index No. and its uses, Various Price Index formulae(Laspeyres', Paasche's, Edgeworth-Marshall and Fisher), Tests of consistency (Time reversal test and Factor reversal test)	07	05
	TOTAL	60 Hours	35

CLASS - XI

SEMESTER – II

SUBJECT : STATISTICS (STAT)

FULL MARKS: 35

CONTACT HOURS: 40 Hours

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT 1	Measures of Dispersion: Range, Mean deviation, Standard deviation, Quartile deviation, Coefficient of variation, Quantile and Percentile with relation between different measures	10	10
UNIT 2	Raw and central moments up to fourth order and their conversions Cauchy –Schwartz Inequality Measures of Skewness and Kurtosis: Different measures based on moments and quantities (associated inequalities involving b_1 and b_2 coefficients)	07	06
UNIT 3	Random experiment: Sample Space, Notion of events and operations with events. Definition of Probability: Classical and Relative frequency approach to probability with limitations. Axiomatic Definition of Probability (Statement only) Theorem of Total Probability, Bonferroni's inequality, Boole's inequality. Compound Probability, Conditional Probability and Bayes' theorem, Statistical Independence of events (No. of events not more than three) and related problems.	12	12
UNIT 4	Concept of polynomials, Different forms of n -th degree polynomials relating to two different interpolation formulae, Remainder theorem. Concept of Interpolation, Δ and E operators and their relation. Simple Interpolation : Newton's Forward and Backward Interpolation formulae (without Derivation)	05	03
UNIT 5	Population Statistics: Introduction: Vital events, Sources of data on Vital events, Rates and Ratio of vital events. Measurement of Mortality: CDR, SDR, STDR Measurement of Fertility: CBR, GFR, ASFR, TFR Measurement of Population Growth: Crude rate of Natural increase and Vital index.	06	04
	TOTAL	40 Hours	35

[Note: 20 Hours reserved for Remedial classes, Tutorials and Home Assignments.]

CLASS - XII

SEMESTER – III

SUBJECT : STATISTICS (STAT)

FULL MARKS: 35

CONTACT HOURS: 60 Hours

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT 1	Mathematics: Concept of series and sequence, Concept of convergence and divergence and related sums. Infinite series, e-series and log series and related sums. Concept of Maximum and Minimum, Concept of Partial derivative, Concept of Infinite Integral(Gamma integral and Beta integral and their relation with factorial)	16	06
UNIT 2	Probability Distributions Random Variables and its Probability distribution, Cumulative distribution function, Probability Mass Function, Probability density function , Expectation, Variance	15	10
UNIT 3	Some Discrete Distribution Uniform distribution, Binomial distribution, Poisson distribution, Geometric distribution and their properties with related problem Sums. Fitting of above distributions.	16	12
UNIT 4	Least square method and curve fitting (linear and exponential)	04	02
UNIT 5	Time series Analysis Introduction, Different components of time series, Different models of time series, Trend determination by method of simple moving averages and by fitting Mathematical curves (straight line and exponential curve)using least square principle.	09	05
	TOTAL	60 Hours	35

CLASS - XII

SEMESTER – IV

SUBJECT : STATISTICS (STAT)

FULL MARKS: 35

CONTACT HOURS: 40 Hours

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT 1	Descriptive Statistics: Bivariate Data, Scatter diagram, Two - way frequency distribution, Marginal and conditional distribution. Simple correlation and its properties. Simple regression Analysis and its related results Rank data and rank correlation.(Spearman's Rank Correlation coefficient –case of no tie)	09	10
UNIT 2	Some Continuous Distribution Rectangular distribution and Normal distribution. their properties with related problem Sums. Fitting of above distributions.	07	07
UNIT 3	Sampling theory and Sampling distribution Population and Sample, Parameter and Statistic, Complete Enumeration and sample surveys, Basic principles of sample survey, Advantages of Sample survey over complete enumeration. Concept of probability sampling, Practical methods of drawing a random sample using a random Number Table, SRSWR and SRSWOR, Concept of Sampling distribution of sample mean and its standard error.	06	05
UNIT 4	p.d.f and shape of χ^2 , t and F with expectation and variance (without derivation)	03	02
UNIT 5	Estimation Idea of inference, Point estimation, Interval estimation, Estimator and estimate. Four basic criteria of Estimator, Concept of bias. Idea of unbiasedness and minimum variance unbiasedness. Point estimation of Binomial proportion, Poisson mean, normal mean and variance (using method of moments).	05	03

UNIT 6	Testing of Hypothesis: Statistical test of Hypothesis-Null and Alternative hypothesis, Simple and Composite Hypothesis, Type I and Type II error, Critical region, level of significance, Power of a test, One sided and Two sided tests. Critical Value. Tests of significance related to a single Binomial Proportion and Poisson Mean(using Large sample approximation), Mean and Variance of a single univariate Normal distribution.	06	05
UNIT 7	Statistical Quality Control Introduction, Idea of Quality and Quality Control, Advantages of Statistical Quality Control, Process and Lot control, Control chart technique. Construction of control charts by variables ($\bar{X} R$) and attributes(p, np)	04	03
	TOTAL	40 Hours	35

[Note:20 Hours reserved for Remedial classes, Tutorials and Home Assignments.]

CLASS: XI

SUBJECT : STATISTICS (STAT)

COURSE CODE: PRACTICAL

FULL MARKS: 30

CONTACT HOURS: 80

PROBLEMS FOR PRACTICAL EXAMINATION: 18 (5×2+4×2)

LABORATORY NOTE BOOK : 04, PROJECT WORKS : 05, VIVA-VOCE : 03

List of Problem Sets :

1. Tabular Presentation of Data, Scrutiny of Data
2. Diagrammatic Representation of Data (Non-Frequency Type)
3. Construction of Frequency Distribution and Graphical Representation of them (Univariate Data only, both Discrete and Continuous Variables)
4. Calculations Relating to Measures of Central Tendency (Problems involving Open Ended Classes, Missing Frequencies, Pooling of Two Sets of Data, Checking Empirical Relations, Finding Median Graphically using Ogives, Finding Mode using Histogram, Checking the Correctness of the Measures etc.)
5. Calculations Relating to Measures of Dispersion (Problems involving Open Ended Classes, Missing Frequencies, Pooling of Two Sets of Data, Step Deviation Methods using shift of Origin and/or Change of Scale, Checking the correctness of the Measures etc.)
6. Calculations Relating to Moments and Measures of Skewness and Kurtosis
(Comment on the Nature of Frequency Distribution, Verification of the Inequalities involving b_1 and b_2 is desirable)
7. Problems involving Polynomial, Δ -Operator, Finite Difference Table etc.
8. Calculations Relating to Index Numbers and their tests
9. Calculations Relating to Mortality Rates and Fertility Rates
10. **Project Works**: It will be based on Descriptive Statistics.

Here, we propose some **mini-projects** :

- (a) Prepare a questionnaire for collecting data on age-sex composition of different families of the locality of a student.
- (b) Collect data on age, family size, place of residence (Urban/Rural) and religion of all the students of your class or other class. Construct frequency distribution of all the variables and represent them by suitable diagrams.
- (c) Collect data on height and weight of all the students of your class or other class. Construct frequency distribution of all the variables and represent them by suitable diagrams.
- (d) Collect the maximum daily temperature ($^{\circ}\text{C}$) and minimum daily temperature ($^{\circ}\text{C}$) of your city from weather report for consecutive 30 days. Then compare these two distributions using suitable diagrams.
- (e) Collect data on the percentage of marks obtained in the last public examination of all the students of your class and present the data using suitable diagrams.
- (f) Collect data on height/weight of a group of students. Calculate the different measures of Central Tendency. Comment on the nature of data (skewness) based on the result you obtained.

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FULL MARKS: 30

CONTACT HOURS: 80

PROBLEMS FOR PRACTICAL EXAMINATION: 18 (5×2+4×2)

LABORATORY NOTE BOOK : 04, PROJECT WORKS : 05, VIVA-VOCE : 03

List of Problem Sets :

1. Scatter Diagram, Calculation of Correlation Coefficient and Regression Coefficient, Identifying the Regression Equations, Finding the Regression Equations from Bivariate Data, Problems on Spearman's Rank Correlation Coefficient (case of no tie).
2. Application and Fitting of Binomial, Poisson and Normal Distributions.
3. Drawing of Random Samples in SRSWR and SRSWOR using Random Number Tables.
4. Sampling Distribution of Sample Mean from a Finite Population based on SRSWR and SRSWOR (Start with a population having a finite number of values (4, 5, 6 etc.); choose a sample size of 2, 3 etc.; list all possible samples of the chosen size; calculate sample mean based on each such sample; obtain the sampling distribution of the sample mean and display this distribution diagrammatically).
5. Estimation of Population Mean and Standard Error of the Estimator of Population Mean under SRSWR and SRSWOR.
6. Testing of Hypothesis in case of Poisson Parameter, Mean and Variance of Normal Distribution, χ^2 goodness of fit.
7. Determination of Trend in Time Series Data using Moving Average Method (period of moving average even and odd), Linear trend equation and Exponential trend equation.
8. Construction of Control Chart (p , np , $\bar{x}$, R)
9. **Project Works :**

Here, we propose some mini-projects :

- (a) Collect the marks obtained in Test Examination and in Final Examination in MP for the students of a year. Plot the data to obtain a scatter diagram showing the relation between these two sets of scores. Calculate Correlation Coefficient and also obtain the Regression Lines. Estimate Final score based on Test score for the students. Compare estimated scores and actual scores. Are they same? If not, then what is the interpretation of it? Explain this in the conclusion of your project report.
- (b) Collect data on heights (in inches) and weights (in kg) of a group of students of same gender and same age group. Draw the scatter diagram of these bivariate data. Calculate correlation coefficient and then compute the regression equations of both the types.
- (c) Collect data on age of father and mother of a group of your friends. Rank the data. Using ranked data, calculate Rank Correlation Coefficient. Comment on the result you obtained.

- (d) Collect the maximum daily temperature ($^{\circ}\text{C}$) and minimum daily temperature ($^{\circ}\text{C}$) of your city from weather report for consecutive 30 days. Then plot the data using a suitable scale. Comment on the nature of the data you obtained.
- (e) Purchase 10 different chocolates from a nearby shop. Ask your two friends separately to rank them according to their preference. Using these data, check whether their preferences are related or not.
- (f) From a group of students of a class select a sample of size 10 using Random Number Table by SRSWR and SRSWOR. Estimate sample mean and sample variance based on the result you obtained.
- (g) Collect the data on the movement of BSE SENSEX for last two weeks. Fit a linear trend to the data and calculate the predicted value for next two days. Verify the correctness of the predicted values with the actual values. Comment on the result you obtained.

INSTRUCTIONS for Laboratory Session and
Preparation of Laboratory Note Book for STATISTICS.

1. For Laboratory Note Book, square sheets and white sheets both are to be used by the students, but if the square sheets are not available then the students may use Laboratory Note Book as used in practical of Biological Sciences, Physics and Chemistry etc.
2. Strictly, HB pencil is to be used in laboratory sessions. Scientific calculators (Non-Programmable) may be used. If required, Statistical Tables are to be supplied by the institutions. Geometry Box may also be used.
3. A problem set on a specific topic covering different numerical problems based on Secondary data is to be supplied to the students in a laboratory session. This may be typed or printed or neatly hand-written in white papers.

Each problem set should carry at the top

- (a) The problem set number
 - (b) Heading (in capital letters)
 - (c) Working date
4. While solving any problem in any of the problem sets, students must mention the necessary theory along with relevant formula and notations, in brief, wherever and whenever needed in the square sheets. No derivation or discussion is needed. Use tables for showing the calculations.
 5. The necessary calculations are to be shown stepwise with specification of units, wherever required. Calculations should be presented neatly, whenever required, in a square sheet or in the ruled side of the inter-leaf sheet.
 6. For graphs and diagrams the cm/mm graph papers are to be used. Both the axes should be labelled clearly, scales to be mentioned and the name of the charts/ diagrams are to be mentioned clearly. The graph sheets are to be presented adjacent to the relevant calculations of the problems concerned.
 7. All the problem sets enlisted in the syllabus must be completed, examined and signed with date by the teacher concerned. Finally, it should be arranged serially according to the content index.
 8. There should be a content index at the very beginning of the Laboratory Note Book which consists of
 - (a) Serial Number of the Chapters
 - (b) Heading of the Chapters
 - (c) Working Date
 - (d) Running Page Number

RULES for the Practical Examination

1. The Practical Examination is to be held on a **single date** simultaneously in all the institutions.
2. If it is not possible to hold the examination on a single date, then there should be **at least three sets of questions** for different dates since Statistics Practical is a numerical problem based practical.
3. The Practical Examination will be of **two hours** duration including Viva-Voce.
4. Questions of Viva-Voce may be asked by the **External Examiner** to test the depth and understanding of the student in both theory and practical, preferably on Project Work.
5. Only **non-programmable** scientific calculators are allowed in the examination.
6. Statistical table will not be given in the question paper. Only some required values will be given in the question paper. **Statistical tables**, if required, should be supplied by the institutions on the date of examination for consultation of the students.
7. The completed Laboratory Note Book **duly checked** covering all the topics/chapters as prescribed in the syllabus must be submitted during the Practical Examination of both Class XI and Class XII.
8. Students **must bring the completed Project Work** given to them on the date of Practical Examination.