M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to SavitribaiPhule Pune University
NAAC accredited 'A' Grade

B.Sc. [Three Year] Statistics [Minor]

(NEP 2020-II, CBCS – Autonomy 26 Pattern)

STRUCTURE OF STATISTICS SYLLABUS

Structure of the course for three years and the pattern of examination and question papers are as specified below

Semester	**Paper code [26 patt]**	**Paper**	**Paper title**	**Credits**	**Marks**		
					CIA	ESE	Total
1	26SBST11MN	I	Descriptive Statistics-I	2	20	30	50
	26SBST12MN	II	Statistics Practical-I	2	20	30	50
II	26SBST21MN	I	Discrete Probability Distributions-I	2	20	30	50
	26SBST22MN	II	Statistics Practical-II	2	20	30	50
	26SBST21VS	I	Statistics Using MS Excel	2	20	30	50

CONTINUOUS INTERNAL EVALUATION (CIE) FOR B.Sc

For Continuous Internal Evaluation (CIE), Evaluation will be done continuously. Internal assessment will be of **20** marks for a paper of 50 Marks. These 20 marks are divided as follows:

a) There will be compulsory Test on Demand MCQ Examination of **20** marks of each subject which would be converted into 0**5 Marks.**
b) Two Class Tests 10 Marks Each. Converted to 05 Marks.
c) Mid Sem Exam of 20 Marks converted to 05 Marks
d) Participation in two activities at department/ college level 05 Marks
e) In case of students failing to score under category (d), the attendance can be considered to give marks.

f) There will be a compulsory Mock Practical Examination, Viva Voce of subjects mentioned in for **20 Marks**.

g) The subject teacher needs to adopt anyone out of the following methods for internal assessment:

Table 7: Methods of Internal Assessment

Written exam	Quiz
Presentations	Projects
Assignments	Tutorials
Oral examination	Open Book Test and Others

1) **DURATION OF SEMESTER END EXAMINATION (FINAL):** Question papers will be set for Thirty Marks (One and Half Hour Duration) for Theory and Thirty Marks (Three and Half Hour) for Practical Examination.

Table 8: Criteria for Paper Setting of Internal Assessment and Semester End Examination

Knowledge	**Understanding**	**Applications, Analysis, Problem Solving**	**Total Marks**
50%	25%	25%	100%

2) **STANDARD OF PASSING:**

- A student must obtain a minimum of 40% marks in Continuous Internal Evaluation (CIE), and minimum 40% marks in Practical Examination and Semester End Examination (External Examination).
- Passing separately in Internal Assessment, Practical Examination and Semester End Examination is compulsory.
- The student has to secure at least 40 marks (40%) in the total assessment (50 Marks) for each subject.
- Students who are failed in Continuous Internal Evaluation (CIE) of any semester can reappear for the same in the next semester.

PAPER-WISE DETAILED SYLLABUS

Offered as	**Minor**
Course/ Paper Title	**Descriptive Statistics – I**
Course Code	26SBST11MN
Semester	I
No. of Credits	2 (2.5 Units equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in pure Statistics.
2.	To present the historical developments in Statistics to the students.
3.	To acquaint students with some basic concepts in Statistics
4.	To familiarize students with elementary statistical methods of analysis of data
5.	To introduce the computation of various measures of central tendency, dispersion, skewness and kurtosis.
6.	To acquaint students with the analysis of data pertaining to attributes and to interpret the results

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the different areas of Statistics
2.	Students will become aware about the role of Statistics in various fields.
3.	Students will be acquainted with the data analysis tools and interpretation of the results

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Introduction to Statistics**	**2**
	1. Meaning of Statistics as a Science. 2. Importance of Statistics. 3. Scope of Statistics: In the field of Industry, Biological sciences, Medical sciences, Economics, Social Sciences, Insurance, Psychology. 4. Statistical organizations in India and their functions: CSO, ISI, NSSO, IIPS (Devnar, Mumbai). 5. Statistical Heritage (Indian Perspective: Dr. V. S. Huzurbazar, Dr. P.C. Mahalnobis, Dr. P. V. Sukhatme, Dr. C. R. Rao).	1 1
Unit II	**Population and Sample**	**04**
	1. Types of characteristics: Attributes: Nominal scale, ordinal scale, Variables: Interval scale, ratio scale, discrete and continuous variables, difference between linear scale and circular scale. 2. Types of data: (i) Primary data, Secondary data. (ii) Cross-sectional data, time series data. 3. Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of a sample and a random sample. Methods of sampling (Description only): Simple random sampling with and without replacement (SRSWR and SRSWOR), stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.	1 1 2
Unit III	**Summary Statistics**	**14**
	1. Presentation of Data. Interpretation of Data from	2

	table and graph. Data validation.	
	2. Frequency Classification: Raw data and its classification, ungrouped frequency distribution, grouped frequency distribution, cumulative frequency distribution, inclusive and exclusive methods of classification, Open end classes, and relative frequency distribution.	2
	3. Measures of Central Tendency:	
	(i) Concept of central tendency of statistical data, Statistical averages, characteristics of a good statistical average.	1
	(ii) Arithmetic Mean (A.M.):Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean.	1
	(iii) Mode and Median: Definition, formulae (for ungrouped and grouped data), merits and demerits. Empirical relation between mean, median and mode.	1
	(iv) Partition Values: Quartiles, Deciles and Percentiles (for ungrouped and grouped data), BoxPlot.	1
	(v) Geometric Mean (G.M.):Definition, formula, merits and demerits. Harmonic Mean (H.M.): Definition. Formula, merits and demerits. Order relation between arithmetic mean, geometric mean, harmonic mean.	1
	4. Measures of Dispersion:	
	(vi) Concept of dispersion, characteristics of good measure of dispersion.	1
	(vii) Range, Semi-interquartile range (Quartile deviation): Definition, merits and demerits, Mean deviation: Definition, merits and demerits, minimality property (without proof),Variance and standard deviation: Definition, merits and demerits, effect of change of origin and scale, combined variance for n groups (derivation for two groups).	2
	(viii) Mean squared deviation: Definition, minimality property of mean squared deviation (with proof), Measures of dispersion for comparison: coefficient of range, coefficient	2

	of quartile deviation and coefficient of mean deviation, coefficient of variation(C.V.)	
Unit IV	**Moments, Skewness and Kurtosis**	**08**
	1. Raw moments for ungrouped data. Central moments for ungrouped and grouped data, Effect of change of origin and scale. Relations between central moments and raw moments, upto 4^{th}order (without proof). 2. Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution. Bowley's coefficient of skewness: Bowley's coefficient of Skweness lies between −1 to 1 (with proof), interpretation using Boxplot. Karl Pearson's coefficient of skewness. Measures of skewness based on moments. 3. Concepts of kurtosis, leptokurtic, mesokurtic and platy kurtic frequency distributions. Measures of kurtosis based on moments.	3 3 2
Unit V	**Theory of Attributes**	**08**
	1. Attributes: Concept of a Likert scale, classification, notion of manifold classification, dichotomy, class-frequency, order of a class, positive class-frequency, negative class frequency, ultimate class frequency, relationship among different class frequencies (two attributes), and dot operator to find the relation between frequencies, fundamental set of class frequencies. 2. Consistency of data upto 2 attributes. 3. Concepts of independence and association of two attributes. Yule's coefficient of association (Q),$-1 \leq Q \leq 1$,interpretation.	4 1 3

References:

1) Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.

2) Ghosh, J. K. and Mitra, S. K., Parthsarthi, K. R. (1993). Glimpses of India's Statistics Heritage,Wiley publishing Co.
3) Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
4) Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
5) Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
6) Neil A.Weiss (2016).Introductory Statistics,Tenth Edition,Pearson.
7) Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.
8) Sarma, K.V.S.(2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
9) Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press.

REFERENCE WEBSITES FOR PAPER I AND PAPERII:

1.www.stats.unipune.ac.in[100DatasetsforStatisticsEducation by Dr. Anil P. Gore, Dr. Mrs. S. A. Paranjpe and Madhav B. Kulkarni available in ISPS folder)].

1. www.freestatistics.tk(NationalStatisticalAgencies)
2. www.psychstat.smsu.edu/sbk00.htm(Onlinebook)
3. www.bmj.bmjournals.com/collections/statsbk/index.shtml
4. www.statweb.calpoly.edu/bchance/stat-stuff.html
5. www.amstat.org/publications/jse/jse-data-archive.html(International journal onteachingand learning ofstatistics)
6. www.amstat.org/publications/chance(Chancemagazine)
7. www.statsci.org/datasets.html(Datasets)
8. www.math.uah.edu/stat(VirtuallaboratoriesinStatistics)
9. www.amstat.org/publications/stats(STATS:themagazineforstudentsofStatistics)
10. www.stat.ucla.edu/cases(CasestudiesinStatistics).
11. www.statsoft.com
12. www.statistics.com

13. www.indiastat.com
14. www.unstat.un.org
15. www.stat.stanford.edu
16. www.statpages.net
17. www.wto.org
18. www.censusindia.gov.in
19. www.mospi.nic.in
20. www.statisticsofindia.in
21. www.nationmaster.com (Population studies)

Offered as	**Minor**
Course/ Paper Title	Statistics Practical – I
Course Code	26SBST12MN
Semester	I
No. of Credits	2.0

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To use various graphical and diagrammatic techniques and interpretation
2.	To analyse data pertaining to discrete and continuous variables and to interpret the results
3.	To compute various measures of central tendency, dispersion, skewness and kurtosis
4.	To interpret summary statistics of computer output
5.	To summarize and analyze the data using computers

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be able to use various graphical and diagrammatic techniques and interpretation

2.	Students will be able to compute various measures of central tendency, dispersion, skewness and kurtosis
3.	Students will be acquainted with the usage of computers for data analysis

S.No.	Title of the experiment	No. of Practicals
1	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiplebar diagram, percentage bar diagram, pie diagram.	1
2	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiplebar diagram, percentage bar diagram, pie diagram. using Ms-Excel/Any statistical software	1
3	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically.	1
4	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically. Using Ms-Excel/Any statistical software	1
5	Tabulation (2 x 2 tables), Tabulation (3 x 3 tables)	1
6	Data Interpretation from various graphs and diagrams.	1
7	Use of random number tables to draw SRSWOR, SRSWR, stratified sample and systematic sample. Using Statistics tables.	1
8	Use of random number tables to draw SRSWOR, SRSWR, stratified sample and systematic sample. Using MS-Excel/Any statistical software	1
9	Computation of measures of central tendency and dispersion (ungrouped data). Use of an appropriate measure and interpretation of results and computation of partition values.	1

10	Computation of Measures of skewness.	1
11	Computation of Measures of kurtosis, Boxplot.	1
12	Computation of summary statistics using MS-Excel	1
13	Computation of summary statistics using PSPP, Any other open source software	1

Offered as	**Minor**
Course/ Paper Title	**Discrete Probability Distributions-I**
Course Code	26SBST21MN
Semester	II
No. of Credits	2 (2.5 Units equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To introduce the students with the basic concepts of probability theory.
2.	To acquaint students with axiomatic theory of probability, concept of random variable, probability distribution (univariate and bivariate) discrete random variables, expectation and moments of probability distribution
3.	To acquaint students to distinguish between random and non-random experiments.
4.	To familiarize students with the probability distribution of random variable (one or two dimensional) in the given situation.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the calculations of the probabilities of events.

2.	Students will become aware about the role of Statistics in the situation of uncertainty.
3.	Students will be acquainted with various available probability models.

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	Basics of Probability	**06**
	1. Experiments/Models, Ideas of deterministic and non-deterministic models. Random Experiment, concept of statistical regularity.	1
	2. Definitions of - Sample space, Discrete sample space: finite and countably infinite, Event, Elementary event, Complement of an event. Certain event and Impossible event Concept of occurrence of an event. Algebra of events and its representation in set theory notation. Occurrence of following events. (i) At least one of the given events, (ii) None of the given events, (iii) All of the given events, (iv) Mutually exclusive events, (v) Mutually exhaustive events, (vi) Exactly one event out of the given events.	2
	3. Classical definition of probability and its limitations. Probability model, probability of an event, equiprobable and non-equiprobable sample space,	1
	4. Axiomatic definition of probability. Theorems and results on probability with proofs based on axiomatic definition such as P(AUB)=P(A)+P(B)-P(A ∩ B). Generalization P (AUBUC),$0 \leq P(A) \leq 1$, P(A) + P(A′) = 1 , P(Φ) = 0,$P(A) \leq P(B)$ when A⊂B, Boole's	2

	inequality.	
Unit II	Conditional Probability and Bayes' Theorem	**05**
	1. Definition of conditional probability of an event. Results on conditional probability. Definition of independence of two events $P(A \cap B) = P(A) \cdot P(B)$, Pairwise independence and mutual independence for three events, Multiplication theorem $P(A \cap B) = P(A) \cdot P(B\|A)$. Generalization to $P(A \cap B \cap C)$. 2. Partition of the sample space, prior and posterior probabilities. Proof of Bayes' theorem. Applications of Bayes'theorem in real life.	3 2
Unit III	Univariate Probability Distributions (on Discrete Sample Space)	**03**
	1. Concept and definition of a discrete random variable. Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), $F(\cdot)$ of discrete random variable, properties of c.d.f.. 2. Mode and median of a univariate discrete probability distribution.	2 1
Unit IV	Mathematical Expectation (Univariate Random Variable)	**08**
	1. Definition of expectation (Mean) of a random variable, expectation of a function of a random variable, m.g.f. and c.g.f. Properties of m.g.f and c.g.f. 2. Definitions of variance, standard deviation (s.d.) and Coefficient of variation (c.v.) of univariate probability distribution, effect of change of origin and scale on mean,variance and s.d. 3. Definition of raw, central and factorial raw moments of univariate probability Distributions and their interrelations **(**without proof). 4. Coefficients of skewness and kurtosis based on moments.	2 2 2 2
Unit V	Some Standard Discrete Probability Distributions	**15**

	1. Degenerate distribution (one point distribution), mean and variance.	1
	2. Uniform discrete distribution, p.m.f., c.d.f., mean, variance, real life situations.	1
	3. Bernoulli Distribution: p.m.f., notation and mean, variance.	2
	4. Binomial Distribution: p.m.f., notation. Recurrence relation for successive probabilities, computation of probabilities of different events, mean, variance, m.g.f. and c.g.f. moments, skewness (comments when $p = 0.5$, $p > 0.5$, $p < 0.5$). Situations where this distribution is applicable. Additive property for binomial distribution.	4
	5. Hypergeometric Distribution: Necessity and importance of Hypergeometric distribution, capture-recapture method. p.m.f., notation.	4
	6. Computation of probability, situations where this distribution is applicable, binomial approximation to hypergeometric probabilities, statement of mean and variance of the distribution (Derivation is not expected).	3

References:

1. Agarwal B.L.(2003).Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta,S.C.and Kapoor,V.K.(1983).Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
4. Hogg, R.V. and Craig R.G.(1989).Introduction to Mathematical Statistics, Ed. Mac Millan Publishing Co., New York.
5. Mayer,P.(1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
6. Mood,A.M.and Graybill, F.A. and Boes D.C. (1974).Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.

7. Rao, V L S Prakash (2008).First Course in Probability and Statistics, New Age International Publishers, New Delhi.
8. Ross S.(2002).A First Course in Probability, Sixth Edition, Pearson Education, Inc.& Dorling Kindersley Publishing, Inc.

Offered as	**Minor**
Course/ Paper Title	**Statistics Practical – II**
Course Code	26SBST22MN
Semester	II
No. of Credits	2.0

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To compute correlation coefficient, regression coefficients
2.	To compute probabilities of bivariate distributions
3.	To fit binomial and Poisson distributions to the given data
4.	To compute probabilities of bivariate distributions
5.	To use computer software to fit the curves to the given numerical data

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be able to correlation coefficient along with graphical representation of correlation with interpretation
2.	Students will be able to fit line of regression to the given data
3.	Students will be acquainted with the fitting of curves as a part of data analysis

S.No.	Title of the experiment	No. of Practicals
1	Scatter diagram, correlation coefficient (ungrouped data).	1
2	Fitting of line of regression of Y on X	1
3	Fitting of second degree curve	1
4	Fitting of exponential curve of the type $Y = ax^b$	1
5	Fitting of Binomial distribution and computation of expected frequencies.	1
6	Applications of Binomial and hypergeometric distributions.	1

7	Fitting of Poisson distribution and computation of expected frequencies.	1
8	Index numbers. 1) Cost of living index numbers 2) Some special Index numbers (Laspeyre's, Paasche's and Fisher's Index Numbers)	2
9	Scatter diagram, correlation coefficient using MS-Excel/ Any statistical software & interpretation.	1
10	Fitting of a line of regression using MS-Excel / Any statistical software & interpretation.	1
11	Fitting of second degree curve using MS-Excel / Any statistical software & interpretation.	1
12	Fitting of exponential curve using MS-Excel / Any statistical software & interpretation.	1

Offered as	**VSC (Minor)**
Course/ Paper Title	**Statistics Using MS Excel**
Course Code	26SBST21VS
Semester	II
No. of Credits	2 (3 Units equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	This course is designed to introduce MS-Excel to the students..
2.	It will enable students to understand basic concept of MS-Excel.
3.	It will help students to represent the data in pictorial forms.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will have learned to open the Excel spread sheet and are able to enter the data in worksheet.
2.	They will be able to represent data into charts, diagrams, graphs, etc.
3.	They can perform various mathematical calculations and can learn the use of excel as calculator.
4.	They can perform various statistical calculations.

Syllabus

Unit No	Title with Contents	No. of Practicals
Unit I	**Introduction to MS-Excel**	**2**
	Ribbon tabs, Ribbon bar, Understanding the worksheet (Rows and Columns, Sheets, Work- books), Active Cell, Columns, Rows, Fill Handle, Address Bar, Formula Bar, Title Bar, File Menu, Quick Access Toolbar, Ribbon Tab, Worksheet Tab, Status Bar. Data Entry in MS Excel.	Approx 1 practical per section
Unit II	**Microsoft Excel Basic Functions**	**2**
	SUM, COUNT, AVERAGE, MIN, MAX, TIME, DATE, LEFT, RIGHT, IF, RAND etc.	
Unit III	**Visualization of Data**	**2**
	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram.	
Unit IV	**Presentation of Data**	**2**
	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically.	
Unit V	**Statistical Computations**	**2**
	Computation of summary statistics, mean , mode, median , partition values, variance, standard deviation, absolute deviation, Range, etc. Scatter diagram, correlation coefficient, fitting of a line of regression, fitting of second degree curve	
Unit VI	**Problem solving with MS-Excel**	**2**
	Computations using basic mathematical and Statistical functions. Diagrammatic representation of data. Graphical representation of frequency data. Computations of correlation coefficients and curve fitting.	

References:

1. Michael Alexander and John Walkenbach (2013), Microsoft Excel Dashboards and Reports, 2nd Edition, Wiley.

2. Greg Harvey (2019). Microsoft Excel 2019 All-in-one for Dummies, Wiley

3**.** John Walkenbach (2018), Excel 2016 Bible ,Wiley

4. Schmuller, Joseph (2020), Statistical Analysis with Excel, 4th Edition, Wiley