M. C. E. Society's
AbedaInamdar 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, CBCS – Autonomy 23 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 [23 patt]**	**Paper**	**Paper title**	**Credits**	**Marks**		
					CIA	ESE	Total
1	23SBST111SEC	I	Introduction to statistical data analysis	2	20	30	50
	23SBST112IKS	II	Indian Statisticians	2	20	30	50
	23SBST1OE	III	Official Statistics [Indian perspective]	2	20	30	50
	23SBST114VSC	IV	Data Handling using MS Excel	2	20	30	50
	23SBST2OE	--	Statistics using MS Excel	2	20	30	50
	23SBST3OE	--	R-Software	2	20	30	50
	23SBST4OE	--	Statistics for Commerce	4	40	60	100
	23SBST5OE	--	Statistics for Business Administration (Computer Applications)	2	20	30	50
II	23SBST121MN	I	Descriptive Statistics-I	2	20	30	50
	23SBST122MN	II	Discrete Probability Distributions-I	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**5Marks.**

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	23SBST121MN
Semester	II
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 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,	2 2

	and relative frequency distribution. 3. Measures of Central Tendency: (i) Concept of central tendency of statistical data, Statistical averages, characteristics of a good statistical average. (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. (iii) Mode and Median: Definition, formulae (for ungrouped and grouped data), merits and demerits. Empirical relation between mean, median and mode. (iv) Partition Values: Quartiles, Deciles and Percentiles (for ungrouped and grouped data), BoxPlot. (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. 4. Measures of Dispersion: (vi) Concept of dispersion, characteristics of good measure of dispersion. (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). (viii) Mean squared deviation: Definition, minimality property of mean squared deviation (with proof), Measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation(C.V.)	 1 1 1 1 1 1 2 2
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).	3

	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 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 InternationalPublishers,NewDelhi.
2) Ghosh, J. K. and Mitra, S. K., Parthsarthi, K. R. (1993). Glimpses of India's StatisticsHeritage,Wiley publishing Co.
3) Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1,SixthRevised Edition,TheWorld Press Pvt. Ltd.,Calcutta.
4) Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, EighthEdition,Sultan Chand and Sons Publishers, NewDelhi.
5) Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition,SultanChand and Sons Publishers, NewDelhi.
6) NeilA.Weiss(2016).IntroductoryStatistics,TenthEdition,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.

REFERENCEWEBSITESFOR PAPERI ANDPAPERII:

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 on teaching and learning of statistics)
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	**Discrete Probability Distributions-I**
Course Code	23SBST122MN
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. 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. 3. Classical definition of probability and its limitations. Probability model, probability of an event, equiprobable and non-equiprobable sample space, 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 inequality.	1 2 1 2
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	3 2

	of Bayes'theorem in real life.	
Unit III	Univariate Probability Distributions (onDiscrete 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(·) 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. 2. Uniform discrete distribution, p.m.f., c.d.f., mean, variance, real life situations. 3. Bernoulli Distribution: p.m.f., notation and mean, variance. 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.	1 1 2 4

	5. Hypergeometric Distribution: Necessity and importance of Hypergeometric distribution, capture-recapture method. p.m.f., notation. 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).	4 3

References:

1. Agarwal B.L.(2003).Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta,S.C.andKapoor,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, NewYork.
4. Hogg, R.V. and Craig R.G.(1989).Introduction to Mathematical Statistics, Ed. Mac Millan Publishing Co., NewYork.
5. Mayer,P.(1972).Introductory Probability and Statistical Applications,AddisonWesleyPublishing Co., London.
6. Mood,A.M.andGraybill,F.A.andBoesD.C.(1974).Introductionto theTheoryofStatistics,Ed. 3, McGraw Hill BookCompany.
7. Rao,VLSPrakash(2008).FirstCourseinProbabilityandStatistics,NewAgeInternationalPublishers,NewDelhi.
8. Ross S.(2002).A First Course in Probability, Sixth Edition, Pearson Education, Inc.& Dorling Kindersley Publishing, Inc.

Offered as	**SEC (Minor)**
Course/ Paper Title	**Introduction to statistical data analysis**
Course Code	23SBST111SEC
Semester	I
No. of Credits	2 (1.5 Unit equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in applied statistics.
2.	To acquaint students with some basic concepts in Statistics
3.	To familiarize students with elementary statistical methods of analysis of data
4.	To introduce the computation of various measures of central tendency, dispersion, skewness and kurtosis.
5.	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 statistical applications
2.	Students will become aware about the role of Statistics in various fields.
3.	Students will be briefly 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**

	6. Meaning of Statistics as a Science. 7. Importance of Statistics. 8. Scope of Statistics: In the field of Industry, Biological sciences, Medical sciences, Economics, Social Sciences, Insurance, Psychology.	1 1
Unit II	**Introduction to data and sampling methods**	**14**
	4. Types of characteristics: Attributes: Nominal scale, ordinal scale, Variables: Interval scale, ratio scale, discrete and continuous variables, difference between linear scale and circular scale. 5. Types of data: (i) Primary data, Secondary data. (ii) Cross-sectional data, time series data. 6. 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.	4 3 7
Unit III	**Sample size calculation and data Analysis**	**20**
	1. Statistical regularity 2. Notion of testing of hypothesis. 3. Sample size determination 4. Importance and benefits of statistical analysis 5. Step-wise process of statistical analysis 6. Statistical analysis methods: Introduction to univariate data analysis methods. Descriptive statistics and data visualization methods. Introduction to statistical inference. Methods for decision making including simple linear regression.Estimation procedures using confidence intervals and hypothesis testing. 7. Introduction to statistical softwares for data analysis: 1)	2 to 3 lectures per section

	MS Excel 2) R Software 3) PSPP (Open source statistical software equivalent to SPSS) 8. Career in statistical analysis as a data scientist/data analyst	

References:

1) Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age InternationalPublishers,NewDelhi.
2) Ghosh, J. K. and Mitra, S. K., Parthsarthi, K. R. (1993). Glimpses of India's StatisticsHeritage,Wiley publishing Co.
3) Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1,SixthRevised Edition,TheWorld Press Pvt. Ltd.,Calcutta.
4) Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, EighthEdition,Sultan Chand and Sons Publishers, NewDelhi.
5) Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition,SultanChand and Sons Publishers, NewDelhi.
6) NeilA.Weiss(2016).IntroductoryStatistics,TenthEdition,Pearson.
7) Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.

Offered as	**VSC (Minor)**
Course/ Paper Title	**Data handling using MS Excel**
Course Code	23SBST114VSC
Semester	I
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 Lectures
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 lecture 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**	**4**
	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram.	
Unit IV	**Presentation of Data**	**6**
	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically.	
Unit V	**Statistical Computations**	**6**
	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**	**10**
	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

Offered as	**IKS (Minor)**
Course/ Paper Title	**Indian Statisticians**
Course Code	23SBST112IKS
Semester	I
No. of Credits	2 (1.5 Unit equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge about statistics.
2.	To familiarize students with Indian heritage of statistics.
3.	To introduce the various past and present Indian statisticians to science students.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the statistical knowledge system in India
2.	Students will become aware about the contributions of various Indians Statisticians in the field of science and technology

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Introduction of statistics as a discipline in India**	**4**
	1. Introduction of Statistical heritage in India 2. Statistics in Ancient times in India 3. Statistical system during British India 4. Statistical system after independence	Approx1 lecture per section
Unit II	**Indian Statisticians [Past]**	**18**
	Introduction and Contribution of following Statisticians 1. Prasanta Chandra Mahalanobis [1893 - 1972] [Father of Indian Statistics] 2. Raj Chandra Bose: [1901 –1987] 3. SamarendraNath Roy: [1906 –1964] 4. Pandurang V. Sukhatme [1911 – 1997] 5. V.S. Huzurbazar [1919 – 1991] 6. Anil Kumar Jain [1919 – 1978] 7. Raghu Raj Bahadur: [1924 –1997] 8. RadhaLaha [1930 – 1999] 9. Sharad D. Gore [1952 – 2023]	Approx 2 Lectures per Statistician
Unit III	**Indian Statisticians [Present]**	**12**
	Introduction and Contribution of following Statisticians [Living legends]. 1. C. R. Rao: [1920-Present)] 2. Jayanta Kumar Ghosh: [1937-Present] 3. Pranab K. Sen: [1937-Present] 4. RajeevaLaxmanKarandikar [Chairman, National statistical commission] 5. A.P. Gore 6. J.V. Deshpande 7. G. Gopal 8. Mrs S SDeshmukh	Approx 2 Lectures per Statistician

References:

1) Ghosh, J.K. ,Mitra, S. K. , and Parthasarathy, K. R. (1992) Glimpses of India's Statistical Heritage, Wiley Eastern, New Delhi. Publishers, New Delhi.
2) Ghosh, J. K, Maiti, P., Rao, T.J., and Sinha, B. K. (1999) Evolution of statistics in India, International Statistical Review, 67, 13-34.
3) Jarret, H.S. (1894) Translation of Ain-i-Akbari, Asiatic Society of Bengal, Vol.II, p.vii.
4) Mahalanobis, P.C. (1922) Anthropological observations on the Anglo-Indians of

Calcutta, Part I, Analysis of male stature, Rec. Ind. Museum, 23, 1-96.

5) Mahalanobis, P.C. (1944) On large-scale sample surveys, Philos. Trans. Roy. Soc., London, Ser. B, 231, 329-451.
6) Mahalanobis, P.C. (1957) The foundations of statistics, Sankhya, 18, 183-194.
7) Martin, M. (1838) History, Antiquities, Topography and Statistics of Eastern India, W.H. Allen, London.
8) Rao, C. R. (1989) Statistics and Truth, Council of Scientific and Industrial Research, New Delhi.
9) Rao, T. J. (2003) Origin of Indian official statistical system, Mahalanobis role, Bulletin International Statistical Institute.
10) Rudra, Ashok (1996) Prasanta Chandra Mahalanobis, A Biography, Oxford University Press, Delhi.

Offered as	**OE (Minor)**
Course/ Paper Title	**Official Statistics [Indian perspective]**
Course Code	23SBST1OE
Semester	I
No. of Credits	2 (1.5 Unit equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge about official statistics in India.
2.	To familiarize students with Indian statistical system.
3.	To introduce the various organizations of statistics in India.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the statistical system in India
2.	Students will become aware about the national incomeand its computation.

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Introduction of Official Statistical System in India**	**4**
	Present official statistical system in India Methods of collection of official statistics, their reliability and limitations. Common indicators used in official statistics.	Approx 2 lecture per section
Unit II	**Statistical Organizations in India**	**18**
	Role of Ministry of Statistics & Program Implementation (MoSPI). Central Statistical Office (CSO). National Sample Survey Office (NSSO). National Statistical Commission (NSC).	Approx 2 -3 lectures per section

	Coordination and Publication Division(CAP). Statistical System across the Indian States / UTs.	
Unit III	**National Income statistics**	**12**
	Producers at the national level Data sources Index numbers [Consumer price Index, Wholesale price index number and index of industrial production]. Concept of Per capita income (PCI). National Income: Basic idea and a brief description of income, expenditure and production approaches. Gross domestic product (GDP). Gross national product (GNP). Problem solving.	Approx 2 lectures per section

References:

1) Rao, T. J. (2003) Origin of Indian official statistical system, Mahalanobis role, Bulletin International Statistical Institute.
2) Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.
3) https://mospi.gov.in/NSSOa
4) https://www.india.gov.in/nsso-reports-publications

CourseTitle	Statistics Using MS-EXCEL	
CourseCode:23SBST2OE		No.ofCredits:2
CourseType:Open Elective		TotalTeaching Hours:30

CourseObjectives	
1.	To provide basic knowledge of MS-EXCEL for statistical techniques to the students.
2.	A student should be able to recall basic concepts and terminology in Statistics and cover basic tools and methods required for data analysis from their studies.

CourseOutcome	
1.	Students will successfully use the program sheet, enter data and to create spreadsheet and maintain the data.
2.	Student will have the Knowledge about Excel and its basic functions, operations-creating charts using MS-EXCEL.

Syllabus

Sr.No.	Topics	No.of Sessions
1.	IntroductiontoMS-EXCEL	1
2.	CreatingandFormattingWorksheetandWorkbook	1
3.	CreatingtableandExecutingbasiccommands	1
4.	Performoperationswithbasicfunctions.	1
5.	Graphicalrepresentation	1
6.	Measuresof CentralTendency	1
7.	MeasuresofDispersion	1
8.	PivotTable	1
9.	LogicalFunctions	1
10.	ExcelShortcutKeys	1

CourseTitle	**R-Software**
CourseCode:23SBST3OE	**No.ofCredits:2**
CourseType:OpenElective	**TotalTeaching Hours:30**

CourseObjectives	
1.	A student should be able to recall basic concepts and terminology in Statistics and covers basic tools and methods required for data analysis from their studies.
2.	A students should demonstrate knowledge of necessary arithmetic and logical operators, Salient functions for manipulating data, and getting help using R.
3.	A student must be able to apply statistical tools and techniques that is,translate information presented verbally into Statistics form, select and use appropriate statistical formulae or techniques to process the Information and draw the relevant conclusion.

CourseOutcome	
1.	Student will have the Knowledge about R and its basic operations-creating a vector, importing data, saving output and graphics using R.
2.	Students will have ability to represent data diagrammatically and graphically using R.

Sr.No.	**Topics**	**No.of Sessions**
1.	Introduction to R	1
2.	Creating vectors and Vector Arithmetic	1
3.	Creating Data Frames, Subset and Transform	1
4.	Diagrammatic Representation of Data	1
5.	Graphical Representation of Data	1
6.	Matrices	1
7.	Sampling methods	1

8.	Measures of Central Tendency	1
9.	Measures of Dispersion	1
10.	Probability	1

Offered as	Open Elective
Course/ Paper Title	Business Statistics for Commerce
Course Code	23SBST4OE
Semester	**I**
No. of Credits	4

Syllabus

Unit No	**Title with Contents**	**No. of Lectures**
Unit I	**Concept of Statistics**	**8**
	1. Role of Statistics in business. 2. Tabulation, Data Condensation. 3. Graphical Methods, Attributes and variables. 4. Classification. 5. Frequency distribution. 6. Cumulative frequencies (LCF, MCF). 7. Graphs: Histogram, Frequency Polygon. 8. Diagrams: Simple bar diagram, multiple bar diagram, pie diagram.	1 1 1 1 1 1 1 1
Unit II	**Measures of Central Tendency and Measures of Dispersion**	**10**
	1. Frequency distribution: Raw data, attributes and variables. 2. Classification of data, frequency distribution,	1

	cumulative frequency distribution, Histogram and ogive curves.	2
	3. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data.	3
	4. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M.,G.M. and H.M.	2
	5. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation(SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems.	2
Unit III	**Population and Sample**	**6**
	1. Definition of Statistics.	1
	2. Scope of Statistics in Economics, Management Science and Industry.	1
	3. Concept of population and sample, methods of data collection: Census and sampling with illustration.	2
	4. Methods of random sampling – SRSWR, SRSWOR, Stratified, Systematic (Description of sampling procedures only).	2
Unit IV	**Correlation and Regression**	**8**
	1. Concept and types of Correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship.	1
	2. Karl Pearson's coefficient of correlation for ungrouped data.	1
	3. Spearman's rank correlation coefficient.(with tie and	2

	without tie) 4. Concept of regression, Lines of regression of Y on X for ungrouped data, prediction using lines of regression on Y on X where Y- dependent variable and X- independent variable. 5. Regression coefficients and their properties (without proof).Examples and problems.	 2 2
Unit IV	**Index numbers**	**8**
	1. Concept of index number, price index number, price relatives. 2. Problems in construction of index number. 3. Construction of price index number: Weighted index Number, Laspeyre's, Paasche's and Fisher's method. 4. Cost of living/ Consumer price index number: Definition, problems in construction of index number. 5. Methods of construction: Family budget and aggregate expenditure. Inflation, Uses of index numbers, commonly used index numbers. 6. Examples and problems.	1 1 2 2 1 1
Unit-V	**Probability Theory**	**5**
	1. Concept of random experiment/trial and Possible outcomes; Sample Space and Discrete Sample Space. 2. Events their types, Algebra of Events, Mutually Exclusive and Exhaustive Events, Complimentary events. 3. Classical definition of Probability, conditional probability, Independence of Events : $P(A \cap B) = P(A)P(B)$,Simple examples	1 2 2
Unit-VI	**Measure of Dispersion, Skewness and Kurtosis**	**8**
	1. Dispersion	2

	2. Measures of Dispersion 3. Range, Interquartile differences 4. Average Deviation 5. Minimal Property of Average Deviation	2 2 1 1
Unit- VII	**Moments**	**7**
	1. Moments about the mean in terms of moments about any point and conversely 2. Effect of change of origin and scale on moments 3. Sheppard's corrections to moments of grouped frequency distributions	2 2 3

Text book:

1. Mathematical and Statistical Techniques- Dr.Abhilasha S. Magar, Manohar B. Bhagirath Himalaya Publishing House (First Edition 2015)
   Unit-I- Chapter 1
2. Mathematical Statistics-J.N. Kapur and H.C. Saxena S. Chand Publication 20th Edition
   Unit-II- Chapter-2
   Unit-III Chapter 1 (Sec 1.1 to 1.3) , Unit-V – Chapter 2 (Sec 2.1 to 2.3), Chapter 3 (Sec 3.1 to 3.2.5), Chapter 10 (Sec 10.1 to 10.4)
3. Sampling techniques. William G. Cochran. Wiley (3rd edition 2007) Unit-IV.

4. Mathematical Statistics-J.N. Kapur and H.C. Saxena S. Chand Publication 20th Edition.
   Unit III and Unit IV: Chapter1, Chapter2,Chapter3, Chapter10.
   Unit-VI and Unit-VII - Chapter-3,

5. Business Mathematics and Statistics- N.G. Das, J.K. Das McGraw Hill, New Delhi.
   UnitIV: Chapter:IndexNumbers.
6. Probability and Statistics with Reliablity, Quing, and Computer Science Applications- Kishor Trivedi Prentice Hall of India, New Delhi.
   UnitV: Chapter1.

Reference books:

1. Fundamentals of Mathematical Statistics Gupta S. C. and Kapoor V. K.:, Sultan

2. Chand and sons23,Daryaganj, New Delhi 110002.

3. Statistical Methods Gupta S. P. and Kapoor V. K.:, Sultan Chand and sons 23,

Daryaganj, NewDelhi110002.

4. Applied Statistics MukhopadhyaParimal New Central Book Agency Pvt. Ltd. Calcutta.

5. Fundamentals of Statistics Goon A.M.,Gupta,M.K.andDasgupta, B. World Press Calcutta.

Website:

1. https://onlinecourses.nptel.ac.in/noc20_mg23/preview

Course/ Paper Title	Statistics for Business Administration (Computer Applications)
Course Code	23SBST5OE
Semester	**I**
No. of Credits	2

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Frequency Distribution**	**8**

	1. Raw data, variable, discrete variable, continuous variable, constant, attribute with illustration. 2. Classification- Concept and definition of classification, 2 objectives of classification, types of Classification. 3. Frequency Distribution- Discrete and Continuous frequency distribution, Cumulative frequency and Cumulative frequency 3 distribution. 4. Graphs & Diagram- Histogram, Ogive curve, Pie-Diagram, Bar Diagram, Multiple bar Diagram Sub-divided bar diagram.	1 1 2 4
Unit II	**Measure of Central Tendency and Measure of Dispersion**	**14**
	1. Concept and meaning of Measure of Central Tendency, Objectives of Measure of Central Tendency, Requirements of good Measure of Central Tendency. 2. Types of Measure of Central Tendency, Arithmetic Mean (A.M), Median, Mode for discrete and Continuous frequency distribution, Merits & Demerits of A.M Median , Mode, Numerical Problem. 3. Determination of Mode and Median graphically. 4. Empirical relation between mean, median, mode 5. Combined Mean., Numerical Problems . 6. Concept and meaning of Measure of dispersion, Requirements of good Measure of dispersion. 7. Types of Measure of Dispersion- Absolute & Relative Measure dispersion (Range, Standard Deviation (S.D.), Variance, Quartile Deviation, Coefficient of Range, 8. Coefficient of Quartile Deviation, and Coefficient of Variation (C.V). 9. Combined Standard Deviation.	2 3 1 1 1 3 2 1
Unit III	Correlation & Regression	8

	1. Concept and meaning of Correlation, Types of correlation (for ungrouped data). 2. Methods to study Correlation: Scatter Diagram, Karl Pearson correlation coefficient, Spearman Rank Correlation Coefficient (with ties and without ties). 3. Regression- Concept and meaning of regression, line of regression equation of Y on X (Y-Dependent variable, X Independent variable). 4. Regression coefficients, properties of regression coefficients.	1 2 2 2 1

TEXT BOOK:

1. Mathematical Statistics-J.N. Kapur and H.C. Saxena S. Chand Publication 20th Edition, New Delhi

Unit I: Chapter1.

Unit II: Chapter2.

Unit III: Chapter3.

References:

1. J.N. Kapur and H.C. Saxena S. Mathematical Statistics. Sultan Chand and Sons Publishers, New Delhi
2. Girish Phatak. Business Statistics. Tech – Max Pune
3. Dr. S. K. Khandelwal. Statistics for Business. International Book House New Delhi
4. J.K. Sharma. Fundamentals of Business Statistics. Pearson New Delhi
5. G.C. Beri. Business Statistics. McGraw-Hill companies New Delhi
6. R.S. N. Pillai Bagavathi. Statistics Theory and Practice. Sultan Chand and Sons
7. Publishers, New Delhi.
8. Dr. S. K. Khandelwal. Statistics for Managerial decision Making. International
9. BookHouse New Delhi

10. Ken Black. Business Statistics For Contemporary Decision Making. Wiley India EditionNew Delhi

REFERENCE WEBSITES:

1. **https://onlinecourses.nptel.ac.in/noc20_mg23/preview**