K. C. E. Society's
Moolji Jaitha College
An 'Autonomous College' Affiliated to
K.B.C. North Maharashtra University, Jalgaon.
NAAC Reaccredited Grade - A (CGPA : 3.15 - 3rd Cycle)
UGC honoured "College of Excellence" (2014-2019)
DST(FIST) Assisted College

KNOWLEDGE IS POWER
ESTD. 1945

के. सी. ई. सोसायटीचे
मूळजी जेठा महाविद्यालय
क.ब.चौ. उत्तर महाराष्ट्र विद्यापीठ, जळगाव संलग्नित
'स्वायत्त महाविद्यालय'
नॅकद्वारा पुनर्मानांकित श्रेणी – 'ए' (सी.जी.पी.ए. : ३.१५ – तिसरी फेरी)
विद्यापीठ अनुदान आयोगाद्वारा घोषित 'कॉलेज ऑफ एक्सलन्स' (२०१४-२०१९)
डी.एस.टी. (फीस्ट) अंतर्गत अर्थसहाय्य प्राप्त

Date :- 01/08/2024

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc. in Statistics (Sem. I & II)

Ref. :- Decision of the Academic Council at its meeting held on 27/07/2024.

The Syllabi of B. Sc. in Statistics (First and Second Semesters) as per **NATIONAL EDUCATION POLICY – 2020 (2024 Pattern)** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2024-25.

Copy of the Syllabi Shall be downloaded from the College Website (www.kcesmjcollege.in)

Sd/-
Chairman,
Board of Studies

To :

1) The Head of the Dept., M. J. College, Jalgaon.
2) The office of the COE, M. J. College, Jalgaon.
3) The office of the Registrar, M. J. College, Jalgaon.

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समर्थ कॉलनी जवळ, जळगांव – ४२५ ००२. (महाराष्ट्र, भारत) । दूरध्वनी क्र. : +९१ २५७–२२३७३६३, २२३४२८१ । ई–मेलः mjcollege@kces.in । वेबसाईटः mjcollege.kces.in

Khandesh College Education Society's

Moolji Jaitha College, Jalgaon

An "Autonomous College"

Affiliated to Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

Structure and Syllabus

B.Sc. Honours/Honours with Research

(FYBSc Statistics)

Under Choice Based Credit System (CBCS)
and
as per NEP-2020 Guidelines

[w.e.f. AcademicYear: 2024-25]

Preface

Welcome to the Bachelor of Science in Statistics program! This syllabus serves as your guide to understand the curriculum and objectives of the program. The field of statistics plays a crucial role in today's data-driven world, and this program is designed to equip you with the necessary knowledge and skills to navigate the ever-expanding realm of statistical analysis. The BSc in Statistics program offers a comprehensive and rigorous study of statistical theory, methodology, and applications. It aims to develop your critical thinking abilities, analytical skills, and problem-solving capabilities, all of which are essential for making informed decisions based on data. Whether you aspire to work in industry, academia, research, or any other sector where data analysis is vital, this program will provide you with a solid foundation in statistical principles and techniques.

The syllabus is structured to cover a wide range of statistical topics, including probability theory, mathematical statistics, statistical modeling, experimental design, regression analysis, multivariate analysis, time series analysis, and more. Throughout the program, you will also have opportunities to enhance your computational skills through the use of statistical software packages widely used in the field.As you progress through this program, you will not only develop a strong statistical foundation but also cultivate essential skills in data collection, data cleaning, data visualization, and effective communication of statistical findings. These skills are highly valued in today's job market, where organizations across industries are seeking professionals who can harness the power of data to drive evidence-based decision-making.

Program Outcomes (PO) for B.Sc. Program:

Program outcomes associated with a B.Sc. degree are as follows:

No.	PO
1	Graduates should have a comprehensive knowledge and understanding of the fundamental principles, theories, and concepts in their chosen field of study.
2	Graduates should possess the necessary technical skills and competencies related to their discipline, including laboratory techniques and data analysis.
3	Graduates should be able to identify, analyze, and solve complex problems using logical and critical thinking skills. They should be able to apply scientific methods and principles to investigate and find solutions.
4	Graduates should be proficient in effectively communicating scientific information, both orally and in writing.
5	Graduates should have a basic foundation in research methods and be capable of designing and conducting scientific investigations.
6	Graduates should be able to work effectively as part of a team, demonstrating the ability to collaborate with others, respect diverse perspectives, and contribute to group projects.
7	Graduates should recognize the importance of ongoing learning and professional development. They should be equipped with the skills and motivation to engage in continuous learning, adapt to new technologies and advancements in their field, and stay updated with current research.

Program Specific Outcome PSO (B.Sc. Statistics):

After completion of this course, students are expected to:

No.	PSO
1	Serve as a statistician with sound theoretical, practical and computational skills.
2	Work as researcher for formulation and solution of mathematical, scientific, societal and industrial problems.
3	Understand the role of statistics in science, society and for National Development.
4	Apply some discrete and continuous distributions which are highly useful in modelling real life.
5	Investigate the relationship between a variable of interest (the response) and a set of related predictor variables and formulate and fit the appropriate regression model to the given dataset.
6	Serve as Administrators/Investigators in the private as well as government sectors and worked as Analyst in Manufacturing (SQC Unit), Pharmaceutical industries.

Multiple Entry and Multiple Exit options:

The multiple entry and exit options with the award of UG certificate/ UG diploma/ or three-year degree depending upon the number of credits secured;

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	UG Certificate	40	44	2	1
5.0	UG Diploma	80	88	4	2
5.5	Three Year Bachelor's Degree	120	132	6	3
6.0	Bachelor's Degree- Honours **Or** Bachelor's Degree- Honours with Research	160	176	8	4

Credit distribution structure for Three/ Four year Honors/ Honors with Research Degree Programme with Multiple Entry and Exit

F.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1)	Subject-II (M-2)	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
I (4.5)	I	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	OE-1(2T)	---	AEC-1(2T) (Eng) VEC-1(2T) (ES) IKS(2T)	CC-1(2T)	22	**UG Certificate**
	II	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	OE-2(2T) OE-3(2P)	---	AEC-2(2T) (Eng) VEC-2(2T) (CI)	CC-2(2T)	22	
	Cum. Cr.	**8**	**8**	**8**	**6**	**---**	**10**	**4**	**44**	
Exit option: Award of UG Certificate with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										

S.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major*		Subject-II (M-2) Minor #	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
2 (5.0)	III	DSC-5(2T) DSC-6(2T) DSC-7(2P)	---	MIN-1(2T) MIN-2(2T) MIN-3(2P)	---	OE-4(2T)	SEC-1(2T)	AEC-3(2T) (MIL)	CC-3(2T) CEP(2)	22	**UG Diploma**
	IV	DSC-8(2T) DSC-9(2T) DSC-10(2P)	---	MIN-4(2T) MIN-5(2P)	---	OE-5(2T)	SEC-2(2T) SEC-2(2P)	AEC-4(2T) (MIL)	CC-4(2T) ۞ FP(2)	22	
	Cum. Cr.	**12**	**---**	**10**	**---**	**4**	**6**	**4**	**8**	**44**	
	Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major & Minor.										

***** Student must choose one subject as a Major subject out of M-1, M-2 and M-3 that he/she has chosen at First year

Student must choose one subject as a Minor subject out of M-1, M-2 and M-3 that he/she has chosen at First year (Minor must be other than Major)

۞ OJT/Internship/CEP should be completed in the summer vacation after 4th semester

T.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
3 (5.5)	V	DSC-11(2T) DSC-12(2T) DSC-13(2T) DSC-14(2P) DSC-15(2P)	DSE-1A/B (2T) DSE-2A/B (2P)	---	---	---	VSC-1(2T) VSC-2(2P)	---	OJT/Int (4)	22	UG Degree
	VI	DSC-16(2T) DSC-17(2T) DSC-18(2T) DSC-19(2T) DSC-20(2T) IKS DSC-21(2P) DSC-22(2P)	DSE-3A/B (2T) DSE-4A/B (2P)	---	---	---	VSC-3(2T) VSC-4(2P)	---	---	22	
	Cum. Cr.	**24**	**8**	**---**	**---**	**---**	**8**	**---**	**4**	**44**	
	Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										

Fourth Year B.Sc. (Honours)

Year (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-23(4T) DSC-24(4T) DSC-25(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	---	22	UG Honours Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-29(4T) DSC-30(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	OJT/Int (4)	22	
	Cum. Cr.	**28**	**8**	**4**	**---**	**---**	**---**	**4**	**44**	
Four Year UG Honors Degree in Major and Minor with 176 credits										

Fourth Year B.Sc. (Honours with Research)

Year (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-23(4T) DSC-24(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	RP(4)	22	UG Honours with Research Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-30(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	RP(8)	22	
	Cum. Cr.	**20**	**8**	**4**	**---**	**---**	**---**	**12**	**44**	
Four Year UG Honours with Research Degree in Major and Minor with 176 credits										

Sem- Semester, **DSC**- Department Specific Course, **DSE**- Department Specific Elective, **OE/GE**- Open/Generic elective, **VSC**- Vocational Skill Course, **SEC**- Skill Enhancement Course, **VSEC**- Vocation and Skill Enhancement Course, **AEC**- Ability Enhancement Course, **IKS**- Indian Knowledge System, **VEC**- Value Education Course, **T**- Theory, **P**- Practical, **CC**-Co-curricular **RM**- Research Methodology, **OJT**- On Job Training, **FP**- Field Project, **Int**- Internship, **RP**- Research Project, **CEP**- Community Extension Programme, **ENG**- English, **CI**- Constitution of India, **MIL**- Modern Indian Laguage

- Number in bracket indicate credit
- The courses which do not have practical 'P' will be treated as theory 'T'
- If student select subject other than faculty in the subjects M-1, M-2 and M-3, then that subject will be treated as Minor subject, and cannot be selected as Major at second year.

Details of F.Y. B.Sc. (Statistics)

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/ Week			Marks			
					T	P	Total	Internal		External	
								T	P	T	P
Semester I, Level – 4.5											
DSC-1	DSC	STA-DSC-111	Descriptive Statistics-I	2	2	---	2	20	---	30	---
DSC-2	DSC	STA-DSC-112	Statistics Practical-I	2	---	4	4	---	20	---	30
OE-1	OE	STA-OE-111	Statistical Techniques-I	2	2	---	2	20	---	30	---
Semester II, Level – 4.5											
DSC-3	DSC	STA-DSC-121	Descriptive Statistics-II	2	2	---	2	20	---	30	---
DSC-4	DSC	STA-DSC-122	Statistics Practical-II	2	---	4	4	---	20	---	30
OE-2	OE	STA-OE-121	Statistical Techniques-II	2	2	---	2	20	---	30	---
OE-3	OE	STA-OE-122	Practical on Statistical Techniques	2	---	4	4	---	20	---	30

Examination Pattern

Theory Question Paper Pattern:

- 30 (External) +20 (Internal) for 2 credits
  - External examination will be of 1½ hours duration
  - There shall be 3 questions Q1 carrying 6 marks and Q2, Q3 carrying 12 marks each. while the tentative pattern of question papers shall be as follows;
  - Q1 Attempt any 2 out of 3 sub-questions; each 3 marks
  - Q 2 and Q3 Attempt any 3 out of 4 sub-question; each 4 marks.

Rules of Continuous Internal Evaluation:

The Continuous Internal Evaluation for theory papers shall consist of two methods:

1. Continuous & Comprehensive Evaluation (CCE): CCE will carry a maximum of 30% weightage (30/15 marks) of the total marks for a course. Before the start of the academic session in each semester, the subject teacher should choose any three assessment methods from the following list, with each method carrying 10/5 marks:

i. Individual Assignments
ii. Seminars/Classroom Presentations/Quizzes
iii. Group Discussions/Class Discussion/Group Assignments
iv. Case studies/Case lets
v. Participatory & Industry-Integrated Learning/Field visits
vi. Practical activities/Problem Solving Exercises
vii. Participation in Seminars/Academic Events/Symposia, etc.
viii. Mini Projects/Capstone Projects
ix. Book review/Article review/Article preparation
x. Any other academic activity
xi. Each chosen CCE method shall be based on a particular unit of the syllabus, ensuring that three units of the syllabus are mapped to the CCEs.

2. Internal Assessment Tests (IAT): IAT will carry a maximum of 10% weightage (10/5 marks) of the total marks for a course. IAT shall be conducted at the end of the semester and will assess the remaining unit of the syllabus that was not covered by the CCEs. The subject teacher is at liberty to decide which units are to be assessed using CCEs and which unit is to be assessed on the basis of IAT.

The overall weightage of Continuous Internal Evaluation (CCE + IAT) shall be 40% of the total marks for the course. The remaining 60% of the marks shall be allocated to the semester-end examinations.
The subject teachers are required to communicate the chosen CCE methods and the corresponding syllabus units to the students at the beginning of the semester to ensure clarity and proper preparation.

Practical Examination Credit 2: Pattern (30+20)

External Practical Examination (30 marks):

- Practical examination shall be conducted by the respective department at the end of the semester.
- Practical examination will be of 3 hours duration and shall be conducted as per schedule.
- Practical examination shall be conducted for 2 consecutive days for 2 hr/ day where incubation condition is required.
- There shall be 05 marks for journal and viva-voce. Certified journal is compulsory to appear for practical examination.

Internal Practical Examination (20 marks):

- Internal practical examination of 10 marks will be conducted by department as per schedule given.
- For internal practical examination student must produce the laboratory journal of practicals completed along with the completion certificate signed by the concerned teacher and the Head of the department.
- There shall be continuous assessment of 30 marks based on student performance throughout the semester. This assessment can include quizzes, group discussions, presentations and other activities assigned by the faculty during regular practicals. For details refer internal theory examination guidelines.
- Finally 40 (10+30) marks performance of student will be converted into 20 marks.

SEMESTER-I

F.Y. B.Sc. Statistics (Major)
Semester I
STA-DSC-111: Descriptive Statistics-I

Total Hours: 30 **Credits: 2**

Course objectives	• To provide knowledge about various data types and presentation of data • To make students aware about the historical development of statistics in India • To specify the scope of measures of central tendency • To specify the scope of measures of dispersion	
Course outcomes	After successful completion of this course, students are expected to: • Understand about the representation of data in a neat, compact and clear form • Explore about the various Statistical institutes and organizations: ISI, NSS, Bureau of Economics and Statistics in States, Indian Institute of Population Sciences (IIPS) • Compute and interpret measures of central tendency • Compute and interpret measures of dispersion	
Unit	**Contents**	**Hours**
Unit I	**Statistics and Presentation of Data** • Meaning of Statistics: numerical information, science, decision making science, general definition of statistics as science. • Scope of Statistics: In the field of Industry, Biological Sciences, Medical Sciences, Economics Sciences, Social Sciences, Management Sciences, Agriculture, Insurance, Information Technology, Education and Psychology. • Limitations of statistics. • Population, statistical population, census, sample, sampling. • Objectives of sampling. Advantages of sampling over census. • Methods of sampling: Simple random sampling with and without replacement, Stratified sampling and Systematic sampling. Illustrations from real life situations. • Meaning of data, raw data, qualitative and quantitative data. • Attributes and Variables, continuous and discrete variables. • Primary data and Secondary data, Sources of secondary data. • Measurement scales: nominal, ordinal, ratio and interval scales. • Tabulation: Meaning of table, Parts of table and Construction of table. • Frequency distribution: Meaning of frequency, class, exclusive and inclusive classes, open-end classes, class width, mid-value, class boundaries and limit, relative frequency. • Cumulative frequency distribution: less than, more than type. Guidelines for construction of classes. Histogram (equal & unequal classes) and Pareto diagram.	8
Unit II	**Indian Knowledge System in Statistics** • Introduction to the Indian Knowledge System and its relevance in Statistics • Historical overview of statistics in India • Introduction to statistical surveys in India and their significance • Statistical institutes and organizations: ISI, NSS, CSO, Bureau of Economics and Statistics in Maharashtra, Indian Institute of Population Sciences (IIPS). • Contribution of ISI to statistical research and education in India	**7**

	• Notable statisticians and their contributions (Indian Perspective) ○ Dr. P. C. Mahalanobis, Dr. P. V. Sukhatme, Dr. V. S. Huzurbazar, Dr. C. R. Rao	
Unit III	**Measures of Central Tendency** • Meaning of central tendency of data, objectives, and requirements of a good measure of Central Tendency. • Arithmetic mean (A.M.): Definition, effect of change of origin and scale, sum of deviations from A.M., combined mean for k groups, merits and demerits. Weighted A.M. • Geometric mean (G.M.): Definition, merits, demerits and its uses. • Harmonic Mean (H.M.): Definition, merits and demerits, uses • Median: Definition, computation formula (without derivation), graphical method of determining median, merits and demerits, • Mode: Definition, computation formula (without derivation), graphical method of determining median, merits and demerits, • A.M.>G.M.>H.M.(for 2 and 3 values) • Use of appropriate measure of central tendency in different situation. • Partition values:-Quartiles, deciles, & percentiles (Definition and Computation for ungrouped and grouped data). Box plot. • Examples and problems.	**8**
Unit IV	**Measures of Dispersion** • Meaning of Dispersion of data and objective. Requirements of a good measure of dispersion. • Range .Definition, Merits and Demerits, uses. • Quartile Deviation (Q.D.): Definition, computation, merits and demerits. • Mean deviation (M.D.), Definition, computation, merits and demerits Minimal Property of Mean Deviation without proof. • Definition of Standard deviation and variance with computation, Properties of variance and Standard Deviation i) Combined Variance and Standard deviation for two groups (with proof) and its extension for k groups ii)Effect of change of origin and scale iii) S.D. $\geq$ M.D. • Absolute and relative measures of dispersion: Coefficient of range, Coefficient of Q.D., Coefficient of M.D., Coefficient of variation (C.V.), Uses of C.V. • Examples and problems.	**7**
Study Resources	• Agarwal, B. L. (2017). Programmed Statistics, Third Edition, New Age International Publishers, New Delhi. • Gupta, S. C. and Kapoor, V. K. (2019). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand and Sons Publishers, New Delhi. • 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. • Sarma, K. V. S. (2010). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi. • Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press. • Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1996): Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.	

F.Y. B.Sc. Statistics (Major)
Semester I
STA-DSC-112: Statistics Practical-I

Total Hours: 60 **Credits: 2**

General Instructions	• All practicals must be carried out by using computers based on Excel software. Student must complete all the practicals to the satisfaction of concerned teacher. • Student must produce at the time of the practical examination, the laboratory journal of practicals completed along with the completion certificate signed by the concerned teacher and the Head of department. • Students must be encouraged to collect live data from real life situations for practicals. The total duration of external practical examination shall be 3(three) hours.	
Course Objectives	• To familiarize students with MS-Excel for statistical analysis. • To explore various methods of drawing sample using MS-Excel. • To explain computation with interpretation of various measures of central tendency using MS-Excel. • To explain computation with interpretation of various measures of dispersion using MS-Excel.	
Course Outcomes	After successful completion of this course, students are expected to: • Draw random sample using sampling methods • Construct tables and frequency distributions • Compute and interpret measures of central tendency • Compute and interpret measures of dispersion	
Sr. No.	**Contents**	**Hours**
1	Introduction to MS Excel I	4
2	Introduction to MS Excel II	4
3	Working with MS Excel Formulas, Logical Functions and Statistical functions	4
4	Drawing random sample using SRSWR, SRSWOR	4
5	Drawing random sample using Systematic sampling and Stratified sampling	4
6	Diagrammatic representation of data	4
7	Graphical representation of data	4
8	Construction of tables	4
9	Construction of frequency distributions	4
10	Measures of central Tendency I	4
11	Measures of central Tendency II	4
12	Measures of dispersion I	4

13	Measures of dispersion II	4
14	Real Life Data Analysis with Excel Tools I	4
15	Real Life Data Analysis with Excel Tools II	4
Study Resources	• Nigam M. (2023). Data Analysis with Excel, BPB Publications, New Delhi. • Agarwal, B. L. (2017). Programmed Statistics, Third Edition, New Age International Publishers, New Delhi. • Gupta, S. C. and Kapoor, V. K. (2019). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand and Sons Publishers, New Delhi. • 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. • Sarma, K. V. S. (2010). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi. • Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press.	

F.Y. B.Sc. Statistics (Open Elective)
Semester I
STA-OE-111: Statistical Techniques-I

Total Hours: 30 **Credits: 2**

Course objectives	• To develop understanding of the concept of sample, population and sampling • To make students aware about measures of central tendency and dispersion • To explore concept of bivariate data and correlation • To explain linear and nonlinear regression	
Course outcomes	After successful completion of this course, students are expected to: • Understand about the collection of the data, condensation and summarization into a compact form • Compute and interpret measures of central tendency and dispersion • Study correlation between two variables • Use regression lines	
Unit	**Contents**	**Hours**
Unit I	**Statistics and Presentation of Data** • Definition, Importance, Scope and Limitations of Statistics. • Population, statistical population, census, sample, sampling. • Objectives of sampling. Advantages of sampling over census. • Methods of sampling: Simple random sampling with and without replacement, Stratified sampling and Systematic sampling. Illustrations from real life situations. • Meaning of data, Raw data, and Qualitative and Quantitative data. • Attributes and Variables, continuous and discrete variables. • Primary data and Secondary data, Sources of secondary data. • Measurement scales: nominal, ordinal, ratio and interval scales. • Tabulation: Meaning of table, Parts of table and Construction of table. • Frequency distribution: Meaning of frequency, class, exclusive and inclusive classes, open-end classes, class width, mid-value, class boundaries and limit, relative frequency. • Cumulative frequency distribution: less than, more than type. Guidelines for construction of classes. Histogram (equal & unequal classes) and Pareto diagram.	8
Unit II	**Measures of Central Tendency and Dispersion** • Meaning of central tendency of data, objectives, and requirements of a good measure of Central Tendency. • Arithmetic mean (A.M.): Definition, sum of deviations from A.M., combined mean for k groups, merits and demerits. Weighted A.M. • Median: Definition, computation formula (without derivation), graphical method of determining median, merits and demerits, • Mode: Definition, computation formula (without derivation), graphical method of determining median, merits and demerits, • Use of appropriate measure of central tendency in different situation. • Partition values:-Quartiles and Deciles (Definition and Computation for	**7**

	ungrouped and grouped data). Box plot. • Meaning of Dispersion of data and objective. Requirements of a good measure of dispersion. • Range .Definition, Merits and Demerits, uses. • Quartile Deviation (Q.D.): Definition, computation, merits and demerits. • Mean deviation (M.D.), Definition, computation, merits and demerits. • Definition of Standard deviation and variance with computation. • Coefficient of variation (C.V.), Uses of C.V. • Examples and problems.	
Unit III	**Correlation** • Meaning of correlation between two variables, positive & negative correlation, • Scatter diagram, Construction of scatter diagram and interpretation. • Product moment correlation (Karl Pearson's correlation coefficient) and its properties, interpretation.(without proof) • Rank correlation: Spearman's rank correlation coefficient. • Examples and Problems	**8**
Unit IV	**Regression** • Meaning of regression, concept of linear and non-linear regression. • Concept of method of least squares. • Linear regression: Fitting of lines of regression by method of least squares. • Regression coefficients and their properties (without proof). • Coefficient of determination. • Examples and Problems	**7**
Study Resources	• Agarwal, B. L. (2017). Programmed Statistics, Third Edition, New Age International Publishers, New Delhi. • Gupta, S. C. and Kapoor, V. K. (2019). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand and Sons Publishers, New Delhi. • 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. • Sarma, K. V. S. (2010). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi. • Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press. • Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1996). Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.	

SEMESTER-II

F.Y. B.Sc. Statistics (Major)
Semester II
STA-DSC-121: Descriptive Statistics-II

Total Hours: 30 **Credits: 2**

Course objectives	• To explain measures of skewness and Kurtosis • To explore the concept of bivariate data and correlation • To make students acquainted with linear and nonlinear regression • To develop understanding of theory of attributes	
Course outcomes	After successful completion of this course, students are expected to: • Compute and interpret measures of skewness and kurtosis • Understand the concepts of Bivariate data, Correlation, types of correlation • Fit regression lines for forecasting • Apply theory of attributes in real life situation	
Unit	**Contents**	**Hours**
Unit I	**Moments, Skewness and Kurtosis** • Raw & central moments; Effect of change of origin and scale on central moments. • Moments about an arbitrary constant for grouped and ungrouped data. • Relation between central moments and raw moments (up to 4-th order). • Concept of Skewness of a frequency distribution; Positive and negative skewness, symmetric frequency distribution • Bowley's coefficient of skewness, Limits of Bowley's coefficient of skewness • Karl Pearson's coefficient of skewness. • Kurtosis: Meaning, Types of Kurtosis:-leptokurtic, mesokurtic & platykurtic. • Measures of skewness and kurtosis based on moments. • Examples and Problems.	7
Unit II	**Correlation** • Bivariate data. Ungrouped and grouped. • Meaning of correlation between two variables, positive & negative correlation, • Scatter diagram, Construction of scatter diagram and interpretation. • Covariance between two variables: Definition, Effect of change of origin and scale • Product moment correlation (Karl Pearson's correlation coefficient) and its properties, interpretation. • Rank correlation: Spearman's rank correlation coefficient, derivation of the formula of rank correlation coefficient (without ties).Rank correlation with ties • Simple numerical examples and problems.	**8**
Unit III	**Regression** • Meaning of regression, concept of linear and non-linear regression. • Concept of method of least squares.	**9**

	• Linear regression: Fitting of lines of regression by method of least squares. • Regression coefficients and their properties (statement and proof). • Angle between the two lines of regression. • Standard error of regression estimate. • Explained and unexplained variation and coefficient of determination. • Non-linear regression: Fitting of non-linear curves of the following type (i)$y = a + bx + cx^2$ (ii) $y = ax^b$ (iii) $y = ab^x$ • Examples and problems.	
Unit IV	**Theory of Attributes** • Concept of attribute, dichotomy, manifold classification, Notations. • Class frequency, order of class, positive class frequency, negative class frequency, contra class frequency, ultimate class frequency • Relation between class frequencies • Method of dot operator to express any class frequency in terms of positive class frequencies. • Fundamental set of class frequencies: Definition, determination whether a set of frequencies is fundamental set of or not (two attributes). • Independence and association of two attributes • Yule's coefficient of association (Q) and its interpretation. • Properties of $Q(-1 \leq Q \leq 1)$ and interpretation of (Q). • Examples and problems.	**6**
Study Resources	• Agarwal, B. L. (2017). Programmed Statistics, Third Edition, New Age International Publishers, New Delhi. • Gupta, S. C. and Kapoor, V. K. (2019). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand and Sons Publishers, New Delhi. • 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. • Sarma, K. V. S. (2010). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi. • Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press. • Montgomery, D. C; Peck, E. A.; Vining, G. G. (2006). Introduction to Linear Regression Analysis, John Wiley and Sons. • Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1996). Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.	

F.Y. B.Sc. Statistics (Major)
Semester II
STA-DSC-122: Statistics Practical-II

Total Hours: 60 **Credits: 2**

General Instructions	• All practicals must be carried out by using computers based on Excel software. Student must complete all the practicals to the satisfaction of concerned teacher. • Student must produce at the time of the practical examination, the laboratory journal of practicals completed along with the completion certificate signed by the concerned teacher and the Head of department. • Students must be encouraged to collect live data from real life situations for practicals. The total duration of external practical examination shall be 3(three) hours.
Course objectives	• To explain students regarding computations and interpretations of coefficient of Skewness and Kurtosis • To teach about computation and interpretion of correlation coefficient using MS-Excel. • To familiarize curve fitting • To provide real-life scenarios where theory of attributes is applicable.
Course Outcomes	After successful completion of this course, students are expected to: • Compute raw and central moments • Compute and interpret coefficient of Skewness and Kurtosis • Analyse bivariate data • Solve problems on theory of attributes

Sr. No.	Contents	Hours
1	Raw and central moments (ungrouped data)	4
2	Raw and central moments (grouped data)	4
3	Bowley's coefficient of skewness	
4	Karl Pearson's coefficient of skewness	4
5	Measures of kurtosis	4
6	Scatter diagram and correlation coefficient (ungrouped data)	4
7	Correlation coefficient for bivariate frequency distribution.	4
8	Rank correlation coefficient I	4
9	Rank correlation coefficient II	
10	Fitting of lines of regression	4
11	Fitting of second degree curve and exponential curve	4

12	Problems on theory of attributes I	4
13	Problems on theory of attributes II	4
14	Real life data analysis I	4
15	Real life data analysis II	4
Study Resources	• Nigam M. (2023). Data Analysis with Excel, BPB Publications, New Delhi. • Agarwal, B. L. (2017). Programmed Statistics, Third Edition, New Age International Publishers, New Delhi. • Gupta, S. C. and Kapoor, V. K. (2019). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand and Sons Publishers, New Delhi. • 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. • Sarma, K. V. S. (2010). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi. • Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press.	

F.Y. B.Sc. Statistics (Open Elective)
Semester II
STA-OE-121: Statistical Techniques-II

Total Hours: 30 **Credits: 2**

Course objectives	• To acquiant students with the concept of death rate and birth rate • To explain procedure of construction of life table • To present applications of Index numbers • To teach students how to apply decision theory in real life situations	
Course outcomes	After successful completion of this course, students are expected to: • Compute mesures of fertility and mortality • Construct life table • Compute index numbers • Apply decision theory	
Unit	**Contents**	**Hours**
Unit I	**Demography** • Vital Statistics, uses, measurement of population. • Measures of mortality: crude death rate, specific death rates (age wise, sex wise). • Standardized death rates (based on age-specific death rates) direct and indirect method, comparative study of these measures, infant mortality rate. • Measures of fertility, Crude birth rate, specific rate (age and sex), total fertility rate, • Comparative study of these measures. • Reproduction rates: G.R.R., N.R.R., comparison and interpretation. • Simple numerical problems.	10
Unit II	**Life Tables** • Introduction and Meaning • Construction of a life table • Uses of a life table • Numerical Problems	**5**
Unit III	**Index Numbers** • Meaning and utility of index numbers • Basic problems involved in the construction of index numbers • Weighted and unweighted index numbers • Various types of index numbers • Construction of consumer price index number • Limitations of index numbers • Examples and problems.	**8**

Unit IV	**Statistical Decision Theory** • Meaning of statistical decision theory, acts, states of nature, outcomes, pay-off and opportunity loss (or regret). • Decision making environment: Decision making under certainty, decision making under uncertainty and decision making under risk. • Decision under uncertainty : Decision rules (i) Maximax (optimistic) criterion, (ii) Minimax regret criterion and Hurwicz criterion (criterion of realism) (iii) Laplace criterion. • Decision under risk: Decision rules (i) Expected value criterion and (ii) Expected opportunity loss criterion. • Examples and problems.	**7**
Study Resources	• Gupta S.C. and Kapoor V. K. (2017). Fundamentals of Applied Statistics. S. Chand and Sons, New Delhi. • Parimal Mukhopadhyay. (2005). Applied Statistics. Books and Allied P Ltd, Kolkata. • Kanti Swarup, Gupta P. K. and Man Mohan.(2004). Operations Research, S. Chand & Sons • Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press.	

F.Y. B.Sc. Statistics (Open Elective)
Semester II
STA-OE-122: Practical on Statistical Techniques

Total Hours: 60 **Credits: 2**

General Instructions	• All practicals must be carried out by using computers based on Excel software. Student must complete all the practicals to the satisfaction of concerned teacher. • Student must produce at the time of the practical examination, the laboratory journal of practicals completed along with the completion certificate signed by the concerned teacher and the Head of department. • Students must be encouraged to collect live data from real life situations for practicals. The total duration of external practical examination shall be 3(three) hours.	
Course Objectives	• To familiarize students with MS-Excel for statistical analysis. • To explain computation with interpretation of various measures of central tendency and dispersion using MS-Excel. • To teach about computation & interpretion of correlation coefficient and construction of regression line using MS-Excel. • To acquiant students with the computations of death rates and birth rates with interpretations using MS-Excel.	
Course Outcomes	After successful completion of this course, students are expected to: • Compute and interpret measures of central tendency and dispersion • Compute and interpret measures of correlation • Construct regression lines • Construct life tables and compute measures of fertility and mortality with iterpretations	
Sr. No.	**Contents**	**Hours**
1	Introduction to MS Excel I	4
2	Introduction to MS Excel II	4
3	Working with MS Excel Formulas, Logical Functions and Statistical functions	4
4	Diagrammatic and Graphical representation of data	4
5	Measures of central Tendency I	4
6	Measures of central Tendency II	4
7	Measures of dispersion I	4
8	Measures of dispersion II	4
9	Scatter diagram and correlation coefficient (ungrouped data)	4

10	Construction of regression line	4
11	Demography I	4
12	Demography II	4
13	Life tables	4
14	Index Numbers	4
15	Statistical Decision Theory	4
Study Resources	• Nigam M. (2023). Data Analysis with Excel, BPB Publications, New Delhi. • Agarwal, B. L. (2017). Programmed Statistics, Third Edition, New Age International Publishers, New Delhi. • Gupta, S. C. and Kapoor, V. K. (2019). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand and Sons Publishers, New Delhi. • 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. • Sarma, K. V. S. (2010). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi. • Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press.	