

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.**



Circular / Syll. Sec./AEDP/ Uni.Cam. & Sub-Cam/Curriculum/ 2026.

It is hereby inform to all concerned that, as per direction by the Government; **the Academic Council & Management Council at it's Meeting held on 02^{ed} June, 2026 & 06th June, 2026 has accepted the "Following Subject wise Curriculum of AEDP programme as per Guidelines of NEP & University Norms"** to be implemented in the university main and sub-campus.

Sr. No.	Name of the UG Curriculum	Intake Capacity
01.	B.Sc. Geoinformatics (Honors)	40
02.	B.Sc. (Honours) in Chemistry & B.Sc. (Honours with Ressearch) in Chemistry	30
✓ 03.	B.Sc. Statistics with Data Analytics	30
04.	B.Sc. Printing & Packaging Technology (Honours)	20
05.	BBA-Agro Business Managment	30

This is effective from the Academic Year 2026-27 and onwards as per appended herewith.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Chhatrapati Sambhajinagar-431 004.
Ref. No. SU/ AEDP/ Uni.Cam. &
Sub-Cam/Curriculum/ 2026/135-43

**Deputy Registrar
Syllabus Section**

Date: 06/ 07/ 2026.

Copy forwarded with necessary action to:-

- 1] **The Head, Department of Geography/ Chemistry/ Statistics/ Printing & Packaging Technology/ Management-(Sub Campus),**
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**
- 3] **The Director, Board of Examinations & Evaluation,**
- 4] **Public Relation Officer [PRO],**

Dr. Babasaheb Ambedkar Marathwada University,
Chhatrapati Sambhajinagar.

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**Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajnagar- 431004**

Department of Statistics



Course Structure (Three year)

For

B.Sc. Statistics with Data Analytics

(AS PER NEP-2020)

For

**Apprenticeship Embedded Degree Programs
(AEDPs)**

Effective from 2026-27

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI
SAMBHAJINAGAR (MS)**

DEPARTMENT OF STATISTICS

B.Sc. STATISTICS WITH DATA ANALYTICS (AEDP) COURSE STRUCTURE (AY 2026–27)

Welcome to the Department of Statistics at Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar. The Department has a rich academic tradition in statistical education and research and is committed to excellence in teaching, innovation, and industry-integrated learning.

The 21st century has witnessed an extraordinary transformation driven by data, artificial intelligence, and predictive technologies. Governments, industries, healthcare systems, finance sectors, agriculture, and social organizations increasingly rely on statistical methods and data analytics to support evidence-based decision-making. As data-centric technologies continue to reshape the global economy, the demand for professionals possessing expertise in statistical modelling, machine learning, computational methods, and analytical thinking has significantly increased.

Recognizing this growing need and aligning with the transformative vision of the National Education Policy (NEP) 2020, the Department of Statistics proudly introduces the B.Sc. Statistics with Data Analytics Honours – Apprenticeship Embedded Degree Programme (AEDP) effective from the academic year 2026–27. The programme has been designed to bridge the gap between theoretical knowledge and real-world application by integrating academic coursework with practical apprenticeship training and industry exposure.

The B.Sc. Statistics with Data Analytics Honours AEDP emphasizes:

- **Multi-disciplinary and Flexible Learning:** Multiple entry and exit options with certification pathways at UG Certificate, Diploma, Degree and Honours levels.
- **Industry-Oriented Apprenticeship:** Structured On-Job Training and apprenticeship opportunities in data analytics industries, research organizations, software companies and statistical consulting sectors.
- **Practical Skill Development:** Integration of statistical computing, machine learning, programming tools, visualization techniques and research projects.
- **Research and Innovation:** Exposure to advanced analytical methods, AI applications, big data systems and predictive modelling.

- **Regional and National Industry Collaboration:** Partnerships with industries and organizations for experiential learning and practical training.

The curriculum follows UGC AEDP guidelines and aligns with NSQF and NHEQF frameworks. The programme aims to create graduates who are analytical thinkers, problem solvers and industry-ready professionals capable of applying statistics and data science methods across multidisciplinary domains.

Programme Objectives of B.Sc. Statistics with Data Analytics

- Develop strong foundations in Statistics, Probability, Data Analytics and Computational Techniques.
- Equip students with practical skills in Excel, R, Python, SPSS, machine learning and data visualization.
- Bridge academic learning with industrial practice through apprenticeship and field training.
- Develop research aptitude and innovation in emerging analytical domains.
- Promote ethical practices in data management, privacy and statistical applications.
- Strengthen analytical and critical thinking abilities for solving complex real-world problems.
- Develop interdisciplinary knowledge across healthcare, economics, finance, business and social sciences.
- Foster entrepreneurship and leadership skills.
- Improve communication and teamwork abilities.
- Encourage lifelong learning and continuous professional development.

Programme Distinctiveness

- Industry-integrated curriculum with apprenticeship opportunities.
- Combination of statistical theory and practical implementation.
- Multiple entry-exit options under NEP-2020.
- Strong emphasis on statistical computing and data science tools.
- Research-oriented and skill-based curriculum.
- Alignment with National Education Policy 2020 objectives.

This programme is designed to create technically competent, ethically grounded and professionally skilled graduates in Statistics and Data Analytics.

A) Admission to Undergraduate Programme

Admission to the Undergraduate Programme shall be conducted according to university guidelines and notifications issued by the university. The Department-level admission process shall be followed according to approved intake capacity. Students admitted shall be promoted with full carryover subject to semester registration requirements.

B) Eligibility for B.Sc. Statistics with Data Analytics (AEDP)

Minimum eligibility:

10+2 Science stream with Mathematics as a subject or equivalent qualification as per university norms.

Minimum marks:

50% for Open category and 45% for Reserved category in the qualifying Examination.

C) Duration

B. Sc. Statistics with Data Analytics AEDP: 3 Years / 6 Semesters (132 Credits)

D) Programme Structure and Credit Distribution

Award Level	Minimum Credits	NSQF Level	Duration
UG Certificate	44	Level 5	After First Year
UG Diploma	88	Level 6	After Second Year
UG Degree	132	Level 7	After Third Year

F) Tripartite Agreement for Apprenticeship / Internship / OJT

A formal agreement shall be signed between:

- University Department
- Industry / Company / Startup
- Student (Apprentice)

G) Attendance

The students must have 75% of attendance in each Discipline Specific Core Courses (DSC), Discipline Specific Elective Courses (DSEC), Open Electives(OE), Ability Enhancement Courses (AEC) or Value Education Course (VEC), Co-curricular Course (CC), On Job Training (OJT), Vocational Skill Courses (VSC), Skill Enhancement Course(SEC) and listed courses for appearing the Internal Evaluations (IE) and/or External Evaluation (EE) examination. However, student having 65% attendance with medical certificate may apply to the Head of Department for commendation of attendance. The student failing to produce such permission or failing in achieving the required attendance, he/she will not be allowed to submit examination form so attend the examination.

H) Course Fees and Intake Capacity**a. Course Fees:**

Rs. 18,000/- per year

b. Number of Seats / Intake Capacity:

The intake capacity for B.Sc. Statistics and Data Analytics shall be 30 seats under the Self-Finance Mode.

I) General Guidelines for the conduct of examinations

The department is conducting its Bachelor's Program under Outcome Based Education – Choice Based Credit System (OBE-CBCS) mode of Academic flexibility. For effective implementation of the OBE-CBCS the department has set following standard code of conduct

a) Departmental Committee:

The Departmental Committee (DC) of the Department will monitor smooth functioning of the program.

b) Results Grievances Redressal Committee:

The department shall form or constitute a Grievance Redressal Committee for each course with the Course Teacher and the HOD. This Committee shall solve all grievances relating to the Assessment of the students. The students uphold the right to submit his / her grievance to the result and grievance committee in writing.

c) Awards of Grades

A ten-point rating scale shall be used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Bachelor's Program. Grade points are based on the total number of marks obtained by him/her in all the heads of examination of the course.

Table I: Grade Points and Equivalent Range of Marks

Sr. No.	Equivalent Percentage (%)	Grade Points	Grade	Grade Description
1	90.00–100	9.00–10.00	O	Outstanding
2	80.00–89.99	8.00–8.99	A++	Excellent
3	70.00–79.99	7.00–7.99	A+	Exceptional
4	60.00–69.99	6.00–6.99	A	Very Good
5	55.00–59.99	5.50–5.99	B+	Good
6	50.00–54.99	5.00–5.49	B	Fair
7	45.00–49.99	4.50–4.99	C+	Average
8	40.01–44.99	4.01–4.49	C	Below Average
9	40.00	4.00	D	Pass
10	<40.00	0.00	F	Fail

Examination and Grading Rules

- I. Non-appearance in any internal or external examination shall be treated as securing zero marks in the concerned examination of the course.
- II. Minimum 'D' grade (4.00 grade points) shall be the minimum requirement to pass a course under the 10-point grading scale. A student obtaining 'F' grade shall be considered failed in the concerned course.
- III. Every student shall be awarded grade points out of a maximum of 10 points in each course based on the 10-point grading system. Based on the grade points obtained in each course:
 - Semester Grade Point Average (SGPA) and
 - Cumulative Grade Point Average (CGPA) shall be computed.

Results will be announced at the end of each semester, and a cumulative grade card with CGPA shall be issued upon completion of the course.

a. Semester Grade Point Average (SGPA)

SGPA is the weighted average of grade points obtained by a student in a semester and shall be calculated as:

$$SGPA = \frac{\sum(\text{Course Credits} \times \text{Grade Points obtained})}{\sum(\text{Course Credits})}$$

The SGPA of all semesters shall be mentioned at the end of each semester.

b. Cumulative Grade Point Average (CGPA)

CGPA represents the overall performance of a student across all semesters and shall be calculated as:

$$CGPA = \frac{\sum(\text{Grade Points earned in all semesters})}{\text{Total Number of Credits in all semesters}}$$

The SGPA and CGPA shall be rounded off to two decimal places.

Structure of the 3-Year Apprenticeship-Embedded Degree Program (AEDP) B.Sc. Statistics with Data Analytics

B.Sc. Statistics with Data Analytics, First Year: 1st Semester (NSQF Level 5.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs. / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CA	UA	Total
Department Specific Course DSC (Major) Mandatory	STA/DSC/T/100	Descriptive Statistics and Data Interpretation	2		2		20	30	50
	STA/DSC/P/125	Practical based on (STA/DSC/T/100)		4		2	20	30	50
	STA/DSC/T/101	Elementary Probability Theory	2		2		20	30	50
	STA/DSC/P/126	Practical based on (STA/DSC/T/101)		4		2	20	30	50
	STA/DSC/T/102	Discrete Probability Distributions	2		2		20	30	50
	STA/DSC/P/127	Practical based on (STA/DSC/T/102)		4		2	20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	STA/GE/OE/T/100	Choose any one course from GE/OE Basket	2		2		20	30	50
SEC (Skill Enhancement Courses) (Choose any one from STA/SEC/P/125 and STA/SEC/P/126)	STA/SEC/P/125	Computation using Statistical Packages (SPSS)		4		2	20	30	50
	STA/SEC/P/126	Advanced Excel		4		2	20	30	50
AEC, VEC, IKS	STA/AEC/T/100	English-I (Common for all the faculty)		2		2	20	30	50
	STA/IKS/T/101	Choose any one from pool of courses (IKS Basket)		2		2	20	30	50
OJT/ FP/CEP/CC/RP	STA/CC/P/125	Health and Wellness (Common for all the faculty)		4		2	20	30	50
			8	28	8	16 (14)	240 (220)	360 (330)	600 (550)

GE/OE-1: Fundamentals of Statistics (This course will be available for the students of other faculty (other than Faculty of Science and Technology))

B.Sc. Statistics with Data Analytics, First Year: 2nd Semester (NSQF Level 5.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs. / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CA	UA	Total
Department Specific Course DSC (Major) Mandatory									
	STA/DSC/T /150	Sampling Techniques	2		2		20	30	50
	STA/DSC/P /175	Practical based on (STA/DSC/T/150)		4		2	20	30	50
	STA/DSC/T /151	Continuous Probability Distributions	2		2		20	30	50
	STA/DSC/P /176	Practical based on (STA/DSC/T/151)		4		2	20	30	50
	STA/DSC/T /152	Basics of Data Analytics	2		2		20	30	50
	STA/DSC/P /177	Practical based on (STA/DSC/T/152)		4		2	20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major									
	STA/GE/OE/T/150	Choose any one course from GE/OE Basket	2		2		20	30	50
VSC (Vocational Skill Courses) (Choose any one from STA/VSC/P/175 and STA/VSC/P/176)	STA/SEC/P /175	Data visualisation using Tableau / Power BI		4		2	20	30	50
	STA/SEC/P /176	Programming with R		4		2	20	30	50
AEC, VEC, IKS	STA/AEC/ T/150	Modern Indian Language (MIL-1) (Choose any one from pool of language courses)		2		2	20	30	50
	STA/IKS/T /151	Constitution of India (Common for all the faculty)		2		2	20	30	50
OJT/ FP/CEP/CC/RP	STA/CC/P/ 175	Yoga Education / Sports and Fitness (Common for all the faculty)		4		2	20	30	50
			8	28	8	16	240	360	600

GE/OE-2: Basics of Sampling Techniques (This course will be available for the students of other faculty (other than Faculty of Science and Technology)

B.Sc. Statistics with Data Analytics, Second Year: 3rd Semester (NSQF Level 6.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs. / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CA	UA	Tot
Department Specific Course DSC (Major) Mandatory	STA/DSC/T /200	Regression Analysis and Modeling	2		2		20	30	50
	STA/DSC/P /225	Practical based on (SUB/DSC/T/200)		4		2	20	30	50
	STA/DSC/T /201	Probability Distributions-II	2		2		20	30	50
	STA/DSC/P /226	Practical based on (SUB/DSC/T/201)		4		2	20	30	50
Minor	SUB/Mn/T/ 200	Linear Algebra for Data Analytics	2		2		20	30	50
	SUB/Mn/T/ 201	Applied Statistics	2		2		20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	STA/GE/ OE/T/200	Choose any one course from GE/OE Basket	2		2		20	30	50
VSC (Vocational Skill Courses) (Choose any one from STA/VSC/P/ 225 and STA/VSC/P/ 226)	STA/VSC/ P/ 225	Basics of Python Programming		4		2	20	30	50
	STA/VSC/ P/ 226	Statistical Computing and Data Structures		4		2	20	30	50
AEC, VEC, IKS	STA/AEC/ T/200	English-II (Common for all the faculty)	2		2		20	30	50
	STA/AEC/ T/201	Environmental Studies	2		2		20	30	50
OJT/ FP/CEP/CC/RP	STA/CC/P/ 225	Cultural Activity / NSS, NCC (Common for all the faculty)		4		2	20	30	50
			14	20	14	10	240	360	600

GE/OE-3: Prediction Techniques (This course will be available for the students of other faculty (other than Faculty of Science and Technology))

B.Sc. Statistics with Data Analytics, Second Year: 4th Semester (NSQF Level 6.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs. / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CA	UA	Total
Department Specific Course DSC (Major) Mandatory	STA/DSC/T/250	Design of Experiments	2		2		20	30	50
	STA/DSC/P/275	Practical based on (STA/DSC/T/250)		4		2	20	30	50
	STA/DSC/T/251	Theory of Hypothesis Testing	2		2		20	30	50
	STA/DSC/P/276	Practical based on (STA/DSC/T/251)		4		2	20	30	50
Minor	STA/Mn/T/250	Time Series Analysis	2		2		20	30	50
	STA/Mn/T/251	Operations Research-I	2		2		20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	STA/GE/OE/T/200	Choose any one course from GE/OE Basket	2		2		20	30	50
SEC (Skill Enhancement Courses) (Choose any one from STA/SEC/P/275 and STA/SEC/P/276) and corresponding Practical's	STA/SEC/P/275	Data Mining Techniques		4		2	20	30	50
	STA/SEC/P/276	Machine Learning Basics		4		2	20	30	50
AEC, VEC, IKS	STA/AEC/T/250	Modern Indian Language (MIL-2) (Choose any one from pool of language courses)	2		2		20	30	50
OJT/ FP/CEP/CC/RP	STA/FP/P/275	Field Project-I		4		2	20	30	50
	STA/FP/P/276	(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	20	30	50
			12	24	12	12	240	360	600

GE/OE-4: Optimization Techniques (This course will be available for the students of other faculty (other than Faculty of Science and Technology))

B.Sc. Statistics with Data Analytics, Third Year: 5th Semester (NSQF Level 7.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs. / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CA	UA	Total
Department Specific Course DSC (Major) Mandatory	STA/DSC/T/300	Statistical Quality Control	2		2		20	30	50
	STA/DSC/P/300	Practical based on (STA /DSC/T/300)		4		2	20	30	50
	STA/DSC/T/301	Statistical Inference	2		2		20	30	50
	STA/DSC/P/301	Practical based on (STA /DSC/T/301)		4		2	20	30	50
Discipline Specific Electives (DSE) (Choose any one from STA/DSE/T/ 300 and STA/DSE/T/ 301) and corresponding Practical's	STA/DSE/T/300	Time Series Analysis-II	2		2		20	30	50
	STA/DSE/P/325	Practical based on (STA/DSC/T/300)	2		2		20	30	50
	STA/DSE/T/301	Design of Experiments-II							
	STA/DSE/P/326	Practical based on (STA/DSC/T/301)	2		2		20	30	50
Minor	STA/Mn/T/300	Big data Analytics	2		2		20	30	50
	STA/Mn/T/301	Introduction to Stochastic Processes	2		2		20	30	50
VSC (Vocational Skill Courses) (Choose any one from SUB/VSC/P/ 325 and SUB/VSC/P/ 326)	STA/VSC/P/325	Analytical Techniques using R/ Python	2		2		20	30	50
	STA/VSC/P/326	Introduction to Deep learning		4		2	20	30	50
OJT/ FP/CEP/CC/RP	STA/FP/CEP/P/325	Field Project-2		4		2	20	30	50
			16	16	16	8	240	360	600

B.Sc. Statistics with Data Analytics, Third Year: 6th Semester (NSQF Level 7.0)

Apprenticeship Mandatory Apprenticeship Program in 6th Semester To bridge the gap between academic knowledge and practical industry experience, an apprenticeship program has been made compulsory for all students in the 6th semester. This initiative aims to ensure that students gain hands-on exposure to real-world applications in their respective fields of study. Students will be advised to join the respective Industry anywhere across the country as per opportunities found on NAPS, NATS, BOAT and BOPT portal.

Course Name	Teaching Scheme (Hrs. / Week)	Credits Assigned	Scheme of Examination		
Apprenticeship	44	22	CIA	SEE	Total
			220	330	550

Syllabus Semester-I

	STA/DSC/T /100: Descriptive Statistics and Data Interpretation (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Course objectives:	
	Learning Outcomes By the end of this course, students will be able to:	
Unit-1	Introduction of some basic concepts Scope and importance of Statistics. Various definitions of Statistics. Statistical Organisations (ISI, NSSO, CSO,), Statisticians and their contributions. (R.A Fisher, Mahalonobis, C.R. Rao) Primary and Secondary data, Types of data : qualitative, quantitative, discrete, continuous, cross-section, time series, failure, industrial, directional data. Presentation of data. Graphical presentation: Histogram, frequency polygon, frequency curves, ogive curves, stem and leaf charts, check sheet. Diagrammatic presentation: Bar diagrams, Pie diagram, Parato diagram, scatter diagram. Different types of scales: Qualitative data (Attributes): Nominal and ordinal scales, Quantitative data (Variables): Interval and ratio scales, linear and circular scales. Classification of data: Discrete and continuous frequency distributions, inclusive and exclusive methods of classification, relative and cumulative frequency distributions.	10L
Unit-2	Measures of Central Tendency Concept of central tendency. Prerequisites of ideal measure of central tendency. Arithmetic mean (A.M.) for frequency and non-frequency data (simple and weighted) trimmed mean, mean of pooled data. Effect of change of origin and scale of A.M., properties of A.M. merits and demerits of A.M. Mode: Computation for frequency and non-frequency data. Derivation of formula for mode. Computation of mode by graphical method. merits and demerits of mode. Median: Computation for frequency and non-frequency data, computation by graphical method, merits & demerits of median. Empirical relation between mean, median and mode. Geometric mean (G.M.) computation for G M for pooled data (for two groups.) G M for ratio of two variables. merits demerits and applications. Harmonic Mean (H. M.) computation for frequency, non-frequency data, merits, demerits, Order relation between AM, GM, HM (with proof for $n=2$). Selection of an average.	10L
Unit-3	Partition values & Measures of Dispersion Concept of Dispersion and characteristics of good measure of dispersion. Range and coefficient of range: merits, demerits and applications. Partition values: Computation by formulae, computation by graphical method and Box plot. Quartile deviation (QD) , coefficient of quartile deviation Mean deviation (MD) about mean, mode, and median, coefficient of MD minimality property (with proof). Variance, standard deviation (S.D.) effect of change of origin and scale on variance. Variance for pooled data (Proof for two groups) $S.D. \leq MD$ about mean, Merits, demerits & uses of S.D. Coefficient of variation (C.V.) uses of C.V., merits & demerits Covariance: for frequency & non frequency data. Effect of change origin and scale & properties Variance of linear combination	10L
	Suggested Readings 1. Fundamentals of Mathematical Statistics, S. C. Gupta (2020), V. K. Kapoor , Sultan Chand & Sons, New Delhi 2. Fundamentals of Applied Statistics, (2007), S. C. Gupta, V. K. Kapoor , Sultan Chand & Sons, New Delhi 3. Statistical Methods (2021), S. P. Gupta, Sultan Chand & Sons, New Delhi	

	4. Basic Statistics (2019), B. L. Agarwal, New Age International Publishers, New Delhi	
	5. Business Statistics (2017), J. K. Sharma, Pearson Education India, New Delhi	

	STA/DSC/P /125: Descriptive Statistics and Data Interpretation (Credit: 02 Contact hrs.: 60 Marks: 50)	
	1. Representation by frequency distribution & Analysis of real-life data collected by students. 2. Graphical Representation of data 3. Diagrammatic Representation of data 4. Computation of Arithmetic Mean 5. Computation of arithmetic mean by change of origin and scale. 6. Computation of Median for ungrouped and grouped data and graphical location. 7. Computation of Mode for ungrouped and grouped data and graphical location. 8. Computation of Quartiles, Deciles and Percentiles and their graphical location. 9. Computation of Quartile deviation and Mean deviation. 10. Computation of Variance, S.D. and coefficient of variation (C.V.)	

	SUB/GE/OE/T/100: Open elective (GE/OE) (Chose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Generic / Open Elective (GE/OE) (Choose any one from pool of courses of GE/OE Basket) It should be chosen compulsorily from the faculty other than that of Major SUB/GE/ OE/T/100 Choose any one course from other faculty (GE/OE Basket)	

	STA/DSC/T /101: Elementary Probability Theory (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Course objectives: 1. To introduce students to the fundamental concepts of probability theory, including experiments, sample space, and events.	

	2. To develop understanding of algebra of events, classical and axiomatic probability, and their applications. 3. To provide knowledge of conditional probability, independence of events, and Bayes' theorem for solving real-life problems. 4. To enable students to understand random variables and probability distributions, including expectation, moments, skewness, kurtosis, and generating functions.	
	Learning Outcomes By the end of this course, students will be able to: 1. Define and apply concepts such as sample space, events, probability laws, and event algebra in problem-solving. 2. Compute probabilities using classical, axiomatic, and conditional approaches, including Bayes' theorem. 3. Analyze and interpret discrete and continuous random variables, along with their distribution functions (PMF, PDF, CDF). 4. Calculate and interpret expectation, variance, moments, skewness, kurtosis, and probability generating functions in statistical analysis.	
Unit-1	Basic concepts in probability theory Concepts of experiments and random experiments. Definitions: Sample Space, Discrete sample space (finite and countably infinite) Event, Elementary event, complement of an event. Algebra of events (Union, Intersection and Complementation) Definitions: Exhaustive events, Favourable events, Mutually Exclusive events, Equally Likely events, Independent events, Impossible events and certain events. Power Set (sample space consisting at least three sample points.) Symbolic representation of given events and description of events in symbolic forms. Examples. Apriori (Classical) definition of probability of an event. Equiprobable sample space, simple examples of computation of probability of the events based on Permutations & Combinations Axiomatic definition of Probability (with reference to finite and countably infinite sample space) Proof of the results: i. $P(Q) = 0$ ii. $P(A') = 1 - P(A)$ iii. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (with proof) and its generalization (statement only) iv. if $A \subset B$, $P(A) \leq P(B)$ v. $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$	10L
Unit-2	Conditional Probability Definition of conditional Probability. Multiplication theorem $P(A \cap B) = P(A) \cdot P(B/A)$. Partition of sample space. Posteriori Probability. Statement and proof of Baye's Theorem. Independence of events. Proof of the results that if A & B are independent then i) $A \& B'$ ii) $A' \& B$ iii) $A' \& B'$ are independent. Pair wise & mutual independence of three events.	10L
Unit-3	Prerequisites of distribution functions Definition of Discrete and continuous random variables. Probability mass function (p.m.f.) and Probability density function (p.d.f.), cumulative distribution functions (discrete and continuous) their properties Probability distribution function of a random variable. Median and Mode of univariate discrete & continuous Probability Distribution. Expectation of a random variable and expectation of function of a random variable. Properties of	10L

	expectation. Mean and variance of univariate distribution and effect of change of origin and scale on mean and variance. Raw and Central moments of univariate distribution their relationship, skewness and kurtosis. Probability generating function (p.g.f) of a random variable and computation of means and variance using p.g.f.	
	Suggested Readings: 1. Fundamentals of Mathematical Statistics S. C. Gupta, V. K. Kapoor (2020), Sultan Chand & Sons, New Delhi 2. A Textbook of Probability S. K. Mangal (2018), S. Chand Publishing, New Delhi 3. Probability Theory and Mathematical Statistics P. N. Arora, S. Arora (2019), S. Chand Publishing, New Delhi 4. An Introduction to Probability Theory K. L. Chung (Indian Reprint 2017), Academic Press / McGraw Hill India	

	STA/DSC/P /126: Practical based on (STA/DSC/T/101) (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives:	
	Learning Outcomes By the end of this course, students will be able to:	
	1. construction of sample space, power set of random experiments 2. computation of probability of events using classical (a priori) definition based on permutations and combinations. 3. Problems based on various results in Probability. 4. Problems based on addition and multiplication theorems of probability. 5. Problems based on conditional probability. 6. Problems based on Baye's theorem. 7. Problems based on mathematical expectation and its properties. 8. Computation of measures of central tendency using mathematical expectations 9. Computation of measures of dispersion using mathematical expectation. 10. To compute and analyze cumulative distribution functions (CDF) for given discrete and Continuous random variables and verify their properties.	

Note: Practical should be done manually as well as using Excel

	STA/DSC/T /102: Discrete Probability Distributions (Credit: 02 Contact Hrs.: 30 Marks: 50)	
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	Course objectives: 1. To introduce the basic concepts of discrete random variables and probability distributions. 2. To develop understanding of standard discrete probability distributions and their properties. 3. To enable students to solve numerical problems and apply probability distributions to real-life situations. 4. To build a foundation for advanced studies in statistics, probability, and data analytics.	
	Learning Outcomes By the end of this course, students will be able to: 1. Understand the concepts of discrete random variables and probability distributions. 2. Compute probabilities, expectation, variance, and other characteristics of discrete distributions. 3. Apply standard discrete probability distributions to real-life problems and statistical situations. 4. Analyze and interpret probabilistic models used in statistics and data analytics.	
Unit-1	Bernoulli distribution: Definition, Mean and variance, Applications. Binomial distribution: Definition and assumptions, additive Property, Mean and variance, Recurrence relation, Mode, Fitting of binomial distribution Poisson distribution: Definition and properties, Mean and variance, mode, Recurrence relation, additive property and its generalization. Fitting of Poisson distribution, Poisson approximation to binomial distribution	10L
Unit-2	Geometric distribution: Definition, Properties, Mean and variance, MGF, Distribution function, Memoryless property. Negative Binomial distribution: Definition, Mean and variance, MGF, CGF, Skewness, kurtosis, Applications. Relation between geometric & negative binomial, Poisson approximation to negative binomial. Hypergeometric distribution: Definition, Mean and variance, Applications	10L
Unit-3	Discrete Uniform distribution: Definition and properties Multinomial distribution: Multinomial experiment and its assumptions, Definition of multinomial distribution, Probability mass function of multinomial distribution, Mean and variance of multinomial variables, Covariance between multinomial variables, Relation between binomial and multinomial distributions, Applications of multinomial distribution.	10L
	Suggested Readings: 1. Fundamentals of Mathematical Statistics S. C. Gupta, V. K. Kapoor (2020), Sultan Chand & Sons, New Delhi 2. Fundamentals of Applied Statistics S. C. Gupta, V. K. Kapoor (2007), Sultan Chand & Sons, New Delhi 3. Statistical Methods S. P. Gupta (2021), Sultan Chand & Sons, New Delhi 4. Probability Theory and Mathematical Statistics P. N. Arora, S. Arora (2019), S. Chand Publishing, New Delhi 5. A Textbook of Probability S. K. Mangal (2018), S. Chand Publishing, New Delhi 6. An Introduction to Probability Theory K. L. Chung (Indian Reprint 2017), McGraw Hill Education (India)	

	7. Introduction to Mathematical Statistics R. V. Hogg, J. W. McKean, A. T. Craig (2019), Pearson India	
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	STA/SEC/P /125: Basics of Python Programming (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives: 1. To introduce the basic concepts and syntax of Python programming. 2. To understand programming logic and problem-solving using Python. 3. To familiarize students with functions, data structures, and Python libraries. 4. To understand basic techniques for handling and analyzing data using Python. 5. To provide a foundation for further studies in data analysis, data science, and related fields.	
	Learning Outcomes By the end of this course, students will be able to: CO1: Understand Python syntax and apply programming concepts to solve problems. CO2: Use functions and data structures for efficient program development. CO3: Apply Python libraries for data manipulation and preprocessing. CO4: Perform data visualization and exploratory data analysis tasks. CO5: Develop Python-based analytical solutions for statistical and real-world datasets.	
Unit-1	Introduction to SPSS & Data Handling Introduction to IBM SPSS Statistics and its applications in statistics and data analytics. SPSS interface: Data View, Variable View, Output Window. Creating, saving, and opening data files. Defining variables: name, type, labels, values, missing values. Data entry, editing, sorting, and filtering. Importing/exporting data (Excel, CSV, text files). Data transformation: Compute variables, Recode variables. Handling missing data and basic data cleaning.	10L
Unit-2	Descriptive Statistics & Visualization Frequency distributions and tables. Measures of central tendency: mean, median, mode. Measures of dispersion: range, variance, standard deviation. Cross-tabulation and contingency tables. Graphical representation: Bar charts, Pie charts, Histograms, Box plots. Descriptive analysis using SPSS menus	10L
Unit-3	Measures of shape: Skewness and Kurtosis. Correlation analysis: Scatter diagram, Karl Pearson's coefficient of correlation, Generating random numbers using SPSS: Using Compute Variable option, Functions like: RV.UNIFORM (uniform distribution), RV.NORMAL (normal distribution), RV.BERNOULLI (Bernoulli trials), RV.BINOMIAL (binomial distribution)	10L

Students are expected to do the following Hands-on Practices apart from theoretical understanding of the topics mentioned above

	1. Introduction to IBM SPSS Statistics: creating datasets, defining variables, and understanding Data View and Variable View. 2. Data entry, editing, sorting, filtering, and handling missing values in SPSS. 3. Importing data from Excel/CSV files and performing basic data cleaning and transformation (compute and recode variables).	
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	4. Construction of frequency distributions and tables using SPSS. 5. Computation of measures of central tendency (mean, median, mode) using SPSS. 6. Computation of measures of dispersion (range, variance, standard deviation). 7. Graphical representation of data: bar charts, pie charts, histograms, and box plots. 8. Cross-tabulation and contingency table analysis. 9. Computation and interpretation of skewness, kurtosis, and correlation (Karl Pearson's coefficient) with scatter diagram. 10. Generation of random numbers using SPSS (RV.UNIFORM, RV.NORMAL, RV.BERNOULLI, RV.BINOMIAL) and simulation of simple experiments.	
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	STA/SEC/P /126: Advanced Excel (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives: 1. To understand the basic components and working environment of MS-Excel and spreadsheet management techniques. 2. To develop skills in data entry, formatting, formulas and commonly used Excel functions. 3. To gain knowledge of logical, text, date-time and lookup functions for data handling and analysis. 4. To understand advanced Excel tools including Data Analysis ToolPak, Pivot Tables, charts and dashboards. 5. To develop skills in automation using Macros for repetitive tasks. 6. To apply Excel for statistical analysis, visualization and interpretation of data.	
	Learning Outcomes By the end of this course, students will be able to: 1. Create, organize and manage spreadsheets efficiently using MS-Excel tools. 2. Apply formulas and functions for data processing and problem solving. 3. Import, clean and analyze datasets using advanced Excel features. 4. Create charts, Pivot Tables, dashboards and visual reports for data presentation. 5. Record and execute Macros for basic automation tasks. 6. Perform statistical analysis including descriptive measures, correlation, regression and hypothesis testing using Excel.	
Unit-1	Basics of MS-Excel and Spreadsheet Management Introduction to MS-Excel and its applications, workbook and worksheet components, rows, columns, cells and ranges. Data entry and editing, formatting techniques, sorting and filtering of data, worksheet protection and spreadsheet management. Working with formulas and Function Library. Basic functions including SUM, PRODUCT and ROUND. Logical functions such as IF, AND and OR. Text functions including MID, TRIM, CONCATENATE and SUBSTITUTE. Date and Time functions. Lookup and reference functions including VLOOKUP, XLOOKUP, INDEX and MATCH. Data validation, error checking, removing duplicates and handling missing values.	10L
Unit-2	Advanced Excel Tools and Data Visualization	10L

	Importing data from .csv, .txt and web sources. Activation and use of Data Analysis ToolPak, descriptive statistics and summary tables. Conditional formatting and creation of charts including bar, line, pie, scatter, histogram and Pareto charts. Introduction to Pivot Tables and Pivot Charts, grouping and summarizing data, slicers and dashboard creation for interactive reporting. Introduction to macros, recording and running macros for automation of repetitive tasks.	
Unit-3	Measures of Central Tendency: Mean, Median and Mode. Measures of Dispersion: Range, Variance and Standard Deviation. Skewness and Kurtosis. Correlation analysis and scatter diagrams. Discrete Probability distributions and frequency analysis using Excel.	10L

Students are expected to do the following Hands-on Practices apart from theoretical understanding of the topics mentioned above

	11. Introduction to Microsoft Excel: creating workbooks and worksheets, data entry, formatting, and basic spreadsheet management. 12. Use of formulas and basic functions (SUM, PRODUCT, ROUND) for numerical computations. 13. Application of logical functions (IF, AND, OR) for decision-making problems in datasets. 14. Use of text functions (MID, TRIM, CONCATENATE, SUBSTITUTE) and date-time functions for data cleaning and manipulation. 15. Implementation of lookup and reference functions (VLOOKUP, XLOOKUP, INDEX, MATCH) for data retrieval. 16. Data validation, error checking, removing duplicates, and handling missing values in datasets. 17. Sorting, filtering and conditional formatting of data; creation of charts (bar, line, pie, scatter, histogram, Pareto). 18. Use of Data Analysis ToolPak for descriptive statistics and summary measures (mean, median, mode, variance, standard deviation). 19. Correlation analysis and scatter diagram using Excel functions and charts. 20. Creation of Pivot Tables and Pivot Charts, use of slicers, and basic dashboard development for data visualization and reporting.	
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	SUB/IKS/T /101: Choose any one from pool of IKS courses (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	IKS (Common for all the faculty)	
	Student can choose one of the IKS courses from IKS basket which is available on the university website.	

	SUB/CC/P/125: Healthy and Wellness (Credit: 02 Contact Hrs.: 30 Marks: 50)	
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	Healthy and Wellness (Common for all the faculty)	
	Syllabus of this subject will be taken from the common syllabus of Dr. Babasaheb Ambedkar Marathwada University, which is available on the university website.	