Darrang College (Autonomous), Tezpur-784001

Syllabus for FYUGP Statistics (Major)

Approved by :
Board of Studies meeting held on 26th July, 2025
&
Academic Council vide Resolution no. 04, dated- 12/08/2025

AIMS OF FOUR-YEAR UNDER GRADUATE PROGRAMME (FYUGP) IN STATISTICS:

The aims of Four-Year under Graduate Programme (FYUGP) in Statistics are:

- The UG Programme in Statistics is structured to develop analytical, critical, and logical thinking skills in students.
- It emphasizes the application of mathematical reasoning in solving real-world problems.
- Students are introduced to diverse and practical statistical concepts throughout the course.
- The programme prepares students for roles like data scientist, statistician, strategic banker, researcher, and biostatistician.
- Graduates can pursue careers in industries, government agencies, public sector units, finance, business, and research.
- The curriculum includes both mathematical and applied statistics topics for well-rounded learning.
- Practical training is provided through hands-on sessions in the Computer Lab.
- Students gain experience using statistical software such as MS Excel, C/C++, R, and SPSS.
- Coding skills and software usage are integrated to deepen understanding of statistical methods.
- The programme aims to equip students with the necessary tools for success in research and industry.

Programme Outcome:

By the end of the programme a UG student of Statistics should be able to know about:

- **Statistical Knowledge**: Gain a strong foundation in theoretical and applied statistics to analyze and interpret data effectively.
- **Mathematical Reasoning**: Develop the ability to use mathematical tools and logical thinking for solving real-life and research-oriented problems.
- **Data Handling Skills**: Acquire skills in data collection, cleaning, visualization, and analysis using modern software and statistical techniques.

- **Computational Proficiency**: Learn to use programming languages and statistical software such as R, Python, SPSS, and C/C++ for data analysis and modeling.
- **Critical Thinking**: Enhance the ability to critically evaluate data sources, methods, and interpretations in a wide range of applications.
- **Research Competence**: Build capability to design and conduct statistical investigations and contribute to interdisciplinary research.
- **Problem Solving**: Apply statistical methods to solve practical problems in domains such as business, health, economics, environment, and public policy.
- **Communication Skills**: Develop effective written and verbal communication skills to present statistical findings clearly to both technical and non-technical audiences.
- **Ethics and Responsibility**: Understand the ethical issues in data handling, privacy, and responsible use of statistical results.
- **Career Readiness**: Prepare for careers in data science, analytics, government services, research institutions, finance, and further academic studies.

Teaching Learning Process:

The programme supports the application of multiple pedagogical approaches in both classroom and computer lab environments.

- Focus on learner-centric and outcome-based teaching methods.
- Use of both traditional lectures and digital tools for content delivery.
- Emphasis on conceptual clarity and practical application.
- Interactive sessions including discussions, quizzes, and problem-solving.
- Regular hands-on training using statistical software like R, SPSS, and Excel.
- Continuous internal assessment through tests, assignments, and presentations.
- Integration of project-based learning for real-life data analysis.
- Opportunities for internships and field work for practical exposure.
- Interdisciplinary approach connecting statistics with other domains.
- Inclusion of soft skill development and ethical value-based activities.

Teaching Learning Tools:

- Blackboard and Whiteboard Teaching – For explaining concepts, formulas, and derivations.

- Power Point Presentations – To visually present data, graphs, and theoretical concepts.
- Statistical Softwares – Tools like R, SPSS, Python, Excel for data analysis and practical's.
- ICT Tools – Projectors, Google Classroom
- Graphs and Charts – Manual and digital graph plotting for visualization.
- Problem-Solving Sessions – Interactive numerical sessions to enhance analytical skills.
- Case Studies – Real-life statistical data applications to encourage critical thinking.
- Group Discussions

Assessment/Evaluation Methods:

- A variety of subject-specific assessment procedures will be used to monitor student progress.
- Continuous evaluation will determine the final grade.
- Evaluation includes both In-semester assessment and End semester examination.
- In-semester evaluation methods include:
    - Class tests
    - In-semester Sessional exams
    - Home Assignments
    - Group Discussions
    - Attendance
- Assessment techniques include:
    - Tutorials
    - In-semester assessment
    - Problem-based assignments
    - Lab reports for practicals
    - Individual project reports
    - Oral presentations (including seminars)
    - Viva-voce
    - End Semester examinations (Theory and Practical)

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FYUGP Structure as per UGC Credit Framework

Year	Semester	Course Code	Title of the Course	Total Credit
1st Year	**1st Semester**	STA-MJ-01014	Introductory Statistics and Probability	4
		STA-MN-01014	Introductory Statistics and Probability	4
		STA-SEC-01013	Statistical Data Analysis Using Excel	3
		VAC		2
		MDC		3
		AEC		4
	Total			**20**
	2nd Semester	STA-MJ-02014	Intermediate Probability Theory	4
		STA-MN-02014	Intermediate Probability Theory	4
		STA-SEC-02013	Statistical Data Analysis Using SPSS	3
		VAC		2
		MDC		3
		AEC		4
	Total			**20**

B.A./B.Sc. IN STATISTICS PROGRAMME (FYUGP)

DETAILED SYLLABUS OF FYUGP 1st SEMESTER

Title of the Course	Introductory Statistics and Probability
Course Code	STA-MJ-01014
Nature of Course	Major
Total Credit	4 (Theory - 03 + Practical - 01)
Contact Hours	45 (Theory) + 30 (Practical)
Distribution of Marks	End Semester (45) + In Semester (30) + End sem Practical (25)

Course Objectives: The objective is to give students foundational ideas about the various statistical methods, measures of central tendency and basics of probability. The students are introduced to the methods of collecting data, their representational formats and basic statistical tools.

Learning Outcomes: At the end of the course, students will be able to analyse a data set, represent the data in tabular and diagrammatic form, prepare the frequency distribution, find the summary measures viz. the measures of central tendency, measure of dispersion, measures of skewness and kurtosis of a univariate data.

Course Outcomes:

CO1: Recall and define fundamental concepts in descriptive statistics and probability, such as mean, median, mode, variance, standard deviation and basic rules of probability.

CO2: Interpret and explain the significance of descriptive statistical measures and probability concepts in real-world contexts. Describe the relationship between descriptive statistics and probability and how they are used to analyze and interpret data.

CO3: Apply descriptive statistical techniques to summarize and analyze data sets, including calculating measures of central tendency, dispersion, and constructing frequency distributions.

CO4: Analyze and interpret data using descriptive statistics and probability techniques, identifying patterns, trends, and relationships within datasets.

CO5: Assess the strengths and limitations of descriptive statistics and probability in addressing real life questions and making informed decisions, and propose improvements or alternative approaches when necessary.

Unit	Content	L	T	P	Total hrs
I	**Statistical Data and its representations:** Definition and scope of Statistics, concepts of statistical population and sample. Types of Data: quantitative and qualitative, primary and secondary data, attributes, variables, scales of measurement-nominal, ordinal, interval and ratio. Data visualization. Presentation & Classification of Data: tabular and frequency distribution, Collection and Scrutiny of Data: Primary data-designing a questionnaire and a schedule; Secondary data- their Major sources including some government publications. Idea of National Surveys (ASER, NFHS etc.)	07	01	-	08
II	**Descriptive Statistics:** Mathematical measures of central tendency: Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, Trimmed Mean, Winsorised Mean and their properties and applications. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Sheppard's corrections, skewness and kurtosis, Partition Values: Fractiles, Quartiles, Deciles, percentiles.	13	02	-	15
III	**Bivariate Data:** Representation of Bivariate Data, scatter diagram, simple, partial and multiple correlation (three variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curve	09	01	-	10
IV	**Introductory Probability**: Introduction, random experiments, sample space, events, algebra of events. Definitions of Probability: classical, statistical and axiomatic. Computational Probability: Conditional	10	02	-	12

	Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications. Idea of Quantum Probability				
V	**Practical:** **Note**: Students can use calculators / Ms Excel programming as convenient**.** 1. Graphical representation of data. 2. Problems based on measures of central tendency & dispersion. 3. Problems based on measures of location. 4. Problems based on moments, skewness and kurtosis. 5. Karl Pearson correlation coefficient 6. Correlation coefficient for a bivariate frequency distribution 7. Lines of regression, angle between lines and estimated values of variables. 8. Estimation of parameters by Method of Least Square 9. Spearman rank correlation with and without ties. 10. Partial and multiple correlations.	-	-	15	30

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I &II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwinand Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. 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.
4. Medhi, J. (2000): Statistical Methods An Introductory text (New Age International (P) Ltd.
5. Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics. Sultan Chand & Sons. New Delhi. (12th Edition).
6. Ross, S. M. (2014). Introduction to probability models. Academic press.
7. Ross, S. M. (2017). Introductory statistics. Academic Press.
8. Ross, S. M. (2020). A first course in probability. Harlow, UK: Pearson.

9. Spiegel, M. R., Srinivasan, R. A., & Schiller, J. J. (2000). Schaum's outline of theory and problems of probability and statistics. Erlangga.
10. Bhat, B. R. (2007). Modern probability theory. New Age International.
11. Feller, W. (1991). An introduction to probability theory and its applications, Volume 2 (Vol. 2). John Wiley & Sons.
12. Weatherburn, C. E. (1949). A first course mathematical statistics (Vol. 158). CUP Archive.
13. Stirzaker, D. (2003). Elementary probability. Cambridge University Press.
14. Larsen, R. J., & Marx, M. L. (1985). An introduction to probability and its applications.
15. McColl, J. H. (2004). Multivariate probability. John Wiley and Sons.

B.A./B.Sc. IN STATISTICS PROGRAMME (FYUGP)

DETAILED SYLLABUS OF FYUGP 2nd SEMESTER

Title of the Course	Intermediate Probability Theory
Course Code	STA-MJ-02014
Nature of Course	Major
Total Credit	4 (Theory - 3 + Practical - 1)
Contact Hours	45 (Theory) + 30 (Practical)
Distribution of Marks	End Semester (45) + In Semester (30) + End sem Practical (25)

Course Objective: This course has the objective of providing exposure to random variable and large scale properties of probability distributions. This is a fundamental course on probability theory, random variables and their distributions to make further progress on statistical analysis. This course also introduces the ideas of Statistical Inference and its importance in real world applications

Learning Outcomes: At the end of the course, students shall be able to appreciate the large sample implications of various statistical measures and also learn about a number of statistical distributions. They will be able to determine whether or not moments exist of any given random variable and if so, to determine them. They will also be able to use tools like Probability Generating function and Moment generating functions to study distributions in addition to learning several univariate discrete and continuous distributions and their characterizations.

Course outcomes:

CO1: Define the concepts of two dimensional random variables, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations.

CO3: Define expectation of single and bivariate random variables and its properties, conditional expectations, conditional variance, moments, factorial moments.

CO3: Explain the properties of generating functions. cumulants, cumulant generating function, characteristic function

CO4: Illustrate the various probability distributions such as Discrete uniform, Bernoulli, Binomial, Poisson, geometric, negative binomial, hyper-geometric, Multinomial, Exponential, Cauchy, Beta and Gamma distributions, Lognormal, their properties and limiting cases and utilize these ideas to solve numerical problems.

Unit	Content	L	T	P	Total hrs
I	**Random variables:** Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, transformation of random variables, Idea of discretisation of continuous random variable.	10	02	-	12
II	**Mathematical Expectation and Generating Functions:** Expectation of single and bivariate random variables and its properties, Computational Expectations of conditional, conditional variance. Generating Function, Moment generating function (mgf), cumulants, cumulant generating function (cgf) and characteristic function (cf), probability generating function (pgf) their properties and related problems. Distribution of CDF.	11	02	-	13
III	**Discrete Probability Distributions:** Discrete uniform, Bernoulli, Binomial, Poisson, geometric, negative binomial, hyper-geometric, logarithmic distribution along with their properties and limiting/approximation cases	09	01	-	10
IV	**Continuous Probability Distributions**: Uniform, normal, negative exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases, Log normal, Laplace, Weibull.	09	01	-	10

V	**Practical:** **Note**: Students can use calculators / Ms Excel/SPSS programming as convenient**.** 1. Fitting of binomial distributions for n and p = q = ½. 2. Fitting of binomial distributions for given n and p. 3. Fitting of binomial distributions after computing mean and variance. 4. Fitting of Poisson distributions for given value of lambda. 5. Fitting of Poisson distributions after computing mean. 6. Fitting of negative binomial. 7. Fitting of suitable distribution. 8. Application problems based on binomial distribution. 9. Application problems based on Poisson distribution. 10. Application problems based on negative binomial distribution. 11. Problems based on area property of normal distribution. 12. To find the ordinate for a given area for normal distribution. 13. Application based problems using normal distribution. 14. Fitting of normal distribution when parameters are given. 15. Fitting of normal distribution when parameters are not given. 16. Fitting of exponential distribution	-	-	15	30

SUGGESTED READING:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.

2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH

Publishing, New Delhi.

4. Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics. Sultan Chand & Sons. New Delhi. (12^{th} Edition).
5. Rohatgi, V. K., & Saleh, A. M. E. (2015). An introduction to probability and statistics. John Wiley & Sons.
6. Goon, A. M., Gupta, M. K., & Dasgupta, B. (1994). An Outline of Statistical Theory (Vols. 1 & 2).
7. Ross, S. M. (2014). Introduction to probability models. Academic press.
8. Ross, S. M. (2017). Introductory statistics. Academic Press.
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15. Larsen, R. J., & Marx, M. L. (1985). An introduction to probability and its applications.
16. McColl, J. H. (2004). Multivariate probability. John Wiley and Sons.
17. Choudhury L., Sarma R., Deka M. and Gogoi S.J. (2023). An Introduction to Statistics.