Course No: NA	Course Name: Probability and Statistics				Course Code: BMAS 0108			
w.e.f. Session:	**Programme:**	**Semester:**	**L**	**T**	**P**	**J**	**Credits**	**Contact Hrs Per Week: 4**
2024-2025	B. Tech. (CSE)	III/IV	4	0	0	0	4	**Total Hours: 4**
Total Evaluation Marks: 100 **Mid Term:** 30 Marks **End Term:** 50 Marks **Internal Assessment**: 20 Marks		**Examination Duration:** Mid Term (2 hours), End Term (3 hours) **Pre-requisite of course:** None						

Course Objective	The objective of this course is to define a variety of basic statistical terms and concepts, solve fundamental statistical problems, and understand the statistical fundamentals to interpret data. Understand probability theory at basic and advanced levels, random variables, and their convergences at weak and strong levels. Apply different probability distributions (discrete and continuous) in real-life scenarios. This course will give exposure to many applications of Statistics viz. Computer Application, Data Analysis, Artificial Intelligence, and Machine Learning.
Course Outcomes	After studying these topics, the students will be able to: **CO1:** Know the basics of Statistics and apply these techniques in the core course of their study. **CO2:** Understand the fundamental concepts of random variables, and their expectations. **CO3:** Understand and apply discrete and continuous probability distributions in real-life situations. **CO4:** Apply the Central Limit theorem in real life scenarios. **CO5:** Understand and model the relationship between two variables. **CO6:** Perform the application of statistical inference in decision-making situations.

COURSE SYLLABUS

Module No.	Content	Hours
I	**[Course Outcome(s) No.: 1 and 2]** **Introduction**: **Levels of measurement**- Nominal scale, Ordinal scale, Interval scale and Ratio Scale with its significance. Cross section and Time series data. Construction of grouped frequency distribution. **Data Visualization:** Data visualization, its importance and benefit of graphical representation in data analysis. Basic Graphical Techniques- Histogram, Line graphs, and Scatter plot. **Descriptive Statistics**: An overview with real-life applications: Measures of Central Tendency-Mean, Median and Mode, Measures of dispersion-Range, Quartile deviation, Mean deviation, and Standard deviation. **Exploratory data analysis**: To examine the data distribution, Handling missing values of the dataset, Handling the outliers using Box plot, Removing duplicate data, Encoding the categorical variables, Standardisation of data. **Probability Theory**: Sample space and Events- Interpretations and Axiomatic definition of probability, Random variable- Discrete and Continuous random variable, Probability mass function (p.m.f.), Probability distribution function (p. d. f.), Cumulative distribution function (c. d. f.). **Mathematical Expectation:** Mathematical Expectation, Moment generating function (m.g.f.). The law of large numbers and Central Limit theorem (C.L.T.) with its significance (without proof).	20

II	**[Course Outcome(s) No.: 3, 4, 5, and 6]** **Discrete Distributions**: Binomial, Poisson and Geometric distributions with real-life applications and properties of each distribution. **Continuous Distributions:** Normal, Gamma and Exponential distributions with real-life applications and properties of each distribution. **Statistical Inference**: Testing of hypothesis-Null and Alternative hypothesis, Level of Significance, Critical and Acceptance region, Type I and Type II error, p-value, power of the test. Large Sample Test- Tests on the mean of a Normal Distribution with known Variance, Single Proportions and difference of Proportions. Small Sample Test- Tests on the mean of a Normal Distribution with unknown Variance (t-test for single mean), Paired t-test and Independent t-test for estimating the difference between two means. **Chi-Square test**: Assumptions about using the Chi-square Test, To test the Independence and Association between two or more variables. **Correlation and Regression:** Meaning and types of correlation, simple correlation, Karl Pearson's coefficient of correlation, significance of correlation, Heatmap for visualizing large datasets and correlations. Simple and Multiple Regression, coefficient of determination (R^2).	20

Text Books:

- Goon, A. M., Gupta, M. K., & Dasgupta, B. (1975). Fundamentals of Statistics. Vol 1. World Press Private Limited
- Johnson, R. A., Miller, I., & Freund, J. E. (2000). Probability and statistics for engineers (Vol. 2000, p. 642p). London: Pearson Education.
- Mood, A. M., Graybill, F. A., & BOES, D. (1963). Introduction to the Theory of Statistics. Mc-Graw Hill Book Company. Inc., New York.
- Navidi, W. C. (2006). Statistics for engineers and scientists (Vol. 2). New York: McGraw-Hill.

Reference Books:

- Devore, J. L. (2013). Probability and statistics for engineering and the sciences/Jay Devore
- Mukhopadhyay, P. (2012). An introduction to the theory of probability. World Scientific.
- Pestman, W. R. (2009). Mathematical statistics. Walter de Gruyter.
- Hogg, R. V., McKean, J. W., & Craig, A. T. (2013). Introduction to mathematical statistics. Pearson Education India.
- Ross, S. (2019). First Course in Probability, A. Pearson Higher Ed.
- Weatherburn, C. E. (1949). A first course mathematical statistic (Vol. 158). CUP Archive.