STS222N: STATISTICS (PROBABILITY AND PROBABILITY DISTRIBUTIONS)

CREDIT: 04 + 02

Course outcomes: After completing this course a student will have:
- *Ability to understand the concept of probability along with basic laws and axioms of probability.*
- *Ability to understand the terms mutually exclusive and independence and their relevance.*
- *Ability to identify the appropriate method (i.e. union, intersection, conditional, etc.) for solving a problem.*
- *Ability to apply basic probability principles to solve real life problems.*
- *Ability to understand the concept of random variable (discrete and continuous), concept of probability distribution.*
- *Knowledge of discrete distributions. Discuss appropriate distribution negative binomial, Poisson, etc. with their properties and application of discrete distribution models to solve problems.*
- *Knowledge of continuous distributions. Discuss the appropriate distribution (i.e., uniform, exponential, normal, etc.) with their properties and application of continuous distribution models to solve problems.*

TNEORY (4 CREDITS)

UNIT-I: Introduction to Probability and Basic Concepts: Random experiment, Trial, Sample point and Sample space, Events, Operations of events, Concept of equally likely, mutually exclusive and Exhaustive events. Definition of Probability: Classical, Relative frequency and Axiomatic approaches. Discrete Probability Space, Properties of Probability under Set Theory Approach, Independence of Events, Additional Law of events. Conditional Probability, Multiplication Law of events, Independence of events. Prior and posterior probabilities. Bayes theorem and its applications.

UNIT-II: Random Variables – Discrete and Continuous, Probability Mass Function (pmf) and Probability density function (pdf), Cumulative distribution function (cdf). Marginal and Conditional distributions, Independence of random variables. Expectation of a random variable and its properties, Expectation of sum of random variables and product of independent random variables, Conditional expectation.

UNIT-III: Discrete Distributions: Moments, Moment generating function (m.g.f.) & its properties. Discrete Probability Distributions: Uniform distribution, Bernoulli distribution Binomial distribution, Poisson distribution (as limiting case of Binomial distribution), Hypergeometric, Geometric and Negative Binomial. (Mean, variance through moments and mgf of these distributions).

UNIT-IV: Continuous Probability Distributions: Uniform, Exponential, Gamma. Normal distribution and its properties, Standard Normal variate, Normal distribution as limiting case of Binomial distribution. (Mean, variance through moments mgf of these distributions).

PRACTICALS (2 CREDITS)

1. Computation of conditional probabilities based on Bayes theorem.
2. Fitting of Binomial distribution
3. Fitting of Poisson distributions.
4. Fitting of Normal distribution.

REFERENCES:
1. David, S. (1994): Elementary Probability, Cambridge University Press.
2. Dudewicz, E.J. and Mishra, S.N. (2008). Modern Mathematics Statistics, Wiley.
3. Gupta, S.C. and Kapoor, V.K. (2000). Fundamentals of Mathematical Statistics (10th ed.), Sultan Chand and Sons.
4. Hanagal, D. D. (2009). Introduction to Applied Statistics: A Non-Calculus Based Approach. Narosa Publishing Comp. New Delhi.
5. Houghton and Mifflin. Lipschutz, S., Lipson, M. L. and Jain, K. (2010). Schaum's Outline of Probability. 2nd Edition. McGraw Hill Education Pvt. Ltd, New Delhi.
6. Meyer, P. (2017). Introductory Probability and Statistical Applications (2nd ed.), New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd.
7. Mood A.M., Graybill F.A. and Boes D.C. (2007). Introduction to the Theory of Statistics (3rd ed.), New Delhi, Tata McGraw Hill Publishing Co. ltd.
8. Mukhopadhyay, P. (1996). Mathematical Statistics, New Delhi, New Central Book Agency Pvt. Ltd.

9. Parzen, E.S. (1992). Modern Probability Theory and its Applications. Wiley Interscience.
10. Pitman, J. (1993). Probability. Narosa Publishing House.
11. Rohatgi, V.K. and Saleh, A.E. (2008). An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
12. Paratha SarathiBishnu and Vandana Bhattacherjee(2019): Data Analysis: Using Statistics and Probability with R Language, PHI Learning Pvt. Ltd. New Delhi.

Suggested Online Links/Readings:
1. http://heecontent.upsdc.gov.in/SearchContent.aspx
2. https://swayam.gov.in/explorer?searchText=statistics
3. https://nptel.ac.in/course.html
4. https://www.edx.org/search?q=statistics
5. www.coursera.org/search?query=statistics