MTH 221: Probability & Statistics

Programme: B.Tech. (ECE) Year: 2nd Year Semester: Even
Course : Core/Math Credits : 4 Hours : 56

Course Context and Overview: This course has been designed as a compulsory course for Electronics and Communication Engineering ECE, CCE and CSE discipline students. The main objective of this course is to provide a foundation in the theory and applications of probability theory and statistics. The emphasis in this course is to teach the basic theoretical concepts and techniques to solve probabilistic and statistical problems arise in engineering and applied science. In this course, we introduce various types of probability models that are applicable in Electronics and Communication Engineering and Computer science.

Prerequisites Courses: Mathematics-I

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1 Be familiar to the fundamentals of probability theory, random variables and random processes
C02 Be understand the mathematical concepts related to probability theory and random processes.
C03 Be analyze the given probabilistic model of the problem.
C04 Be familiar with applications of Probability theory and random processes in science and engineering problems occurred in real world phenomena
C05 Be prepare students for a wide range of courses in communications, signal processing, control and other areas of engineering in which randomness has an important role.

Course Topics:

Topics	**Lecture Hours**	
UNIT - I 1. **Topic** Introduction to Probability Theory		

1.1 Introduction, Review of set theory, countable and uncountable sets, Sample Space; Events; Definition of Probability function, Properties of Probability function, continuity of probability function. 1.2 Conditional Probability; Total Probability Theorem; Bayes' Theorem, Independent Events; counting: permutation and combination		7
UNIT - II **2. Topic** The Concept of random variable, Function(s) of random variable(s)		13
2.1 Random Variable; Events generated by random variables, 2.2 Distribution function, probability density function (pdf), probability mass functions (pmf). Discrete uniform, Binomial, Poisson, Geometric, Normal, Exponential, Continuous uniform random variables. 2.3 Function of a random variable, distributions, pdf and pmf of function of random variable. 2.4 Expectation, Variance; Moments, 2.5 Joint distribution and joint density function, Function of two random variables. 2.6 Expected value and variance of function of random variables, Covariance, Correlation coefficient, Covariance matrix and its properties, 2.7 Conditional distributions, Conditional expectation,		
UNIT – III **3. Topic** Probabilistic Inequalities, Characteristic Function, Limit Theorems		5
Jensen's Inequality, Markov's Inequality, Chebyshev's Inequality; Characteristic Function and it's properties. Weak and strong law of large numbers, central limit theorem;		
UNIT - IV **4. Topic:** Estimation		15
Unbiased Estimates, minimum-variance unbiased estimators, Maximum likelihood estimation, confidence intervals, Testing Hypotheses, Neyman-Pearson Lemma, Likelihood Ratio Tests, Students's t-distribution. Parametric test based on Chi-square, normal, t, F distributions. Simple Linear regression.		

Text Book:

1. Sheldon M. Ross: A First Course in Probability, Pearson Education India; 9 edition (2013)
2. Sheldon M. Ross, Introductory Statistics, Academic Press, 2nd Edition, 2010.

Other text books:

1. Sheldon M. Ross, Introduction to Probability Models, Academic Press, 10th Edition, 2010
2. Papoulis & S.U. Pillai, Probability, Random Variables and Stochastic Processes, Mc Graw Hill, 4th Edition, 2002.
3. Sheldon M. Ross, Introduction to Probability & Statistics for Engineers and Scientists, Academic Press, 4th Edition, 2009
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh: An Introduction to Probability and Statistics, Wiley; Second edition (2008).

Additional Resources:

1. MIT Open Course on Introduction to Probability and Statistics by Jeremy Orloff\\ (https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/)
2. NPTEL Lectures on Probability and Statistics by Prof. Somesh Kumar (IIT Kharagpur) \\ (http://nptel.ac.in/courses/111105041/1)

Evaluation Methods:

Item	Weightage
Quiz1	15%
Quiz2	
Attendance	10%
Midterm	25%
Final Examination	50

Instructors: Dr. Vikas Gupta, Dr. Sunil Kumar Gauttam, Dr. Manish Garg and Dr. Dheerendra Mishra

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