MAT-2020/CS-1209/PHY-1208-1

1. Course Name: MAT 2020: Probability and Statistics.

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3. Overview: This is a first course in probability theory where the students are expected to learn the foundations, basic concepts of probability theory and be able to solve problems. We shall also discuss some preliminary concepts and foundations of statistics. This course is the first step to take future advanced courses in probability and statistics.

4. Course Prerequisites: Students are expected to have a strong background in permutation and combination and calculus. Hence the following courses are prerequisites:

1. Mathematics in 10+2 standard.

2. MAT 1000: Calculus.

5. Syllabus: Frequency and axiomatic definition of probability, random experiments with equally likely finite outcomes, Inclusion exclusion principle. General finite sample spaces, infinite sample spaces. Concept of probability spaces and construction of probability measures. Conditional probability, Bayes theorem, Independence of events. Random variable (discrete), probability mass function and distribution function. Examples: Bernoulli, Binomial, Poisson, Geometric distributions. Expectation and variance of a random variable, sum law and product law of expectation, moment generating functions. Random vector (discrete), joint distribution, Marginal distributions, joint moment generating functions, covariance, Multinomial distributions. Continuous random variables, density functions, distribution functions, expectation, variance, moment generating function, example: uniform, normal, and exponential. Continuous random vector, joint density function, joint distribution function, conditional density, example: multivariate normal.

Inequalities: Markov, Chebyshev. Weak variant of law of large numbers, Central Limit Theorem (without proof).

Descriptive statistics, Distribution of sampling statistics, Parameter Estimation and Hypothesis testing basics.

Simple linear regression with one regressor (only if time permits).

6. Suggested texts:

1. S. M. Ross: First Course in Probability, Pearson.

2. S. M. Ross: Introduction to Probability and Statistics for Engineers and Scientists

3. J. L. Devore: Probability and Statistics for Engineering, Cengage, 8th edition, 2012.

4. V. K. Rohatgi, E. S. Saleh: An Introduction to Probability and Statistics, Wiley-Blackwell, 3rd edition, 2015.

6. Grading policies: Will be discussed later.