**PROBABILITY THEORY**

1. Sample space; algebra of events; s-algebra of events. Probability measure on a s-algebra; s-algebra of Borel sets; Kolmogorov axioms.
2. Random variables; Discrete density functions, probabilities in discrete sample space, equally likely outcomes.
3. Continuous density functions, probabilities in continuous sample space,
4. Functions of random variables; s-field generated by a random variable.
5. Bivariate random vectors; Bivariate joint density functions.
6. Marginal and conditional density functions, independent random variables.
7. Definition and properties of Expectation (Lebesgue integral). Special expectations; the mean, variance, standard deviation.
8. Covariance and correlation coefficient, Chebyshev’s inequalities.
9. Generating functions; the moment generating function, characteristic function, computation of moments using moment-generating function.
10. Asymptotic Distributions; Convergence in probability and distribution; Law of large numbers: Weak law of Large numbers, Strong law of large numbers.
11. Limit theorems: Continuity theorem of characteristic function; Central limit theorem

Books: 1) Ross S. , *A First Couse in Probability.* Prentice Hall Inc.

 2) Mood A.M., Graybill F. A., Boes D.C. , *Introduction to the Theory of Statistics.*

 McGraw Hill

**STATISTICS**

1. Estimation: The likelihood function and maximum likelihood estimators.
2. Properties of estimators: Mean-square-error, unbiasness, consistency.
3. Fisher information and efficient estimators.
4. Asymptotic properties of maximum likelihood estimators.
5. Confidence intervals: (1-α) confidence intervals and Pivotal quantities.
6. Testing statistical hypothesis and test statistics.
7. Optimal Tests: Randomized tests,
8. Powerful tests: power function, Simple hypothesis, Neyman-Pearson Theorem*.*
9. Likelihood Ratio tests.
10. Sufficient Statistics.
11. Some one-sample, Two-sample and paired models.
12. Regression analysis.
13. Non-parametric tests: One-sample Sign and Rank tests.

Books: 1)R.V. Hogg & A. T. Craig., *Introduction to Mathematical Statistics*. New Jersey: Prentice Hall International 1995.

 2) Mood A.M., Graybill F. A., Boes D.C., *Introduction to the Theory of Statistics.* McGraw Hill; 3rd edition.

 3) R.J. Larsen. *An Introduction to Mathematical Statistics* and its Applications. Prentice-Hall, 1981.