COURSE – 3

Probability, Statistics and Random Processes

Code: IC 210

Credit: 2.5-0.5-0-3

Course Outline: The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modeling, climate prediction and computer networks etc. Students are required to do a project based on real time data.

Course description:

Introduction to Probability (Theory of Gambling): Definitions, scope and examples; Sample spaces and events; Axiomatic definition of probability; Joint and conditional probabilities; Independence, total probability; Bayes' rule and Applications.   [5 Lectures]

Random variables (Dealing with Uncertainty): Definition of random variables, continuous and discrete random variables; Cumulative distribution function (cdf) for discrete and continuous random variables; Probability mass function (pmf); Probability density functions (pdf) and properties; Jointly distributed random variables; Conditional and joint density and distribution functions; Function of random a variable; Expectation: mean, variance and moments of a random variables.

[10 Lectures]

Distribution Functions (Fitting of a Function): Some special distributions: Uniform, Exponential, Chi-square, Gaussian, Binomial, and Poisson distributions; Moment-generating and characteristic functions and their applications; Chebysev inequality; Central limit theorem and its significance; Parameter estimation and confidence intervals for parameters; Regression; Hypothesis Testing.

[11 Lectures]

Random process (Modeling of Chance): Autocorrelation and autocovariance functions; Stationarity; Ergodicity; Correlation and covariance; White noise process and white noise sequence; Gaussian process; Poisson process; Random walk, Markov Processes, Markov chains, Introduction to Queuing theory.

[10 Lectures]

Text Books

1. Sheldon M. Ross, *"Introduction to Probability and Statistics for Engineers and Scientists"*, Academic Press, (2009).
2. Kishor S. Trivedi, *"Probability and Statistics with Reliability Queuing and Computer Science Applications"*, Second Edition, Wiley-Interscience, (2001).

Reference Books

1. Athanasios Papoulis, *"Probability Random Variables and Stochastic Processes"*, 4th edition, McGraw-Hill, (2002).
2. D. C. Montgomery and G.C. Runger, *"Applied Statistics and Probability for Engineers"*, 5th edition, John Wiley & Sons, (2009).
3. Robert H. Shumway and David S. Stoffer, *"Time Series Analysis and Its Applications with R Examples"*, Third edition, Springer Texts in Statistics, (2006).