

# Stochastic Systems

## Course Code: EE-891

### Course Description

This course starts by introducing the Statistical concepts from the very basics and concludes by explaining an important stochastic model, i.e., Variational Auto-encoder, which is one of the most influential probabilistic model. The course includes the Probabilistic Graphical Models (PGM) which are the fundamental tool in addressing many state-of-the-art problems with a wide applications in the field of medical diagnosis, scene understanding, speech recognition and many more.

### Text Book:

1. Probability and Random Processes for Electrical Engineering, by Alberto Leon-Garcia [1994].
2. Probabilistic Graphical Models: Principle and Techniques by Daphne Koller and Nir Friedman [2009].

### Reference Book:

1. Probability and Stochastic Processes – A Friendly Introduction for Electrical and Computer Engineers, by Roy D. Yates and David J. Goodman [2014].

### Prerequisites

None

### ASSESSMENT SYSTEM

Quizzes	5-10%
Assignments	5-10%
Mid Terms	25-30%
ESE	40-50%

### Teaching Plan

Week No	Topics	Learning Outcomes
1-2	Introduction	Probability Theory, Mutual Exclusivity, Axioms of Probability, Conditional Probability, Bayes' Rule, Chain Rule
3-5	Random Variables	PDF, CDF, PMF, Conditional PDF and Conditional CDF, Expected Value, Variance, Functions of RVs
6-8	Multiple Random Variables	Independence, Functions of Multiple RVs, Joint Probabilities, Joint and Marginal Distributions, PDF and PMF, Correlation and Covariance, Auto Correlation and Auto Covariance, Sum of RVs

9	<b>MID TERM EXAM</b>	
10-12	Representation: Probabilistic graphical models	Bayesian Networks (Directed Models), Template Models for Bayesian Networks, Structures CPDs for Bayesian Networks, Markov Networks (Undirected Models), Decision Making
13-15	Inference: Probabilistic graphical models	Variable Elimination, MAP algorithms, Sampling methods, Inference in Temporal Models
16	Learning: Probabilistic graphical models	Probabilistic Learning Models, Practical Applications and challenges
17	Probabilistic graphical models	Semester Project Presentation & Discussion
18	<b>End Semester Exams</b>	

