

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (COMMUNICATION SYSTEMS ENGG) (05)

SUBJECT NAME: Statistical Signal Analysis

SUBJECT CODE: 2720501

M.E. SEM-II

Type of course: Core Subject

Prerequisite: Higher Engineering Mathematics, Fundamental knowledge of signals and systems along with types, Probability and Information Theory.

Rationale:

PG Students of EC Engineering need to possess good understanding of the fundamentals Algebra and random variable. They are expected to be able to understand sequence of random variable, conditional expectation and statistical independence and perform matlab implementation of stochastic processes like wide sense stationary processes, orthogonal increment processes. They will be practiced in mean square derivative and mean square integral of stochastic process.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Probability Models in Electrical and Computer Engineering: Mathematical Models as Tools in Analysis and Design, Deterministic models, Probability models: Statistical regularity, building a probability model.	6	14%
2	Basic Concepts of Probability Theory: The sample space, Events, Set operations, Discrete sample space, continuous sample space, sampling with replacement and with ordering, sampling without replacement and with ordering, conditional probability, and independence of events.	6	14%
3	Random variables: The notion of random variables, cumulative distribution function, the probability distribution function, discrete random variable, continuous random variable, functions of random variables, expected value of random variables, Markov and Chebyshev Inequality.	5	12%
4	Multiple Random variable: Vector random variable, Pairs of random variable, Independence of two random variables, conditional probability and conditional expectation, multiple random variables, functions of several random variables.	5	12%
5	Sums of Random Variables and Long Term Averages: Sums of random variables, the sample mean and the laws of large numbers.	3	7%

6	Random process : Joint distribution of time samples, the mean, autocorrelation, Gaussian random process, multiple random process, discrete-time random process, binomial counting and random walk process, Poisson process, stationary random process: wide sense stationary random process, wide sense stationary Gaussian random process, continuity, derivatives and integral of random process, time averages of random process and ergodic theorems.	8	19%
7	Analysis and processing of random signals: Power spectral density: continuous time random process, discrete time random process, power spectral density as a time average, continuous time system, discrete time system, amplitude modulation by random signals.	5	12%
8.	Markov chains: Markov process, discrete Markov chain, continuous time Markov chain: state occupancy times, transition rates and time dependant state probability, steady state probability and global balance equation.	4	9%
	total	42	100%

Reference Books:

1. Alberto leon Gracia, Probability and Random Processes for Electrical Engineer, 2nd Ed PE India
2. A.Papoulis, Probability Random Variables and stochastic Processes, 2nd Ed Mc Graw Hill
3. A. Larson and B.O. Schubert, Stochastic Processes, Vol.I and II, Holden-Day
4. W.Gardener, Stochastic Processes, McGraw Hill.
5. S. Haykin, Adaptive filter theory, prentice Hall.
6. B.P.Lathi, Modern Analogue and Digital communication, Oxford uni. Press.

Course Outcome:

By the end of this course, the student should be able to do the followings

1. To design a probability model.
2. To compute the functions of several random variables.
3. To find joint distribution function.
4. To find mean square continuity and mean square derivative.
5. To find the transformation of random variables.

List of Experiments:

Sr. No.	Experiment Name
1	Write a MATLAB program to find the joint distribution of time samples.
2	Write a MATLAB program for derivatives of random process.
3	Write a MATLAB program for integration of random process.
4	Write a MATLAB program for joint densities function of random variables.
5	Write a MATLAB program for marginal densities function of random variables.

- 6 Write a MATLAB program for finding mean square derivative of stochastic process.
- 7 Write a MATLAB program for finding mean square integral of stochastic processes.
- 8 Write a MATLAB program to find Least square error.
- 9 Write a MATLAB program to find mean square error.
- 10 Write a MATLAB program to find out convergence of sequences of random variables.

Design based Problems (DP)/Open Ended Problem:

1. Write MATLAB code to find joint pdf of two jointly continuous random variables.
2. Write matlab code to find pdf of sum of random variables.

List of Software:

Matlab

Learning website:

www.nptel.ac.in

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.