



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC503	Random Signal Analysis	4	1	--	4	1	--	5
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	ETC 405: Signals and Systems ETC 401: Applied Mathematics IV
After successful completion of the course, student will be able to	
Course Outcomes	CO1 Prove mathematically and interpret statistical properties that will be used in later semesters in the design and analysis of communication systems
	CO2 Analyze statistical behavior of single and multiple random variables and be able to manipulate them.
	CO3 Students can solve engineering problems using axiomatic probability theory, random variables, and random processes

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Overview of Probability Theory and Basics of Random Variables		1,3	10
	1.1	Sample space, events, set operations, the notion and axioms of probability.		
	1.2	Conditional probability, Joint probability, Baye's rule, Independence of events, Sequential Experiments.		
	1.3	Notion of random variable.		
	1.4	Continuous random variables, probability density function, probability distribution function, Uniform, Exponential and Gaussian continuous random variables and distributions.		
	1.5	Discrete random variables, probability mass function, probability distribution function, binomial, Poisson and geometric discrete random variables and distributions.		
2	Operations on One Random Variable		1,2	07
	2.1	Functions of a random variable and their distribution and density functions.		
	2.2	Expectation, Variance and Moments of random variable.		
	2.3	Transformation of a random variable, Markov, Chebyshev and Chernoff bounds, characteristic functions, moment theorem		
3	Multiple of Random Variables And Convergence		1,4	08
	3.1	Vector random variables, Pairs of random variables, Joint CDF, Joint PDF Independence, Conditional CDF and PDF, Conditional		



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		Expectation		
	3.2	One function of two random variable, two functions of two random variables; joint moments, joint characteristic function, covariance and correlation-independent, uncorrelated and orthogonal random variables.		
4	Sequence Of Random Variables And Convergence:		1,2,4	05
	4.1	Random sequences, Limit theorems; Strong and weak laws of large numbers,		
	4.2	Central limit theorem and its significance		
5	Random Process		1,5	10
	5.1	Random process: Definition, realizations, sample paths, discrete and continuous time processes		
	5.2	Probabilistic structure of a Random process; mean, correlation and covariance functions, stationarity of random process.		
	5.3	Ergodicity, Transmission of WSS random process through LTI system		
	5.4	Spectral analysis of random processes, power density spectrum bandwidth, crosspower density spectrum.		
	5.5	Gaussian and Poisson random process		
6	Markov Chains And Introduction To Queuing Theory		1,5,	12
	6.1	Markov processes		
	6.2	Discrete Markov chains, The n-step transition probabilities, steady state probabilities.		
	6.3	Introduction to Continuous time Markov chains.		
	6.4	Classifications of states.		
	6.5	Markovian models		
	6.6	Birth and death queuing models		
	6.7	Steady state results		
	6.8	Single and Multiple server Queuing models		
	6.9	Finite source models		
	6.10	Little's formula		
			Total	52

References

1. Alberto Leon Garcia, "*Probability And Random Processes For Electrical Engineering*", second edition Low price edition Pearson education.
2. Miller, "*Probability And Random Processes-With Applications to Signal Processing and Communication*", first edition 2007, Elsevier.
3. Papoulis and S. Unnikrishnan Pillai, "*Probability, Random Variables and Stochastic Processes,*" Fourth Edition, McGraw Hill.
4. H. Stark and J. Woods, "*Probability and Random Processes with Applications to Signal Processing,*" Third Edition, Pearson Education.
5. Hwei Hsu, "*Probability Random Variable,s Random Process, Schaulm's Outlines,*TMH,2004.