Course Code	21MAB203T	Course Name	PROBABILITY AND STOCHASTIC PROCESSES	Course Category	B	BASIC SCIENCES	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Mathematics*	Data Book / Codes / Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*describe the applications on discrete and continuous random variables*
CLR-2:	*assess the applications of two-dimensional random variables*
CLR-3:	*infer the various modes of convergence of random variables and their limit theorems*
CLR-4:	*relate the specialized knowledge in random processes in signals and systems*
CLR-5:	*determine the applications of spectral density functions and linear time-invariant systems*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	*evaluate the characteristics of discrete and continuous random variables*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2:	*explain the model and analyze systems using two-dimensional random variables*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3:	*classify limit theorems and evaluate upper bounds using various inequalities*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4:	*analyze the characteristics of random processes*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5:	*examine problems in spectral density functions and linear time-invariant systems*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 - One-Dimensional Random Variable and Probability Distributions **12 Hour**

One-dimensional random variable: Discrete Case-Probability function, Cumulative Distribution Function, continuous random variable-Probability density function, Cumulative distribution function-properties, Problems on one-dimensional random variable, Expectation, variance, Moments - raw and central moments, Binomial distribution –moments, Binomial distribution-Applications, Poisson distribution-moments, Poisson distribution –Applications, Exponential distribution-moments, Exponential distribution-Applications, Normal Distribution-moments, Normal Distribution-Applications, Uniform Distribution-moments, Uniform Distribution-Applications, Function of a random variable, Applications of random variables in engineering.

Unit-2 - Two-Dimensional Random Variable and Correlation Functions **12 Hour**

Two-dimensional random variables-Discrete cases, Probability function of (X, Y) - Marginal probability distribution, Conditional probability distribution of (X, Y), Problems on discrete random variables, Continuous random variables – Joint PDF, Marginal Probability distributions, Conditional probability distribution of (X, Y), Problems on continuous two-dimensional random variables, Independent random variables, Cumulative distribution function-properties of F(x, y), Expected values of two-dimensional random variables, Covariance and correlation, Conditional expected values, Problems on uncorrelated random variables, Functions of two-dimensional random variables, Probability density functions of the type Z=XY, Probability density functions of the type Z=X-Y, Probability density functions of the type Z=X/Y. Application of two-dimensional random variables in engineering.

Unit-3 - Probability Bounds and Central Limit Theorems **12 Hour**

Limit theorems--Markov's inequality, Chebyshev's inequality without proof, Chebyshev's inequality - Applications, Chebyshev's inequality – Applications using Binomial distribution, Chebyshev's inequality– Applications using Exponential distribution, The weak law of large numbers, Central limit theorem without proof, Central limit theorem - Applications, Central limit theorem- Applications using Poisson random variables, Central limit theorem- Applications using Exponential random variables, The strong law of large numbers, The strong law of large numbers, One-sided Chebychev's inequality, Cauchy Schwartz inequality, Chernoff bounds, Chernoff bounds for the standard normal variate, Chernoff bounds for the Poisson random variate, Jenson's inequality, Applications of Central Limit Theorem in engineering.

Unit-4 - Random Processes and Stationary Processes	**12 Hour**
Random Processes-Introduction, Classification of random processes, Distribution of the process, Averages of the process, Stationary, SSS, WSS processes, Problems on stationary and SSS processes, Problem, Problems on WSS process, Problems on WSS process, Autocorrelation function -properties, Proof of properties, Problems on autocorrelation function, Application of autocorrelation function, Cross-correlation-properties, Proof of properties, Problems on Cross-correlation function, Ergodicity, Mean ergodic process, Mean ergodic theorem, Applications of random process in engineering.	
Unit-5 - Spectral Density of Random Process and Linear System with Random Inputs	**12 Hour**
Power spectral density function- properties, Proof of properties, Problems on power spectral density function, Problems on power spectral density function, Power density spectrum, Problems based on power density spectrum, Linear systems with random inputs, Representation of system in the form of convolution, Unit impulse response of the system, Properties, Applications of unit impulse function, Einstein Weiner-Khinchine Relationship, Cross-power density spectrum-problems, Cross-power density spectrum Cross-power density spectrum, Applications of power spectral density functions in engineering, Applications of power spectral density functions in engineering.	

Learning Resources	1. *A. Papoulis, S. Unnikrishna Pillai, Probability, Random Variables and Stochastic Processes 4th Edition, Mcgraw Hill, 2002.* 2. *Henry Stark, Probability and Random Processes with Applications to Signal Processing, Third Edition, Pearson 2004* 3. *Sheldon Ross, A first course in Probability, Sixth Edition, 2011.*	4. *S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 11th Edition, 2015.* 5. *Jay L DeVore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning India Pvt. Ltd, 2012.* 6. *T. Veerarajan, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, 4th Edition, McGraw-Hill Education, New Delhi, 2015.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	*Remember*	20%	-	20%	-	20%	-
Level 2	*Understand*	20%	-	20%	-	20%	-
Level 3	*Apply*	30%	-	30%	-	30%	-
Level 4	*Analyze*	30%	-	30%	-	30%	-
Level 5	*Evaluate*	-	-	-	-	-	-
Level 6	*Create*	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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