BECE207L	Random Processes	L	T	P	C
		2	1	0	3
Pre-requisite	**BECE202L/Signals and Systems &BMAT202L & BMAT202P/Probability and Statistics**	**Syllabus version**			
		1.0			

Course Objectives

1. To familiarize the students with two and multi-random variable theory.
2. To enable the students process the random signals in time and frequency domains.
3. To make the students understand the noise concepts and design a matched filter to increase the Signal to Noise Ratio (SNR).

Course Outcome

The students will be able to

1. Compute the probability density functions for multiple random variables
2. Perform transformation on multiple random variables and complex random variables
3. Interpret the random processes in terms of stationarity, statistical independence, and correlation.
4. Compute the power spectral density of the random signals
5. Interpret the effect of random signals on LTI systems output both in the time and frequency domain.
6. Design the Optimum linear systems for extracting signals in the presence of noise.

Module:1	**Continuous and Discrete Multiple Random Variables**	**6 hours**

Introduction to Random Variables – Vector Random Variables- Joint Distribution and its Properties-Joint Density and its Properties-Joint Probability Mass Function – Conditional Distribution and Density-Statistical Independence –Distribution and Density of Function of Random Variables – Central Limit Theorem.

Module:2	**Operations on Multiple Random Variables**	**7 hours**

Joint Moments for continuous and discrete random variables – Joint Central Moments – Joint Characteristics Function – Jointly Gaussian Random Variables – Transformations of Multiple Random Variables – Linear Transformation of Gaussian Random Variables – Complex Random Variables.

Module:3	**Random Processes – Temporal Characteristics**	**7 hours**

Random Process: Classifications. Stationarity and Independence. Time Averages and Ergodic Random process. Characterizing a Random Process: The Mean, Correlation Functions, Covariance Functions, and their Properties-Different processes: Gaussian Random Process-Poisson Random Process, Weiner Process, and Markov process, and Complex Random Process.

Module:4	**Random Processes – Spectral Characteristics**	**7 hours**

Power Density Spectrum and its Properties-Cross PSD and its properties, Relationship between Correlation and Power Spectrum- Power Spectral density of a WSS discrete Time random processes and Sequences. Power Spectrum of Complex Processes.

Module:5	**Linear Systems with Random Inputs**	**5 hours**

Linear system Fundamentals-Linear systems with continuous-Time and discrete-Time random inputs. Random Signal Response of Linear Systems-Product Device response to a Random Signal-Spectral Characteristic of System Response. Response of quadratic, half wave, full-wave, and sigmoid detectors to Gaussian signals.

Module:6	**Noise and Modelling of Noise Sources**	**6 hours**
Noise Definitions- White noise and colored noise. System Evaluation using Random noise - Spectral Characteristic of System Response for Noise-Noise Bandwidth – Bandpass – Band limited – Narrow Band Processes. Resistive Noise Sources – Arbitrary Noise Sources – Effective Noise Sources-Noise Temperature-Noise Figure-Incremental Modelling of Noisy Networks- Modelling of Practical Noisy Networks.		
Module:7	**Optimum Linear Systems**	**5 hours**
Signal to Noise Ratio – Mean Square Error- Optimization by Parameter Selection- Matched Filter for Colored Noise- Matched Filter for White Noise-Practical Applications.		
Module:8	**Contemporary issues**	**2 hours**
Guest Lecture from Industries and R & D Organizations		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	P.Z. Peebles, Probability, Random Variables, and Random Signal Principles, 2017, 4th edition, McGraw Hill, New Delhi, India.
Reference Books	
1.	Papoulis and S.U. Pillai, Probability, Random variables and stochastic processes, 2017, 4th edition, McGraw Hill, New Delhi, India.
2.	Hwei Hsu, Probability, Random variables, Random Processes, 2017, Schaum's outline series, McGraw Hill, New Delhi, India.

Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
Recommended by Board of Studies	14-05-2022		
Approved by Academic Council	No. xx	Date	DD-MM-YYYY