General Sir John Kotelawala Defence University
Department of Electrical, Electronics and Telecommunication Engineering
Module Descriptor – Random Signals and Processes

Module Code	ET2202	**Module Title**	**Advanced Signal and Systems**			
Credits	2	**Hours/ Semester**	**Lectures**		**Prerequisites**	MA2103, ET2103
GPA/ NGPA	GPA		**Continuous Assessments/ Tutorials**			
Module Objectives		Apply probabilistic and statistical analysis as to electrical signals and systems				
Learning Outcomes		After the completion of this module, the student will be able to **LO1: Examine** random variables in terms of their statistical characteristics **LO2: Apply** bivariate random variables for communication channels **LO3: Infer** noise as a random process **LO4: Discuss** different ways in which probabilistic models are used in telecommunications theory and practice.				
Contents		**Introduction** Review of deterministic signals and systems analysis. Differentiate random signals from deterministic signals. Review of basic probability concepts. Introduction to random variables and processes. Illustrative application of probability models in communications such as the binary symmetric channel.				
		Random Variable Definition of a random variable. Classification of random variables as continuous and discrete. Characterization of each type of random variable using the probability density/mass function, the cumulative distribution function, mean and variance. Functions of random variables. Transformation of random variables. Uniform, Binomial and Poisson, Gaussian random variables and examples of their application in communication systems.				
		Bivariate Random Variables Joint and conditional distributions, correlation and independence. Transformation of bivariate random variables. The Rayleigh random variable and its application in wireless channel characterization.				
		Random Vectors Extension of bivariate random variable analysis to random vectors (multivariate random variables), multivariate probability density functions, correlation and covariance matrices. Characteristics of the Gaussian random vector.				
		Noise as a Random Process Representation of white noise, low-pass noise, and band-pass noise as random processes. Illustrative applications such as in performance analysis of communication systems, optimum filtering				
		Random Processes Examples of real-life phenomena which can be modeled as random processes. Characterization of random processes, their classification as stationary, wide sense stationary and ergodic. Derivation of the power spectral density function of random processes. Multiple random processes and their interrelationships. Transmission of random processes through linear time invariant systems, and related spectra. Examples of processes in communications systems which are modeled as random processes				

Laboratory/ Practical Sessions	Multivariate Gaussian Random Processes Linear Filtering of Random Processes
Method of Assessment	Continuous Assessments : 30% End semester examination : 70%
References	1. Hwei Hsu, (2014). Schaum's Outline of Probability, Random Variables, and Random Processes, 3rd Edition, McGraw-Hill Education . 2. Simon Haykin, Communication Systems, (2006). 4th Edition, Wiley India Pvt. Limited. 3. A Bruce Carlson, (1986). Communication Systems 3rd Edition, 3rd edition, McGraw-Hill.

Linkage between Learning Outcomes (LO) and Program Outcomes (PO)

	Program Outcomes											
Learning Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
LO1 (0.34)	M	H	H	H	H				L	L		L
LO2 (0.17)	H	H	H	H	H				L	L		L
LO3 (0.22)	H	H	H	H	H				L	L		L
LO4 (0.27)	H	H	H	H	H				L	L		L
Module	**H**	**H**	**H**	**H**	**H**				**M**	**M**		**M**