Devi Ahilya University, Indore, India Institute of Engineering & Technology				III Year B.E. (Electronics & Instrumentation Engg.)			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
EIR5E2	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Random Processes	**3**	**1**	**2**	**3**	**1**	**1**	**5**
Duration of Theory Paper: 3 Hours							

Prerequisite: Students should have in depth knowledge of signals, signal processing and statistics.

Rationale: We introduce random processes and their applications. We first introduce the basic concepts of random variables, random vectors, and random fields. We then introduce common random processes including the white noise, Gaussian processes, Poisson processes, and Markov random fields. We address moment analysis (including Karhunen- Loeve transform), the frequency-domain description, and linear systems applied to random processes. Advanced topics in modern statistical signal processing such as linear prediction, linear models and spectrum estimation are discussed.

Unit 1:

Definition of a random variable (discrete and continuous), distribution of a random variable (cdf and pdf), commonly used random variables.

Unit 2:

Joint density of two or more random variables and their properties, random vectors, Conditional distribution/density, Bayes' rule for pdfs, chain rule for densities.

Unit 3:

Independence of random variables, Functions of random variables. Two functions of two random variables (and deriving their joint density). Order statistics, Mean, variance and other moments. Conditional Mean. Covariance, correlation coefficient.

Unit 4 :

Convergence of random variables (almost surely, r^th mean, in probability, in distribution). Bivariate Normal random variables, Multi-variate Normal Random Variables, PDF, Covariance Matrix, Characteristic Function, and properties. Transformation of Correlated Random variables into Uncorrelated ones.

Unit 5 :

Random processes, definitions, mean, auto-correlation, and auto-covariance function. First and higher order density of random processes. Independent and Stationary Increments Property. Gaussian random process, Brownian motion.

Random processes in linear systems. Discrete Random Processes in LTI systems.

Reference Books:

1. S. U. Pillai Probability, Random Variables, and Stochastic Processes. Papoulis,. 2001.
2. R. Gallager, Stochastic Processes: Theory for Applications.
3. A. Leon-Garcia, Probability and Random Processes for Electrical Engineering, 2nd ed., Prentice Hall, 1993.

Course Outcome:

After learning the course the students should be able to:

1. apply knowledge of mathematics, science, and engineering.
2. design and conduct experiments, as well as to analyze and interpret data.
3. design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.