Prasad V. Potluri Siddhartha Institute of Technology, Kanuru, Vijayawada.

Department of ECM **PVP12**

2/4 B.Tech. FOURTH SEMESTER

EM4T2 **Probability Theory and Stochastic Processes** **Credits: 3**

Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives:

- To acquire the fundamental knowledge in probability concepts
- To manage situations involving more than one random variable and functions of random variables in engineering applications.
- To be acquainted with systems involving random signals and to analyze the response of random inputs to linear time invariant systems

Learning Outcomes:

After successful completion of the course, Graduates shall be able to
- Define probability and interpret probability by modelling sample spaces.
- Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance
- Can handle the problems involving multiple random variables.
- Understand Stationary process
- Evaluate response of a linear system to Random Process.

UNIT I
Probability: Probability introduced through Sets and Relative Frequency, Joint Probability and Conditional Probability, , Baye's theorem, Independent Events.

UNIT II
The Random Variable : Definition of a Random Variable, condition for a function to be a random variable , Discrete and Continuous, Distribution and Density functions, Properties, Gaussian, Exponential, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties.

UNIT III
Operation On One Random Variable – Expectations : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Nonmonotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

UNIT IV
Multiple Random Variables : Vector Random Variables, Joint Distribution function and its Properties, Conditional Distribution and Density, Statistical Independence, Distribution and Density of Sum of Random Variables, Central Limit Theorem, (Proof not expected).

UNIT V
Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Characteristic Functions, Jointly Gaussian Random Variables Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT VI
Random Process: Random Process Concept, Stationarity and Independence, Correlation Functions, autocorrelation and cross correlation functions and its properties, Gaussian Random Process, Poisson Random Process.

UNIT-VII
Random Process Spectral Characteristics: Power Density Spectrum and its properties, Relationship between Power Spectrum and Auto Correlation Function, Cross Power Density Spectrum and its properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT VIII
Linear Systems With Random Inputs : Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

TEXT BOOKS :

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

REFERENCES :

1. Communication Systems Analog & Digital – R.P. Singh and S.D. Sapre, TMH, 1995.
2. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem,Oxford, 3rd Edition, 1999.
4. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003.