**20EC2201 – PROBABILITY THEORY AND STOCHASTIC PROCESSES**

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| **Course category:** | Program core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 0- 0 |
| **Prerequisite:** | Knowledge of Signals and systems, integrations and differential equations. | **Sessional Evaluation :**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course**  **Objectives** | Students undergoing this course are expected to: | |
| 1. Provide mathematical background and probability theory. 2. Understand the random variable concepts with distribution and density functions. 3. Know basic concepts of multiple random variables, Conditional probability and conditional expectation, joint distribution and independence. 4. Make the difference between time averages and statistical averages. 5. Analysis of random process and application to the signal processing in the communication system. 6. Demonstrate the students how to model a noise source and design of filters for white and coloured noises and maximize S/N ratio. | |
| **Course Outcomes** | Upon successful completion of the course , the students will be able to: | |
| CO1 | Understand fundamentals of probability theory |
| CO2 | Learn the fundamentals of random variables. |
| CO3 | Illustrate the concepts of vector random variables and related problems. |
| CO4 | Remember the characterization of random processes and their properties |
| CO5 | Evaluate response of a system to random signal and noise |
| CO6 | Know the noise and how these noises are effecting the communication system |
| **Course**  **Content**  **Course**  **Content** | **UNIT-I**  **PROBABILITY**: Introduction, Set theory and Venn diagrams -Axioms- Joint and conditional probability - Bayes’ theorem - Bernoulli trials.  **UNIT –II**  **RANDOM VARIABLE**: Concept — Distribution function — Density functions —Conditional density functions — Expectation — Conditional expected value — Moments — Chebyshev, Markov’s and Chernoff’s inequalities — Characteristics and moment generating functions - Transformation of continuous and discrete random variables.  **UNIT –III**  **MULTIPLE RANDOM VARIABLES**: Vector random variables — Joint distribution / Density functions — Conditional density / Distribution functions - Statistical independence — PDF and CDF for sum of random variables — Central limits theorem - Operations on multiple random variables — Expected value of function of random variables — Joint characteristic function — Joint by Gaussian random variables — Transformations of multiple random variables.  **UNIT – IV**  **RANDOM PROCESSES:** Concept — Stationarity — Independence — Time averages — Ergodicity — Correlation function and its Properties.  Gaussian process— Power spectral density and its properties — Relation between power spectral density and auto-correlation — Cross power spectral density and its properties— Definition of white and coloured noise.  **UNIT-V**  **LINEAR SYSTEMS WITH RANDOM INPUTS:** Random signal response of linear system — System evaluation using random noise— Spectral characteristics of system response - Band pass, Band limited and Narrow band processes — Properties of band limited processes.  **UNIT-VI**  **MODELING OF NOISE SOURCES:** Classification of noise sources — Resistive (Thermal) noise — Effective noise temperature — Antenna as a noise source — Available power gain — Equivalent networks — Input noise temperature — Noise figure.  **OPTIMUM LINEAR SYSTEMS:** Maximization of (S/N); Matched filter for coloured and white noise — Minimization of Mean Squared Error — Wiener filter. | |
| **Text Books and Reference Books** | **TEXT BOOKS:**   1. P.Z.Peebles Jr., “Probability Random Variables and Random Signal Principles”. Tata McGraw-Hill, 4th edition, 2001. 2. A.Papoulis and S.Unnikrishna Pillai, “Probability Random Variables and Stochastic Processes”, PHI, 4th edition, 2008 3. J.LAunon and V.Chandrasekhar, “Introduction to Probability and Random Processes”, McGraw-Hill 2nd edition , 1997.   **REFERENCE:**   1. D.G. Childer, “Probability and Random Processes”, McGraw Hill, 2nd edition 1997. 2. GR.Babu and K. Pushpa, “Probability Theory and Stochastic Processes”, Premier Publishing House, 3rd edition 2010. | |
| **E-Resources** | 1. http://nptel.ac.in/cources 2. https:// iete-elan.ac.in 3. https://freevideolectures.com/university/iit | |

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| Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low) | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | - | - |
| CO2 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | - | - |
| CO3 | 3 | 3 | 3 | 1 | 1 | - | - | 1 | - | 2 | - | 2 | - | - |
| CO4 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | - | - |
| CO5 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | - | - |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 2 | - | 2 | - | - |