# **PROBABILITY AND COMPLEX VARIABLES**

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| Course Category: | Basic Sciences&Humanities | | Credits: | 3 |
| Course Type: | Theory | | Lecture-Tutorial-Practical: | 3-0-0 |
| Pre-requisite: | Intermediate Mathematics | | Sessional Evaluation:  External Evaluation:  Total Marks: | 30  70  100 |
| Course  Outcomes: | After completing the course,students will be able to | | | |
| **CO1** | Understand the concepts of Probability, Random Variables, and their characteristics. | | |
| **CO2** | Learn how to deal with multiple random variables ,conditional probability, joint distribution and statistical independence | | |
| **CO3** | Formulate and solve engineering problems involving random variables | | |
| **CO4** | Analyze limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions | | |
| **CO5** | Understand Cauchy theorem, Cauchy integral formulas and apply these to evaluate complex contour integrals. Classify singularities and poles; find residues and evaluate complex integrals using the residue theorem. | | |
| Course  Content: | **UNIT I****Probability&Random Variable:** Probability through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms ,Joint Probability, Conditional Probability, Total Probability, Bayes’ Theorem, Independent Events. Random variables (discrete and continuous) ,probability density functions, properties ,mathematical expectation. Mixed Random Variable Distribution and Density function s,Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh. **UNITII****Operations on Random variable:** Moments-moments about the origin, Central moments, Variance and Skew, Chebyshev’s inequality ,moment generating function ,characteristic function.  Multiple Random Variables: Vector Random Variables ,Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density– Point Conditioning ,Interval conditioning ,Statistical Independence. **UNITIII****Operations on Multiple Random variables:** Operations on Multiple Random Variables: Expected Value of a Function of Random Variables ,Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties of Gaussian random variables. **UNITIV****Complex Variable– Differentiation:** Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations ,analytic functions harmonic functions ,finding harmonic conjugate-construction of analytic function by Milne Thomson method. **UNITV****Complex Variable–Integration:** Line integral-Contour integration, Cauchy’s integral theorem (Simple Case), Cauchy Integralformula,Powerseriesexpansions:Taylor’sseries,zerosofanalyticfunctions,singularities, Laurent’s series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. | | | |
| **Text Books**  **&**  **Reference Books** | **Textbooks:**  1. Peyton Z. Peebles, “Probability, Random Variables & Random Signal Principles”, 4thEdition,TMH,2002. 2. B.S.Grewal,HigherEngineeringMathematics,KhannaPublishers,2017,44thEdition  **ReferenceBooks:**  1. Athanasios Papoulis and S.UnnikrishnaPillai,“Probability,Random Variables andStochastic Processes”,4thEdition,PHI,2002 2. ErwinKreyszig,AdvancedEngineeringMathematics,WileyIndia 3. HenryStarkandJohnW.Woods,“ProbabilityandRandomProcesseswithApplicationtoSignalProcessing,”3rd Edition,PearsonEducation,2002. 4. B.V.Ramana,HigherEngineeringMathematics,McGrawHillpublishers.  **OnlineLearningResources:** 1.https://onlinecourses.nptel.ac.in/noc20\_ma50/preview     2.https://onlinecourses.nptel.ac.in/noc21\_ma66/preview | | | |

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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** | **2** |
| CO2 | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **2** |
| CO3 | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **2** |
| CO4 | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **2** |
| CO5 | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **2** |