**Probability for Computing**

**Tentative Guidelines**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit** | **Topic** | **Reference** | |
| **Table of Content** | **Book** |
| **1.** | Basic Probability: Introduction to the notion of probability, Random experiment, Sample space and Events, Probability defined on events, Algebra of events. Conditional probabilities, independent events, Bayes’ theorem. | **1.1**  **1.2**  **1.3**  **1.4**  **1.5**  **1.6** | **[1]** |
| **2.** | Random Variables: Introduction to Random Variables, Probability mass/density functions, Cumulative distribution functions. Discrete Random Variables (Bernoulli, Binomial, Poisson, Multinomial and Geometric). Continuous Random Variables (Uniform, Exponential and Normal). Expectation of a Random Variable, Expectation of Function of a Random Variable and Variance. Markov inequality, Chebyshev’s inequality, Central Limit Theorem, Weak and Strong Laws of Large Numbers. | **2.1**  **2.2**  **2.3 (Excluding 2.3.3)**  **2.4**  **2.8** | **[1]** |
| **3.** | Joint Distributions: Jointly distributed Random Variables, Joint distribution functions, Independent Random Variables, Covariance of Random Variables, Correlation Coefficients, Conditional Expectation. | **2.5.1**  **2.5.2**  **2.5.3**  **3.1**  **3.2**  **3.3**  **3.4** | **[1]** |
| **4.** | Markov Chain and Information Theory: Introduction to Stochastic Processes, Chapman–Kolmogorov equations, Classification of states, Limiting and Stationary Probabilities.  Random Number Generation, Pseudo Random Numbers, Inverse Transformation Method, Rejection Method, Uncertainty, Information and Entropy, Mutual Information, KL Divergence. | **4.1**  **4.2**  **4.3**  **(Till example 4.17)**  **4.4**  **(Till example 4.22)** | **[1]** |

**References**

[1] Sheldon M. Ross Introduction to Probability Models, 10th Edition, Elsevier, 2019.

[2] Trivedi, K.S. Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd edition, Wiley, 2015.

[3] Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, Mathematics for Machine Learning, 1st edition, Cambridge University Press, 2020.

[4] Ian F. Blake, An Introduction to Applied Probability, John Wiley.

**Additional References**

1. James L. Johnson, Probability and Statistics for Computer Science, 6th edition, Wiley, 2004.
2. David Forsyth, Probability and Statistics for Computer Science, 1st edition, Springer, 2019.
3. Freund J.E., Mathematical Statistics with Applications, 8th edition, Pearson Education, 2013.
4. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 9th edition, Cengage Learning, 2020.