Course: OE
Introduction to Probability Theory

| Semester: II | Credits: 2 | Subject Code: OE1-22306 | Lectures: 30 |

Course Outcomes:

At the end of the course the learner will be able to:
- CO1 - Apply methods of Counting Principles, Permutation, and Combination to real life situations. Apply concepts of experiments, sample space, events required in the calculation of probabilities.
- CO2 - Use the basic probability rules, including additive and multiplicative laws, independent and mutually exclusive events, in problem solving.
- CO3 - Understand and apply concepts of conditional probabilities and independence of random variables.
- CO4 - Understand and apply discrete probability distributions to various real life problems.

Unit 1: Theory of Probability   15

- Counting Principles, Permutation, and Combination.
- Deterministic and non-determination models.
- Random Experiment, Sample Spaces (Discrete and continuous)
- Events: Types of events, Operations on events.
- Probability - classical definition, probability models, axioms of probability, Probability of an event.
- Theorems of probability (without proof)
i) $0 \leq P(A) \leq 1$, ii) $P(A) + P(A') = 1$, iii) $P(\Phi) = 0$, iv) $P(A) \leq P(B)$ when $A \subset B$,
ii) iv) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- Numerical problems related to real life situations.
- Concepts and definitions of conditional probability, multiplication theorem
  $P(A \cap B) = P(A).P(B|A)$
- Bayes' theorem and its applications.
- Concept and definition of independence of two events.
- Numerical problems related to real life situations.

Unit 2: Random variable, Standard Discrete Distributions   15

- Definition of random variable (r.v.), discrete and continuous random variable.
- Definition of probability mass function (p.m.f.) of discrete r.v.
- Cumulative distribution function (c.d.f.) of discrete r.v. and their properties. (Characteristic properties only)
- Definition of expectation and variance of discrete r.v., theorems on expectation and variance (statement only).
- Determination of median and mode using p.m.f. only. Problem solving.
- Discrete Uniform Distribution: definition, mean, variance.
- Binomial Distribution: definition, mean, variance, additive property, Bernoulli distribution as a particular case with n =1. Illustration of real life situations.

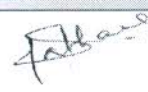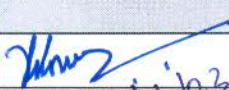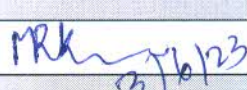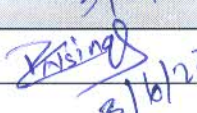| Board of Studies	Department	Name	Signature
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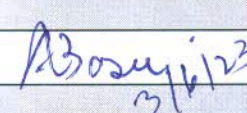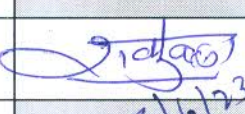
- Poisson Distribution: definition, mean, variance, mode, additive property, limiting case of B(n,p). Illustration of real life situations.
- Problem solving.
  * Only statements of mean and variance, derivation is not expected.

Recommended: Text books

- Kulkarni M.B., Ghatpande S.B., Gore S.D. 1999, *Common Statistical Tests*, Satyajeet Prakashan, Pune
- Kulkarni M.B., Ghatpande S.B. 2007, *Introduction to Discrete Probability and Probability Distributions* SIPF Academy
- Sarma K.V.S. 2001 *Statistics Made Simple. Do it Yourself on P.C.* Prentice Hall

Reference Books:

- Agarwal B. L., *Programmed Statistics*, New Age International Publishers.
- Freund J.E., *Modern Elementary Statistics*, Pearson Publication, 2005.
- George W. Snedecor, William G, Cochran, *Statistical Methods*, John Wiley & sons
- Kennedy and Gentle, *An Introductory Statistics*.
- Kulkarni M.B., Ghatpande S.B., *Introduction to Discrete Probability and Probability Distributions*, SIPF Academy, 2007.
- Medhi J., *Statistical Methods (An Introductory Text)*, New Age International, 1992.
- Mukhopadhyay P., *Mathematical Statistics (3rd Edition)*, Books And Allied (P), Ltd 2015.
- Probability, Statistics, *Design of Experiments and Queuing Theory with Applications of Computer Science*, Trivedi K.S., Prentice Hall of India, New Delhi 2001.
- Sheldon Ross, *A First course in Probability*, Pearson Education Inc.

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