Teaching Plan

Month	Period	Topic / sub- topic to be taught (f.y term- 1)
July	5	**1. Sample Space and Events (2extra)** 1.1 Experiments/Models, Ideas of deterministic and non-deterministic models. 1.2 Definitions of - (i) Sample space, (ii) Discrete sample space : finite and countably infinite, (iii) Event, (iv) Elementary event, (v) Complement of an event. 1.3 Concepts of occurrence of an event. 1.4 Algebra of events and its representation in set theory notations. Occurrence of : (i) at least one of the given events, (ii) none of the given events, (iii) all of the given events, (iv) mutually exclusive events, (v) mutually exhaustive events, (vi) exactly one event out of the given events. 1.5 Examples and Problems
August	9	**2. Probability (for finite sample space only)** 2.1 Equiprobable sample space, probability of an event, certain event, impossible event, classical definition of probability and its limitations, relative frequency approach. 2.2 Non-equiprobable sample space, probability with reference to a finite sample space : probability assignment approach, probability of an event. 2.3 Axioms of probability. 2.4 Probability of union of two events. Theorem of total probability P(A [B) = P(A) + P(B) − P(A \ B) and its generalization to three events (withproof). 2.5 To prove (i) P(A') = 1 − P(A), (ii) If Ais a subset of B, P(A) ≤ P(B), (iii) $P(\bigcup_{i=1}^{k} Ai) \leq P($

		$\sum_{i=1}^{k} Ai$) (Boole’s inequality). 2.6 Examples and Problems. **3. Conditional Probability and Independence.(3reamain out of 12 in augeust)** 3.1 Definition of independence of two eventsP(A \ B) = P(A) · P(B) 3.2 Pairwise independence and mutual independence for three events. 3.3 Definition of conditional probability of an event.
Sept.	9	3.4 Multiplication theorem P(A ∩ B) = P(A) · P(B/A). Generalisation to P(A∩ B∩ C). 3.5 Bayes’ Theorem (with proof). 3.6 Examples and Problems. **4. Univariate Probability Distributions (defined on Discrete Sample Space)** 4.1 Concept and definition of a discrete random variable. 4.2 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), F(·) of discrete random variable, properties of (c.d.f.). 4.3 Mode and median of a univariate discrete probability distribution. 4.2 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), F(·) of discrete random variable, properties of (c.d.f.).
Oct.	10	4.3 Mode and median of a univariate discrete probability distribution. 4.4 Examples and Problems. **5. Mathematical Expectation (Univariate Random Variable) (remaing 5 lec)** 5.1 Definition of expectation of a random variable, expectation of a function of a random variable. 5.2 Definitions of mean, variance of univariate probability distribution, effect of change of origin and scale on mean and variance. 5.3 Probability generating function (PGF), Simple properties, mean and variance using PGF.

Teaching Plan

Month	Period	Topic / sub- topic to be taught (f.y term- 2)
Nov.	9	5.4 Definition of raw, central and factorial moments of univariate probability distributions and their interrelations. 5.5 Examples and Problems.
Dec	12	**6. Bivariate Probability Distribution (defined on Finite Sample Space)** 6.1 Definition of two-dimensional discrete random variable, its joint p.m.f. and its distributionfunction and their properties. 6.2 Computation of probabilities of events in bivariate probability distribution. 6.3 Concepts of marginal and conditional probability distributions. 6.4 Independence of two discrete random variables. 6.5 Examples and Problems. **7. Mathematical Expectation (Bivariate Random Variable)** (remaining 1 lec) 7.1 Definition.
Jan.	6	7.2 Theorems on expectations of sum and product of two jointly distributed random variables. 7.3 Conditional expectation. 7.4 Definitions of conditional mean and conditional variance. 7.5 Definition of raw and central moments. 7.6 Definition of covariance, correlation of coefficient (ρ), independence and uncorrelatednessof two variables. 7.7 Variance of linear combination of variables. 7.8 Examples and Problems. **8. Some Standard Discrete Probability Distribution (remaining 9**

		lec) 8.1 Uniform discrete distribution on integers 1 to n: - p.m.f., c.d.f,mean, variance, reallife situations, comment of mode and median. 8.2 Bernoulli Distribution : p.m.f., mean variance, moments distribution of sum of independent identically distributed Bernoulli variables. 8.3 Binomial Distribution : p.m.f. P(x)= $\{\binom{n}{x} p^x q^{n-x}$; x=0,1,....,n. 0<p<1, q=1-p. X follows Binomial with parameter n and p. Recurrence relation for successive probabilities, computation of probabilities of different events, computation of median for given parameters, mode of the distribution, mean, variance, moments, skewness (comments when p = 0.5, p > 0.5, p < 0.5), P.G.F. additive property of binomial variables, conditional distribution of X given X + Y , where X and Y are independent, B(n_1, p) and B(n_2, p) variables.
		8.4 Hypergeometric Distribution : p.m.f., p(x)= $\{\binom{M}{x}\binom{N-M}{n-x}/\binom{N}{n}$; x=a,a+1,....,b. where a = max(0, n − N + N), b = min(n,M) Notation : X is follows H(N,M, n). Computation of probability, situations where this distribution is applicable, binomial approximation to hypergeometric probabilities, mean and variance of the distribution. 8.5 Poisson Distribution : p.m.f. p(x) = e^{-m}m^{x}
Feb.	24	

		x! , x = 0, 1, 2, · · · ; m > 0. State the mean, variance, additive property (no derivation). Derivation of Poisson distribution as a limiting case of binomial distribution. 8.6 Example and Problems.