K. T. S. P. Mandal's
Hutatma Rajguru Mahavidyalaya , Rajgurunagar
Department Of Statistics
Syllabus Completion Report
Academic Year 2023-24Term- I

Sr.No	Class	Paper	Name of Teacher
1	F.Y.B.Sc	Descriptive Statistics I	Thorat S.R.
2	F.Y.B.Sc	Discrete Probability	Thorat S.R.
3	S.Y.B.Sc	Continuous Probability Distributions	Thorat S.R.

Paper : Descriptive Statistics I. **Class: F.Y.B.Sc**

Month	Topic	Subtopic
July 2023	1**. Introduction to Statistics**	1.1 Meaning of Statistics as a Science. 1.2 Importance of Statistics. 1.3 Scope of Statistics: 1.4 Statistical organizations in India and their functions:
	2. Population and Sample	2.1 Types of characteristics: 2.2 Types of data: 2.3 Notion of a statistical population 2.4 Methods of sampling
	3.Presentation of data	3.1 Classification 3.2 Frequency Distribution 3.3 Methods of classification 3.4 Cumulative frequencies 3.5 Relative frequency

		3.6 Guidelines for choice of classes 3.7 Graphical representation of statistical data 3.8 Stem and leaf chart 3.9 Data Analysis and interpretation
Aug 2023 **Sept 2023** **Oct 2023**	**4. Measures of central tendency** **5. Measures of Dispersion**	4.1 Introduction 4.2 Objectives of Measures of Central Tendency 4.3 Arithmetic Mean (A.M.) 4.4 Trimmed mean 4.5 Median 4.7 Geometric mean 4.8 Mode Harmonic mean 4.9 Weighted means 4.9 Partition values 4.10 Box and whisker plot 5.1 Introduction 5.2 Measures of Dispersion 5.3 Range and Coefficient of range 5.4 Quartile deviation 5.5 Mean deviation and coefficient of mean deviation 5.6 Mean square deviation 5.7 Variance , standard deviation , coefficient of variation
Nov 2023	**6. Moments** **7. Skewness and Kurtosis**	6.1 Raw moments (m'r) for ungrouped and grouped data 6.2 Central moments (mr) for ungrouped and grouped data 6.3 Relations between central moments and raw moments, upto 4-th order 7.1 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution. 7.2 Bowley's coefficient of skewness

Nov 2023		7.3 Karl Pearson's coefficient of skewness. 7.4 Measures of skewness based on moments (β_1,γ_1). 7.4 Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency distributions. 7.5 Measures of kurtosis based on moments (β_2,γ_2).
Nov 2023	**8. Theory of Attributes**	8.1 Attributes: 8.2 Consistency of data upto 2 attributes. 8.3 Concepts of independence and association of two attributes. 8.4 Yule's coefficient of association (Q), $-1 \leq Q \leq 1$, interpretation.

Paper : Discrete Probability and probability Distributions I

Class: F.Y.B.Sc

Month	Topic	Subtopic
July 2023	**1. Basics of Probability**	1.1 Experiments/Models, Ideas of deterministic and non-deterministic models. Random Experiment, concept of statistical regularity. 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. (vi) Certain event (vii) Impossible event Concept of occurrence of an event. Algebra of events and its representation in set theory notation. Occurrence of following events. (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. 1.3 Classical definition of probability and its limitations. Probability model, probability of an event, equiprobable and non-equiprobable sample space, 1.4 Axiomatic definition of probability. Theorems And results on probability with proofs based on axoomatic approach. Such as, $P(AUB) = P(A)+P(B)- P(A\cap B)$ Generalisation $P(AUBUC), 0\leq P(A)\leq 1, P(A)+P(A')=1, P(\phi)=0$, $P(A) \leq P(B)$ if A is subset of B, Boole's inequality 2.1 Definition of conditional probability of an event. Definition of independence of two events

	2.Conditional Probability and Baye's theorem	$P(A \cap B) = P(A) \cdot P(B)$ Pairwise independence and mutual independence for three events Multiplication theorem $P(A \cap B) = P(A) \cdot P(B\|A)$. Generalization to $P(A \cap B \cap C)$. 2.2 Partition of the sample space Proof of Bayes' theorem. Applications of Bayes' theorem in real life True Positive, False positive and sensitivity of test as application of Baye's theorem.
Aug 2023 **Sept 2023**	**3. Univariate Probability Distributions (Defined on Discrete Sample Space)** **4. Mathematical Expectation (Univariate Random Variable)**	3.1 Concept and definition of a discrete random variable. 3.2 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), $F(\cdot)$ of discrete random variable, properties of c.d.f.. 3.3 Mode and median of a univariate discrete probability distribution 4.1 Definition of expectation (Mean) of a random variable, expectation of a function of a random variable, , m.g.f. and c.g.f. Properties of m.g.f and c.g.f. 4.2 Definitions of variance, standard deviation (s.d.) and Coefficient of variation (c.v.) of univariate probability distribution, effect of change of origin and scale on mean, variance and s.d. 4.3 Definition of raw, central and factorial raw moments of univariate probability Distributions and their interrelations **(**without proof). 4.4 Coefficients of skewness and kurtosis based on moments.

Oct / Nov 2023	**5. Some Standard Discrete Probability Distributions - I**	5.1 Degenerate distribution, mean and variance 5.2 Uniform discrete distribution, p.m.f., c.d.f., mean, variance, real life situations, comments on mode and median 5.3 Bernoulli Distribution: p.m.f., mean, variance 5.4 Binomial Distribution: p.m.f., mean, variance 5.5 Hypergeometric Distribution : p.m.f., Computation of probability, situations where this distribution is applicable, binomial approximation to hypergeometric probabilities, mean and variance of the distribution

Paper : Continuous Probability Distributions Class: S.Y.B.Sc (Sem-III)

Month	Topic	Subtopic
Aug 2023	**1.Continuous Univariate Distributions:**	1.1 Continuous sample space: Definition, illustrations. Continuous random variable: Definition, probability density function (p.d.f.), cumulative distribution function (c.d.f.), properties of c.d.f. (without proof), probabilities of events related to random variable. 1.2 Expectation of continuous r.v., expectation of function of r.v. E[g(X)], mean, variance, geometric mean, harmonic mean, raw and central moments, skewness, kurtosis. 1.3 Moment generating function(M.G.F.):Definition and properties,cumulant generating function (C. G. F.) : definition, properties. 1.4 Mode, median, quartiles. 1.5 Probability distribution of function of r. v.: $Y = g(X)$ using i) Jacobian of transformation for g(.) monotonic function and one-to-one, on to functions, ii) Distribution function for $Y = X^2$, $Y = \|X\|$ etc., iii) M.G.F. of g(X).
Aug/ sept 2023	**2.Continuous Bivariate Distributions:**	2.1 Continuous bivariate random vector or variable b(X, Y): Joint p. d. f. , joint c. d. f , properties (without proof), probabilities of events related to r.v. (events in terms of regions bounded by regular curves, circles, straight lines). Marginal and conditional distributions.

		2.2 Expectation of r.v., expectation of function of r.v. E[g(X, Y)], joint moments, Cov (X,Y), Corr (X, Y), conditional mean, conditional variance, E[E(X|Y = y)] = E(X), regression as a conditional expectation. 2.3 Independence of r. v. (X, Y) and its extension to k dimensional r. v. Theorems on expectation: i) E(X + Y) = E(X) + E(Y), (ii) E(XY) = E(X) E(Y), if X and Y are independent, generalization to k variables. E(aX + bY + c), Var (aX + bY + c). 2.4 M.G.F. : $M_{X,Y}(t_1, t_2)$, properties, M.G.F. of marginal distribution of r. v.s., properties $M_{X,Y}(t_1, t_2) = M_X(t_1, 0)\, M_Y(0, t_2)$, if X and Y are independent r. v.s., $M_{X+Y}(t) = M_{X,Y}(t, t)$, $M_{X+Y}(t) = M_X(t)\, M_Y(t)$ if X and Y are independent r.v.s. 2.5 Probability distribution of transformation of bivariate $U = f_1(X, Y)$, $V = f_2(X, Y)$.
Oct 2023	**3.Standard Univariate Continuous Distributions:**	**3.1 Uniform or Rectangular Distribution:** Probability density function (p.d.f.) Notation : X ~ U[a, b] . p. d. f., sketch of p. d. f., c. d. f., mean, variance, symmetry. Distribution of i) $X - a$, ii) $b - X$, iii) Y = F(X), where F(X) is the c. d. f. of continuous r. v. X. Application of the result to model sampling. (Distributions of X + Y, X – Y, XY and X/Y are not expected.)
Oct / Nov 2023		**3.2 Normal Distribution:** p. d. f. curve, identification of scale and location parameters, nature of probability curve, mean, variance,

		M.G.F., C.G.F., central moments, cumulants, b_1 , b_2 , g_1, g_2 , median, mode, quartiles, mean deviation, additive property, computations of normal probabilities using normal probability integral tables, probability distribution of : i) $\frac{X - m}{}$, ii) aX + b, iii) aX + bY + c, iv) X^2 , where X and Y are independent normal variates. Probability distribution of $\bar{X}$, the mean of n i. i. d. $N(m, s^2)$ r. v s. Normal probability plot, q-q plot to test normality. Model sampling from Normal distribution using (i) Distribution function method and (ii) Box-Muller transformation as an application of simulation. Statement and proof of central limit theorem (CLT) for i. i. d. r. v. s with finite positive variance.(Proof should be using M.G.F.) Its illustration for Poisson and Binomial distributions.
Nov 2023		**3.3 Exponential Distribution:** Probability density function (p. d. f.) Nature of p. d. f., density curve, interpretation of a as rate and $1 / a$ as mean, mean, variance, M. G. F., C. G. F., c. d. f., graph of c. d. f., lack of memory property, median, quartiles. Distribution of min(X, Y) with X, Y i. i. d. exponential r. v. s.

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Syllabus Completion Report
Academic Year 2023-24 Term II

Sr.No	Class	Paper	Name of Teacher
1	F.Y.B.Sc	Descriptive Statistics II	Thorat S.R.
2	F.Y.B.Sc	Discrete Probability Distributions	Thorat S.R.
3	S.Y.B.Sc	Sampling Distributions and Exact Test	Thorat S.R.

Paper : Descriptive Statistics II. **Class: F.Y.B.Sc**

Month	Topic	Subtopic
December 2023	1**. Correlation**	1.1 Bivariate data, Scatter diagram and interpretation. 1.2 Concept of correlation between two variables 1.3 Covariance between two variables (m11) : 1.4 Karl Pearson's coefficient of correlation (r) 1.5 Spearman's rank correlation coefficient: compute Karl Pearson's correlation coefficient between ranks.
Dec. 2023 **Jan. 2024**	**2. Fitting of Curve** **(Regression Line)**	2.1 Concept of dependent and independent variables. 2.2 Identification of response and predictor variables and relation between them. 2.3 Simple linear regression model: $Y= a + b X + \varepsilon$ 2.4 Concept of residual, plot of residual, coefficient of determination

Jan. /Feb. 2024	**3. Curve fitting**	3.1 Necessity and importance of drawing second degree curve. 3.2 Fitting of second degree curve 3.3 Fitting of exponential Curve of the type $Y=ab^x$ and $Y=aX^b$
March 2024	**4. Index Number**	4.1 Introduction. 4.2 Definition and Meaning. 4.3 Problems/considerations in the construction of index numbers. 4.4 Simple and weighted price index 4.5 Simple and weighted price index 4.6 Laspeyre's, Paasche's and Fisher's Index numbers. 4.7 Consumer price index number (i) family budget method (ii) aggregate expenditure method. 4.3 Shifting of base, splicing, deflating, purchasing power. 4.4 Description of the BSE sensitivity and similar index numbers.

Paper : Discrete probability Distributions **Class: F.Y.B.Sc**

Month	Topic	Subtopic
Jan. 2024	**1. Some Standard Discrete Probability Distributions**	**1.1 Poisson distribution:** m.g.f. and c.g.f. Moments, mean, variance, skewness and kurtosis, Additive Property for Poisson distribution Conditional distribution of X given (X+Y) for Poisson distribution. **1.2 Geometric distribution:** Mean, variance, m.g.f. and c.g.f. Lack of memory Property.
Feb 2024	**2. Bivariate Discrete Probability Distribution**	2.1 Definition of two-dimensional discrete random variable, its joint p.m.f. and its distribution function and their properties 2.2 Concept of identically distributed random variables. 2.3 Computation of probabilities of events in bivariate probability distribution. 2.4 Concepts of marginal and conditional probability distributions. 2.5 Independence of two discrete random variables based on joint and marginal p.m.f.s
March 2024	**3.Mathematical Expectation (Bivariate Random Variable)**	3.1 Definition of raw and central moments, m.g.f, c.g.f. 3.2 Theorems on expectations .3.3 Conditional expectation. 3.4 Definitions of conditional mean and conditional variance. 3.5 Definition of covariance, coefficient of correlation, independence and uncorrelatedness of two variables. 3.6 Variance of linear combination of variables Var(aX + bY).Correlation coefficient

Paper : Sampling Distributions and Exact Test **Class: S.Y.B.Sc (Sem-IV)**

Month	Topic	Subtopic
Feb 2024	**1. Gamma Distribution**	P.D.F , Nature of Probability curve , M.G.G,C.G.F, moments,Cumulants,Skewness,Kurtosis,Mode, Additive Property, Distribution of sum of i.i.d exponential variables.
March 2024	**2.Chi-square Distribution**	Definition of Chi-squarer. v. as sum of squares of i. i. d. standard normal variables Derivation of p. d. f. of with n degrees of freedom (d. f.) using M. G. F., nature of p. d. f. curve, computations of probabilities using tables of distribution. mean, variance, M. G. F., C. G. F., central moments, mode, additive property.
	3.Student's t-distribution	Definition of T r. v. with n d. f. Derivation of p. d. f., nature of probability curve, mean, variance, moments, mode, use of tables of t-distribution for calculation of probabilities, statement of normal approximation.
March / April 2024	**4.Snedecore's F-distribution:**	Definition of F r. v. with n_1 and n_2 d. f. Derivation of p. d. f., nature of probability curve, mean, variance, moments, mode. Distribution of 1/F use of tables of F-distribution for calculation of probabilities. Interrelations between Chi-Square , T and F distribution. Tests based on chi-square distribution: Test for independence of two attributes arranged in 2 X2 contingency table. (With Yates' correction).

April 2024	**5.Test of Hypothesis:**	Test for independence of two attributes arranged in r X s contingency table, McNemar's test Test for 'Goodness of Fit'. (Without rounding-off the expected frequencies). d) Test for population variance equal to specified σ_0^2 value. when i) mean is known , ii) mean is unknown. Tests based on t-distribution: t-tests for population means : i) one sample and two sample tests for one sided and two sided alternatives. Confidence interval. Paired t-test for one-sided and two-sided alternatives. Test based on F-distribution: Test for equality of two population variance. when i) means are known, ii) means are unknown.

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