# K. T. S. P. Mandal's
# Hutatma Rajguru Mahavidyalaya , Rajgurunagar
## Department Of Statistics
## Teaching Plan
## Academic Year 2020-21
## Term- 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 | Discrete Probability Distributions and Time series | Thorat S.R. |
| **4** | S.Y.B.Sc | Continuous Probability Distributions | Thorat S.R. |

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

| Month | Topic | Subtopic |
|---|---|---|
| **Sept/Oct 2020** | 1**. Introduction to Statistics** | 1.1 Meaning of Statistics as a Science.<br>1.2 Importance of Statistics.<br>1.3 Scope of Statistics:<br>1.4 Statistical organizations in India and their functions: |
| | **2. Population and Sample** | 2.1 Types of characteristics:<br>2.2 Types of data:<br>2.3 Notion of a statistical population<br>2.4 Methods of sampling |
| | **3.Presentation of data** | 3.1 Classification<br>3.2 Frequency Distribution<br>3.3 Methods of classification |

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| | | 3.4 Cumulative frequencies<br>3.5 Relative frequency<br>3.6 Guidelines for choice of classes<br>3.7 Graphical representation of statistical data<br>3.8 Stem and leaf chart<br>3.9 Data Analysis and interpretation |
| **Oct/Nov 2020** | **4. Measures of central tendency** | 4.1 Introduction<br>4.2 Objectives of Measures of Central Tendency<br>4.3 Arithmetic Mean (A.M.)<br>4.4 Trimmed mean<br>4.5 Median<br>4.7 Geometric mean<br>4.8 Mode Harmonic mean<br>4.9 Weighted means<br>4.9 Partition values<br>4.10 Box and whisker plot |
| | **5. Measures of Dispersion** | 5.1 Introduction<br>5.2 Measures of Dispersion<br>5.3 Range and Coefficient of range<br>5.4 Quartile deviation<br>5.5 Mean deviation and coefficient of mean deviation<br>5.6 Mean square deviation<br>5.7 Variance , standard deviation , coefficient of variation |
| **Dec 2020** | **6. Moments** | 6.1 Raw moments (m'r) for ungrouped and grouped data<br>6.2 Central moments (mr) for ungrouped and grouped data<br>6.3 Relations between central moments and raw moments, upto 4-th order |
| | **7. Skewness and Kurtosis** | 7.1 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution.<br>7.2 Bowley's coefficient of skewness<br>7.3 Karl Pearson's coefficient of skewness.<br>7.4 Measures of skewness based on moments ($\beta 1, \gamma 1$). |

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| **Jan/ feb 2021** | **8. Theory of Attributes** | 7.4 Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency distributions.<br>7.5 Measures of kurtosis based on moments ($\beta 2, \gamma 2$).<br><br>8.1 Attributes:<br>8.2 Consistency of data upto 2 attributes.<br>8.3 Concepts of independence and association of two attributes.<br>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 |
|---|---|---|
| **Sept/Oct 2020** | **1. Basics of Probability** | 1.1 Experiments/Models, Ideas of deterministic and non-deterministic models.<br>Random Experiment, concept of statistical regularity.<br>1.2 Definitions of - (i) Sample space,<br>(ii) Discrete sample space: finite and countably infinite, (iii) Event, (iv) Elementary event,<br>(v) Complement of an event. (vi) Certain event<br>(vii) Impossible event<br>Concept of occurrence of an event.<br>Algebra of events and its representation in set theory notation.<br>Occurrence of following events.<br>(i) at least one of the given events,<br>(ii) none of the given events,<br>(iii) all of the given events,<br>(iv) mutually exclusive events,<br>(v) mutually exhaustive events,<br>(vi) exactly one event out of the given events.<br>1.3 Classical definition of probability and its limitations.<br>Probability model, probability of an event, equiprobable and non-equiprobable sample space,<br>1.4 Axiomatic definition of probability. Theorems And results on probability with proofs based on axoomatic approach. Such as,<br>$P(AUB) = P(A)+P(B)- P(A\cap B)$<br>Generalisation<br>$P(AUBUC), 0\leq P(A)\leq 1, P(A)+P(A')=1, P(\phi)=0,$<br>$P(A) \leq P(B)$ if A is subset of B, Boole's inequality |
| | **2.Conditional Probability and** | 2.1 Definition of conditional probability of an event.<br>Definition of independence of two events |

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| | **Baye's theorem** | $P(A \cap B) = P(A) \cdot P(B)$<br>Pairwise independence and mutual independence for three events<br>Multiplication theorem $P(A \cap B) = P(A) \cdot P(B\|A)$.<br>Generalization to $P(A \cap B \cap C)$. |
| **Nov 2020** | **3. Univariate Probability Distributions (Defined on Discrete Sample Space)**<br><br>**4. Mathematical Expectation (Univariate Random Variable)** | 2.2 Partition of the sample space<br>Proof of Bayes' theorem. Applications of Bayes' theorem in real life<br>True Positive, False positive and sensitivity of test as application of Baye's theorem.<br><br>3.1 Concept and definition of a discrete random variable.<br>3.2 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), $F(\cdot)$<br>of discrete random variable, properties of c.d.f..<br>3.3 Mode and median of a univariate discrete probability distribution<br><br>4.1 Definition of expectation (Mean) of a random variable, expectation of a function<br>of a random variable, m.g.f. and c.g.f. Properties of m.g.f and c.g.f.<br>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. |
| **Jan 2021** | | 4.3 Definition of raw, central and factorial raw moments of univariate probability<br>Distributions and their interrelations **(**without proof).<br>4.4 Coefficients of skewness and kurtosis based on moments. |

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| | **5. Some Standard Discrete Probability Distributions - I** | 5.1 Degenerate distribution, mean and variance<br>5.2 Uniform discrete distribution, p.m.f., c.d.f., mean, variance,<br>real life situations, comments on mode and median<br>5.3 Bernoulli Distribution: p.m.f., mean, variance |
| **Feb 2021** | | 5.4 Binomial Distribution: p.m.f., mean, variance<br>5.5 Hypergeometric Distribution : p.m.f., Computation of probability, situations where this distribution is applicable,<br>binomial approximation to hypergeometric probabilities, mean and variance of<br>the distribution |

**Paper : Discrete Probability Distributions and Time series**

**Class: S.Y.B.Sc ( Sem-I)**

| Month | Topic | Subtopic |
|---|---|---|
| **Sept/Oct 2020** | **1. Statndard Discrete Distributions** | **1.1 Negative Binomial Distribution:** Probability mass function (p. m. f.)<br><br>Notation: X ~ NB (k, p).<br><br>Nature of p. m. f., negative binomial distribution as a waiting time distribution, M.G.F., C.G.F., mean, variance, skewness, kurtosis (recurrence relation between moments is not expected). Relation between geometric and negative binomial distribution. Poisson approximation to negative binomial distribution. Real life |
| **Nov 2020** | | **1.2 Multinomial Distribution:** Probability Mass function, Notation<br>use of MGF to obtain means, variances, covariances, total correlation coefficients, multiple and partial correlation coefficients for k= 3, univariate marginal distribution, distribution of $X_i + X_j$ , conditional distribution of $X_i$ given $X_i + X_j = r$ ,<br>variance – covariance matrix, rank of variance – covariance matrix and its interpretation and real life situations and applications. |

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| **Dec 2020** | | **1.3 Truncated Distributions:**<br><br>Concept of Truncated distribution, truncation to the right, left and on both sides. Binomial distribution B(n, p) left truncated at X=0 (value zero is discarded), its p.m.f., mean, variance .<br>Poisson distribution P(m) left truncated at X=0 (value zero is discarded), its p.m.f. , mean, variance. Real life situations and applications. |
| **Jan/ Feb 2021** | **2.Time Series:** | 2.1 Meaning and utility of time series, Components of time series: trend, seasonal variations, cyclical variations, irregular (error) fluctuations or noise.<br><br>2.2 Exploratory data analysis: Time series plot to (i) check any trend, seasonality in the time series (ii) learn how to capture trend.<br><br>2.3 Methods of trend estimation and smoothing: (i) moving average, (ii) curve fitting by least square principle, (iii) exponential smoothing.<br><br>2.4 Measurement of seasonal variations :<br>i) simple average method,<br>ii) ratio to moving average method, iii) ratio to trend where trend is calculated by method of least squares. |

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| | | 2.5 Choosing parameters for smoothing and forecasting.<br>2.6 Forecasting based on exponential smoothing.<br><br>2.7 Double exponential smoothing i.e. Holt-Winters method<br><br>2.8 Fitting of autoregressive model AR (1), plotting of residuals.<br><br>2.9 Data Analysis of Real Life Time Series: |

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

| Month | Topic | Subtopic |
|---|---|---|
| **Sept/ Oct 2020** | **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.<br>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.<br>1.3 Moment generating function(M.G.F.):Definition and properties,cumulant generating function ( C. G. F.) : definition, properties.<br>1.4 Mode, median, quartiles.<br>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). |
| **Nov 2020** | **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.<br><br>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.<br><br>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). |

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| | | 2.4 M.G.F. : $M_{X,Y}(t_1, t_2)$ , properties, M.G.F. of marginal distribution of r. v.s., properties<br><br>$M_{X,Y}(t_1, t_2) = M_X(t_1, 0)\, M_Y(0, t_2)$ , if X and Y are independent r. v.s.,<br>$M_{X+Y}(t) = M_{X,Y}(t, t)$ ,<br><br>$M_{X+Y}(t) = M_X(t)\, M_Y(t)$ if X and Y are independent r.v.s.<br>2.5 Probability distribution of transformation of bivariate<br>$U = f_1(X, Y)$ ,<br>$V = f_2(X, Y)$ . |
| **Dec 2020** | **3.Standard Univariate Continuous Distributions:** | **3.1 Uniform or Rectangular Distribution:**<br>Probability density function (p.d.f.)<br>Notation : X ~ U[a, b] .<br>p. d. f., sketch of p. d. f., c. d. f., mean, variance, symmetry. Distribution of<br>i) $X - a$ , ii) $b - X$ , iii) Y = F(X), where F(X) is the c. d. f. of continuous r. v. X.<br>Application of the result to model sampling.<br>(Distributions of X + Y, X – Y, XY and X/Y are not expected.) |
| **Dec 2020/ Jan 2021** | | **3.2 Normal Distribution:**<br><br>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,<br>computations of normal probabilities using normal probability integral tables,<br>probability distribution of : i) $X - m$ ,<br>ii) aX + b, iii) aX + bY + c, iv) $X^2$ , where X and Y are independent normal variates. Probability distribution of |

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| | | $\bar{X}$ , 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. |
| **Jan/Feb 2021** | | **3.3 Exponential Distribution:**<br><br>Probability density function (p. d. f.)<br><br>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. |

Prof .Thorat S.R.

| Sr.No. | Class | Paper | Name of Teacher |
|---|---|---|---|
| 1 | F.Y.B.C.S. | Descriptive Statistics-I | Bakare S.M. |
| **2** | F.Y.B.C.S. | Mathematical Statistics | Bakare S.M. |
| **3** | F.Y.B.B.A (C.A) | Business Statistics | Bakare S.M. |
| **4** | F.Y.B.Com. | Business Mathematics and Statistics | Bakare S.M. |

**Paper : Descriptive Statistics-I** **Class: F.Y.B.Sc(Computer Science)**

| Month | Topic | Subtopic |
|---|---|---|
| **Sept 2020** | **1.Data Condensation and Presentation of data** | 1.1 Meaning of Statistics as a Science.<br>1.2 Importance of Statistics.<br>1.3 Scope of Statistics:<br>1.4 Data Condensation:<br>Types of data, attributes & variables<br>1.5. Graphical representation of statistical data<br>Histogram, Ogive curves, Stem and leaf chart |
| **Oct 2020** | **2. Descriptive Statistics** | 2.1 **Measures of central tendency**<br>2.2 Objectives of Measures of Central Tendency<br>2.3 Arithmetic Mean (A.M.)<br>2.4 Trimmed mean<br>2.5 Median & mode: Definition, Formula, merits & Demerits, graphical method for computation<br>2.6 Empirical relation<br>2.7 Partition values<br>2.8 Box and whisker plot<br><br>**2.9 Measures of Dispersion**<br>Introduction<br>2.10 Measures of Dispersion<br>2.11 Range and Coefficient of range<br>2.12 Quartile deviation<br>2.13 Mean deviation and coefficient of mean deviation<br>2.14 Mean square deviation<br>2.15 Variance , standard deviation , coefficient of variation |

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| **Nov / Dec 2020** | **3. Moments, Skewness and Kurtosis** | **Moments:**<br>3.1 Raw moments (m'r) for ungrouped and grouped data<br>3.2 Central moments (mr) for ungrouped and grouped data<br>3.3 Relations between central moments and raw moments, upto 4-th order<br><br>3.4 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution.<br>3.5 Bowley's coefficient of skewness<br>3.6 Karl Pearson's coefficient of skewness.<br>3.7 Measures of skewness based on moments ($\beta 1, \gamma 1$).<br>3.8 Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency<br>distributions.<br>3.9 Measures of kurtosis based on moments ($\beta 2, \gamma 2$). |
| **Jan 2021** | **4. Theory of Attributes** | 4.1 Attributes:<br>4.2 Consistency of data upto 2 attributes.<br>4.3 Concepts of independence and association of two attributes.<br>4.4 Yule's coefficient of association (Q), $-1 \leq Q \leq 1$, interpretation. |

**Paper : Mathematical Statistics Class: F.Y.B.Sc(Computer Science)**

| Month | Topic | Subtopic |
|---|---|---|
| **Sept 2020** | **1. Theory of Probability** | 1.1 Counting Principles, Permutation, and Combination.<br>1.2 Deterministic and non-determination models.<br>1.3 Random Experiment, Sample Spaces (finite and countably infinite)<br>1.4 Events: types of events, Operations on events.<br>1.5 Probability - classical definition, probability models, axioms of probability, probability of an event.<br>1.6 Theorems of probability (with proof) i) $0 \leq P(A) \leq 1$ ii) $P(A) + P(A') = 1$ iii) $P(A) \leq P(B)$ when $A \subset B$ iv) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$<br>1.7 Numerical problems related to real life situations |
| **Sept/ Oct 2020** | **2. Conditional Probability and Independence** | 2.1Concepts and definitions of conditional probability, multiplication theorem $P(A \cap B)=P(A).P(B\|A)$<br>2.2 Bayes' theorem (without proof)<br>2.3 Concept of Posterior probability, problems on posterior probability.<br>2.4 Definition of sensitivity of a procedure, specificity of a procedure. Application of Bayes' theorem to design a procedure for false positive and false negative.<br>2.5 Concept and definition of independence of two events.<br>2.6 Numerical problems related to real life situations. |
| **Oct/ Nov 2020** | **3. Random Variable** | 3.1 Definition of Discrete and continuous random variable (r. v.),<br>3.2 Definition of probability mass function (p.m.f.) of discrete r.v. and Probability density function of continuous r.v..<br>3.3 Cumulative distribution function (c.d.f.), its properties.<br>3.4 Definition of expectation and variance of discrete and continuous r.v., theorem on expectation and |

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| | | variance (statement only).<br>3.4 Determination of median and mode using p.m.f. only.<br>3.5 Numerical problems related to real life situations. |
| **Dec 2020 /Jan 2021** | **4. Standard Discrete Distributions** | 4.1Discrete Uniform Distribution: definition, mean, variance.<br>4.2 Binomial Distribution: definition, mean, variance, additive property, Bernoulli distribution as a particular case with n = 1.<br>4.3 Geometric Distribution (p.m.f $p(x) = pqx$ , x = 0,1,2.....): definition,mean, variance.<br>4.4 Poisson Distribution: definition, mean, variance, mode, additive property, limiting case of B(n, p)<br>4.5 Illustration of real life situations.<br>4.6 Numerical problems related to real life situations |

**Paper : Business Statistics** **Class: F.Y.B.B.A. (Sem-I)**

| Month | Topic | Subtopic |
|---|---|---|
| **Sept 2020** | **1.Concept of Statistics** | 1.1 Meaning of Statistics as a Science.<br>1.2 Importance of Statistics.<br>1.3 Scope of Statistics:<br>1.4 Data Condensation:<br>Types of data, attributes & variables<br>1.5. Graphical representation of statistical data<br>Histogram, Ogive curves, Cumulative frequency curve |
| **Oct 2020** | **2. Measures of central tendency** | 2.1 **Measures of central tendency**<br>2.2 Objectives of Measures of Central Tendency<br>2.3 Arithmetic Mean (A.M.)<br>2.4 Trimmed mean<br>2.5 Median & mode: Definition, Formula, merits & Demerits, graphical method for computation<br>2.6 Empirical relation<br>2.7 Partition values<br>2.8 Box and whisker plot |
| **Nov/ dec 2020** | **3. Measures of Dispersion** | **Measures of Dispersion**<br>Introduction<br>3.1Measures of Dispersion<br>3.2 Range and Coefficient of range<br>3.3Quartile deviation<br>3.4 Mean deviation and coefficient of mean deviation<br>3.5 Mean square deviation<br>3.6 Variance , standard deviation , coefficient of variation |
| **Jan 2021** | **4. Correlation and Regression** | 4.1 Concept of Correlation<br>4.2 Types of correlation<br>4.3 Karl Pearson's coefficient of correlation<br>4.4 Meaning of Regression<br>4.5 Two regression equations<br>4.6 Numerical problems. |

**Paper - Business Mathematics & Statistics-I** **Class**:F.Y.B.Com

| Sr. No. | Month | Topic |
|---|---|---|
| **1** | **Sept 2020** | **3. Population and Sample**<br>Definition of Statistics, Scope of Statistics in Economics, Management Science and Industry. Concept of population and sample, methods of data collection: Census and sampling with illustration. Methods of random sampling – SRSWR, SRSWOR, Stratified, Systematic |
| 2 | **Oct/ Nov 2020** | **4. Measure of Central tendency and Dispersion**<br>Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and ogive curves.<br>Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution,cumulative frequency distribution, Histogram and ogivecurves.<br>Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped andgrouped data. Combined mean, Merits and demerits ofmeasures of central tendency, Geometric mean:definition, merits and demerits, Harmonic mean:sdefinition, merits and demerits, Choice of A.M., G.M. and H.M.<br><br>Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems. |

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| **3** | **Dec 2020** | **1.Interest and Annuity**<br>Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems. |
| **4** | **Jan 2021** | **2.Shares and Mutual Funds**<br>Concept of share, face value, market value, dividend, brokerage, equity shares, preferential shares, bonus shares. Examples and Problems<br>Concept of Mutual Funds, Problems on calculation of Net Income after considering entry load, Dividend, Change in Net Asset Value (NAV) and exit load. Averaging of price under the Systematic Investment Plan (S.I.P.). Examples and Problems |

**Prof. Bakare S.M.**

# K. T. S. P. Mandal's
# Hutatma Rajguru Mahavidyalaya , Rajgurunagar
## Department Of Statistics
## Teaching Plan
## Academic Year 2020-21
## 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 | Test of Significance and Statistical Methods | Thorat S.R. |
| **4** | S.Y.B.Sc | Sampling Distributions and Exact Test | Thorat S.R. |

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

| Month | Topic | Subtopic |
|---|---|---|
| **May 2021** | 1**. Correlation** | 1.1 Bivariate data, Scatter diagram and interpretation.<br>1.2 Concept of correlation between two variables<br>1.3 Covariance between two variables (m11) :<br>1.4 Karl Pearson's coefficient of correlation (r)<br>1.5 Spearman's rank correlation coefficient:<br>compute Karl Pearson's correlation coefficient between ranks. |
| **June 2021** | **2. Fitting of Curve (Regression Line)** | 2.1 Concept of dependent and independent variables.<br>2.2 Identification of response and predictor variables and relation between them.<br>2.3 Simple linear regression model: $Y= a + b X + \varepsilon$<br>2.4 Concept of residual, plot of residual, coefficient of |

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| | | determination |
| **June/ July 2021** | **3. Curve fitting** | 3.1 Necessity and importance of drawing second degree curve.<br>3.2 Fitting of second degree curve<br>3.3 Fitting of exponential Curve of the type $Y=ab^x$ and $Y=aX^b$ |
| **July/Aug 2021** | **4. Index Number** | 4.1 Introduction.<br>4.2 Definition and Meaning.<br>4.3 Problems/considerations in the construction of index numbers.<br>4.4 Simple and weighted price index<br>4.5 Simple and weighted price index<br>4.6 Laspeyre's, Paasche's and Fisher's Index numbers.<br>4.7 Consumer price index number<br>(i) family budget method<br>(ii) aggregate expenditure method.<br>4.3 Shifting of base, splicing, deflating, purchasing power.<br>4.4 Description of the BSE sensitivity and similar index numbers. |

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

| Month | Topic | Subtopic |
|---|---|---|
| **May 2021** | **1. Some Standard Discrete Probability Distributions** | **1.1 Poisson distribution:**<br>m.g.f. and c.g.f. Moments, mean, variance, skewness and kurtosis,<br>Additive Property for Poisson distribution<br>Conditional distribution of X given (X+Y) for Poisson distribution.<br><br>**1.2 Geometric distribution:**<br>Mean, variance, m.g.f. and c.g.f.<br>Lack of memory Property. |
| **June/July 2021** | **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<br>2.2 Concept of identically distributed random variables.<br>2.3 Computation of probabilities of events in bivariate probability distribution.<br>2.4 Concepts of marginal and conditional probability distributions.<br>2.5 Independence of two discrete random variables based on joint and marginal p.m.f.s |
| **July/Aug 2021** | **3.Mathematical Expectation (Bivariate Random Variable)** | 3.1 Definition of raw and central moments, m.g.f, c.g.f.<br>3.2 Theorems on expectations<br>.3.3 Conditional expectation.<br>3.4 Definitions of conditional mean and conditional variance.<br>3.5 Definition of covariance, coefficient of correlation, independence and<br>uncorrelatedness of two variables.<br>3.6 Variance of linear combination of variables<br>Var( aX + bY).Correlation coefficient |

**Paper : Test of Significance and Statistical Methods**
**Class: S.Y.B.Sc ( Sem-IV)**

| Month | Topic | Subtopic |
|---|---|---|
| **May/June 2021** | **I) Tests of Hypothesis** | Statistics and parameters, statistical inference : problem of estimation and testing of hypothesis. Estimator and estimate. Unbiased estimator (definition and illustrations only). Statistical hypothesis, null and alternative hypothesis, Simple and composite hypothesis, one sided and two sided alternative hypothesis, critical region, type I error, type II error, power of the test, level of significance, p-value. Two sided confidence interval, finding probabilities of type I error and type II error when critical regions are specified .<br>i) Test for population mean equal to specified value<br>ii) Test of equality of two population mean<br>iii) Test for population proportion equal to specified value.<br>iv) Test for equality of two population proportions. |
| **June/July 2021** | **II) Multiple Linear Regression Model:** | Definition of multiple correlation coefficient $R_{Y.XX}$ .<br>Derivation of the expression for the multiple correlation coefficient. Properties of multiple correlation coefficient<br>Interpretation of coefficient of multiple determination $^{1\,2}$<br>Definition of partial correlation coefficient<br>Fitting of regression plane of Y on $X_1$ and $X_2$, by the method of least squares; obtaining normal equations, solutions of normal equations Residuals : Definition, order, derivation of variance, properties. Definition and interpretation of partial regression coefficients<br>Properties of partial correlation coefficient: |
| **July 2021** | **III) Dempgraphy** | Vital events, vital statistics, methods of obtaining vital statistics, rates of vital events, sex ratios, dependency ratio. |

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| | | Death/Mortality rates: Crude death rate, specific (age, sex etc.) death rate, standardized death rate (direct and indirect), infant mortality rate.<br>Fertility/Birth rate: Crude birth rate, general fertility rate, specific (age, sex etc.) fertility rates, total fertility rate.<br>Growth/Reproduction rates : Gross reproduction rate, net reproduction rate.<br>Interpretations of different rates, uses and applications.<br>Trends in vital rates as revealed in the latest census. |
| **July/Aug 2021** | **IV) Queuing Model** | M/M/1: FIFO as an application of exponential distribution, Poisson distribution and geometric distribution : Inter arrival rate , service rate ($\mu$), traffic intensity ,queue discipline probability distribution of number of customers in queue, average queue length, average waiting time in:<br>i) queue,<br>ii) system. |

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

| Month | Topic | Subtopic |
|---|---|---|
| **May 2021** | **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. |
| **June 2021** | **2.Chi-square Distribution** | Definition of Chi-squarer. v. as sum of squares of i. i. d. standard normal variables<br>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. |
| **July / Aug 2021** | **4.Snedecore's F-distribution:** | Definition of F r. v. with $n_1$ and $n_2$ d. f.<br>Derivation of p. d. f., nature of probability curve, mean, variance, moments, mode.<br>Distribution of 1/F use of tables of F-distribution for calculation of probabilities.<br>Interrelations between Chi-Square , T and F distribution.<br>Tests based on chi-square distribution:<br>Test for independence of two attributes arranged in 2 X2 contingency table. (With Yates' correction). |

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| | **5.Test of Hypothesis:** | Test for independence of two attributes arranged in r X s contingency table, McNemar's test<br><br>Test for 'Goodness of Fit'. (Without rounding-off the expected frequencies ).<br><br>d) Test for population variance equal to specified $\sigma_0^2$ value. when i) mean is known , ii) mean is unknown.<br>Tests based on t-distribution:<br><br>t-tests for population means : i) one sample and two sample tests for one sided and two sided alternatives. Confidence interval.<br>Paired t-test for one-sided and two-sided alternatives.<br><br>Test based on F-distribution:<br>Test for equality of two population variance. when i) means are known, ii) means are unknown. |

**Thorat S.R.**

| Sr. No | Class | Paper | Name of Teacher |
|---|---|---|---|
| 1 | F.Y.B.Sc (Computer Science) | Methods of applied Statistics (CSST -121) | Raut P.D. |
| **2** | F.Y.B.Sc (Computer Science) | Continuous Probability Distributions and Testing of Hypothesis (CSST -122) | Raut P.D. |
| **3** | F.Y.B.Com | Business Mathematics and Statistics - II | Raut P.D. |

**Paper : Methods of applied Statistics** **Class:** F.Y.BSc (Computer Science).

| Month | Topic | Subtopic |
|---|---|---|
| **May 2021** | **1. Correlation (for bivariate raw data)** | 1.1 Bivariate data, scatter diagram<br>1.2 correlation<br>1.3 Karl Pearson's coefficient of correlation, limit of r<br>1.4 interpretation of r, coefficient of determination, Auto correlation<br>1.5 Numerical problems |
| **June 2021** | **2.Regression** | 2.1 Regression<br>2.2 linear Regression<br>2.3 Fitting of straight line using least square method<br>2.4 Properties of Regression coefficients<br>2.5 Non linear Regression: second degree curve, growth curve<br>2.6 Residual plot, mean residual sum of squares<br>2.7 Numerical problems |
| **June/July 2021** | **3. Multiple and partial correlation and Regression (for trivariate data)** | 3.1 Yule's notation and concept of multiple regression<br>3.2 Fitting of multiple Regression plane<br>3.3 Partial Regression coefficient<br>3.4 Multiple correlation coefficient<br>3.5 Partial correlation coefficient<br>3.6 Numerical problems |
| **July 2021** | **4. Time Series** | 4.1 Meaning and utility<br>4.2 Component of Time series |

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| | | 4.3 Additive and Multiplicative models<br>4.4 Methods of estimating trend : moving average method, least square method and exponential smoothing method<br>4.5 Elimination of trend using additive and multiplicative models<br>4.6 Simple time series models<br>4.7 Numerical problems |

**Paper :** Continuous Probability Distributions and Testing of Hypothesis

**Class:** F.Y.B.Sc (Computer Science).

| Sr. No. | Month | Topic |
|---|---|---|
| 1 | **May/June 2021** | **UNIT 1:Standard Continuous Probability Distributions**<br>1.1 Uniform Distribution: statement of p.d.f., mean, variance, nature ofprobability curve.<br>Theorem (without proof): The distribution function of any continuous r.v. if it is<br>invertible follows U(0, 1) distribution<br>1.2 Exponential Distribution: statement of p.d.f. of the form,$f(x) = (1/\theta)\, e(-x/\theta)$, mean,<br>variance, nature of probability curve, lack ofmemory property.(with proof)<br>1.3 Paratodistribution :Form of pdf $f(x):\alpha/\ x(\alpha+1)$ ; $x \geq 1$, $\alpha > 0$. Mean, variance, symmetry,<br>applications<br>1.4 Normal Distribution: statement of p.d.f., identification of parameters,nature of<br>probability density curve, standard normal distribution,symmetry, distribution of aX+b,<br>aX+bY+c where X and Y are independent normal variables, computations of probabilities<br>usingnormal probability table, normal approximation to binomial and Poisson distribution,<br>central limit theorem (statement only ), normal probability plot. Box Muller transformation<br>1.4 Numerical problems related to real life situations.. |
| 2 | **June 2021** | **UNIT 2:Concepts and definitions related to testing of hypothesis**<br>2.1 Concepts of population and sample.<br>2.2 Definitions: random samplefrom a probability distribution, parameter, statistic, standard error of estimator.<br>2.3 Concept of null hypothesis and alternative hypothesis (Research hypothesis), critical<br>region,level of significance, type I and type II error, one sided and two sided tests, Test<br>of hypothesis,p-value.. |

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| **3** | **June/July 2021** | **UNIT 3:Parametric Tests**<br>1.1 Large Sample Tests<br><br>3.1.1Ho: $\mu = \mu o$Vs H1: $\mu \neq \mu o$, $\mu < \mu o$, $\mu > \mu o$ (One sided and two sided tests)<br><br>3.1.2 Ho: $\mu 1 = \mu 2$ Vs H1: $\mu 1 \neq \mu 2$, $\mu 1 < \mu 2$, $\mu 1 > \mu 2$ (One sided and two sidedtests)<br><br>3.1.3 Ho: P = Po Vs H1: P ≠Po, P < Po, P > Po (One sided and two sided tests)<br><br>3.1.4 Ho: P1 = P2 Vs H1: P1≠P2, P1 < P2, P1 > P2 (One sided and two sidedtests)<br><br>3.1.5 Numerical problems related to real life situations.<br><br>3.2 Test based on F- distribution<br>3.2.1 F-test for testing significance of equality of two population variances.<br><br>3.3 Tests based on t – distribution<br>3.3.1 Ho: $\mu 1 = \mu 2$ Vs H1: $\mu 1 \neq \mu 2$, $\mu 1 < \mu 2$, $\mu 1 > \mu 2$ (One sided and two sided tests)<br><br>3.3.2 Paired t-test.<br>3.4 Tests based on Chi square distribution<br>3.4.1 Chi-square test for goodness of fit<br>3.4.2 Test for independence of attributes (mxn and 2x2)<br><br>3.5 Numerical problems related to real life situations. |
| **4** | **July 2021** | **UNIT 4 :Simulation**<br>4.1 Introduction, concept of simulation , random numbers, pseudo random numbers ,<br><br>Advantages , Disadvantages of Simulation. Applications<br>4.2 Methods of simulation, Linear congruential generator and simulation from Uniform,<br><br>Exponential and Normal Distribution. |

**Paper : Business Mathematics & Statistics-II** **Class:** F.Y.B.Com

| Sr. No. | Month | Topic |
|---|---|---|
| **1** | **May/June 2021** | **1.Matrices and Determinants (up to order 3 only)**<br>Definition of a Matrix, Types of Matrices, Algebra of Matrices, Determinants, Adjoint of a Matrix, Inverse of a Matrix via Adjoint Matrix, Homogeneous System of Linear equations, Condition for Consistency of homogeneous system, Solution of Non-homogeneous System of Linear equations (not more than three variables), Applications in Business and Economics, Examples and Problems. |
| 2 | **June 2021** | **2.Linear Programming Problems (LPP) (for two variables only)**<br>Definition and terms in a LPP, formulation of LPP, Solution by Graphical method, Examples and Problems |
| **3** | **June/July 2021** | **3.Correlation and Regression**<br>Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship.<br>Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie)<br>Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems. |
| **4** | **July 2021** | **4.Index numbers**<br>Concept of index number, price index number, price relatives. Problems in construction of index number. Construction of price index number: Weighted index Number, Laspeyre's, Paasche's and Fisher's method. Cost of living / Consumer price index number: Definition, problems in construction of index number. Methods of construction: Family budget and aggregate expenditure. Inflation, Uses of index numbers, commonly used index numbers. Examples and problems. |

**Prof. Raut P.D.**