Shri Sangameshwar Education Society's

Sangameshwar College, Solapur [Autonomous]

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

Kannada Linguistic Minority Institute

NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 1(6)
2nd July, 2020

UG Science Programme: B.Sc.-I To be implemented from A.Y. 2020-2021

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in: **Statistics**

Structure and Examination for: Discipline Specific Core Courses (DSC-A and DSC-B)

Table-1

Semester	Course		Teaching Scheme/week			
			Course Code	Hours	Lectures	Credits
I	DSC-A	Theory-I: Descriptive Statistics-I	2031108	4	5	4
		Theory-II: Probability and Discrete Probability Distributions-I	2031109			
		Practical-I: Statistics Practical	2031223	3.2	4	2
II	DSC-B	Theory-I: Descriptive Statistics-II	2031208	4	5	4
		Theory-II: Probability and Discrete Probability Distributions-II	2031209			
		Practical-I: Statistics Practical	2031223	3.2	4	2

Table-2

Semester	Course		EXAMINATION Marks			Credits
			CA	SEE	Total	
I	DSC-A	Theory-I: Descriptive Statistics-I	15	35	50	4

		Theory-II: Probability and Discrete Probability Distributions-I	15	35	50	
II	DSC-B	Theory-I: Descriptive Statistics-II	15	35	50	4
		Theory-II: Probability and Discrete Probability Distributions-II	15	35	50	
	DSC-A & DSC-B	Practical-I: Statistics Practical	30	70	100	4

CA: Continuous Assessment SEE: Semester End Examination

Note: -

The above structure (Table-1 and Table-2) is for Sem-I and Sem-II of the undergraduate B.Sc.-I * /B.S.Ecs.-I /B.C.A.-I programmes under science faculty.

* B.Sc.-I Select any four DSC form Chemistry /Physics /Mathematics /Statistics /Electronics /Botany /Zoology /Geography /Psychology.

DSC: Discipline Specific Core Course **AECC:** Ability Enhancement Compulsory Course

Passing in each course is compulsory including Democracy. Course.

SGPA/CGPA and Total Marks will be calculated excluding AECC and Democracy. Courses.

Compulsory Course:

DEMOCRACY	2000232	DEMOCRACY ELECTIONS AND GOVERNANCE
PHY EDU	2000233	PHYSICAL EDUCATION

Syllabus for: Discipline Specific Core Courses (DSC-A and DSC-B)

SEM-I

Academic Council 1(6) **2nd July, 2020** **DSC-A Theory-I Title: Descriptive Statistics-I (2031108)**		**Hours 30**
Unit 1	**Introduction to Statistics:** • Definition and scope of Statistics, Meaning of Descriptive Statistics, Concepts of statistical population and sample, Census method and Sampling method, Advantages of sampling method. • Meaning of Data, primary data, secondary data, qualitative data, quantitative data, attributes, variables-discrete and continuous, scales of measurement-nominal, ordinal, interval and ratio. • Tabular Presentation-Frequency distribution (discrete and continuous), cumulative frequencies, relative frequencies. • Graphical Presentation-Histogram, frequency polygon, frequency curve, Ogives.	7
Unit 2	**Measures of Central Tendency :** • Meaning of Central Tendency and measure of central tendency. Various measures of central tendency (Definition, use, numerical problems)- Arithmetic Mean (A.M.), Geometric Mean(G.M.), Harmonic Mean (H.M.), Median, Mode, Mean of pooled data, Weighted A.M. Partition values- Quartiles, Deciles, Percentiles. • Effect of change of origin and scale on A.M.(statement and proof), Sum of deviations of observations from A.M.(statement and proof), A.M. ⩾ G.M. ⩾ H.M. (proof when n=2 positive observations), G.M. is the geometric mean of A.M. and H.M. (proof when n=2 positive observations), Empirical relation between Mean, Median and Mode. • Determination of Mode from Histogram, determination of Median and partition values from ogives.	8
Unit 3	**Measures of Dispersion:** • Meaning of dispersion(or variability) and measure of dispersion. Types- Absolute and Relative measures of dispersion. • Various measures of dispersion(Definition, use, numerical problems) - Range and coefficient of range, Quartile Deviation(Q.D.) and coefficient of Q.D., Mean Deviation(M.D.) about mean/median and coefficient of M.D., Standard Deviation(S.D.) and Coefficient of variation(C.V.), Variance, Mean Square Deviation(M.S.D.), S.D. of pooled data. • Effect of change of origin and scale on S.D., Minimal property of M.D.(statement only), Minimal property of M.S.D.(statement and proof).	8
Unit 4	**Moments, Skewness, Kurtosis:** • Momemts: Raw moments about origin μ'_r , raw moments about any value A $\mu'_r(A)$, Central moments μ_r (at least first 4 moments). Effect of change of origin and scale on central moments, Central moments in terms of raw moments, Sheppard's correction and its need. Cumulants, Relation between cumulants and central moments. Numerical problems. • Skewness: Meaning of skewness, types of skewness, Bowley' coefficient of skewness, Karl Pearson's coefficient of skewness, coefficient of skewness based on moments. Numerical problems. • Kurtosis: Meaning of kurtosis, types of kurtosis, coefficient of kurtosis based on moments. Numerical problems.	7
Course Outcomes: After completion of this course, students can understand the basics of Descriptive Statistics and its methods. They can easily present the data graphically and apply various measures to describe the data using the aspects -central tendency, dispersion, skewness and kurtosis.		

DSC-A Theory-II Title: Probability and Discrete Probability Distributions-I (2031109)		**Hours 30**
Unit 1	**Sample space and Events:** • Concepts of experiments and random experiments. • Definitions: Sample space Ω , Discrete sample space (finite and countably infinite), Event, Elementary event, Compound event, favourable event. • Algebra of events (Union, Intersection, Complementation). • Definitions: Mutually exclusive events, Exhaustive events, Impossible event (Null event or empty event), Certain (Sure) event. • Power set |P(Ω) (sample space consisting at most 3 sample points). • Symbolic representation of given events and description of events in symbolic form. • Illustrative examples.	5
Unit 2	**Probability:** • Equally likely outcomes (events), apriori (classical) definition of probability of an event. Equiprobable sample space.Simple examples of computation of probability of various events, including based on Permutations and Combinations. • Axiomatic definition of probability with reference to a finite and countably infinite sample space. • Proof of the results: (i) P(∅) = 0 , (ii) P(A) = 1 − P(A) , (iii) Addition law of probability : P(A ∪ B) = P(A) + P(B) − P(A ∩ B) , extension of this to P(A ∪ B ∪ C) , (iv) If A ⊂ B , P (A) ≤ P (B), (v) 0 ≤ P(A ∩ $\bar{B}$) ≤ P (A) ≤ P(A ∪ B) ≤ P (A) + P (B), (vi) P(A ∩ $\bar{B}$) = P(A) − P(A ∩ B) , Illustrative examples based on the results (i) to (vi) .	9
Unit 3	**Conditional Probability and Independence of events:** • Definition of conditional probability of an event. • Multiplication law of probability for any two events A and B : P(A ∩ B) = P(A) · P(B/A) • Partition of sample space. • Idea of Posteriori probability, Statement and proof of Baye's theorem, examples on Baye's theorem. • Concept of Independence of two events. Multiplication law of probability for two independent events A and B : P(A ∩ B) = P(A)· P(B) • Proof of the result that if A and B are independent then, i) A and $\bar{B}$ are also independent ii) $\bar{A}$ and B are also independent iii) $\bar{A}$ and $\bar{B}$ are also independent. • Pairwise and Mutual Independence for three events. • Examples on conditional probability, multiplication law, Baye's theorem, independence of events.	8
Unit 4	**Univariate Probability Distributions (finite sample space):** • Definitions: Discrete random variable, Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) of a discrete random variable. • Properties of c.d.f. (statements only). • Probability distribution of function of random variable. • Median and Mode of a univariate discrete probability distribution. • Mathematical Expectation : Definition of expectation of a random variable, expectation of a function of a random variable. • Results on expectation: i) E (c) = c, where c is a constant, ii) E (aX + b) = a E (X) + b, where a and b are constants. • Definitions of mean and variance of a discrete random variable. Effect of change of origin and scale on mean and variance.	8

	• Definition of raw and central moments. • Definition of moment generating function (m.g.f.) of a discrete random variable. Effect of change of origin and scale on m.g.f. Determination of mean and variance by using m.g.f. • Examples.	
Course Outcomes: After completion of this course, students can understand the basics of probability and its methods. They can easily compute the probabilities of various events in the situation of random experiments. Also they can understand basics of probability distribution of a discrete random variable.		

Academic Council 1(6) **2nd July, 2020**	**SEM-II** **DSC-B Theory-I Title: Descriptive Statistics-II (2031208)**	**Hours 30**
Unit 1	**Theory of Attributes :** • Attributes: Notation, dichotomy, class frequency, order of class, positive and negative class frequency, ultimate class frequency, fundamental set of class frequency, relationships among different class frequencies (up to three attributes). • Concept of Consistency, conditions of consistency (up to three attributes). • Concept of Independence and Association of two attributes. • Yule's coefficient of association (Q): Definition, interpretation. Coefficient of colligation (Y): Definition, interpretation. Relation between Q and Y: $Q = 2Y/(1+Y2)$, $\|Q\| \geq \|Y\|$. • Numerical problems.	6
Unit 2	**Correlation:** • Bivariate data (X,Y), Covariance of X and Y, Effect of change of origin and scale on covariance. • Concept of correlation between two variables, Types of correlation. • Scatter diagram, its utility. • Karl Pearson's coefficient of correlation (r): Definition, Computation for ungrouped and grouped data, Properties : i) $-1 \leq r \leq 1$, ii) Effect of change of origin and scale.(iii) Interpretation when $r = -1, 0, 1$. • Spearman's rank correlation coefficient: Definition, Computation (for with and without ties). Derivation of the formula for without ties. • Numerical problems.	8
Unit 3	**Regression:** • Concept of regression, Lines of regression, Fitting of lines of regression by the least squares method. Regression coefficients (b_{xy}, b_{yx}) and their geometric interpretations, Properties: i) $b_{xy} \times b_{yx} = r^2$ or $r = \pm \sqrt{b_{xy} \times b_{yx}}$, ii) $0 \leq b_{xy} \times b_{yx} \leq 1$, iii) If one of the regression coefficient is greater than unity then the other must be less than unity. iv) $(b_{xy} + b_{yx}) / 2 \geq r$, v) Effect of change of origin and scale on regression coefficients, vi) the point of intersection of two regression lines. ((i) to (v) are with proof). • Derivation of acute angle between the two lines of regression. • Fitting of second degree curve, exponential type curve, logarithmic curve. • Numerical problems.	8

Unit 4	**Index Numbers:** • Definition of Index number. Uses (Utilities) of Index numbers. Types of Index numbers- Price, Quantity and Value index numbers. Meaning of current time and base time. Problems involved while constructing index numbers. • Methods of construction of index numbers for price, quantity and value - Simple aggregate method, Average of price or quantity relatives methods using arithmetic mean and geometric mean. Weighted aggregate method, Weighted average of price or quantity relatives methods. • Laspeyre's, Paasche's and Fisher's price and quantity index numbers. Marshall Edgeworth and Bowley's price and quantity index numbers. • Cost of living index number. • Time reversal test and Factor reversal test. Unit test. • Numerical problems based on the above methods.	8
Course Outcomes: After completion of this course, students can analyze data pertaining to attributes and interpret the results. They can study about the correlation between two variables and use the knowledge in regression analysis. They can construct index numbers in the various fields of economics and study the relative changes occurred in variables.		

DSC-B Theory-II Title: Probability and Discrete Probability Distributions-II (2031209)		**Hours 30**
Unit 1	**Discrete Probability Distributions (finite sample space) - I:** • One point distribution:Defintion, mean and variance. • Two point distribution:Definition, mean and variance. • Bernoulli Distribution: Definition, mean, variance, distribution of sum of independent and identically distributed Bernoulli variables. • Discrete Uniform Distribution: p.m.f., mean and variance. • Examples.	5
Unit 2	**Discrete Probability Distributions (finite sample space) - II** • Binomial Distribution: Definition with parameters(n, p) using p.m.f. $P(X = x) = {}_nC_x\, p^x q^{n-x}$, $x = 0,1,2, \quad n$ $= 0$, otherwise Notation: $X \sim B(n, p)$, Recurrence relation for successive probabilities, Computation of probabilities of different events, mean and variance, mode, skewness, m.g.f., Additive property of binomial variates. Examples. • Hypergeometric Distribution: Definition with parameters (N, M, n) using p.m.f. $P(X = x) = \dfrac{{}_MC_x \; {}_{N-M}C_{n-x}}{{}_NC_n}$, $x = \max(0, n-(N-M)) \quad \min(n, M)$ $= 0$, otherwise Notation: $X \sim H(N, M, n)$, mean and variance of distribution assuming $n \leq N - M \leq M$, approximation of Hypergeometric to Binomial. Examples.	8

Unit 3	**Discrete Probability Distributions (countably infinite sample space):** • Definition of random variable (defined on countably infinite sample space) • Poisson Distribution: Definition of Poisson distribution with parameter λ . Mean, variance, m.g.f., Recurrence relation for successive Probabilities, Additive property of Poisson distribution.	8

	Poisson distribution as a limiting case of Binomial distribution, examples. • Geometric Distribution: Definition of Geometric with parameter p. Mean, Variance,distribution function, m.g.f., Lack of memory property, examples. • Negative Binomial Distribution: Definition of Negative Binomial with parameters (k, p), Geometric distribution is a particular case of Negative Binomial distribution, Mean, Variance, m.g.f., Recurrence relation for successive probabilities, examples. • Relation between Geometric and Negative binomial distributions. • Poisson distribution as a limiting case of Negative binomial distribution.	
Unit 4	**Bivariate Discrete Probability Distributions:** • Definition of bivariate discrete random variable (X,Y) on finite sample space, Joint p.m.f., and c.d.f., Properties of c.d.f. (without proof). Computation of probabilities of events in bivariate probability distribution, concept of marginal and conditional probability distribution, independence of two discrete r.v.s, Examples. • Mathematical Expectation: Definition of expectation of function of r.v. in bivariate distribution, Theorems on expectations: (i) $E(X+Y) = E(X) + E(Y)$ (ii) $E(XY) = E(X)\cdot E(Y)$ when X and Y are independent, expectation and variance of linear combination of two discrete r.v.s., definition of conditional mean, conditional variance, covariance and correlation coefficient, Cov(aX+bY, cX+dY), distinction between uncorrelated and independent variables, joint m.g.f, proof of the m.g.f. of sum of two independent r.v.as the product of their m.g.f. examples.	9
Course Outcomes: After completion of this course, students can understand some standard discrete probability distributions and compute probabilities of occurring of various events in real life situations. Also they can understand basics of probability distribution of a bivariate discrete random variable.		

DSC-A & DSC-B Practical-I (2031223)	
Experiment	Title
1	Collection of data-I
2	Collection of data-II
3	Graphical presentation of the frequency distribution (Histogram, frequency polygon, frequency curve, Location of Mode, Ogive curves, Location of Partition values).
4	Measures of Central Tendency -I
5	Measures of Central Tendency -II
6	Measures of the Dispersion-I
7	Measures of the Dispersion-II
8	Moments, Skewness & Kurtosis for both ungrouped and grouped data.
9	Using MS-EXCEL: Graphical presentation, Compute A.M., G.M., H.M., Variance, C.V., M.D. ,Moments
10	Probability-I (Sample space, favourable points, computation of simple probability based on sets on Unit-1 & Unit-2 of DSC-A Theory-II)
11	Probability-II (Unit-3 & Unit-4 of DSC-A Theory-II)
12	Attributes
13	Correlation coefficient and Spearman's Rank correlation (ungrouped and grouped data)

14	Regression for both ungrouped and grouped data.

15	Construction of Index Numbers
16	Applications of Discrete uniform, Bernoulli, Binomial and Hypergeometric distributions.
17	Applications of Poisson, Geometric and Negative-Binomial distributions
18	Bivariate Discrete distribution (Computations of probabilities, Expectations and Variances
19	Using MS-EXCEL: Correlation and Regression (fitting of lines of regression , second degree cureve, exponential type curve, logarithmic curve for ungrouped data).
20	Using MS-Excel : Applications of discrete probability distributions.

Note :

1. Students are allowed to use any type of calculator or computer using any software like MS-Excel for computations in practical.
2. Students must complete the practical to the satisfaction of the concerned teacher.
3. Students must produce laboratory journal along with completion certificate signed by the HoD of Statistics at the time of practical examination.
4. Nature of SE (at the end of 2nd Sem) practical examination for 70 marks: A student has to attempt any two questions out of four asked, each for 25 marks. 10 marks are reserved for the assessment of journal. Also, 10 marks are reserved for the oral examination. Duration of practical examination is 4 hours.
5. Nature of CA of practical for 30 marks: 5 marks are reserved for data collection , 5 marks are reserved for active participation in laboratory work and 20 marks are reserved for assessment of the laboratory test..

Teaching-Learning-Evaluation: Equipments/Tools/Methods/etc:
Use of class room teaching, laboratory, computers, calculators, data collection, test based on MCQ, etc.

List of Books:

- Bhat B. R., Srivenkatramana, T and Madhava K. S. (1996) : Statistics : A Beginner's Text Vol. 1, New Age International (P), Ltd.
- Croxton F. E., Cowden D. J. and Kelin S. (1973) : Applied General Statistics, Prentice Hall of India.
- Goon, Gupta and Dasgupta: Fundamentals of Statistics Vol. I & II, World Press, Calcutta.
- Gupta S. P : Statistical Methods.
- Snedecor G. W.and Cochran W. G. (1967) : Statistical Methods Lowa State University Press.
- Walker and Lev : Elementary Statistical Methods.
- Gupta & Kapoor : Fundamentals of Mathematical statistics, S.Chand.
- Gupta & Kapoor : Fundamentals of Applied Statistics , S.Chand.
- Parimal Mukhopadyay : Fundamentals of Mathematical statistics.
- Dr. P.G. DIXIT, Dr. Mrs. S.V. Rajmanya, R.V. Rajmane, Dr. P.M. Dargopatil : Descriptive Statistics-I Statistics Paper-I B.Sc. Part-I Semester-I
Publisher: Nirali Prakashan, Pune.
- Dr. P.G. DIXIT, Dr. Mrs. S.V. Rajmanya, R.V. Rajmane, Dr. P.M. Dargopatil : Probability and Probability Distributions-I Statistics Paper-II B.Sc. Part-I Semester-I
Publisher: Nirali Prakashan, Pune.
- Mood A. M., Graybill F. A. and Boes D. C. (1974) : Introduction to the Theory of Statistics, McGraw Hill.

- Hoel P. G. (1971) : Introduction to Mathematical Statistics, Asia Publishing House.
- Meyer P. L. (1970) : Introductory Probability and Statistical Applications, Addison Wesley.
- Rohatgi V. K. and Saleh A. K. Md E(2002) : An introduction to probability and statistics , John Wiley and Sons (Asia).
- Hogg R. V. and Crag R. G. : Introduction to Mathematical Statistics Ed. 4

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