"Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE (AUTONOMOUS), KOLHAPUR.

Department of Statistics

Syllabus of B. Sc. I

w.e.f. June 2021

Semester I and II, CBCS

Semester	Part	Course Code	Course Title	No. of Credits
I	I	DSC - 1004 A	Descriptive Statistics - I	02
	II	DSC - 1004 A	Elementary Probability Theory	02
II	I	DSC - 1004 B	Descriptive Statistics II	02
	II	DSC - 1004 B	Discrete Probability Distributions	02
	Practical I	--	--	02

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B. Sc. Part – I CBCS Syllabus with effect from June 2021

STATISTICS - DSC - 1004 A

Semester: I Part- I

Descriptive Statistics -I

Theory: 36Hours Credits - 2

Course Outcomes - At the end of this course students will be able to:

CO1.To know scope of Statistics and sampling methods.
CO2. Compute descriptive statistics,
CO3. Compute moments, skewness, kurtosis and to interpret it.
CO4. Analyze data pertaining to attributes and interpret the results.

Unit	Contents	Hours Allotted
1	**Introduction to Statistics** 1.1 : Definition and scope of statistics: Population and sample, Meaning of primary and secondary data. Qualitative data (Attributes): nominal and ordinal scale. Quantitative data (Variables): Interval and ratio scale, discrete and continuous variables, raw data. 1.2 : Sampling Methods: Census survey, sample survey Advantages of Sampling, Types of sampling: Simple Random Sampling, Stratified Random Sampling, Systematic Sampling,	**05**
2	**Measures of Central Tendency and Dispersion** 2.1 : Concept of Central tendency of statistical data, Statistical average, Requirements of good statistical average. 2.2 : **Arithmetic Mean (A.M)**: Definition) Effect of change of origin and scale, (i)Sum of Deviation of observations from A.M is zero. (ii)Sum of squares Deviation of observations from A.M is, minimum, (iii) Combined mean of k series (prove for two series and generalize for k series) Weighted A.M. 2.3 : **Geometric Mean (G.M)**: Definition, Properties: i) G. M. of pooled data (for two groups), ii) G. M. of ratio of two series, is the ratio of their G. M's. 2.4 : **Harmonic Mean (H.M.)**: Definition, Relation: A.M ≥ G.M ≥ H.M (proof for n =2 positive observations). 2.5 : **Median**: Definition, Derivation of formula for grouped frequency distribution. 2.6 : **Mode**: Definition, Derivation of formula for grouped frequency distribution. Empirical relation between Mean, Median and Mode. Graphical method of determination of Median and Mode.	**17**

	2.7 : **Partition values** Quartiles, Deciles and Percentiles, Box Plot 2.8 : Comparison between averages in accordance with requirements of good average. 2.9 : Situations where one kind of average is preferable to others. **Measures of Dispersion:** 2.10 : Concept of dispersion, Absolute and Relative measures of dispersion, Requirements of a good measure of dispersion. 2.11 : Range: Definition, Coefficient of range, Use in SQC. 2.12 : Quartile Deviation (Semi-interquartile range): Definition, Coefficient of Q.D. 2.13 : Mean Deviation: Definition, Coefficient of M.D., Minimal property of M.D. 2.14 : Mean Square Deviation: Definition, Minimal property of M.S.D. 2.15: Variance and Standard Deviation: Definition, Effect of change of origin and scales of pooled data (proof for two groups). 2.16: Coefficient of Variation: Definition and use. 2.17: Comparison of S.D. with other measures.	
3	**Moments, Skewness and Kurtosis:** 3.1 : Moments: Raw moments (μ_r') and Central moments (μ_r) for ungrouped and grouped data. 3.2 : Effect of change of origin and scale on central moments, relation between central moments and raw moments (up to 4th order). 3.3 : Sheppard's corrections. 3.4 : Skewness: Concept of skewness of a frequency distribution, Types of skewness. 3.5 : Bowley's coefficient of skewness, Karl Pearson's coefficient of skewness, Measure of skewness based on moments. 3.6 : Kurtosis: Concept of kurtosis of a frequency distribution, Types of kurtosis. 3.7 : Measure of kurtosis based on moments.	**08**
4	**Theory of Attributes:** 4.1 : 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). 4.2 : Concept of Consistency, conditions of consistency (up to three attributes). 4.3 : Concept of Independence and Association of two attributes. 4.4: Yule's coefficient of association (Q): Definition, interpretation. Coefficient of colligation (Y): Definition, interpretation. Relation between Q and Y, $Q = 2Y/(1+Y^2)$, $\|Q\| \geq \|Y\|$. 4.5: Illustrative examples	**06**

References:

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.
2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
3. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.
4. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
5. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Lowa State University Press.
6. Waiker and Lev.: Elementary Statistical Methods.
7. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics- Sultan& Chand

STATISTICS - DSC - 1004 A
Semester: I Part- II
Elementary Probability Theory
Theory: 36 Hours Credits - 2

Course Outcomes - At the end of this course students will be able to:

CO1. Distinguish between Deterministic and Non-deterministic experiments.
CO2. Understand the basic concepts of probabilities.
CO3. Learn theorems on probabilities and compute probabilities.
CO4. Understand concepts of probabilities and independence of events.
CO5. Understand the concept of discrete random variable, probability distributions and mathematical expectations.

Unit	Contents	Hours Allotted
1	**Sample space and Events:** 1.1 : Concepts of experiments and random experiments. 1.2 : Definitions: Sample space, Discrete sample space (finite and countably infinite), Event, Types of events: Elementary event, Compound event, Impossible events, Certain event, favorable event 1.3 : Algebra of events (Union, Intersection, Complementation). 1.4: Definitions of Mutually exclusive events, Exhaustive events, 1.5 : Power set |P(Ω) (sample space consisting at most 3 sample points). 1.6 : Symbolic representation of given events and description of events in symbolic form. 1.7 : Illustrative examples.	**08**
2	**Probability:** 2.1 : Equally likely outcomes (events), apriori (classical) definition of probability of an event. Equiprobable sample space, simple examples of computation of probability of the events based on Permutations and Combinations. 2.2 : Axiomatic definition of probability with reference to a finite and countably infinite sample space. 2.3 : Proof of the results: i) P (Φ) = 0, ii) P (Ac) = 1- P (A), iii) P (A ∪B) = P (A) + P (B) – P (A ∩ B) (with proof) and its generalization (Statement only).	**10**

	iv) If $A \subset B$, $P(A) \leq P(B)$, v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$. 2.4 : Definition of probability in terms of odd ratio. 2.5 : Illustrative examples based on results in (2.3) and (2.4).	
3	**Conditional Probability& Independence of events:** 3.1 : Definition of conditional probability of an event. 3.2 : Multiplication theorem for two events. Examples on conditional probability. 3.3 : Partition of sample space. 3.4 : Idea of Posteriori probability, Statement and proof of Baye's theorem, examples on Baye's theorem. 3.5 : Concept of Independence of two events. 3.6 : Proof of the result that if A and B are independent then, i) A and B^c, ii) A^c and B iii) A^c and B^c are independent. 3.7 : Pairwise and Mutual Independence for three events. 3.8: Elementary examples.	**8**
4	**Mathematical Expectation of discrete random variable (finite sample space)** 3.8 : Definition of 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. 3.9 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) $E(aX + b) = a E(X)$ 3.10 + b, where a and b are constants, Definitions of mean, variance of univariate distributions. Effect of change of origin and scale on mean and variance. Definition of raw, central moments. Pearson's coefficient of skewness, kurtosis, Definition of probability generating function (p.g.f.) of a random variable. Effect of change of origin and scale on p.g.f. Definition of mean and variance by using p.g.f., 3.11 Examples.	**10**

References:

1. Bhat B. R., Srivenkatramana T and Madhava Rao K. S. (1997): Statistics: a Beginner's Text, Vol. II, New Age International (P) Ltd.
2. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision-Making, Prentice Hall.
3. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol.II, World Press, Calcutta.
4. Mood A. m., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
5. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
6. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
7. Meyer P.L.(1970): Introductory Probability and Statistical Applications, Addision Wesley.
8. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John Wiley & Sons (Asia)
9. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics- Sultan & Chand
10. Mukhopadhyay P. (2006): Probability. Books and Allied (P) Ltd

Note: 1. In theory examination, the weight age to the numerical problems should not exceed 40%.

2. Students can use scientific calculators in theory examination.

B. Sc. Part – I CBCS Syllabus with effect from June, 2019

STATISTICS - DSC - 1004 B

Semester: II Part- I

Descriptive Statistics -II

Theory: 36 Hours Credits - 2

Course Outcomes - At the end of this course students will be able to:

CO1.Understand concept of bivariate data.
CO2 To compute correlation coefficient and its interpretation.
CO3.To compute regression coefficients and regression lines.
CO4.Understand the need of vital statistics and concepts of mortality and fertility.
CO5. Know the concept and use of time series.

Unit	Contents	Hours Allotted
1	**Correlation:** 1.1: Bivariate Random variable (X, Y), Bivariate data, Formation of bivariate frequency distribution 1..2: Definition of Marginal totals, Mean of X, Mean of Y, Variance of X, Variance of Y, Covariance of XY. 1.3: Effect of change of origin and scale on covariance. 1.4: Theoretical examples. 1.5 : Concept of correlation between two variables, Types of correlation. 1.6 : Scatter diagram, its utility. 1.7 : 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 $r = -1, 0, 1$. 1.8 : Spearman's rank correlation coefficient: Definition, Computation (for with and without ties). Derivation of the formula for without ties and modification of the formula for with ties.	**09**
2	**Regression:** 2.1 : Concept of regression, Lines of regression, Fitting of lines of regression by the least square method. 2.2 : Regression coefficients (bxy, byx) and their geometric interpretations, Properties: i) bxy× byx = r2 , ii) bxy× byx ≤ 1, iii) (bxy + byx) / 2 ≥ r, iv) Effect of change of origin and scale on regression coefficients, v) the point of intersection of two regression lines. 2.3 : Derivation of acute angle between the two lines of regression. 2.4: Coefficient of determination.	**09**
3	**Demography:** 2.1 : Introduction and need of vital statistics 2.2 : Mortality rates: Crude death rate (CDR), Specific Death Rate (SDR), Standardized Death Rate (STDR). 2.3 : Fertility Rates: Crude Birth Rate (CBR), Age Specific Fertility Rate (ASFR), General Fertility Rate (GFR), Total Fertility Rate	**10**

	(TFR). 2.4 : Reproduction Rate: Gross Reproduction rate (GRR), Net Reproduction Rate (NRR). 2.5 : Lifetable, Notations and terminology, Expectation of life, Stationary population, Stable population, Central Mortality Rate, Force of Mortality, Assumptions, Description and construction of life table, Uses of life table.	
4	**Time Series:** 1.1: Meaning and need of time series analysis, components of times (i) Secular trend (ii) Seasonal Variation (iii) Cyclical Variation (iv) Irregular Variation, Additive and Multiplicative model, utility of time series. 2: Measurement of trend: (i) Moving averages method (ii) Progressive average method (iii) Least square method. (iv) Measurement of seasonal indices by simple average method.	**08**

References:

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.
2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
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5. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Iowa State University Press.
6. Waiker and Lev.: Elementary Statistical Methods.
7. Kapur, J. N and Gupta, H. C,: Fundamentals of Mathematical Statistics. S. Chand and sons, New Delhi.
8. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics- Sultan &Chand

STATISTICS - DSC - 1004 B
Semester: II Part - II
Discrete Probability Distributions
Theory: 36 Hours Credits - 2

Course Outcomes - At the end of this course students will be able to**:**

CO2. Apply some univariate standard discrete probability distributions to different situations and mathematical expectations.

CO2. To learn relation between different discrete distributions

CO3. Concept of bivariate random variable, probability distributions

Unit	Contents	Hours Allotted
1	**Standard Discrete Probability Distributions- I: (finite sample space):** 1.1 : Idea of one point, two-point distributions and their mean and variances. 1.2 :. Discrete Uniform Distribution: p.m.f., mean and variance. 1.3 : Bernoulli Distribution: p.m.f., mean, variance, distribution of sum of independent and identically distributed Bernoulli variables 1.4: Binomial Distribution: Binomial random variable, p.m.f. with Parameters (n, p), Recurrence relation for successive probabilities, Computation of probabilities of different events, mean and variance, mode, skewness, p.g.f., Additive property of binomial variates. Examples. 1.5: Hyper geometric Distribution: p.m.f. with parameters (N, M, n), Computation of probability of different events, Recurrence relation for successive, probabilities, mean and variance of distribution assuming $n \leq N - M \leq M$, approximation of Hypergeometric to Binomial. Examples.	**10**
2	**Discrete Distributions: Poisson, Geometric and Negative Binomial Distribution (countably infinite sample space):** 3.1 : Definition of random variable (defined on countably infinite sample space) 3.2 : Poisson Distribution: Definition of Poisson with parameter λ. Mean, variance**,** probability generating function (p.g.f.). Recurrence relation for successive Probabilities, Additive property of Poisson distribution. Poisson distribution as a	**10**

	limiting case of Binomial distribution, examples. 3.3 : Geometric Distribution: Definition of Geometric with parameter p. Mean, Variance, distribution function, p.g.f., Lack of memory property, examples. 3.4 : Negative Binomial Distribution: Definition of Negative Binomial with parameters (k, p), Geometric distribution is a particular case of Negative Binomial distribution, Mean, Variance, p.g.f., Recurrence relation for successive probabilities, examples.	
3	**Bivariate Probability Distribution: (Defined on finite sample space)** 4.1: 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 and problems	**08**
4	**Mathematical Expectation (Bivariate random variable)**: 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 p.g.f, proof of the p.g.f. of sum of two independent r.v.as the product of their p.g.f. Examples and problems.	**08**

Books Recommended:

1. Bhat B. R., Srivenkatramana T and Madhava Rao K. S. (1997): Statistics: a Beginner's Text, Vol. II, New Age International (P) Ltd.
2. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision-Making, Prentice Hall.
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6. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
7. Meyer P. L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.
8. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley& Sons (Asia)

Note: 1. In theory examination, the weightage to the numerical problems should not exceed 40%.

2. Students can use scientific calculators in theory examination.

Practical-I Credits -2

Course Outcomes - At the end of this practical paper students will be able to:

CO1. Use various graphical and diagrammatic techniques and interpret.
CO2. Compute descriptive statistics.
CO3. Compute correlation coefficient, regression coefficient.
CO4. Fit some univariate discrete probability distributions.
CO5. Compute probabilities of bivariate distributions.
CO6. Compute mortality, fertility rates.

Sr. No.	Title of the Experiment
1.	Graphical representation of frequency distribution.
2.	Measures of Central Tendency I (Ungrouped data)
3.	Measures of Central Tendency II (Grouped data)
4.	Measures of Dispersion I (Ungrouped data)
5.	Measures of Dispersion II (Grouped data)
6.	Moments, Skewness and Kurtosis I (Ungrouped data)
7.	Moments, Skewness and Kurtosis II (Grouped data)
8.	Attributes (Missing frequencies, Consistency),
9.	Attributes (Association and Independence)
10.	Correlation Coefficient & Spearman's Rank Correlation (Ungrouped data)
11.	Regression (Ungrouped data)
12.	Correlation Coefficient and Regression (Grouped data)
13.	Demography I
14.	Demography II
15.	Time Series Analysis
16.	Bivariate Discrete distribution I
17.	Bivariate Discrete distribution II
18.	Fitting and Application of Binomial & Hypergeometric distribution
19.	Fitting and Application of Poisson distribution
20.	Fitting and Application of Geometric and Negative Binomial distribution

Note:

i. Observation table and/or calculations using statistical formulae should be done by MS-EXCEL and verify by using library functions.
ii. Computer printout is to be attached to the journal.
iii. Student must complete the entire practical to the satisfaction of the teacher concerned.
iv. Student must produce the laboratory journal along with the completion certificate signed by Head of Department, at the time of practical examination.

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New course structure to be implemented w.e.f. June 2021

For B.Sc./BCA/B.Sc. Computer science (Entire)

Sr. No.	**Internal Examination DSC Course**				Total (a+b+c+d)	Conversion of 80 marks in **Total (I) (e)**	**SEE (Semester End Examination) DSC Course**		**Total (II)(f+g)= h**	**Total (I and II)** (e+h) = **i**
	Paper-I (Two tests each of 10 marks) (a)	Paper-II (Two tests each of 10 marks) (b)	Home assignment Paper I (c)	Home assignment Paper II (d)			Paper-I (f)	Paper-II (g)		
1	20	20	20	20	80	**20**	40	40	**80**	**100**

Nature of Internal and SEE (Semester End Examination) Examination

1) For internal examination, there shall be two tests (online/offline) of ten marks and one home assignment of 20 marks for each paper per semester.
2) For internal examination there shall be conversion of 80 marks in 20 marks and for passing 7 marks is required out of 20.
3) For SEE (Semester End Examination), there shall be two papers (Paper I and Paper II) of each DSC course per semester, each of 40 marks.
4) There shall be combined passing for SEE (Semester End Examination) of Paper-I and Paper -II i.e 28 marks is required out of 80.
5) There shall be separate passing is mandatory for both internal and SEE (Semester End Examination).

Practical Examination B.Sc.I (as per BoS guidelines)

Sr.No.	Lab work	Journal (Punctuality, Neatness)	Attendance, and participation in the practical's, motivation	Total
1	40	5	5	50

Nature of Question Paper (Except English)

Semester: I
Paper- I

Time : 2 hours **Total Marks: (40)**

Instructions: (1) **All** questions are **compulsory**.
(2) Figures to the **right** indicate **full** marks.
(3) Draw **neat**, labeled diagrams **wherever** necessary.
(Paper setter may add or delete any instruction if required)

Q.1. Select correct alternative. **(8)**

(i) .....
a) b) c) d)
(ii) .....
a) b) c) d)
(iii) .....
a) b) c) d)
(iv) .....
a) b) c) d)
(v) .....
a) b) c) d)
(vi) .....
a) b) c) d)
(vii) .....
a) b) c) d)
(viii) .....
a) b) c) d)

Q. 2. Attempt any two **(16)**

(i)
(ii)
(iii)

Q.3. Attempt any four **(16)**

(i)
(ii)
(iii)
(iv)
(v)
(vi)