Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B++' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: STATISTICS

Name of the Course: B.Sc. I (Sem.– I & II)

(Syllabus to be implemented from June 2022)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR.

B.Sc. Part-I (STATISTICS) Choice Based Credit and Grading System

Semester Pattern Syllabus

(To be implemented from June, 2022)

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Punyashlok Ahilyadevi Holkar Solapur University has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/ minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on Student's performance in examinations.

Outline of Choice Based Credit System:

1. ***Core Course:*** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. ***Elective Course:*** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. ***Ability Enhancement Courses (AEC):*** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC).**
"AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines.
SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Credit: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 20 marks and University Evaluation for 80 marks.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science and Technology

Choice Based Credit System (CBCS),

(w.e.f.2022-23) Revised Structure for B. Sc-I

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
Class :	**B.Sc.- I Semester – I**									
Ability Enhancement Compulsory Course (AECC)		English Paper I Part-A (communication skill)		4.0			50	40	10	2.0
Core Courses (*Students can opt any Four Subjects from the Twelve Subjects Listed below.		DSC 1A	Paper- I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 2A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 3A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 4A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
Total				**24**	--	--	**450**	**360**	**90**	**18**
Class :	**B.Sc.- I Semester – II**									
Ability Enhancement Course(AECC)		English Paper I Part-B (communication skill)		4.0			50	40	10	2.0
Core Courses (*Students can opt any Four Subjects from the Twelve Subjects Listed below.		DSC 1B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 2B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 3B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 4B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		Democracy, Elections and Good Governance		3			50	40	10	NC
Total (Theory)				**24**	--	--	**450**	**360**	**90**	**18**
Core Practical		DSC 1 A & 1B	Practical I	--	--	4	100	80	20	4.0
		DSC 2 A & 2B	Practical I	--	--	4	100	80	20	4.0
		DSC 3A & 3B	Practical I	--	--	4	100	80	20	4.0
		DSC 4A & 4B	Practical I	--	--	4	100	80	20	4.0
Total (Pract.)						**16**	**400**	**320**	**80**	**16**
Grand Total				**48**		**16**	**1300**	**1040**	**260**	**52**

*Core Courses: Chemistry/Physics/ /Mathematics/Statistics/Botany/Zoology/ Microbiology/ Electronics/Computer Science Geology/ Geography/Psychology

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR.

B.Sc. Part-I (STATISTICS) Choice Based Credit and Grading System Semester Pattern

Syllabus

(To be implemented from June, 2022)

Title of the course: B.Sc. Part-I Statistics (Semesters I and II)

Introduction: Statistics is the study of the collection, organization, analysis, interpretation, and presentation of data. Statistics plays a vital role in every fields of human activity. Statistics has important role in determining the existing position of per capita income, unemployment, population growth rate, housing, schooling medical facilities etc. in a country. Now a days Statistics holds a central position in almost every field like Industry, Commerce, Medical Science, Physics, Chemistry, Biology, Information Technology, Social Sciences, Psychology etc., and hence applications of Statistics are very wide. Today, Statistics is increasingly becoming important in a number of professions and people from all walks of life actively use Statistics, from politicians, businessmen to engineers and biologists.

There are mainly at least three reasons for studying Statistics: (1) Data are everywhere, (2) Statistical techniques are used to make decisions that affect our lives and (3) No matter what your career, you will make professional decisions that involve data. An understanding of statistical methods will help you to make these decisions more effectively.

Eligibility of the course: Standard XII Science or equivalent examination passed.

Duration: One year divided into two semesters.

Medium of instruction: English

Scheme of Evaluation:

As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for internal evaluation (College Assessment (CA)) of 20 marks and external evaluation (University Assessment (UA)) of 80 marks.

Semester – I

Theory: (100 marks)

University Examination (80 marks): No. of theory papers: 2 (Paper I and Paper II of 40 marks each)

Internal Continuous Evaluation: (Total 20 marks: Paper I and Paper II of 10 marks each**)**

(a) Internal Evaluation- Tests/ Home Assignments / Tutorials / Seminars / Viva/ Group Discussion.

Semester – II

Theory: (100 marks)

University Examination (80 marks): No. of theory papers: 2 (Paper III and Paper IV of 40 marks each)

Internal Continuous Evaluation: (Total 20 marks : Paper III and Paper IV of 10 marks each)

(a) Internal Evaluation- Tests/ Home Assignments / Tutorials / Seminars / Viva/ Group Discussion.

Practical Examination: (100 marks)

University Examination **(80 marks)**: No. of practical course: 1

Internal Continuous Evaluation: (20 marks)

(a) Internal practical test : **10 marks**

(b) Viva/group discussion/model or chart/attendance/overall behavior: **10 marks**

Passing Standard

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in University Examination (theory) and passed in internal assessment of a same paper shall be given FC Grade. Such student will have to reappear for University Examination only. A student who fails in internal assessment and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination as well as internal assessment.

ATKT

Candidate passed in all papers, except **5 (five)** papers combined together of semester I and II of B.Sc. Part-I Statistics examination shall be permitted to enter upon the course of Semester III of B.Sc. Part-II Statistics

STRUCTURE OF COURSE

Semester No.	Paper No.	Title of the Paper	Marks
I	STATISTICS PAPER-I	Descriptive Statistics-I	50 (40-UA and 10-CA)
	STATISTICS PAPER-II	Elementary Probability Theory	50 (40-UA and 10-CA)
II	STATISTICS PAPER-III	Descriptive Statistics-II	50 (40-UA and 10-CA)
	STATISTICS PAPER-IV	Discrete Probability Distribution	50 (40-UA and 10-CA)
ANNUAL EXAM.	STATISTICS PRACTICAL	Statistics Practical Paper-I	100 (80-UA and 20-CA)

Teaching Periods:

1. Total teaching periods for Two Theory Papers are five periods per week in each semester.

2. Total teaching periods for Practical-I are four periods per week per batch.

Duration of examination:

1. Duration for each theory paper of 40 marks is two hours for University Assessment.

2. Duration for Practical is four hours per batch.

Equivalence of Papers

Paper No.	Name of the Old Paper	Name of the New Paper
I	Descriptive Statistics -I	Descriptive Statistics -I
II	Probability and Probability Distribution-I	Elementary Probability Theory
III	Descriptive Statistics -II	Descriptive Statistics -II
IV	Probability and Probability Distribution-II	Discrete Probability Distribution
Practical-I	Statistics Practical Paper-I	Statistics Practical Paper-I

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

CORE COURSE-I

PAPER-I: Descriptive Statistics-I

(Total Credits: 2, Contact Hrs: 30)

Course Outcomes:

The main objective of this course is to acquaint students with some basic statistics. They will be introduced to some elementary statistical methods of analysis. At the end of this course students are expected to be able to

1. acquire knowledge of data and types of data,
2. prepare frequency distribution and represent it graphically,
3. compute and interpret various measures of central tendency, dispersion, skewness, kurtosis,
4. analyze qualitative data.

Contents:

Unit - 1 **(15 hrs.)**

1.1 Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: primary and secondary data, quantitative and qualitative data, attributes, variables, discrete and continuous variables, scales of measurement - nominal, ordinal, interval and ratio scale. Presentation: tabular and graphical, including histogram and ogives.

1.2 Attributes: Notation, dichotomy, class frequency, order of class, positive and negative class frequency, ultimate class frequency, fundamental set of class frequency, relationship 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: $Q = 2Y/(1+Y2)$, $|Q| \geq |Y|$. Illustrative examples.

1.3 Measures of Central Tendency: Concept of central tendency, average, requirements of good average. **Arithmetic Mean (A.M.):** Definition, Effect of change of origin and scale, Deviation of observations from A.M., Mean of pooled data, Weighted A.M. **Geometric Mean (G.M.):** Definition, G. M. of pooled data (for two groups). **Harmonic Mean (H.M.):** Definition, Relation: $A.M \geq G.M \geq H.M$ (proof for $n = 2$ positive observations). **Median:** Definition, Derivation of formula for median of grouped frequency distribution. **Mode:** Definition, Derivation of formula for mode of grouped frequency distribution. Empirical relation among mean, median and mode. Graphical methods of determination of Median and Mode. **Partition values:** Quartiles, Deciles and Percentiles. Comparison between averages

in accordance with requirements of good average. Situations where one kind of average is preferable to others. Illustrative examples.

Unit – 2 **(15 hrs.)**

2.1 Measures of Dispersion: Concept of dispersion, Requirements of a good measure of dispersion. Absolute and Relative measures of dispersion, **Range:** Definition, Coefficient of range. **Quartile Deviation (Q. D. or Semi-inter quartile range):** Definition, Coefficient of Q.D. **Mean Deviation (M.D.):** Definition, Coefficient of M.D., Minimal property of M.D. **Mean Square Deviation (M.S.D.):** Definition, Minimal property of M.S.D. **Variance and Standard Deviation (S.D.):** Definition, Effect of change of origin and scale, S.D. of pooled data (proof for two groups). **Coefficient of Variation:** Definition and use. Illustrative Examples.

2.2 Moments: Raw moments and central moments for ungrouped and grouped data. Effect of change of origin and scale on central moments, relation between central moments and raw moments (up to 4^{th} order). Sheppard's corrections. **Skewness:** Concept of skewness, types of skewness. Bowley's coefficient of skewness, Karl Pearson's coefficient of skewness. Measures of skewness based on moments. **Kurtosis:** Concept of kurtosis, Types of kurtosis. Measures of kurtosis based on moments. Illustrative examples.

PAPER –II: Elementary Probability Theory

(Total Credits: 2, Contact Hrs: 30)

Course Outcomes:

The main objective of this course is to acquaint students with the concept of probability. At the end of this course students are expected to be able to

1. distinguish between random and non-random experiments,
2. acquire knowledge of concepts of probability,
3. use basic theorems of probability
4. understand concept of conditional probability and independence of events

Contents:

Unit – 1 **(15 hrs.)**

1.1 Sample space and events: Concepts of experiments. Random and non-random experiments, Definitions: Sample space, Discrete sample space (finite and countably infinite), Event, Elementary event, Compound event, Favourable event, Algebra of events (Union, Intersection and Complementation), Definitions of mutually exclusive events, Exhaustive events, Impossible events, Certain event, Power set $|P(\Omega)$ (sample space consisting at most 3 sample points), Symbolic representation of events, Illustrative examples.

1.2 Probability: Equally likely outcomes (events), apriori (classical) definition of probability of an event, Equiprobable sample space, simple examples of computation of probability of the

events, Axiomatic definition of probability with reference to a finite and countably infinite sample space. Proof of the results:

i) $P(\Phi) = 0$,

ii) $P(A^C) = 1 - P(A)$,

iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (with proof) and its generalization for three events (Statement only),

iv) If $A \subset B$, $P(A) \leq P(B)$,

v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$.

Definition of probability in terms of odds ratio, Illustrative examples.

Unit – 2 **(15 hrs.)**

2.1 Conditional Probability: Definition of conditional probability of an event, Multiplication theorem for two events, Examples on conditional probability, Partition of sample space, Idea of posteriori probability, Baye's theorem (Statement and proof), Examples on Baye's theorem.

2.2 Independence of events: Concept of independence of two events. Proof of the result that if A and B are independent events, then i) A and B^c are independent events, ii) A^c and B are independent events, iii) A^c and B^c are independent events, Pairwise and Mutual Independence for three events, Illustrative examples.

SEMESTER-II

CORE COURSE-II

PAPER-I: Descriptive Statistics-II

(Total Credits: 2, Contact Hrs: 30)

Course Outcomes:

The main objective of this course is to familiarize students with the concepts of correlation and regression. At the end of this course students are expected to be able to

1. compute correlation coefficient, interpret its value,
2. compute regression coefficient, interpret its value and use in regression analysis.
3. compute and interpret various index numbers.
4. compare various index numbers.

Contents:

Unit – 1 **(15 hrs.)**

1.1 Correlation: Bivariate data, Concept of correlation between two variables, Types of correlation. Scatter diagram, its utility. **Covariance:** Definition, effect of change of origin and scale. **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 (with and without ties), Derivation of the formula for without ties, modification of the formula for with ties, Illustrative examples.

1.2 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) $b_{xy} \times b_{yx} = r^2$, ii) $b_{xy} \times b_{yx} \leq 1$, iii) $(b_{xy} + b_{yx}) / 2 \geq r$, iv) Effect of change of origin and scale on regression coefficients, v) The point of intersection of two regression lines, Derivation of acute angle between the two lines of regression, Illustrative examples.

Unit – 2 **(15 hrs.)**

2.1 Index Numbers: Meaning and utility of index numbers, construction of index numbers. Types of index numbers: price, quantity and value index numbers, Unweighted and weighted index numbers using (i) aggregate method, (ii) average of price or quantity relative method (using A.M. & G.M.), Index numbers using Laspeyre's, Paasche's, Edgeworth- Marshall and Fisher's formula.

2.2 Tests of index numbers: Unit test, Time reversal test and Factor reversal tests. Cost of living index number: definition, construction by using (i) Family Budget and (ii) Aggregate expenditure method, shifting of base and purchasing power of money, consumer price index numbers.

PAPER –IV: Discrete Probability Distribution

(Total Credits: 2, Contact Hrs: 30)

Course Outcomes:

The main objective of this course is to acquaint students with concept of random variable and discrete probability distribution. At the end of this course students are expected to be able to

1. acquire concept of discrete random variable and its p.m.f. and c.d.f.
2. compute mathematical expectation of random variable,
3. acquire knowledge of discrete probability distributions,
4. apply discrete probability distributions in real life situations.

Contents:

Unit – 1 **(15 hrs.)**

1.1 Univariate Probability Distributions (finite sample space): 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, Examples.

1.2 Mathematical expectation (Univariate random variable): 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 univariate distribution, Effect of change of origin and scale on mean and variance, Definition of raw, central moments, Pearson's coefficient of skewness and kurtosis, Definition of probability generating function (p.g.f.) of a random variable, Effect of change of origin and scale on p.g.f., Computation of mean and variance by using p.g.f. Examples.

Unit – 2 **(15 hrs.)**

2.1 Some Standard Discrete Probability Distributions: (Finite sample space):

One point Distribution: p.m.f., mean and variance

Two point Distribution: p.m.f., mean and variance

Bernoulli Distribution: p.m.f., mean, variance, p.g.f, distribution of sum of independent and identically distributed Bernoulli variables.

Discrete Uniform Distribution: p.m.f., mean and variance.

Binomial Distribution: p.m.f. with parameters (n, p), Recurrence relation for successive probabilities, Mean and Variance, p.g.f., Additive property, Computation of probabilities of different events.

Hyper geometric Distribution: p.m.f. with parameters (N, M, n), Recurrence relation for successive probabilities, Mean and Variance of distribution assuming $n \leq N - M \leq M$, Computation of probability of different events.

2.2 Some Standard Discrete Probability Distributions: (Countably infinite sample space):
Definition of discrete random variable (defined on countably infinite sample space)
Poisson Distribution: p.m.f., Mean, Variance**,** p.g.f., Recurrence relation for successive probabilities, Additive property, Poisson distribution as a limiting case of Binomial distribution (Statement only), examples.
Geometric Distribution: p.m.f., Mean, Variance, c.d.f., p.g.f., Lack of memory property, examples.
Negative Binomial Distribution: p.m.f., Geometric distribution is a particular case of Negative Binomial distribution, Mean, Variance, p.g.f., Recurrence relation for successive probabilities, examples.

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Books Recommended:

1. Bhat B. R., Srivenkatramana, T and Madhava 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, Gupta and Dasgupta: Fundamentals of Statistics Vol. I & II, World Press, Calcutta.

4. Gupta S. P : Statistical Methods.

5. Snedecor G. W.and Cochran W. G. (1967) : Statistical Methods Lowa State University Press.

6. Walker and Lev : Elementary Statistical Methods.

7. Applied Statistics : Gupta and Kapoor.

8. Dixit P. G. and Thigale T. K. : A text book of Statistics Paper - I & II

9. Fundamentals of Mathematical statistics: Gupta & Kapoor.

10. Mood A. M., Graybill F. A. and Boes D. C. (1974) : Introduction to the Theory of Statistics, McGraw Hill.

11. Hoel P. G. (1971) : Introduction to Mathematical Statistics, Asia Publishing House.

12. Meyer P. L. (1970) : Introductory Probability and Statistical Applications, Addison Wesley.

13. Rohatgi V. K. and Saleh A. K. Md E(2002) : An introduction to probability and statistics , John Wiley and Sons (Asia).

14. Hogg R. V. and Crag R. G. : Introduction to Mathematical Statistics Ed. 4

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STATISTICS PRACTICAL PAPER – I

Pre requisites : Knowledge of the topics in the theory papers.

Course Outcome : At the end of this course students are expected to be able to

1) represent statistical data graphically.

2) compute various measures of central tendency, dispersion, skewness and kurtosis.

3) compute correlation coefficient, regression coefficients.

4) analyze data pertaining to discrete variables and to interpret the results.

5) understand consistency, association and independence of attributes.

6) compute price index number, quantity index number and value index numbers.

LIST OF PRACTICALS

1.1) Graphical representation of the frequency distribution (Histogram, frequency polygon, frequency curve, Location of Mode, Ogive curves, Location of Partition values)

1.2) Measures of Central tendency- I (Ungrouped data)

1.3) Measures of Central tendency-II (Grouped data)

1.4) Measures of the Dispersion -I (Ungrouped data)

1.5) Measures of the Dispersion -II (Grouped data)

1.6) Moments, Skewness and Kurtosis – I (Ungrouped data)

1.7) Moments, Skewness and Kurtosis – II (Grouped data)

1.8) Correlation Coefficient and Spearman's Rank Correlation Coefficient (Ungrouped data)

1.9) Correlation Coefficient (Grouped data)

1.10) Regression – I (Ungrouped data)

1.11) Regression – II (Grouped data)

1.12) Attributes-I (Missing frequencies and Consistency)

1.13) Attributes- II (Association and Independent of Attributes)

1.14) Applications of Binomial distribution.

1.15) Applications of Hypergeometric distribution.

1.16) Applications of Poisson distribution.

1.17) Applications of Negative Binomial distribution.

1.18) Index Numbers.

1.19) & 1.20) Case Study equivalent to two practicals. (Case study-different datasets may be collected and students will be asked to use Statistical tools they have learnt.)

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Note :

1) Along with the regular practical Ex. No. 1,2,3,4,5,6,7,8,9 are expected to run on Computers using MS-Excel.
2) Elementary statistical analysis using MS- Excel: Numerical computations and computations using statistical library functions.
3) Student must complete all the practicals to the satisfaction of the teacher concerned.
4) Students must produce laboratory journal along with completion certificate signed by Head of the Department at the time of practical examination.

Laboratory Requirements :

Laboratory should be well equipped with sufficient number of electronic calculators and computers along with necessary software, UPS and printers.

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Nature of Practical Question Paper

B. Sc. Part – I (Statistics)

In the practical question paper there shall be four questions each of 35 marks, a student has to attempt any two questions. In only one of the four questions there shall be a sub-question of 10 marks based on MS- Excel.

a) Evaluation of the MS – Excel based questions will be online and should be demonstrated to examiner.
b) 5 marks are reserved for the journal and 5 marks for the oral examination.
c) Practical Examination will be of four hours duration which includes viva examination and online demonstration.

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