



**SU/BOS/Science/350**

**Date: 24/06/2024**

**To,**

The Principal,  
All Concerned Affiliated Colleges/Institutions  
Shivaji University, Kolhapur

**Subject:** Regarding Minor Change syllabi of B.Sc. Part-I (Sem.I & II) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

**Ref:** SU/BOS/Science/876/ Date: 26/12/2023 Letter.

**Sir/Madam,**

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the Minor Change syllabi, nature of question paper of B.Sc. Part-I (Sem.I & II ) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

B.Sc.Part-I (Sem. I & II ) as per NEP-2020 (2.0)			
1.	Botany	9.	Geology
2.	Physics	10.	Zoology
3.	Statistics	11.	Chemistry
4.	Astrophysics	12.	Geography
5.	Mathematics	13.	Electronics
6.	Microbiology	14.	Drug Chemistry
7.	Plant Protection	15.	Industrial Microbiology
8.	Astrophysics and Space Science	16.	Sugar Technology (Entire)

This syllabus, nature of question and equivalence shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in) NEP-2020@suk(Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

**Dy Registrar**  
**Dr. S. M. Kubal**

**Copy to:**

1	The Dean, Faculty of Science & Technology	4	B.Sc. Exam/ Appointment Section
2	Director, Board of Examinations and Evaluation	5	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	6	Affiliation Section (U.G.) (P.G.)



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PHONE: EPABX-2609000, [www.unishivaji.ac.in](http://www.unishivaji.ac.in), [bos@unishivaji.ac.in](mailto:bos@unishivaji.ac.in)

**शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र**

दूरध्वनी-ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दूरध्वनी ०२३१-२६०९०९४  
०२३१-२६०९४८७



**SU/BOS/Science/876**

**Date: 26/12/2023**

**To,**

The Principal,  
All Concerned Affiliated Colleges/Institutions  
Shivaji University, Kolhapur

**Subject:** Regarding syllabi of B.Sc. Part-I (Sem. I & II ) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

**Sir/Madam,**

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of B.Sc. Part-I (Sem. I & II ) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

<b>B.Sc.-I (Sem. I &amp; II ) as per NEP-2020 (2.0)</b>			
1.	Mathematics	7.	Electronics
2.	Statistics	8.	Chemistry
3.	Physics	9.	Sugar Technology (Entire)
4.	Botany	10.	Geography
5.	Microbiology	11.	Geology
6.	Industrial Microbiology	12.	Zoology

This syllabus, nature of question and equivalence shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. These chances are available for repeater students, if any.

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2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education



SU/BOS/Science/379

Date: 08/07/2024.

To,

The Principal,  
All Concerned Affiliated Colleges/Institutions  
Shivaji University, Kolhapur

**Subject:** Regarding Minor Change syllabi of B.Sc. Part-I (Sem.I & II) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

**Ref:** SU/BOS/Science/876/ Date: 26/12/2023 & SU/BOS/Science/350/ Date: 24/06/2024 Letter.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the Minor Change syllabi, nature of question paper of B.Sc. Part-I (Sem.I & II ) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

B.Sc.Part-I (Sem. I & II ) as per NEP-2020 (2.0)			
1.	Physics	2.	Statistics

This syllabus, nature of question and equivalence shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in) NEP-2020@suk(Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

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**B. Sc. Part – I Semester – I**  
**DSC-I**  
**(DESCRIPTIVE STATISTICS – I)**  
**Theory: 30 hrs. Marks -50 (Credits: 02)**

**Course Outcomes:** The students will acquire knowledge of

- i. Meaning and scope of Statistics, various statistical organizations.
- ii. Population, sample and various methods of sampling.
- iii. Various measures of central tendencies and dispersion.
- iv. Moments, skewness and kurtosis.

**CONTENTS:**

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

**1.1 Introduction to Statistics:** Meaning of Statistics as a Science, Importance of Statistics, Definition of Statistics, Various fields where Statistics is used, Names of various statistical organizations in India.

- **Population and Sample:** Statistical population. Finite population, Infinite population, Census method, Sampling method, Advantages of sampling method over census method.
- **Methods of sampling (Description only):** Sample and Random sample, Simple random sampling with and without replacement (SRSWR and SRSWOR), Stratified random sampling, Systematic sampling.

**1.2 Nature of Data:** Primary and Secondary data, Time series data, Quantitative and Qualitative data, Attributes, Variables, Discrete and Continuous variables, Scales of measurement - Nominal, Ordinal, Interval and Ratio scale, illustrative examples.

- **Presentation of Data: Classification:** Raw data and its classification, Discrete frequency distribution, Continuous frequency distribution, Cumulative frequency distribution, Inclusive and Exclusive methods of classification, Open end classes, Relative frequency distribution, illustrative examples.

**Unit - 2** **(15 hrs.)**

**2.1 Measures of Central Tendency:** Mathematical and positional, Concept of central tendency of statistical data, statistical average, requirements of good statistical 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, illustrative examples.
- **Harmonic Mean (H.M.):** Definition, Relation:  $A.M. \geq G.M. \geq H.M$  (proof for  $n = 2$  positive observations), illustrative examples.
- **Median:** Definition, Derivation of formula for grouped frequency distribution.
- **Mode:** Definition, Derivation of formula for grouped frequency distribution. Empirical relation between mean, median and mode. Graphical method 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.

**2.2 Measures of Dispersion:** Concept of dispersion, Absolute and Relative measures of dispersion, Requirements of a good measure 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, variance and S.D. of pooled data (proof for two groups).
- **Coefficient of Variation:** Definition and use. Illustrative examples.

**2.3 Moments, Skewness and Kurtosis:**

- **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<sup>th</sup> order). Sheppard's corrections.
- **Skewness:** Concept of skewness of a frequency distribution, types of skewness. Bowley's coefficient of skewness, Karl Pearson's coefficient of skewness, measure of skewness based on moments.
- **Kurtosis:** Concept of kurtosis of a frequency distribution, Types of kurtosis, Measure of kurtosis based on moments. Illustrative examples.

#### Books Recommended:

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. Gupta V.K. & Kapoor S.C.: Fundamentals of Mathematical Statistics.- Sultan & Chand.
6. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
7. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.

### B. Sc. Part – I Semester – I DSC-II (ELEMENTARY PROBABILITY THEORY) Theory: 30 hrs. Marks -50 (Credits: 02)

**Course Outcomes:** Students will be able to;

- i. Distinguish between random and non-random experiments
- ii. Use the basic probability rules, including additive and multiplicative laws
- iii. Understand concept of conditional probability and independence of events.
- iv. Understand concept of univariate random variable and its probability distributions

#### CONTENTS:

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

**1.1 Sample space:** Concepts of experiments and random experiments. Definitions: Sample space, Discrete sample space (finite and countably infinite).

• **Events:** Elementary event, Compound event. Algebra of events (Union, Intersection, 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 given events and description of events in symbolic form. Illustrative examples.

**1.2 Probability:** Equally likely outcomes (events), a priori (classical) definition of probability of an event. Equi-probable sample space, simple examples of computation of probability of the events based on permutations and combinations. Definition of probability in terms of odd ratio with illustrative examples.

• **Axiomatic definition of probability and 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 (Statement only), iv) If  $P(A \subset B)$ ,  $P(A) \leq P(B)$  v)  $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$ .

• **Conditional Probability:** Definition of conditional probability of an event. Multiplication theorem for two events. Examples on conditional probability.

##### Unit - 2 (15 hrs.)

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

- **Baye's theorem:** Partition of sample space, Idea of posterior probability, statement and proof of Baye's theorem, illustrative examples on Baye's theorem.
- **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:** Median and mode of a univariate discrete probability distribution. Examples.

**2.2 Mathematical expectation (Univariate random variable):** Definition of expectation of a random variable. Expectation of a function of a random variable, Results on expectation of a functions of a random variable: i)  $E(c) = c$ , where c is a constant, ii)  $E(aX + b) = aE(X) + b$ , where a and b are constants,

- **Mean and variance:** Definitions of mean and variance of univariate distribution,  $V(aX + b) = a^2V(X)$
- **Raw and central moments:** Definition of raw and central moments.
- **Probability generating function (p.g.f.):** Definition of probability generating function (p.g.f.) of a random variable, Mean and variance by using p.g.f., Effect of change of origin and scale on p.g.f.

#### **Books Recommended:**

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
4. Hogg, R.V. and Craig R.G.(1989).Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.
5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
6. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, Mc Graw Hill Book Company.
7. Rao, VLS Prakash (2008). First Course in Probability and Statistics, New Age International Publishers, New Delhi.
8. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.
9. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia).

### **B. Sc. Part – I Semester – I DSC-P-I (STATISTICS PRACTICAL - I) Practical: 60 hrs. Marks -50 (Credits: 02)**

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

**Course Outcomes:** Students will able to;

- i. Acquire knowledge of computations using MS-Excel.
- ii. Represent statistical data diagrammatically and graphically.
- iii. Compute various measures of central tendency, dispersion, moments, skewness and kurtosis.
- iv. Interpret summary Statistics of computer output.

#### **List of Practicals:**

1. Data handling and computations using MS-Excel.
2. Diagrammatic and Graphical presentation.

3. Use of random numbers to draw SRSWOR, SRSWR sample.
4. Use of random numbers to draw Stratified and Systematic sample.
5. Measures of central tendency.
6. Measures of the dispersion.
7. Moments, skewness and kurtosis.
8. Computation of probabilities using Baye's theorem.
9. Case study equivalent to 2 practicals.

**Notes:**

- a. Students must complete all experiments using MS-Excel.
- b. Case study - Different data sets from newspapers, internet, and magazines may be collected and students will be asked to use statistical techniques/tools which they have learnt.
- c. MS-Excel should be used at the time of practical examination for calculation.
- d. Student must complete the entire practical to the satisfaction of the teacher concerned.
- e. Student 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 at least 20 computers along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

**Nature of Practical Question Paper:**

- a. In the practical question paper there shall be four questions each of 16 marks, a student has to attempt any two questions.
- b. Computations should be completed using MS-Excel and should be demonstrated to examiner. Experiment aim, formulae, results etc. should be written on practical answer paper.
- c. 8 marks are reserved for case study, 5 marks are reserved for the journal and 5 marks for the oral examination.
- d. Practical examination is of four hours duration which includes viva (oral) examination and on line demonstration.

**B. Sc. Part – I: Semester – I**

**OE–I**

**Semester – I**

**(BASIC STATISTICS PRACTICAL-I)**

**Practical: 60 Hrs. Marks: 50 (Credits: 02)**

**Course Outcomes:**

After completion of this practical course, the student will be able to:

- i) apply sampling techniques in real life.
- ii) perform classification and tabulation of primary data.
- iii) represent the data by means of simple diagrams and graphs.
- iv) summarize data by computing measures of central tendency.

**LIST OF PRACTICALS:**

1. Classification, tabulation and frequency distribution –I: **Qualitative** data.
2. Classification, tabulation and frequency distribution –II : **Quantitative** data.
3. Diagrammatic representation of data by using Pie Diagram and Bar Diagrams.
4. Graphical representation of data by using Histogram, Frequency Polygon, Frequency Curve and Locating Modal Value.
5. Graphical representation of data by using Ogive Curves and Locating Quartile Values.
6. Sampling : Simple random sampling (with and without replacement) and stratified random sampling.

7. Measures of central tendencies: Mean, Mode and Median.

8. Case study : Application of at least three practicals from above.

**Note:** Essential requirements for doing all the practicals from above list are:

- i) Students should be made familiar with theory part of every practical.
- ii) Students are expected to be familiar in using MS-Excel software as an essential computing tool, otherwise they also can use Scientific Calculators.

**Reference Books:**

1. Agarwal B. L. (2019) *Basic Statistics*, New Age International (P) Limited.
2. Gupta S. C. (2019) *Fundamentals of Statistics*, Himalaya Publishing House Pvt. Ltd.
3. Patil P.Y. and Kore B. G. (2023) *Statistics Practical Paper-I*, Nirali Publication, Kolhapur
4. Rita Kumari (2023) *Sankhiki: Statistics*, Motilal Banarasidas.
5. Sharma V. K. (2012) *Elements of Statistics*, Gullybaba Publishing House Pvt. Ltd.

**B. Sc. Part – I Semester – II**

**DSC-III**

**(STATISTICAL METHODS)**

**Theory: 30 hrs., Marks -50 (Credits: 02)**

**Course Outcomes:** The students will acquire knowledge of

- i. the time series data and its analysis,
- ii. rates of vital events, its computation and interpretation,
- iii. how to compute and interpret index numbers,
- iv. cost of living index number and its utility,

**Unit 1:**

**(15 hrs.)**

**1.1 Analysis of Time Series Data:**

- Meaning and need of time series data analysis.
- Components of time series: (i) secular trend (ii) seasonal variations (iii) cyclical variations (iv) random or irregular variations.
- Additive model and multiplicative model.
- Utility of time series data analysis.
- Measurement of secular trend by using: (i) moving average method (ii) progressive average method (iii) least square method.
- Measurement of seasonal variations by simple average method.

**1.2 Demography:**

- Introduction and need of vital statistics;
- Vital events and rates of vital events,
- Measurement of fertility: Crude Birth Rate (CBR), Age Specific Fertility Rate (ASFR), General Fertility Rate (GFR) and Total Fertility Rate (TFR);
- Measurement of mortality: Crude death rate (CDR), Specific Death Rate (SDR), Age Specific Death Rate (ASDR), Infant Mortality Rate (IMR), Standardized Death Rate (STDR) by i) direct method ii) indirect method ;
- Measurement of Population Growth: Gross Reproduction Rate (GRR), Net Reproduction Rate (NRR), relation between GRR and TFR; Introduction to Life tables.

**Unit 2**

**(15 hrs.)**

**2.1 Index Numbers:**

- Meaning and utility of index numbers.
- Price, Quantity and Value index numbers.
- Problems in the construction of index numbers.
- Types of index numbers: Un-weighted and weighted index numbers.



- Methods of computing un-weighted index numbers: (a) Simple aggregate method and (b) Average of price or quantity relative method (using A.M. or G.M.).
- Methods of computing weighted index numbers: (a) Laspeyre's method (b) Paasche's method and (c) Fisher's method.

## 2.2 Tests of Index Numbers:

- Unit test, time reversal test and factor reversal tests.
- Cost of living index numbers, construction of cost of living index numbers by using (i) Family budget method and (ii) Aggregate expenditure method.
- Purchasing power of money; difference between money wages and real wages.
- Meaning and interpretation of BSE (Bombay Stock Exchange) and NSE (National Stock Exchange) indices.

## 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. Chatfield C. "The Analysis of Time Series –An Introduction", Chapman & Hall, 2004.
3. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
4. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol.I and II, World Press, Calcutta.
5. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
6. Gupta V.K. & Kapoor S.C. Fundamentals of Applied Statistics.- Sultan & Chand
7. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
8. Kendall M.G. "Time Series", Charles Griffin, 1978.
9. Snedecor G.W. and Cochran W. G. "Statistical Methods", Iowa State University Press.
10. Srivastava D. S: A Text book of Demography.
11. Waiker and Lev.: Elementary Statistical Methods.

## B. Sc. Part – I Semester – II

### DSC-IV

### (DISCRETE PROBABILITY DISTRIBUTIONS)

**Theory: 30 hrs. Marks -50 (Credits: 02)**

**Course Outcomes:** The students will acquire knowledge of

- i. One point, Two point and Bernoulli distributions,
- ii. Discrete uniform, Binomial and Hypergeometric distributions,
- iii. Poisson, Geometric and Negative binomial distributions.
- iv. Applications of these distributions in real-life situations.

## Unit 1:

**(15 hrs.)**

### 1.1 Some standard discrete distributions on finite sample space-I:

- One point distribution: p. m. f., mean and variance,
- Two point distribution: p. m. f., mean and variance,
- Bernoulli distribution: p. m. f., p. g. f., mean, variance.
- Discrete Uniform Distribution: p. m. f., mean and variance.

### 1.2 Some standard discrete distributions on finite sample space-II:

- Binomial Distribution: Genesis of the distribution, Binomial random variable, p. m. f. with parameters (n, p), recurrence relation for obtaining successive probabilities, mean, variance and mode of the distribution; skewness, p. g. f., Additive property of binomial variates; distribution of sum of independent and identically distributed Bernoulli variables, numerical problems.
- Hypergeometric Distribution: Genesis of the 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 distribution (Statement only), numerical problems.

**Unit 2:** Some standard discrete probability distributions on countable infinite sample space: **(15 hrs)**

**2.1 Poisson distribution:** Genesis of the distribution; probability mass function (p. m. f.) of Poisson distribution with parameter  $\lambda$ , mean, variance, probability generating function (p. g. f.); Recurrence relation for obtaining successive probabilities; Additive property of Poisson distribution; Poisson distribution as a limiting case of Binomial distribution (Statement Only); numerical problems.

**2.2 Geometric and Negative Binomial distributions:**

- Geometric Distribution: Genesis of the distribution, probability mass function (p. m. f.) of Geometric distribution with parameter  $p$ , mean and variance, cumulative distribution function (c. d. f.), probability generating function (p. g. f.); Lack of memory property; numerical problems.
- Negative Binomial Distribution: Genesis of the distribution, probability mass function (p. m. f.) of Negative binomial distribution with parameters  $(k, p)$ . Geometric distribution as a particular case of Negative binomial distribution; mean, variance and p. g. f.; recurrence relation for obtaining successive probabilities; numerical problems.

**Books Recommended:**

1. Gupta S. C. & Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.
2. Goon, A.M., Gupta M.K. and Dasgupta B: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
3. Hogg R. V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
4. Mood A.M., Graybill F.A.: Introduction to theory of Statistics.
5. Boes D.C. Tata, McGraw Hill, New Delhi. (Third Edition)
6. Parimal Mukhopadhyaya: An Introduction to the Theory of Probability. World Scientific Publishing.
7. Walpole R.E. & Mayer R.H.: Probability & Statistics, MacMillan Publishing Co. Inc, New York.

**B. Sc. Part – I Semester – II**  
**DSC-P-II**  
**(STATISTICS PRACTICAL-II)**  
**Practical: 60 hrs. Marks -50 (Credits: 02)**

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

**Course Outcomes:** After completion of this course, students will be able to:

- i. analysis and interpret time series data,
- ii. compute and interpret population mortality, fertility and growth rates,
- iii. compute and interpret price, quantity and value index numbers,
- iv. understand the applications of discrete probability distributions.

**List of Practicals:**

1. Analysis of Time Series data. (Measurement of trend by moving average, progressive average and least square methods, Seasonal indices by simple average method).
2. Demography-I (Measurement of Mortality rates).
3. Demography-II (Measurement of Fertility and reproduction rates).
4. Computation of Index numbers.
5. Applications of discrete uniform and Binomial distributions.
6. Applications of Hypergeometric distribution.
7. Applications of Poisson distribution.
8. Applications of Geometric and Negative Binomial distributions.

9. Case study equivalent to 2 Practicals.

**Notes:**

- a) Students must complete all experiments using MS-EXCEL.
- b) Case study – In case study, students are expected to analyze real data sets (primary or secondary) using statistical techniques / tools which they have learnt.
- c) MS-EXCEL should be used at the time of practical examination for calculation.
- d) Student must complete the entire practical to the satisfaction of the teacher concerned.
- e) Student 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 at least 20 computers along with necessary softwares, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

**Nature of Practical Question Paper:**

- a) In the practical question paper there shall be four questions each of 16 marks, a student has to attempt any two questions.
- b) Computations should be completed experiments using MS-EXCEL and should be demonstrated to examiner. Aim of the experiment, Formulae, Results etc. should be written on practical answer paper.
- c) 8 marks are reserved for case study, 5 marks are reserved for the journal and 5 marks for the oral examination.
- d) Practical examination is of four hours duration which includes viva (oral) examination and on line demonstration.

**B. Sc. Part - I, Semester - II**

**OE-II**

**Semester – II**

**(BASIC STATISTICS PRACTICAL-II)**

**Practical: 60 Hrs. Marks: 50 (Credits: 02)**

**Course Outcomes:**

After completion of this practical course, the student will be able to:

- i) exhibit variation in data by computing measures of dispersion.
- ii) demonstrate and interpret correlation between two variables by using Scatter Plot.
- iii) compute correlation coefficient between two variables and interpret the values of correlation coefficient.
- iv) obtain linear regression of dependent variable on independent variable and hence estimate value of dependent variable for given value of independent variable.

**LIST OF PRACTICALS:**

1. Measures of dispersion - I: Range, Quartile Deviation, Standard Deviation and their respective relative measures for **ungrouped** data
2. Measures of dispersion -II: Range, Quartile Deviation, Standard Deviation and their respective relative measures for **grouped** data.
3. Scatter Plot.
4. Karl Pearson's correlation coefficient.
5. Spearman's rank correlation coefficient.
6. Linear Regression Equations-I: Obtaining Linear Regression Equations and estimation of dependent variable when bivariate data is given.

7. Linear Regression Equations-II: Obtaining Arithmetic Means, Correlation Coefficient and estimation of dependent variable when Linear Regression equations are given.

8. Case study : Application of at least three practicals from above.

**Note:** Essential requirements for doing all the practicals from above list are:

- i) Students should be made familiar with theory part of every practical.
- ii) Students are expected to be familiar in using MS-Excel software as an essential computing tool, otherwise they also can use Scientific Calculators.

**Reference Books:**

- 1. Agarwal B. L. (2019) *Basic Statistics*, New Age International (P) Limited.
- 2. Gupta S. C. (2019) *Fundamentals of Statistics*, Himalaya Publishing House Pvt. Ltd.
- 3. Patil P.Y. and Kore B. G. (2023) *Statistics Practical Paper-I*, Nirali Publication, Kolhapur
- 4. Rita Kumari (2023) *Sankhiki: Statistics*, Motilal Banarasidas.
- 5. Sharma V. K. (2012) *Elements of Statistics*,