

**Rayat Shikshan Sanstha's**  
**SADGURU GADAGE MAHARAJ**  
**COLLEGE, KARAD**

**(An Autonomous College)**

**Revised Syllabus**

**Bachelor of Science**

**Part II**

**STATISTICS (Minor)**

Choice Based Credit System (CBCS) as per NEP - 2020

Syllabus Implemented w. e. f. June, 2024

**Paper V: MN-BST23-301**

**Statistical Methods –I**

**Credits: 02**

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

- i) The concept of multiple correlations, partial correlation and their computations.
- ii) Need, Construction and utility of various index numbers.
- iii) The concepts related to national income and different methods of estimation of national income.

**Unit-1:**

Credit: 01

**1.1:** Concept of distinguishable elementary units, sampling units, sampling frame, random sampling and non-random sampling. Advantages of sampling method over census method, objectives of a sample survey, Designing a questionnaire, Characteristics of a good questionnaire, Concept of sampling and non-sampling errors. Handling of nonresponse cases.

**1.1.1 : Simple random sampling:** Simple random sampling from finite population of size N with replacement (SRSWR) and without replacement (SRSWOR): Definitions, population mean and population total as parameters, inclusion probabilities.

**1.1.2 : Stratified Sampling:** Real life situations where stratification can be used. Description of stratified sampling method where sample is drawn from individual stratum using SRSWOR method.

**1.1.4: Systematic Sampling:** Real life situations where systematic sampling is appropriate. Technique of drawing a sample using systematic sampling.

Estimation of population mean and population total.

Comparison of systematic sampling with SRSWOR.(Without Proof)

**1.2: Reliability Theory**

Binary Systems : Block diagrams , definition of binary coherent structure and illustrations. Coherent system of component at most three (a) Series , (b) Parallel , (c) 2 out of 3: G Minimal cut, minimal path representation of system.

Reliability of binary system: Reliability of above systems  $h(p)$ , when components are independent and identically distributed with common probability  $p$  of operating.

## **Unit-2:**

Credit: 01

### **2.1: Index Numbers :**

Meaning and utility of index numbers , problems in construction of index numbers. Types of index numbers: price, quantity and value. Unweighted and Weighted index numbers using (i) aggregate method , (ii) average of price or quantity relative method (A.M. or G.M. is to be used as an average). Index numbers using : Laspeyre's , Paasche's and Fisher's formula. Tests of index numbers : unit test, time reversal test and factor reversal tests. Cost of living index number : definition , problems in construction, construction by using (i) Family Budget and (ii) Aggregate expenditure method.

### **2.2 : National Income :**

Definitions of national income by (i) Marshall,(ii) Pigou and (iii) Fisher. Different concept of national income (i) Gross national product (GNP),(ii) Net national product (NNP). Personal income, disposable income, per capita income, gross domestic product(GDP), national income at market price, national income at factor cost, national income at current prices, national income at constant prices. Methods of estimation of national income and the difficulties in methods (i) output method, (ii) income method, (iii) expenditure method. Importance of national income.

### **Books Recommended:**

1. Barlow R. E. and Proschan Frank: Statistical Theory of Reliability and Life Testing. Holt Rinehart and Winston Inc., New York.
2. Sinha S. K.: Reliability and Life Testing, Second Edition, Wiley Eastern Publishers, New Delhi.
3. Parimal Mukhopadhyaya: An Introduction to the Theory of Probability. World Scientific Publishing.
4. Hogg R.V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
5. Gupta S. C. & Kapoor V.K.: Applied Statistics. Sultan Chand & sons, New Delhi.

## **B.Sc.II : Semester III :**

### **MN-BSP23-302: Practical – III**

**Credits:02**

**Pre requisites :** Knowledge of the topics in the theory papers and MS-Excel.

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

- i)** Compute multiple and partial correlation coefficients.
- ii)** Compute reliability of Series and parallel system.

### **Practical –III**

1. Simple Random Sampling
2. Stratified Sampling.
3. Systematic Sampling.
4. Reliability Theory-I
5. Reliability Theory-II
6. Index Numbers-I ( Computations of index numbers and tests of adequacy)
7. Index Numbers-II (Shifting of base , splicing, deflating, purchasing power of money)
8. National Income.

**Note:**

- a) Students must complete all practicals by using MS-EXCEL.
- b) MS-EXCEL should be used at a time of practical examination for computation purpose.
- c) Student must complete the entire practical to the satisfaction of the teacher concerned.

Student must produce the laboratory journal along with the completion certificate signed by Head of Department, at the time of College practical Examination

**Nature of Practical Examination:**

- a) Student will be asked to solve/attempt any Two problems out of FOUR for Practical paper Practical Paper III.
- b) Practical Paper III carries 45 Marks with distribute 5 marks will be reserved for Practical Journal completion and 5 marks for oral on entire practical work.
- c) 5 marks will be reserved for case study and oral on it.
- d) MS-EXCEL should be used for computation purpose. Students evaluation during practical examination will be online and students should demonstrate / explain his computations to the examiner.
- e) Practical examination of each Paper will be of 4 hours duration which includes oral as well as online demonstration.
- f) There should be two subject experts at the time of Practical examination.

**Nature of Question Paper for Theory Examination (40+10 Pattern ) as per NEP-2020:**

**Maximum Marks : 40**

**Duration : 2 Hrs**

**Que. 1 Select the most correct alternatives from the following [8 Marks]**

**Que. 2 Attempt any TWO of the following [16 Marks]**

**Que. 3 Attempt any FOUR of the following [16 Marks]**

**B. Sc. Part II (Semester-IV)**

**Paper VI : MN-BST23-401**

**Statistical Methods-II**

**Credits:02**

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

- i) The Concept and use of time series analysis.
- ii) The meaning, purpose and use of Statistical Quality, Construction and working of control charts for variables and attributes.
- iii) Applying the appropriate small sample tests and large sample tests in various situations.

**Unit 1:**

Credit:01

**1.1 : Time Series:**

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.

Measurements of trends : (i) Moving averages method (ii) Progressive averages method (iii) Least square method (iv) Measurement of seasonal indices by simple average method.

**1.2: Statistical Quality Control:**

Meaning and purpose of S.Q.C., Process control, Product control, chance causes, assignable causes, Shewhart's control chart- construction & working, lack of control situation.

Control charts for variables - control chart for mean, control chart for range, construction and working of mean & range charts for unknown standards, revised control limits.

Control charts for Attributes – Defects, defectives, fraction defective, control chart for fraction defective (p-chart) for fixed sample size and unknown standards, construction and working of chart. Control charts for number of defects (C-chart), for unknown standards, construction and working of C-chart.

**Unit 2:**

Credit:01

**2.1 : Testing of Hypothesis - I:**

Notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistics  $\bar{X}$  and  $S^2$  when sample is drawn from normal distribution (statement only). Hypothesis, Simple and composite hypothesis, Null and

alternative hypothesis, type I and type II errors, Critical region, level of significance, p-value. One and two tailed test, power of test.

**2.2: Testing of Hypothesis - II:** General procedure of testing of hypothesis.

**Small Sample Tests:**

t- test : Test for means: i)  $H_0: \mu = \mu_0$ , ii)  $H_0: \mu_1 = \mu_2$ , (where  $\sigma_1^2 = \sigma_2^2$ ), iii) Paired t-test  
 $\chi^2$  - test : Test for population variance  $H_0: \sigma^2 = \sigma_0^2$  ( Mean Known and unknown)  
F – test : Test for equality of two population variances  $H_0: \sigma_1^2 = \sigma_2^2$

**Large Sample Tests:**

- A) Tests for means: i) Testing of population mean;  $H_0: \mu = \mu_0$   
ii) Testing equality of population means;  $H_0: \mu_1 = \mu_2$
- B) Tests for Proportion: i) Testing of population Proportion;  $H_0: P = P_0$   
ii) Testing equality of population Proportion;  $H_0: P_1 = P_2$
- C) Test for population correlation by using Fisher's Z- transformation:  
i) Testing of population correlation;  $H_0: \rho = \rho_0$   
ii) Testing equality of population correlations;  $H_0: \rho_1 = \rho_2$
- D)  $\chi^2$  – tests for : i) Goodness of fit of given probability distribution and  
ii) Test for independence of attributes when data is in the form of:  
a) m x n contingency table  
b) 2 x 2 contingency table, Yate's correction for continuity.

**Books Recommended:**

1. Chatfield C. : "The Analysis of Time Series –An Introduction", Chapman & Hall.
2. Gupta S. C. & Kapoor V.K.: Applied Statistics. Sultan Chand & sons, New Delhi.
3. Kendall M.G. : "Time Series", Charles Griffin.
4. Dr. Kore B.G. and Dr. Dixit P.G.: "Statistical Methods-II", Nirali Prakashan, Pune.
5. Gupta S. C. & Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.

**B.Sc.II : Semester IV :**

**MN-BSP23-402: Practical-IV**

**Credits:02**

**Pre requisites :** Knowledge of the topics in the theory papers and MS-Excel.

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

- i) Test various hypothesis about parameters of specified distribution for given data.
- ii) Construct various control chart.

**Practical – IV**

1. Large sample tests for means.
2. Large sample tests for proportions.
3. Tests based on Chi square distribution.(Test for population variance, Test for goodness of fit.)Tests for independence.
4. Tests based on t distribution ( $\mu = \mu_0, \mu_1 = \mu_2$ ; paired t test)
5. Tests based on F distribution. ( $\sigma_1^2 = \sigma_2^2$ )
6. Time Series.-I (Trend by Progressive averages, Moving average )
7. Time Series.-II (least square methods)
8. Construction of R and X charts.
9. Construction of P and C charts.



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