| DEPARTMENT OF STATISTICS | | | | *CLASS: I M.Sc. Statistics* | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Course Type** | **Course Code** | **Course Title** | **Credits** | **Contact Hours/week** | **CIA** | **Ext** | **Total** |
| II | Major Core-6 | 21P2SMC6 | Sampling Techniques | 4 | 5 | 25 | 75 | 100 |

| **Nature of Course** | | | | |
|---|---|---|---|---|
| Knowledge and skill | ✓ | | Employability oriented | |
| Skill oriented | | | Entrepreneurship oriented | |

**Course Objectives:**

- To define the concept of population under study
- To study various sampling methods, determination of the sample size and the application of sampling techniques in various disciplines.

| Unit | Description | Hours | K-level | CLO(s) |
|---|---|---|---|---|
| **I** | *(Simple random sampling, stratified random sampling and systematic sampling methods. Estimation of essential population characteristics.* ***Not for Examination for knowledge purpose only****)* Ratio Estimator: Approximate variance – Confidence limits – Comparison of the Ratio estimator with mean per unit – Conditions under which Ratio estimator is a BLUE – Bias term – Separate and combined ratio estimators – Unbiased Ratio Type estimator (Hartley and Ross). Regression Estimators – Regression estimates with pre assigned "b" – sample estimate of variance – Bias – Regression estimators in Stratified Sampling. | 18 | K3 | **1** |
| **II** | Varying probability sampling: Cumulative total method and Lahiri's method. Estimation in PPS sampling with replacement, and without replacement; General selection procedures, Narian's Scheme of sample selection and Sen-Midzuno method – Ordered estimator: Des Raj, Unordered estimators: Hurwitz – Thompson estimator and Murthy's estimator. | 16 | K3 | **2** |
| **III** | Cluster Sampling: Equal cluster sampling – Estimators of mean and variance, optimum cluster size, Unequal cluster sampling – Estimators of mean and variance, varying probability cluster sampling. | 12 | K4 | **3** |
| **IV** | Two stage sampling – variance of the estimated mean. Multiphase sampling: Double sampling for stratification – Optimum allocation – Estimated variance in Double sampling for stratification. | 15 | K4 | **4** |
| **V** | Sources of errors in Surveys – A mathematical model of the effects of call-backs – a mathematical model of the errors of measurement – Interpenetrating subsampling method. | 13 | K2 | **5** |

**Books for Reference:**


1. Singh, D and Choudhary, F.S. (1977) Theory and Analysis of Sample Survey Designs.Wiley Eastern, New Delhi.
2. Cochran, W.G, (2007), Sampling Techniques, Third Edition, John Wiley & Sons, New Delhi.
3. Ardilly, P. and Yves T. (2006) Sampling Methods: Exercise and Solutions. Springer, New York.
4. Desraj (1976) Sampling Theory, McGraw Hill, New York.
5. Mukhopadyay, P. (2007) Survey Sampling.Narosa, New Delhi.
6. Sukhatme, P.V. and Sukhatme, B.V. (1970) Sampling Theory Surveys with Applications, 2/e, Iowa State University Press,Iowa.
7. Kish, L. (1961) Survey Sampling, Wiley, New York.
8. Murthy, M.N (1997) Sampling Theory and methods, Statistical Publishing Society, Calcutta.
9. Thompson, S.K, (2012), Sampling, John Wiley and Sons, New York.
10. Sampath S (2001), Sampling Theory and Methods, The new age international ltd. New Delhi.


**Web references:**

1. sampling methods
   https://uca.edu/psychology/files/2013/08/Ch7-Sampling-Techniques.pdf
   http://iced.cag.gov.in/wp-content/uploads/C-07/SAMPLING_TECHNIQUES.pdf
2. Ratio Estimator
   http://182.18.165.51/Fac_File/STUDY183@323405.pdf
3. Regression Estimators
   https://nptel.ac.in/content/storage2/courses/111104073/Module6/Lecture20.pdf
   http://home.iitk.ac.in/~shalab/sampling/chapter6-sampling-regression-method-estimation.pdf
4. Varying probability sampling
   http://150.107.117.36/NPTEL_DISK4/NPTEL_Contents/Web_courses/Phase2_web/111104073/Module7/Lecture24.pdf
   https://nptel.ac.in/content/storage2/courses/111104073/Module7/Lecture23.pdf
5. Cluster Sampling
   https://nptel.ac.in/content/storage2/courses/111104073/Module9/Lecture30.pdf
   http://home.iitk.ac.in/~shalab/sampling/chapter9-sampling-cluster-sampling.pdf
6. Two stage sampling
   http://home.iitk.ac.in/~shalab/sampling/chapter10-sampling-two-stage-sampling.pdf
   https://nptel.ac.in/content/storage2/courses/111104073/Module10/Lecture33.pdf
7. Sources of errors in Surveys
   http://web.hku.hk/~plhyu/7006/chap3.pdf

**Rationale for Nature of the course**

Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies.

**Activities having direct bearing on Skill development / Employability / Entrepreneurship**

Seminars on Data collection with issues in the field work and decision of sample size

**Pedagogy**

Chalk and Talk, PPT, Seminar, Interaction, Problem solving.

**Lecture Schedule**

| Unit | Topics | Hours | Mode |
|---|---|---|---|
| I | Simple random sampling, stratified random sampling and systematic sampling methods. Estimation of essential population characteristics. | **5** | PPT, Chalk and Talk and Assignments |
| | Ratio Estimator | **3** | |
| | Regression Estimators | **4** | |
| | Regression estimates with pre assigned "b" – sample estimate of variance – Bias | **3** | |
| | Regression estimators in Stratified Sampling | **3** | |
| II | Varying probability sampling- Cumulative total method and Lahiri's method | **4** | PPT, Chalk and Talk and Assignments |
| | Estimation in PPS sampling with replacement, and without replacement | **4** | |
| | General selection procedures, Narian's Scheme of sample selection and Sen-Midzuno method | **4** | |
| | Ordered estimator: Des Raj, Unordered estimators: Hurwitz – Thompson estimator and Murthy's estimator | **4** | |
| III | Cluster Sampling: Equal cluster sampling – Estimators of mean and variance, optimum cluster size | **6** | PPT, Chalk and Talk, Assignments and seminar |
| | Unequal cluster sampling – Estimators of mean and variance, varying probability cluster sampling. | **6** | |
| IV | Two stage sampling – variance of the estimated mean. | **3** | PPT, Chalk andTalk, |
| | Multiphase sampling: Double sampling for stratification. | **2** | |
| | Optimum allocation | **3** | |
| | Estimated variance in Double sampling for stratification. | | |
| V | Sources of errors in Surveys – A mathematical model of the effects of call-backs | **2** | PPT, Chalk and Talk, Assignments |
| | mathematical model of the errors of measurement | **3** | |
| | Interpenetrating subsampling method. | **3** | |

**Course Learning Outcomes**

On the successful completion of the course, students will be able to

| CLO's | Course Learning Outcomes | Knowledge |
|---|---|---|
| **CLO-1** | Use practical applications of ratio and regression method of | Up to K3 |
| **CLO-2** | Apply varying probability sampling viz. PPSWR, PPSWOR including Lahiri's method and Murthy's estimator for survey. | Up to K3 |
| **CLO-3** | Implement Cluster sampling for equal and unequal sampling | Up to K4 |
| **CLO-4** | Discuss and estimate two stage sampling and multiphase sampling | Up to K4 |
| **CLO-5** | Define and distinguish errors in survey | Up to K2 |

**MAPPING CLOs WITH PSOs**

| # | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|---|---|---|---|---|---|---|---|
| **CLO-1** | 2 | 3 | 2 | 1 | 1 | 2 | 2 |
| **CLO-2** | 2 | 3 | 2 | | | 2 | 2 |
| **CLO-3** | 2 | 3 | 2 | 1 | 1 | 2 | 2 |
| **CLO-4** | 2 | 3 | 2 | | | 2 | 2 |
| **CLO-5** | 2 | 2 | 2 | | | 3 | 2 |

Advance application – 3; Intermediate level – 2; Basic level - 1

**CIA I – Blue Print**

| Units | CLOs | K- Level | Section A | | Section B | | Section C | |
|---|---|---|---|---|---|---|---|---|
| | | | Short Answers | | (Either/or Choice) | | (Open Choice) | |
| | | | No. of Questions | K- Level | No. of Questions | K- Level | No. of Questions | K- Level |
| 1 | CLO 1 | Up to K3 | 2 | K1 , K2 | 2 | K2, K3 | 1 | K3 |
| 2 | CLO 2 | Up to K3 | 3 | K1, K2,K3 | 2 | K2, K3 | 2 | K2, K3 |
| No. of Questions to be asked | | | 5 | | 4 | | 3 | |
| No. of Questions to be answered | | | 5 | | 2 | | 2 | |
| Marks for each question | | | 2 | | 5 | | 10 | |
| Total Marks for each section | | | 10 | | 10 | | 20 | |

**CIA-I :: Distribution of section wise marks with K levels.**

| K Levels | Section B (Short Answers) | Section C (Either/ or) | Section D (Open choice) | Total marks | % of marks without choice | Consolidated |
|---|---|---|---|---|---|---|
| K1 | 4 | - | - | 4 | 6.67 | 46.67% |
| K2 | 4 | 10 | 10 | 24 | 40.00 | |
| K3 | 2 | 10 | 20 | 32 | 53.33 | 53.33% |
| K4 | - | - | - | - | - | - |
| K5 | - | - | - | - | - | - |
| Total marks | 10 | 20 | 30 | 60 | | |

**CIA II – Blue Print**

| Units | CLOs | K- Level | Section A | | Section B | | Section C | |
|---|---|---|---|---|---|---|---|---|
| | | | Short Answers | | (Either/or Choice) | | (Open Choice) | |
| | | | No. of Questions | K- Level | No. of Questions | K- Level | No. of Questions | K- Level |
| 1 | CLO 3 | Up to K3 | 3 | K1, K1, K2 | 2 | K3,K2 | 2 | K2, K3 |
| 2 | CLO 4 | Up to K4 | 2 | K2, K3 | 2 | K3, K4 | 1 | K4 |
| No. of Questions to be asked | | | 5 | | 4 | | 3 | |
| No. of Questions to be answered | | | 5 | | 2 | | 2 | |
| Marks for each question | | | 2 | | 5 | | 10 | |
| Total Marks for each section | | | 10 | | 10 | | 20 | |

**CIA-II :: Distribution of section wise marks with K levels.**

| K Levels | Section B (Short Answers) | Section C (Either/ or) | Section D (Open choice) | Total marks | % of marks without choice | Consolidated |
|---|---|---|---|---|---|---|
| K1 | 4 | - | - | 4 | 6.67 | 38.33% |
| K2 | 4 | 5 | 10 | 19 | 31.66 | |
| K3 | 2 | 10 | 10 | 22 | 36.67 | 36.67% |
| K4 | - | 5 | 10 | 15 | 25.00 | 25% |
| K5 | - | - | - | - | - | - |
| Total marks | 10 | 20 | 30 | 60 | 100 | |

**Summative Examination Blue Print**

| S. No. | CLOs | K Level | Section A | | Section B | | Section C (Either/or Choice) | Section D (Open Choice) |
|---|---|---|---|---|---|---|---|---|
| | | | MCQs | | Short Answers | | | |
| | | | No. of questions | K Level | No. of questions | K level | | |
| 1 | CLO 1 | Up to K3 | 2 | K2& K3 | 1 | K2 | 2(K2& K3) | 1(K3) |
| 2 | CLO 2 | Up to K3 | 2 | K2 & K3 | 1 | K2 | 2(K2 & K3) | 1(K3) |
| 3 | CLO 3 | Up to K4 | 2 | K3 & K4 | 1 | K1 | 2(K4 & K4) | 1(K4) |
| 4 | CLO 4 | Up to K4 | 2 | K3 & K4 | 1 | K3 | 2(K4 & K4) | 1(K4) |
| 5 | CLO 5 | Up to K2 | 2 | K1 & K1 | 1 | K1 | 2(K1 & K1) | 1(K2) |
| No. of Questions to be asked | | | 10 | | 5 | | 10 | 5 |
| No. of Questions to be answered | | | 10 | | 5 | | 5 | 3 |
| Marks for each question | | | 1 | | 2 | | 5 | 10 |
| Total Marks for each Section | | | 10 | | 10 | | 25 | 30 |

**Distribution of section wise marks with K levels for SummativeExamination**

| K Levels | Section A MCQs | Section B (Short Answers) | Section C (Either/ or) | Section D (Open choice) | Total marks | % of marks without choice | Consolidated |
|---|---|---|---|---|---|---|---|
| K1 | 2 | 4 | 10 | - | 16 | 13.33 | |
| K2 | 2 | 4 | 10 | 10 | 26 | 21.67 | 35% |
| K3 | 4 | 2 | 10 | 20 | 36 | 30 | 30% |
| K4 | 2 | - | 20 | 20 | 42 | 35 | 35% |
| K5 | - | - | - | - | - | - | - |
| Total marks | 10 | 10 | 50 | 50 | 120 | 100 | 100% |

**Course Designers:**

1. **Dr. P. Vetri Selvi**
2. **Dr. A. Saberunnisa**