Discipline Specific Elective for B. Sc. (H) Statistics

DISCIPLINE SPECIFIC ELECTIVE COURSE-2A: COMPUTER PROGRAMMING IN C

CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the Course			Eligibility Criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical / Practice		
Computer Programming in C	4	3	0	1	Class XII with Mathematics	---

Learning Objectives:
The learning objectives of this course are as follows:
- To introduce computer programming and its roles in problem-solving.
- To describe data structures
- To develop logics that will help to create well-structured programs using C language

Learning Outcomes:
After successful completion of this course, students should be able to:
- Understand various data types, operators, library functions, Input/Output operations.
- Decision making and branching and looping.
- Use Arrays, Characters, and strings.
- Understand user-defined functions, and recursive functions.
- Storage class of Variables
- Apply Pointers and Structure
- Pre-processors: Macro substitution, macro with argument
- File inclusion in C, I/O operations on files.

SYLLABUS OF DSE-2A
Theory

UNIT I (6 hours)
Introduction to C
History and importance of C. Components, basic structure programming, character set, C tokens, Keywords and Identifiers and execution of a C program. Data types: Basic data types, Enumerated data types, derived data types. Constants and variables: declaration and assignment of variables, Symbolic Constants, overflow and underflow of data.

UNIT II (9 hours)
Expressions and I/O functions
Operators and Expressions: Arithmetic, relational, logical, assignment, increment/decrement and conditional operators, precedence of operators in an expression. Managing input and output from the standard devices.

UNIT III (12 hours)
Branching and Arrays
Decision making and branching - if…else, nesting of if…else, else if ladder, switch. Looping in C: for, while, do…while, jumps in and out of loops.
Arrays: Declaration and initialization of one-dim and two-dim arrays. Character arrays and strings: Declaring and initializing string variables, reading and writing strings from Terminal (using scanf and printf only).

UNIT IV (9 hours)
Functions and Storage class
User- defined functions: definition of functions, return values and their types, function prototypes and calls. Category of Functions and recursive function. Passing arrays to functions, Storage class of Variables.

UNIT V (9 hours)
Pointers, Macros and Files
Pointers: Declaration and initialization of pointer variables, accessing the address of a variable, accessing a variable through its pointer, pointer expressions, pointer increments/decrement and scale factor. Pointers and arrays, functions returning pointers. Introduction of structure. Pre-processors: Macro substitution, macro with argument, file inclusion in C. Defining and opening a file (only r, w and a modes), closing a file, I/O operations on files-fscanf and fprintf functions.

PRACTICAL/LAB WORK – 30 Hours
List of Practicals:
1. Roots of a quadratic equation (with imaginary roots also)
2. Sorting of an array and hence finding median
3. Mean, Median and Mode of a Grouped Frequency Data
4. Variance and coefficient of variation of a Grouped Frequency Data
5. Preparing a frequency table
6. Value of n! using recursion
7. Random number generation from exponential, normal (using CLT) and gamma distribution calculate sample mean and variance.
8. Matrix addition, subtraction, multiplication, Transpose and Trace
9. Fitting of Binomial distribution and apply Chi-square test for goodness of fit
10. Chi-square contingency table
11. t-test for difference of means
12. Paired t-test
13. F-ratio test
14. Multiple and Partial correlation.
15. Compute ranks and then calculate rank correlation(without tied ranks)

16. Fitting of lines of regression

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:
- Balagurusamy, E. (2019): Programming in ANSI C, 8th Edition, Tata McGraw Hill.
- Gottfried, B.S. (1998): Schaum's Outlines: Programming with C, 2nd Edition, Tata McGraw Hill
- Kernighan, B.W. and Ritchie, D. (1988): C Programming Language, 2ndEdition,Prentice Hall.

SUGGESTED READING:
- Kanetkar, Y. (2020) : Let Us C, 18th Edition, BPB Publications
- Perry, G. and Miller, D. (2015) : C Programming Absolute Beginner's Guide, 3rd Edition, Pearson Publications

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE-2B:
ADVANCED TECHNIQUES OF SAMPLE SURVEYS

CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

Course title and code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lectures	**Tutorials**	**Practical/ Practice**		
Advanced Techniques of Sample Surveys	4	3	0	1	Class XII with Mathematics	Knowledge of sample surveys

Learning Objectives:
The learning objectives of this course are as follows:
- To introduce advanced techniques relating to stratified and systematic sampling, ratio and regression methods of estimation.
- To introduce cluster and two-stage sampling when the population is divided into groups.
- To describe the errors due to factors other than the inductive process of inferring about the population from a sample.

Learning Outcomes:
After successful completion of this course, students should be able to:
- Understand Post Stratification,

- Determine the optimum number of strata and their construction
- Comprehend Circular systematic sampling
- Apply Ratio and Regression method of estimation under the Superpopulation model
- Use Cluster sampling, and Two-stage sampling
- Classify non-sampling errors

SYLLABUS OF DSE-2B
Theory

UNIT I (15 Hours)
Stratified and Systematic Sampling
Stratified Sampling: Post Stratification, effect of increasing the number of strata, determination of optimum number of strata, construction of strata (Neyman allocation, Proportional allocation and approximate method by Dalenius and Hodges), method of collapsed strata, allocation requiring more than 100% sampling.
Systematic Sampling: Circular systematic sampling, Yates' and Cochran method of estimation of sampling variance.

UNIT II (15 Hours)
Superpopulation Model and Cluster Sampling
Superpopulation model, Ratio method of estimation under superpopulation model, regression method of estimation under superpopulation model.
Cluster Sampling (equal-sized clusters): Estimation of population mean and its variance, efficiency of cluster sampling, the effect of formation of clusters randomly, efficiency of cluster sampling in terms of intra-class correlation, estimation of efficiency, optimum size of cluster.

UNIT III (15 Hours)
Two-Stage Sampling and Non-Sampling Errors
Two-stage sampling/sub-sampling (Equal first stage units): Estimation of population mean and its variance, Estimator of variance of the sample mean, allocation of sample to two-stages, comparison of two-stage with one-stage sampling.
Non-sampling errors: Classification of non-sampling errors, types of non-sampling errors, bias due to non-response, Hansen and Hurwitz technique, comparison of Hansen and Hurwitz technique with SRS under a cost constraint

PRACTICAL/LAB WORK – 30 Hours
List of Practicals:

Practical Work based on:
1. Dalenius and Hodges method of construction of strata
2. Determination of optimum number of strata
3. Cluster sampling
4. Circular systematic sample
5. Ratio method of estimation under superpopulation model
6. Regression method of estimation under superpopulation model
7. Two-stage sampling

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:

- Cochran, W.G. (2011): Sampling Techniques (3rd Ed.), Wiley Eastern John Wiley and Sons..
- Sukhatme, P. V., Sukhatme, B. V., Sukhatme, S., Asok, C.(1984). Sampling Theories of Survey with Application, IOWA State University Press and Indian Society of Agricultural Statistics.
- Gupta, S.C. and Kapoor, V.K. (2007): Fundamentals of Applied Statistics, Sultan Chand and Sons.
- Singh, D. and Chaudhary, F. S. (2015): Theory and Analysis of Sample Survey Designs.

SUGGESTED READING:

- Murthy M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta.
- Des Raj and Chandhok P. (1998): Sample Survey Theory, Narosa Publishing House.
- Goon, A. M., Gupta, M. K. and Dasgupta, B. (2001): Fundamentals of Statistics (Vol.2), World Press.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE-2C: DEMOGRAPHY

CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

Course title and code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lectures	Tutorials	Practical/ Practice		
Demography	4	3	0	1	Class XII with Mathematics	knowledge of basic statistics

Learning Objectives:

The learning objectives of this course are as follows:
- To introduce various demographic concepts and to explain the nature and scope of population studies.
- To explain evaluation and adjustments in age data using different indices.
- To introduce the construction of abridged life tables and the estimation and projection of population by different methods.
- To describe the Graduation of mortality rates by different methods.

Learning Outcomes:

After successful completion of this course, students should be able to:
- Understand the various components of Demography, sources of demographic data collection and errors therein.
- Comprehend population potential, density and concentration.

- Analyse the completeness of registration data using the Chandrasekharan-Deming formula.
- Use concepts of Stable and Stationary Populations.
- Use Balancing Equations.
- Use Myer's and UN indices in evaluating age data.
- Apply measures of the aging of population.
- Understand the concept of Abridged life tables and their construction by Reed and Merrell method and Greville's method.
- Synthesize population estimation and projection by different methods.
- Use Graduation of mortality rates by Makeham's and Gompertz graduation formula.
- Fit of Logistic curve and Makeham's formula.
- Understand the scope of population studies and its relationship with other disciplines.

SYLLABUS OF DSE-2C
Theory

UNIT I: (15 Hours)
Demographic concepts
Definition of demography and its various components, Major sources of demographic data collection and errors therein; Coverage and content errors, Rate of population change, Population density, Population potential, Population composition, Scale of urbanization and scale of population concentration, Concept of Stationary and stable populations, Nature and scope of population studies and its relationship with other disciplines. Balancing equations and its uses.

UNIT II: (15 Hours)
Adjustment of demographic data and abridged life tables
Measures of aging of population: Aged-child ratio, Old-age dependency ratio, Child dependency ratio, Age-dependency ratio, Adjustment of age data at younger age groups and adult ages. Chandrasekharan-Deming formula to check completeness of registration data. Myer's index, United Nation's index.
Abridged life tables: Concept and its construction by Reed-Merrell method and Greville's method.

UNIT III (15 Hours)
Population Estimates and Projections and Graduation of Mortality Rates:
Inter-censal and post-censal estimates by mathematical and component method ; Population Projection by the mathematical method: Logistic curve and its fitting by Pearl and Reed method and Rhodes method. Graduation of mortality rates: Makeham's and Gompertz graduation formula. Fitting of Makeham's formula.

PRACTICAL/LAB WORK - 30 hours
List of Practicals:
1. To find the Population density of a place.
2. To find Population Potential.
3. To find Rate of population change
4. To find Age Dependency ratio.

5. To find Aged Child ratio.
6. To find Child Dependency ratio.
7. To construct Abridged Life Table by Reed and Merrell method.
8. To Construct Abridged Life Table by Greville's method.
9. To fit Logistic curve by Pearl and Reed method.
10. To fit Logistic curve by Rhode's method.
11. To fit Makeham's formula by the method of Four Selected Points.
12. To fit Makeham's formula by the method of Partial Sums.

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:
● Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
● Mukhopadhyay P. (1999): Applied Statistics, Books and Allied (P) Ltd.
● Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
● Pathak, K. B. and F. Ram (1998), *Techniques of Demographic Analysis*, 2nd Edition, Himalaya Publishing House, Bombay.

SUGGESTED READINGS:
● Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
● Keyfitz N., Beckman John A. (1985): Demography through Problems S-Verlag New York
● Ramakumar R. (1986): Technical Demography. Wiley Eastern Limited.

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B.Sc. (P)/B.A(P) with Statistics as Major

Category II

DISCIPLINE SPECIFIC CORE COURSE-7: ELEMENTS OF STATISTICAL INFERENCE

CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the Course	Eligibility Criteria	Pre-requisite