**This document is prepared from the following University Notifications**

- https://www.du.ac.in/uploads/new-web/15092023_Indis_sem1.pdf
- https://www.du.ac.in/uploads/new-web/notifications-2021/28032023_nep-Faculty%20of%20Interdisciplinary%20&%20Applied%20Sciences.pdf
- https://www.du.ac.in/uploads/new-web/15092023_Indis_sem3.pdf
- https://www.du.ac.in/uploads/new-web/18092023_Inter_4.pdf

## DISCIPLINE SPECIFIC ELECTIVES (DSE-3)

### 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 | | |
| Mathematics Foundation for Computing ELDSE-1C | 4 | 3 | 0 | 1 | Course Admission Eligibility | Basic Knowledge of Python language |

### Learning Objectives

The Learning Objectives of this course are as follows:

- The aims is to introduce to students of electronics new mathematics such as Boolean algebra, relations, and graph theory which though look abstract concepts can be used effectively to design and analyze electronic circuits.
- To apply mathematical techniques for real world and engineering problems and expose students to some front-line techniques used in industry and academics.

### Learning outcomes

The Learning Outcomes of this course are as follows:

- Formulate recurrence relations to solve problems involving an unknown sequence. Student should see the significance in light of the Forbenius method they learn.
- Use Boolean algebra to design and analyze digital switching circuitry, such as found in personal computers, pocket calculators, CD players, cellular telephones, and a host of other electronic products.
- Appreciate circuit analysis in terms of topology.

### SYLLABUS OF ELDSE-1C Total Hours- Theory: 45 Hours, Practicals: 30 Hours

**UNIT – I ( 12 Hours)**

**Elementary Combinatorics:** Basic counting principles, Permutations and Combinations (with and without repetitions), Binomial theorem, Multinomial theorem, Counting subsets, Set-partitions, Stirling numbers Principle of Inclusion and Exclusion, Derangements, Inversion formula.

**Generating functions:** Algebra of formal power series, Generating function models, Calculating generating functions, Exponential generating functions.

**UNIT – II (10 Hours)**

**Recurrence Relations:** Recurrence Relations, generating functions, iteration and induction, Linear Recurrence Relations with constant coefficients and their solution, Substitution Method, Divide and conquer relations, Solution of recurrence relations, Solutions by generating functions.

**UNIT – III (11 Hours)**

**Boolean Algebras and Switching Circuits:** Axioms of Boolean Algebra, De Morgan's law, Simplification of Boolean Expressions, Representation theorem, Boolean polynomials, Boolean polynomial functions, Disjunctive normal form and conjunctive normal form, Minimal forms of Boolean polynomial,3, 4 and 5 variable Karnaugh diagrams, Quine-McCluskey method, Switching circuits and applications of switching circuits.

**UNIT – IV (12 Hours)**

**Graph Theory:** Introduction to Graph Theory with emphasis on DC circuit analysis, Representing circuital network as a graph, identification of branches, nodes, Tree branch/ twig. Formulation of incidence matrix. Usage of incidence matrix to solve for node voltage in two loop DC circuits with voltage and/ or current sources.

**Practical component (if any) – Mathematics Foundation for Computing *(Python software)***

### Learning outcomes

The Learning Outcomes of this course are as follows:

- Implement python programs to calculate permutation and combinations.
- Write python programs based on Boolean Algebra and Minimize Karnaugh diagrams
- Should be able to do node analysis using incidence matrix/ Graph Theory.

### LIST OF PRACTICALS ( Total Practical Hours – 30 Hours)

1. Write a program that generates all the permutations of a given set of digits (with or without repetitions).
2. Write a program to generate Fibonacci Series using recursion.
3. Write a program to implement binary search using recursion.
4. Write a Program to accept the truth values of variables x and y, and print the truth table of the following logical operations:
   a. Conjunction
   b. Disjunction
   c. NAND
   d. NOR
   e. Exclusive OR
   f. Exclusive NOR
   g. Negation

5. Determine node voltages of given two loop circuits using given incidence matrix.

**Essential/recommended readings**

1. V. Krishnamurthy, Combinatorics, Theory and Application, Affiliated East-West Press 1985.
2. C.L. Liu & Mahopatra, Elements of Discrete mathematics, 2nd Sub Edition 1985, Tata McGraw Hill
3. G. Langholz, A. Kandel and J. Mott, Foundations of Digital Logic Design, World Scientific, Singapore, 1998.
4. Kenneth H. Rosen. Discrete Mathematics and Its Application. McGraw-Hill Education, Pennsylvania, U.S.A, 2011.
5. M.O. Albertson and J.P. Hutchinson, Discrete Mathematics with Algorithms, John Wiley and Sons (USA, 1988).

**Suggestive readings**

1. T.H. Coremen, C.E. Leiserson, R. L. Rivest, Introduction to Algorithms, Prentice Hall India (3rd edition 2009)

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