MTL 406	Lab - 1	2 Credits (2 hours lab /week)

Practicals for I Semester

Mathematics practical with Free and Open Source Software (FOSS) tools for computer programs

Course Outcome/Specific Outcome: Students will have the knowledge and skills to implement the programmes listed below in the Scilab programming language. Student are expected to apply these programming skills of computation in science and Engineering.

1) Program to accept three integers and print the largest among them and program to check whether a given integer is even or odd and also positive or negative.
2) Program to find roots of a quadratic equation.
3) Program to perform arithmetic operations using switch case.
4) Program to convert binary number to decimal number and decimal number to binary number.
5) Program to calculate factorial of a number and program to print Fibonacci numbers.
6) Program to search an element in the array.
7) Program to arrange a set of given integers in an ascending order and print them.
8) Program to find row sum and column sum of a matrix.
9) Program to find the Transpose, Trace and Norm of a matrix.
10) Program to find sum, difference and product of two matrices.
11) Program to test whether a given integer is a prime and program to generate prime numbers between two give numbers.
12) Program to find the Armstrong Number between two given numbers and program to test whether a given number is Palindrome or not.

Note: The above list may be changed annually with the approval of the PG BOS in Mathematics.

II Semester

MTE 451	Discrete Mathematics and Applications	3 Credits (36 hours)

Prerequisite: Basic Mathematics up to XII/PU.

Course Outcome: Students will have the knowledge and skills to explain the concepts of Discrete Mathematics and to develop logical thinking and its application to computer science, to enhance one's skills in solving real life problems related to counting, by applying various counting techniques, to illustrate applications of Boolean algebra and group theory in designing logic gates and coding theory.

Course Specific Outcome: At the end of the course students will have the knowledge and skills to:
- Apply basic number theory concepts like divisibility, modular arithmetic in solving congruences, changing the base of number system and their usage in cryptography.
- Solve many real life problems related to counting by the use of special tools like recurrence relations and generating functions.
- Design and simplify the logic gate networks by using lattices and Boolean algebra.
- Apply concept of groups in generating binary coding, decoding and also in error detection and error correction in the binary coding system.

Unit I - Number Theory and Cryptography:

Divisibility and Modular Arithmetic, Integer Representations and Algorithms, Primes and Greatest Common Divisors, Solving Congruences, Applications of Congruences, Cryptography.

(8 Hours)

Unit II - Counting Techniques:

The Basics of Counting, The Pigeon-hole Principle, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Recurrence Relations, Applications of Recurrence Relations, Solving Linear Recurrence Relations, Generating Functions. Principle of Inclusion-Exclusion, Applications of Inclusion-Exclusion.

(12 Hours)

Unit III - Order Relations and Structures:

Product Sets and Partitions, Relations, Properties of Relations, Equivalence Relations, Partially Ordered Sets, Extremal Elements of Partially Ordered Sets, Lattices, Finite Boolean Algebras, Functions on Boolean Algebras, Boolean Functions as Boolean Polynomials.

(8 Hours)

Unit IV - Groups and Coding Theory:

Binary Operations Revisited, Semigroups, Products and Quotients of Semigroups, Groups, Products and Quotients of Groups, Coding of Binary Information and Error Detection, Decoding and Error Correction.

(8 Hours)

References

[1] Kenneth H. Rosen, *Discrete Mathematics and Its Applications*, 7th Ed., Tata Mc-Graw-Hill, 2012.

[2] Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, *Discrete Mathematical Structures*, 3rd Ed., Prentice Hall, 1996.

[3] Grimaldi R, *Discrete and Combinatorial Mathematics*, 5th Ed., Pearson, Addison Wesley, 2004.

MTH 452	Algebra - II	4 Credits (48 hours)

Course Outcome: Students will have the knowledge and skills to apply the advanced topics viz., Unique factorization domains, Field theory and Galois Theory in Coding theory and Cryptography, and also in diverse situations in physics, chemistry and engineering etc.

Course Specific Outcome: At the end of the course students will have the knowledge and skills to **e**xplain, demonstrate accurate and efficient use of the following advanced topics in various situations -

- Unique factorization domains
- Euclidean domains
- Fields(including finite fields), algebraically closed fields
- The fundamental theorem of algebra. Galois Theory.

Unit I - Factoring:

Unique factorization domains, Euclidean domains, Content of polynomials, Primitive polynomials, Gauss lemma, Unique factorization in R[x], where R is a U.F.D., Irreducibility test mod *p*, Eisenstein's criterion, Gauss primes.

(16 Hours)

Unit II - Fields:

Algebraic and transcendental elements, The degree of a field extension, Finding the irreducible polynomial, Ruler and compass constructions, Isomorphism of field extensions, Adjoining roots, Splitting fields, Finite fields, Primitive elements, Algebraically closed fields, The fundamental theorem of algebra.

(20 Hours)

Unit III - Galois Theory:

Automorphisms and Fields, Separable Extensions, Galois Theory, Illustrations of Galois Theory, Cyclotomic Extensions, Insolvability of the Quintic.

(12 Hours)

References

[1] Michael Artin, *Algebra*, 2nd Ed., Prentice Hall of India, 2013.

[2] J. B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Addison Wesley, 2003.

[3] I. N. Herstein, *Topics in Algebra*, 2nd Ed., John Wiley & Sons, 2006.