Semester I

DISCIPLINE SPECIFIC CORE COURSE -1 (DSC-1): Single and Multivariable Calculus

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		
Single and Multivariable Calculus, DSC-1	**04**	**3**	**0**	**1**	**Class XII pass**	**Mathematics till XII**

Learning Objectives

Calculus is the most powerful tool in mathematics with widespread applications. The goal of this course is for students to gain proficiency in calculus computation. The course builds up on the topics, namely limits and continuity, differentiation and integration. These topics will use to solve application problem in a variety of fields such as physics, biology, business and economics.

Learning outcomes

- A good understanding of basic concepts of limits, derivatives, continuity, asymptotes, sequence and series, integrals, vector valued functions, partial differentiation, multiple integrals, etc.
- Able to find points of discontinuity for functions and classify them and understand the consequences of the intermediate value theorem for continuous functions.
- Able to solve applied problems using basic concepts of calculus.
- Able to explain why calculus is valuable in daily life.
- Create a project using the fundamental knowledge and principle of differential and integral calculus that helps to provide a hands-on experience of the same.
- Able to plot and manipulate the curves appropriately to make various real-life models like studying the projectile motion in firecrackers and the flow of water in fountain.
- Create animations of given problems using MATHEMATICA software.

SYLLABUS OF DSC-1

UNIT – I (12 hours)
Limits and continuity

Limits at infinity - Indeterminate forms - Special limits involving exponential and logarithmic functions – Asymptotes - Graphs of function and its derivatives - Optimization problems - Fluency in differentiation - Concavity and inflexion points - Sequences, infinite series including Taylor approximations, Power series

UNIT – II (9 hours)
Integration

Parametric equations of curves, arc length and surface area-Vector valued functions, differentiation and integration of vector valued functions

UNIT – III (15 hours)
Functions of several variables

Level curves and surfaces - Limits and continuity of functions of two and three real variables - Partial differentiation (two variables), partial derivative as a slope, partial derivative as a rate, Maxima and Minima

UNIT – IV (12 hours)
Multiple Integrals

Line, surface and volume integrals - Applications of Green's, Stokes and Gauss's Theorem.

Practical component – (32 hours)

Engineering Kitchen Activity (Symbolic Mathematics Software) [Laboratory]

- Introduction of basic functions
- Plotting of graphs of functions and their derivatives
- Manipulating the parameters in a graph
- Fitting of a curve
- Parametric plot of curves (Eg. Trochoid, Cycloid, Epicycloid)
- Obtaining surfaces of revolution of curves
- Plotting functions of two variables and their level curves
- Graphical illustration of limits for functions of two variables
- Innovation Project

Essential/recommended readings

1. *Calculus*, T. M. Apostol, Volumes 1 and 2, Wiley Eastern, 1980.
2. *Calculus - Single and Multivariable*, Hughes-Hallett et al., John-Wiley and Sons, 2003.
3. *Calculus*, James Stewart, Thomson, 2003.

4. *Calculus and Analytic Geometry*, G. B. Thomas and R. L. Finney, Addison-Wesley, 1998.

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

DISCIPLINE SPECIFIC CORE COURSE – 2 (DSC-2): Discrete Mathematics

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		
Discrete Mathematics and its applications **DSC-2**	**04**	**3**	**1**	**0**	**Class XII pass**	**Mathematics till XII**

Learning Objectives

The objective of this paper is to familiarize the student with basic concepts of logic and combinatorics. The aim of the paper is also to conceptualize the terminologies of graph theory, isomorphism, paths, cycles, circuits, graph coloring in various physical situations. Throughout this paper, students will be encouraged to develop their own algorithms and to analyze their computational complexities. Further, students may develop codes in any of the programming language for implementation of various algorithms.

Learning outcomes

After completing this course, student should be able to;

- Familarize with basic concepts of logic
- Understand combinatorics principles: sets, permutations,

combinations, recurrence relations etc.

- Conceptualize basic terminologies of graph theory, isomorphism, connectivity etc
- Understand concepts of paths, cycles, circuits and their applications in various fields
- Learn different shortest path algorithms, their computational complexities, implementation & programming
- Understand travelling salesman problem and its importance
- Understand the concept of graph coloring with real applications, planar graphs and algorithms
- Conceptualize trees, spanning trees and algorithms

SYLLABUS
OF DSC-2

UNIT – I (16 hours)
Logic and Combinatorics

Propositional Logic; Truth tables; Conditional statements; Logic and Bit operations; Propositional and logical equivalences; De Morgan's law; Applications of propositional logic. Sets, counting of sets - Permutation - Combination - Inclusion - exclusion - Generating functions - Recurrence relations

UNIT – II (16 hours)
Graph Theory

Introduction - Basic terminologies - Graph representation - Euler relation Isomorphism- Connectivity - Cut vertices and edges - Covering - Euler and Hamilton paths and circuits

UNIT – III (16 hours)
Applications of Graph Theory

Shortest Path Algorithms: Dijkstra's algorithm -Travelling salesman problem - Scheduling problems - Matching - Independent sets - Coloring - *Planar graph*: idea of region - Euler formula - Kuratowski theorem and application

UNIT – IV (16 hours)
Tree

Basic terminology, traversal, Prefix code - Idea of data compression: Huffman code - Spanning tree - Minimum spanning tree: Prim's and Kruskal method.

Practical component – NIL

Essential/recommended readings

1. *Discrete and Combinatorial Mathematics,* Ralph Grimaldi, International Edition, 2003.
2. *Discrete Mathematical Structures,* Bernard Kolman, Robert Busby, Sharon Ross, International Edition, 2008.
3. *Discrete Mathematics and Its Applications,* K. H. Rosen, McGraw-Hill, 2008.

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

DISCIPLINE SPECIFIC CORE COURSE– 3 (DSC-3): Programming Fundamentals

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		
Programming Fundamentals, DSC-3	04	3	0	1	Class XII pass	Mathematics till XII

Learning Objectives

This course aims at providing the fundamental knowledge of programming. This course trains students to design code, write programs to instruct computer systems. In addition, the course objective is to give an understanding of real-world data, tasks and their representation in terms of programs.

Learning outcomes

After completing this course, students will have:

- understanding of Programming Concepts
- understanding of real-world applications development through programs
- understanding of independent data and collection of data and their organization
- understanding of memory allocation on runtime
- understanding of the program life cycle
- understanding of testing, coding guidelines, debugging and integration.

SYLLABUS OF DSC-3

UNIT – I (16 Hour)
Philosophy of programming and algorithm

Algorithm and its characteristics-Programming philosophy-Problem solving process- Programming language concepts-Program life cycle

UNIT – II (16 Hour)
Data representation and storage

Data definition structures such as types-constants-variables-Expressions such as arithmetic- logical-Precedence and associative rules-Control Structures-Functions-Variable scope

UNIT – III (16 Hour)
Multiple data item and processing
Preprocessing - Arrays, Structures – Strings - Pointers - Memory allocation

UNIT – IV (16 Hour)
Permanent storage and information handling
Files handling – Coding guidelines - testing & debugging-System testing & Integration

Practical component –

Engineering Kitchen Activity [Laboratory]

- User input and output programs having mathematical operations
- Pattern printing programs
- Programs for operators implementation
- Programs to implement function
- Programs to implement collection such as Array and String
- Programs to implement structure
- Innovation Project

Essential/recommended readings

1. *C++: The Complete Reference, Fourth Edition*, Herbertz Schildt, McGraw Hill, 2015.
2. *The C++ Programming Language, 4th Edition*, Bjarne Stroustrup, Addison-Wesley, 2013.
3. *Computer Science: A Structured Approach Using C++ 2nd Edition*, Behrouz A. Forouzan, Richard F. Gilberg, 2004
4. *The C Programming Language (Ansi C Version)*, Brian W. Kernighan, Dennis M. Ritchie, 1990.