Department of Applied Mathematics
Delhi Technological University,
(Formerly Delhi College of Engg.)
Bawana Road, Delhi – 42.

I Year

Details of Course:

Course Title	Course Structure			Pre-Requisite
AM101: Mathematics-I	L	T	P	NIL
	3	1	0	

Course Objective: To acquaint the students with the knowledge of series & sequence, single & multiple variable calculus, knowledge of vector calculus and their applications.

Course Outcome (CO):

CO1	Analyse an infinite series of positive terms for convergence or divergence, and distinguish between absolute and conditional convergence.
CO2	Apply differential calculus to obtain Maclaurin's and Taylor's expansions, find the radius of curvature, sketch some standard curves, and calculate arc length and surface area using definite integrals.
CO3	Explain the various concepts of calculus and the properties of functions of several variables, find the maxima-minima, and estimate the error.
CO4	Explain the concept of multiple integrals, and apply multiple integration techniques for solving problems related to area and volume.
CO5	Interpret various concepts of differential and integral calculus of vector point functions and apply them to evaluate work done by a force or in other applications, and understand the concepts underlying Green's, Stoke's, and Gauss divergence theorems.

S. No.	Contents	Contact hours
UNIT 1	Infinite series: Tests for convergence of positive term series (Comparison, Ratio, nth Root, integral, Raabe's, Logarithmic), Alternating series, Absolute convergence, Conditional convergence.	8
UNIT 2	Differential & Integral Calculus of single variable: Maclaurin's and Taylor's Expansions, Radius of curvature, Tracing of some standard curves, Applications of definite integral to arc length and surface area of revolution (Cartesian and polar coordinates).	8
UNIT 3	Calculus of several variables: Partial differentiation, Euler's theorem, Total derivative, Taylor's Expansion, Maxima-Minima, Lagrange's method of multipliers, Applications in estimation of error and approximation.	8
UNIT 4	Multiple Integrals: Double integral (Cartesian and polar co-ordinates), change of order of integration, triple integrals (Cartesian, cylindrical and spherical co-ordinates), Applications to area and volume.	9
UNIT 5	Vector Calculus: Scalar and vector point functions, gradient, directional derivative, divergence, curl and their interpretations. Line integral, surface integral and volume integral, Applications to work done by the force, Green's, Stoke's and Gauss divergence theorems.	9
	Total	42

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Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	Kreyszig; Advanced Engineering Mathematics, Wiley-India, 10th Edition ISBN-978-1-119-45592-9	2020
2.	Jain and Iyenger; Advanced Engineering Mathematics, Narosa, 5th Edition ISBN-978-81-8487-560-7	2019
3.	Alan Jeffery; Advanced Engineering Mathematics, Academic Press ISBN- 978-93-80501-50-5	2010
4.	Thomas and Finney; Calculus and Analytic Geometry, Narosa, ISBN-978-81-85015-52-1	2013
5.	Dennis G. Zill; Advanced Engineering Mathematics, Jones and Bartee Publications, 6th Edition ISBN-978-12844105902.	2016

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Details of Course:

Course Title	Course Structure			Pre-Requisite
AM102: Mathematics-II	L	T	P	NIL
	3	1	0	

Course Objective: To impart knowledge of matrices, Differential equations, Laplace transform, Fourier series & their applications.

Course Outcome (CO):

CO1	Solve the system of linear equations, interpret the eigenvalues and eigenvectors of a matrix.
CO2	Explain the concept of differential equations and evaluate various methods to solve ordinary differential equations.
CO3	Find the series solutions of differential equations using Power series and Frobenius methods.
CO4	Implement the integral transformation using the concept of Laplace transformation and apply it to solve differential equations.
CO5	Find Fourier series of a periodic function and apply it in harmonic analysis.

S. No.	Contents	Contact hours
UNIT 1	Matrices: Rank of a matrix, inverse of a matrix using elementary row transformations, solutions of system of linear equations, eigen values and eigen vectors of a matrix.	8
UNIT 2	Ordinary differential equations: Second and higher order linear differential equations with constant coefficients, General solution of homogenous and non-homogenous equations, method of variation of parameters, simultaneous linear differential equations.	9
UNIT 3	Special Functions: Power series method, Frobenious method, Legendre equation, Legendre Polynomials, Rodrigues formula, Bessel equation, Bessel function of first kind and their Orthogonal properties.	9
UNIT 4	Laplace Transforms: Basic properties, Laplace transform of derivatives and integrals, Inverse Laplace transform, Differentiation and Integration of Laplace transform, Convolution theorem, Unit step function, periodic function. Applications of Laplace transform to initial and boundary value problems.	8
UNIT 5	Fourier series: Fourier series (2π period and of arbitrary period), Fourier series of Even and odd functions, half range Fourier series, Harmonic analysis.	8
	Total	42

17/2/25

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	Kreyszig; Advanced Engineering Mathematics, Wiley-India, 10th Edition ISBN-978-1-119-45592-9	2020
2.	Jain and Iyenger; Advanced Engineering Mathematics, Narosa, 5th Edition ISBN-978-81-8487-560-7	2019
3.	Alan Jeffery; Advanced Engineering Mathematics, Academic Press ISBN- 978-93-80501-50-5	2010
4.	Peter V. O'Neil; Advanced Engineering Mathematics, Cengage Learning. ISBN-978-81-315-0310-2	2007
5.	Dennis G. Zill; Advanced Engineering Mathematics, Jones and Bartee Publications, 6th Edition ISBN-978-12844105902.	2016

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC102:	L	T	P	NIL
Discrete Mathematics	3	1	0	

Course Objective: To provide knowledge of combinatorial problem, algebraic structure, logic and graph theory required for building mathematical foundation.

Course Outcome (CO):

CO1	Describe concepts of set theory, relations, functions, and discrete structures to solve various problems.
CO2	Apply logical equivalences to simplify and manipulate logical expressions, and apply rules of inference to derive conclusions from premises in both propositional and predicate logic.
CO3	Apply the concepts of counting principles and combinatorics to solve problems, identify various algebraic structures and describe their properties.
CO4	Describe lattices and explain the structure of Boolean algebra to construct and simplify Boolean expressions.
CO5	Illustrate, formulate and solve the problems based on the concepts of graphs and trees.

S. No.	Contents	Contact hours
UNIT 1	Basic concepts of set theory, operations on sets, Cartesian products, relations, equivalence relation, equivalence classes, operations on relations, partial order relation, Hasse diagram, functions, recursive functions.	8
UNIT 2	Proposition, compound propositions, well-formed formulae, truth tables, tautology, contradiction, equivalence, algebra of proposition, normal forms, theory of inference, predicate logic: predicates, quantifiers, free and bound variables, theory of inference for predicates.	8
UNIT 3	Permutations, combinations, Discrete Numeric Function, Generating Function, recurrence relations, Principles of Inclusion and Exclusion, Dearrangement, Pigeon Whole Principle. Definition and properties of semigroups, monoids and groups, homomorphism, Rings and their homomorphism.	10
UNIT 4	Definition of lattice, properties of lattices, bounded, complemented, distributive and complete lattice, Introduction, axioms and theorems of Boolean algebra, algebraic manipulation of Boolean expressions.	8
UNIT 5	Graphs, digraphs, adjacency matrix, incidence matrix, connectivity, subgraphs, trees, spanning tree, complete graphs, walk, path, cycle. Isomorphism of Graph.	8
	Total	42

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill	1997
2.	C. L. Liu, D. P. Mohapatra, Elements of Discrete Mathematics, 4th Edition, Tata McGraw-Hill	2017
3.	Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill	2001
4.	A. M. Raigorodskii, M. T. Rassias, Discrete Mathematics and Applications, 1st Edition, Springer	2020

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC 103: Python Programming	L	T	P	Basic computer knowledge
	0	0	4	

Course Objective: To introduce fundamentals of programming using Python and understand the concepts of the program.

CO1	Identify and recall the fundamental syntax, operators, and data structures in Python, such as variables, arithmetic operators, strings, lists, and dictionaries.
CO2	Explain how Python functions, expressions, and statements work together to produce desired outcomes, and describe the flow of execution in basic programs.
CO3	Apply Python programming techniques to develop simple applications using loops, conditionals, and error handling to solve practical problems.
CO4	Analyze the behavior of Python programs, including stack diagrams, recursion, and scope, to identify potential errors and optimize code for efficiency.
CO5	Design and develop complex Python programs incorporating object-oriented principles such as classes, inheritance, and custom exceptions to address real-world challenges.

S.No.	Contents	Contact hours
UNIT 1	**Introduction to Python:** Arithmetic Operators, Variables, Expressions and Statements in Python, Function Calls, Parameters and Arguments, Infinite Recursion and Stack Diagrams, Logical Operators, Conditional and Alternative Execution, Iterations in Python.	6
UNIT 2	**Strings and Dictionaries in Python**: Immutable Strings, String Methods and Comparison, Mutable Lists, List Operations and Methods, Concept of Dictionary and Looping, Reverse Lookup, Immutable Tuples, Tuples as Return Values, Concepts of Namespaces and scope.	6
UNIT 3	**Error handling and Files in Python:** Error handling using try and except, Create your own exceptions, Filenames and Paths, Persistence, Reading and Writing, Catching Exceptions, Attributes. **Object Oriented Concepts in Python:** Introduction to Classes and Methods, Mutable Objects, Classes and Functions, Pure Functions, Modifiers, Inheritance	9
	TOTAL	21

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Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1	Deitel, P., & Deitel, H. Intro to Python for Computer Science and Data Science. Pearson Education, ISBN: 978-9353949518.	2020
2	Barry, P. Head First Python. O'Reilly, 3rd Edition, ISBN: 978-1492051299.	2023
3	Matthes, E. Python Crash Course: A Hands-on, Project-based Introduction to Programming. No Starch Press, 3rd Edition, ISBN: 978-1718502703.	2023
4	Brown, M. C. Python: The Complete Reference. McGraw Hill Education, 4th Edition, ISBN: 978-9387572942.	2018

PRACTICALS LIST	
1	Write a program to determine whether the given three coordinates ((x1, x2), (y1, y2) and (z1, z2)) are collinear or not.
2	Given any number say N, write a program to print the prime numbers between 1 to N.
3	Write a program to print Fibonacci series using a for loop.
4	Write a program to declare variables of string data type and perform different operations on them.
5	Write a program to create, insert and delete Lists.
6	Write a program to create, insert and delete Dictionaries.
7	Write a program to create, insert and delete Sets and Tuples.
8	Create a function search_list that takes a list of values as arguments and searches for a particular number in the list.
9	Write a program to implement the Rock Paper Scissors game.
10	Write a program for the division of two numbers where the denominator is 0. This will throw an exception and handle the exception using try and except.
11	Write a program that can create your own exceptions.

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC104: Complex Analysis	L	T	P	NIL
	3	1	0	

Course Objective: To acquaint the students with the knowledge of complex variables, contour integration, conformal mappings.

Course Outcome (CO):

CO1	Describe complex numbers, variables, and functions and their various representations.
CO2	Analyse analytic functions, solve problems using Cauchy-Riemann equations and construct analytic functions.
CO3	Examine and apply various types of transformation types.
CO4	Evaluate the complex integrals using various techniques.
CO5	Apply series expansion, examine various types of singularities and calculate the residues.

S. No.	Contents	Contact hours
UNIT 1	Algebra of complex numbers, the complex plane, polynomials, power series, radius of convergence, transcendental functions, Riemann Sphere, Stereographic Projection.	8
UNIT 2	Analytic functions, Cauchy-Riemann equations, Harmonic functions, Construction of analytic functions.	8
UNIT 3	Linear and bilinear Transformation, cross ratio and conformal Mappings.	8
UNIT 4	Line integral in the Complex Plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of Analytic functions, Morera's theorem, Cauchy's estimate, Liouville's theorem, Fundamental theorem of Algebra.	9
UNIT 5	Taylor Series and Laurent Series, Singularities, types of singularities, zeros and poles, Residues, Residue theorem and its applications to evaluate improper real integrals.	9
	Total	42

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	J. B. Conway; Functions of One Complex Variable, Springer	2012
2.	J. Bak and D. J. Newman; Complex Analysis, Springer, 3rd Edition.	2017
3.	Churchill and Brown; Complex Analysis with applications, Mc Graw Hill, 9th Edition.	2009
4.	Complex variables, Schaum outlines.	2009
5	A. Bourchtein and L. Bourchtein, Complex Analysis, 1st Edition, Springer	2021

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Details of Course:

Course Title	Course Structure			Pre-Requisite
MC 106:	L	T	P	NIL
MATLAB Programming	0	0	4	

Course Objective: To introduce fundamentals of MATLAB programming and perform mathematical operations in MATLAB.

Course Outcome (CO):

CO1	Demonstrate basic mathematical operations, including working in the command window and contrast different data types and structures available.
CO2	Implement and apply relational and logical operations and conditional and iterative structures for decision-making and iterative processes.
CO3	Apply operations or tools to analyze and visualize data.
CO4	Judge the suitability of tools for different computational and mathematical tasks.
CO5	Design and implement projects.

S.No.	Contents	Contact hours
UNIT 1	**Introduction to MATLAB:** Starting MATLAB, Working in the Command Window, Arithmetic Operations with Scalars, Elementary Math Built-in Functions, Defining Scalar Variables, and Commands for Managing Variables.	4
UNIT 2	**Arrays:** One-Dimensional and Two-Dimensional Arrays, Array Addressing, Adding and Deleting Elements, Built-in Functions for Handling Arrays, Strings, Mathematical Operations with Arrays: Addition, Subtraction, Multiplication, and Division, Generation of Random Numbers.	6
UNIT 3	Relational and Logical Operators, Conditional Statements, Switch Case, Loops, Break and Continue commands. **Plots**: The plot command, fplot command, plotting multiple graphs in the same plot, histograms.	6
UNIT 4	**Polynomials and Symbolic Math**: Polynomials, Curve Fitting, Solving Algebraic Equations, Differentiation, Integration, User-defined functions.	5
	TOTAL	21

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Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1	Attaway, D. *MATLAB: A Practical Introduction to Programming and Problem Solving*. Butterworth-Heinemann, 6th Edition, ISBN: 978-0323917506.	2022
2	Eshkabilov, S. *Beginning MATLAB and Simulink: From Beginner to Pro*. Apress, 2nd Edition, ISBN: 978-1484287477.	2022
3	Gilat, A. *MATLAB: An Introduction with Applications*. John Wiley & Sons Inc., 6th Edition, ISBN: 978-1119299257.	2017

PRACTICALS LIST	
1	Write a program for basic arithmetic operations with scalars.
2	Write a program to demonstrate mathematical built-in functions.
3	Write a program to create 1-D and 2-D arrays. Further, add and delete elements in the arrays.
4	Write a program to perform mathematical operations (addition, subtraction, array multiplication, array division) on arrays.
5	Write a program to calculate the rank of a 2-D array.
6	Write a program to demonstrate conditional statements and switch cases.
7	Write a program to demonstrate loops.
8	Write a program to construct plots using the plot/fplot command.
9	Write a program to construct histograms.
10	Write a program to solve polynomials and algebraic equations using map functions.
11	Write a program to demonstrate differentiation and integration for a given function.