Maharashtra Education Society's

Abasaheb Garware College

(Autonomous)

(Affiliated to Savitribai Phule Pune University)

Two Year M.Sc. Degree Program in Mathematics

(Faculty of Science and Technology)

Syllabi under Autonomy

M.Sc. I (Mathematics)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2022-2023

Title of the Course: M. Sc. (Mathematics)

Preamble:

Taking into consideration the rapid changes in science and technology and new approaches in different areas of Mathematics and related subjects, Board of studies in Mathematics after a thorough discussion with the teachers of Mathematics from Abasaheb Garware College and experts from industry as well as other Academic institutions has prepared the syllabus of M.Sc. I Semester - I and Semester- II (w.e.f. 2022-23) Mathematics course under the Choice Based Credit System (CBCS). The model curriculum as developed by U. G. C. is used as a guideline for the present syllabus.

Program Outcomes:

1) To maintain updated curriculum.
2) To take care of fast development in the knowledge of Mathematics.
3) To enhance the quality and standards of Mathematics Education.
4) To provide a broad common frame work, for exchange, mobility and free dialogue across the Indian Mathematicians and associated community.
5) To create an aptitude for Mathematics in those students who show a promise for higher studies and creative work in Mathematics.
6) To create confidence in others, for equipping themselves with that part of Mathematics which is needed for various branches of Sciences or Humanities in which they have aptitude for higher studies and original work.

Eligibility:

Passed B.Sc. [Mathematics] or equivalent course.

Structure of the course: M.Sc. Mathematics

Year	Semester	Course Type	Course Code	Course Title	Remark	Credit	No. of Lectures /Practical to be conducted
1	I	Core	PSMT-111	Linear Algebra	Theory	4	60
		Core	PSMT-112	Group Theory	Theory	4	60
		Core	PSMT-113	Advanced Calculus	Theory	4	60
		Core	PSMT-114	Ordinary Differential Equations	Theory	4	60
		Core	PSMT-115	C Programming	Theory	2	30
		Core	PSMTP-115	C Programming	Practical	2	12
	II	Core	PSMT-121	Complex Analysis	Theory	4	60
		Core	PSMT-122	Rings and Modules	Theory	4	60
		Core	PSMT-123	General Topology	Theory	4	60
		Core	PSMT-124	Partial Differential Equations	Theory	4	60
		Core	PSMT-125	Programming with Python	Theory	2	30
		Core	PSMTP-125	Programming with Python	Practical	2	12

Year	Semester	Course Type	Course Code	Course Title	Remark	Credit	No. of Lectures /Practical to be conducted
2	III	Core	PSMT-231	Measure and Integration	Theory	4	60
		Core	PSMT-232	Integral Equations	Theory	4	60
		Core	PSMT-233	Functional analysis	Theory	4	60
			Choose any two between PSMTELE-234A and PSMTELE-234F				
		Elective	PSMTELE-234A	Graph Theory	Theory	4	60
		Elective	PSMTELE-234B	Data analytics using Python	Theory	4	60
		Elective	PSMTELE-234C	Classical Mechanics and calculus of variation	Theory	4	60
		Elective	PSMTELE-234D	Algebraic topology	Theory	4	60
		Elective	PSMTELE-234E	Number Theory	Theory	4	60
		Elective	PSMTELE-234F	Probability and Statistics	Theory	4	60
	IV	Core	PSMT-241	Numerical Analysis	Theory	4	60
		Core	PSMT-242	Field theory	Theory	4	60
		Core	PSMT-243	Differential Geometry	Theory	4	60
			Choose any two between PSMTELE-244A and PSMTELE-244F				
		Elective	PSMTELE-244A	Combinatorics	Theory	4	60
		Elective	PSMTELE-244B	Machine learning using Python	Theory	4	60
		Elective	PSMTELE-244C	Dynamical Systems	Theory	4	60
		Elective	PSMTELE-244D	Commutative Algebra	Theory	4	60
		Elective	PSMTELE-244E	Representation theory of finite groups	Theory	4	60
		Elective	PSMTELE-244F	Coding Theory	Theory	4	60

The study tour is important to learn, network and collaborate with academics, students and industry professionals in Science and Technology, Engineering and Mathematics recruiters. It is also important to know and understand different cultures, easily adapt to new environments, skilfully negotiate business deals.

Therefore, department of Mathematics should arrange a student's study tour in each academic year.

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SEMESTER-I

Course Code and Title: PSMT-111: LINEAR ALGEBRA

Lectures: 60 (Credits- 4)

Course Outcomes:

1. To learn vector spaces, basis and dimension.
2. Explain the concept of linear transformation and study its applications
3. Students are able to find eigenvalues, eigenvectors, minimal polynomial, diagonalizable matrix.
4. Students learn inner product spaces, self adjoint, normal and unitary operators.

Unit I: Vector Spaces [8 Hours]

1.1 Definition and Examples
1.2 Subspaces
1.3 Basis and Dimension

Unit II: Linear Transformation [12 Hours]

2.1 Linear Transformations
2.2 Quotient Spaces
2.3 Direct sum
2.4 Matrix of linear transformation
2.5 Duality

Unit III. Canonical forms [20 Hours]

3.1 Eigenvalues and eigenvectors
3.2 The Minimal polynomial
3.3 Diagonalizable and Triangulable operators
4.4 The Jordan form

Unit IV. Inner Product spaces [16 Hours]

4.1 Inner products
4.2 Orthogonality
4.3 The Adjoint of a linear transformation
4.4 Unitary Operators
4.5 Self adjoint and normal operators

4.6 Polar and Singular value decompositions

Unit V: Applications of Linear Algebra [4 Hours]

(At least three applications to be taken from Chapter 11 of book 2)

Recommended Book:

1) Vivek Sahai, Vikas Bist, Linear Algebra, Narosa Publication.
   Unit 1: Chapter 2: 1 to 3
   Unit 2: Chapter 2: 4 to 8
   Unit 3: Chapter 3: 1 to 4
   Unit 4: Chapter 4: 1 to 6
2) Elementary Linear Algebra (Applications Version) (11th Edition) – Howard Anton, Chris Rorres. (Wiley)

Reference Books:

1) K. Hoffman, Ray Kunze, Linear Algebra, Prentice Hall of India Private Ltd.
2) P. B. Bhattacharya, S. R. Nagpaul, S. K. Jain, First Course in Linear Algebra, 2nd Edition, New Age International Publishers.
3) S. Kumaresan, Linear Algebra A Geometric Approach, PHI Learning Private Ltd

Course Code and Title: PSMT-112: GROUP THEORY

Lectures: 60 (Credits- 4)

Course Outcomes:

1. Students are able to understood the difference between centralizer, normalizer and stabilizer.
2. To learn group action, conjugation and class equation.
3. To explain Sylow theorem and to apply Sylow theorems for solving problems.
4. Students learn direct and semidirect products and fundamental theorem of finitely generated abelian groups.
5. To study p-groups, Nilpotent groups and solvable groups.

UNIT-I: Groups, Subgroups, Quotient groups and Homomorphism [18 Hours]

1.1 Revision Definition and Examples of groups
1.2 Definition and examples of subgroups
1.3 Centralizers and Normalizers, Stabilizers and Kernels
1.4 Cyclic groups
1.5 Definition and examples of quotient groups
1.6 Isomorphism theorems

UNIT-II: Group Actions [24 Hours]

2.1 Group actions and permutation representation
2.2 Group acting on themselves by left multiplication and Cayley's Theorem
2.3 Group acting on themselves by conjugation and Class equation
2.4 Automorphisms
2.5 The Sylow Theorems
2.6 The simplicity of A_n

UNIT-III: Direct and Semidirect Product and Abelian groups [10 Hours]

3.1 Direct Products
3.2 Fundamental theorem of Finitely generated Abelian groups
3.3 Semidirect Products

UNIT-IV: Solvable groups [8 Hours]

4.1 p-groups, Nilpotent groups and solvable groups

Recommended Books:

David S. Dummit, Richard M. Foote, Abstract Algebra, 2nd Edition, John Wiley and Sons (Indian Edition)
Unit 1: Chapter 1: 1.1 to 1.3, Chapter 2: 2.1 to 2.3, Chapter 3: 3.1 to 3.3
Unit 2: Chapter 4: 4.1 to 4.6
Unit 3: Chapter 5: 5.1, 5.2, 5.5
Unit 4: Chapter 6: 6.1

Reference Books:

1. S. Luthar, I. B. S. Passi, Algebra (Vol 1), Groups; Narosa Publication House.
2. N. Herstein, Topics in Algebra, Wiley Eastern Ltd.
3. M. Artin, Algebra, Prentice Hall.
4. N. S. Gopalkrishnan, University Algebra, Wiley Eastern Ltd.
5. J. B. Fraleigh, A First Course in Abstract Algebra, 7th Edition, Pearson Edition Ltd.

Course Code and Title: PSMT-113 - ADVANCED CALCULUS

Lectures: 60 (Credits- 4)

Course Outcomes:

1. To learn directional derivatives.
2. Students are able to find work done using line integral.
3. Understand geometric interpretation of the double integral as a volume.
4. Students learn Green's theorem, Stoke's theorem, surface integral, curl and divergence, divergence theorem.

UNIT-I: Differential Calculus of Scalar and Vector Fields [20 Hours]

1.1 Functions from R^n to R^m, Scalar and vector fields, Limits and continuity.

1.2 The derivative of a scalar field with respect to a vector, Directional derivatives and partial derivatives, Partial derivatives of higher order, Inverse function theorem and Implicit Function theorem. (Without proof)

1.3 Directional derivatives and continuity, The total derivatives, The gradient of a scalar field, A sufficient condition for differentiability.

1.4 A chain rule for derivatives of scalar fields, Applications to geometry, Level Sets, Tangent planes, Derivatives of vector fields, Differentiability implies Continuity, The chain rule for derivatives of vector fields, Matrix form of the chain rule.

UNIT-II: Line Integrals [10 Hours]

2.1 Paths and line integrals, other notations for line integrals, Basic properties of line integrals.

2.2 The concept of work as a line integral, Line integrals with respect to arc length, Further applications of line integrals.

2.3 Open connected sets. Independence of the path, The first and second fundamental theorem of calculus for line integrals, Necessary and sufficient conditions for a vector field to be a gradient, Necessary conditions for a vector field to be a gradient.

UNIT-III: Multiple Integrals [15 Hours]

3.1 Partitions of rectangles. Step functions, The double integral of a step function, The definition of the double integral of a function defined and bounded on a Rectangle, Upper and lower double integrals, Evaluation of double integral by repeated one- dimensional integration, Geometric interpretation of the double integral as a volume, Worked examples.

3.2 Integrability of continuous functions; Integrability of bounded functions with Discontinuities, Double integrals extended over more general regions, Applications to area and volume, Worked examples.

3.3 Green's theorem in the plane (without proof), Some applications of Green's theorem, A necessary and sufficient condition for a two-dimensional vector field to be a gradient.

3.4 Change of variables in a double integral, Special cases of the transformation formula with proof, General case of the transformation formula with proof, Extensions to higher dimensions, Change of variables in an n-fold integral, Worked examples.

UNIT-IV: Surface Integrals [15 Hours]

4.1 Parametric representation of a surface, The fundamental vector product, The fundamental vector product as a normal to the surface, Area of a parametric surface.

4.2 Surface integrals, Change of parametric representation, Other notations for surface integrals

4.3 The theorem of Stokes, Curl and divergence of a vector field, Properties of curl and divergence, the divergence theorem (Gauss' theorem) and applications of divergence theorem.

Recommended Book:

1. Tom M. Apostol, Calculus Volume II (Second Edition) Indian Reprint 2016 (John Wiley & Sons, Inc) ISBN:978-81-265-1520-2.
2. For "Inverse Function Theorem" and "Implicit Function Theorem", use Tom M. Apostol, Mathematical Analysis 2nd Edition Narosa Publication 20th Reprint 2002. ISBN 978-81-85015-66-8.

Unit 1: Chapter 8: 8.1, 8.4, 8.6-8.22

Unit 2: Chapter 10: 10.2 to 10.11, 10.14 to 10.16

Unit 3: Chapter 11: 11.2 to 11.15, 11.19 to 11.22, 11.26 to 11.33

Unit 4: 12.1 to 12.15, 12.19, 12.20

Reference Books:

1) Gerald B. Folland, Advanced Calculus, Pearson Edition 2012. 2) A Devinatz, Advanced Calculus (Holt, Reinhart & Winston) 1968.

Course Code and Title: PSMT-114: ORDINARY DIFFERENTIAL EQUATIONS

Lectures: 60 (Credits - 4)

Course Outcomes:

1. Students are able to find solution of linear equations of first order.
2. Students are able to find solution of homogeneous and non-homogeneous equations of second order.
3. Explain Euler's equation, Legendre equation and Bessel's equation.
4. Understand Existence and Uniqueness of solutions

Unit I: Linear equations with constant coefficients [18 hours]

1.1 Linear equations of the first order
1.2 The equation y'+ay=0
1.3 The equation y'+ay=b(x)
1.4 The general linear equations of first order
1.5 Second order homogeneous equations
1.6 Initial value problems for second order equations
1.7 Linear dependence and independence
1.8 Formula for the Wronskian
1.9 Non-homogeneous equations of order two
1.10 Homogeneous equations of order n
1.11 Non-homogeneous equations of order n
1.12 Algebra of constant coefficients equations

Unit II: Linear equations with variable coefficients [14 hours]

2.1 Initial value problems for the homogeneous equation
2.2 Solutions of the homogeneous equation
2.3 Wronskian and linear independence
2.4 Reduction of order of the homogeneous equation
2.5 Non-homogeneous equations with analytic coefficients
2.6 Homogeneous equations
2.7 Legendre equation

Unit III: Existence and uniqueness of solutions to first order equations [14 Hours]

3.1 Equations with variables separate
3.2 Exact equations
3.3 Method of successive approximations

3.4 Lipschitz condition
3.5 Approximation to, and Uniqueness of, solutions

Unit IV: Linear Equations with regular singular points [14 hours]

4.1 Euler equation
4.2 Second order equation with regular singular points
4.3 Exceptional cases
4.4 Bessel's equation
4.5 Regular singular point at infinity

Recommended Book:

E. A. Coddington, An Introduction to Ordinary Differential Equations (Prentice-Hall).
Unit 1: Chapter 1: 4 to 7, Chapter 2: 2 to 7, 10, 12
Unit 2: Chapter 3: 2 to 7
Unit 3: Chapter 5: 2 to 5, 8
Unit 4: Chapter 4: 2, 3, 6, 7, 9

Reference Books:

G. F. Simmons and S. G. Krantz, Differential Equations (Tata McGraw-Hill).

Course Code and Title: PSMT-115: C Programming

Lectures: 30 (Credits- 2)

Course Outcomes:

1. Students understand various operators, characters, data types in C.
2. Students are able to use if else statement, for loop, while loop in C.
3. Students are able to define functions in C and use array structure.
4. Students understand the use of pointers, structures and unions.

Unit I: Introductory Concepts, Operators and Expressions: [4 Lectures]

Introduction to computer, Computer Characteristics, Types of Programming Languages, Introduction to C, C character set, Identifiers and keywords, Data types, Constants, Variables and arrays, Declarations, Expressions, Statements, Symbolic constants, Arithmetic operators, Unary operators, Relational and Logical operators, Assignment operators, Bitwise operators.

Unit II: Data Input and Outputs: and Control Statements [6 Lectures]

Preliminaries, Single character input-getchar () function, Single character output putchar () function, Writing output data-printf function, Formatted input-output, Get and put functions, Preliminaries, if, if-else, if-else-if ladder, Conditional Operator (ternary operator), while loop, The do-while statement. The for statement, Nested loops, The switch statement. The break statement, The continue statement, The comma operator.

Unit III: Functions, Program Structures [7 Lectures]

A brief overview, Function, Declaration, Definition, and call, Passing arguments to a Function, specifying argument data types, Recursion, Storage classes, Automatic variables, External variables, Static variables, register variables,

Unit IV: Arrays, Pointers [10 Lectures]

Defining an array, Processing an array, Passing arrays to a function, Multidimensional arrays, Arrays and strings, Fundamentals. Pointer declarations, Passing pointer to a function, Pointer and one-dimensional arrays, Dynamic memory allocation, Operations on pointers, Pointers and multidimensional arrays, Array of pointers, Pointer to function, Passing functions to other functions, More about pointer declarations.

Unit V: Structures and Unions [3 Lectures]

Defining a structure, Processing a structure, User defined data types (typedef), Structures and pointers. Passing structure to a function, Self-referential structures, Unions.

Recommended book:

Programming with C. By Byron S. Gottfried. Schaum's Outline series.
Unit 1: Chapter 1: 1.1, 1.4, 1.10, 1.11, Chapter 2: 2.1, 2.3, 2.7 to 2.13, Chapter 3: 3.1 to 3.4
Unit 2: Chapter 4: 4.1 to 4.8, Chapter 6: 6.1 to 6.4, 6.8 to 6.10
Unit 3: Chapter 7: 7.1 to 7.6, Chapter 8: 8.1 to 8.4
Unit 4: Chapter 9: 9.1 to 9.4, 10.1, Chapter 11: 11.2 to 11.10
Unit 5: Chapter 12: 12.1 to 12.5, 12.7

Reference Book:

The C Programming Language. By Brian W. Kernighan, Dennis M. Ritchie.

Course Code and Title: PSMTP-115: Practical On C Programming: (Credits- 2)

One practical 4 hrs per week:
Total 12 practicals based on all of the above topics will be conducted.

SEMESTER-II

Course Code and Title: PSMT-121: COMPLEX ANALYSIS

Lectures: 60 (Credits- 4)

Course Outcomes:

1. Students understand the different properties of complex numbers.
2. Study complex integration.
3. Students are able to classify singularities.
4. Students are able to find residues.

Unit I: The Complex Number System. [4 hours]

1.1 The real numbers.
1.2 The field of complex numbers.
1.3 The complex plane.
1.4 The Polar representation and roots of complex numbers.
1.5 Lines and half planes in complex plane.
1.6 The extended plane and its spherical representation.

Unit II: Elementary properties and examples of Analytic Functions: [12 hours]

2.1 Power series
2.2 Analytic functions
2.3 Analytic functions as mappings, Mobius transformations.

Unit III: Complex integration: [22 hours]

3.1 Riemann Stieltjes integrals.
3.2 Power series of analytic functions.
3.3 Zeros of an analytic function.
3.4 The index of a closed curve.
3.5 Cauchy's theorem and Integral formula.
3.6 Homotopic version of Cauchy's theorem and simple connectivity.
3.7 Counting zeros: the Open Mapping theorem.
3.8 Goursat's theorem.

Unit IV: Singularities and The Maximum Modulus Theorem [22 hours]

4.1 Classification of singularities.
4.2 Residues.

4.3 The argument Principle.
4.4 The Maximum Principle
4.5 Schwartz's Lemma
4.6 The Riemann mapping theorem (Without proof)

Recommended Book:

John B. Conway Functions of One Variable, Springer International student edition
Unit 1: Chapter 1: 1 to 6
Unit 2: Chapter 3: 1 to 3
Unit 3: Chapter 4: 1 to 8
Unit 4: Chapter 5: 1 to 3, Chapter 6: 1, 2

Reference Books:

1. S. Ponnusamy, Foundation of Complex Analysis, Narosa Publications. (Second Edition)
2. L.V. Alfors, Complex Analysis, McGraw Hill, 1979.
3. J. W. Brown and R.V. Churchill, Complex Variables and Applications, Indian Edition. (Eighth Edition)

Course Code and Title: PSMT-122: GENERAL TOPOLOGY

Lectures: 60 (Credits- 4)

Course Outcomes:

1. Students study topological spaces.
2. Students study connectedness and compactness of topological spaces.
3. Students study countability and separation axioms of topological spaces.
4. Understand difference between Metric Spaces and Topological Spaces.

Unit 1: Topological Spaces [15 Hours]

1.1 Infinite Sets and Axiom of Choice
1.2 Well Ordered Sets
1.3 Topological Spaces
1.4 Basis for a Topology
1.5 Order Topology
1.6 Product Topology on X× Y
1.7 Subspace Topology

Unit 2: Continuous Functions [10 Hours]

2.1 Closed Sets and Limit Points
2.2 Continuous Functions
2.3 The Product Topology, Metric Topology
2.4 Quotient Topology

Unit 3: Connected and Compact Spaces [20 Hours]

3.1 Connected spaces
3.2 Connected Subspaces of Real Line
3.3 Components and Local Connectedness
3.4 Compact spaces
3.5 Compact Subspaces of the Real Line
3.6 Limit point compactness
3.7 Local Compactness

Unit 4: Countability and Separation Axioms [15 Hours]

4.1 The Countability Axioms
4.2 The Separation axioms and Normal Spaces

4.3 Urysohn Lemma
4.4 The Urysohn Metrization Theorem (Without proof)
4.5 Tietze Extension Theorem (Without proof)
4.6 Tychonoff's Theorem (Without proof)

Recommended Book:

J. R. Munkres, Topology: A First Course, (Prentice Hall, Second Edition), 2000.
Unit 1: Chapter 1: 9, 10, Chapter 2: 12 to 16
Unit 2: Chapter 2: 17 to 22
Unit 3: Chapter 3: 23 to 29
Unit 4: Chapter 4: 30 to 35, 37

Reference Books:

1. K J¨anich. Topology. Springer, 1984.
2. M A Armstrong. Basic Topology. Springer, 1983.
3. O Viro, O Ivanov, V Kharlamov, and N Netsvetaev. Elementary Topology: Problem Textbook, AMS Publication, 2008.
4. K. D. Joshi, Introduction to General Topology, John Wiley & Sons .

Course Code and Title: PSMT-123: RINGS AND MODULES

Lectures: 60 (Credits - 4)

Course Outcomes:

1. Students understand the different examples of rings
2. Students learn ideals.
3. Students understand domains, PID and UFD.
4. Students learn free module, quotient module, simple module and module over PID.

Unit I: Introduction to Rings [14 hours]

1.1 Basic definitions and examples

1.2 Polynomial Rings, Matrix Rings, Group Rings

1.3 Ring Homomorphisms and Quotient Rings

1.4 Properties of Ideals

1.5 Rings of fractions

Unit II: Euclidean domains, Principal ideal domains and Unique factorization domains [12 hours]

2.1 Euclidean domains

2.2 Principal Ideal domains

2.3 Unique factorization domains

Unit III: Polynomial Rings [14 hours]

3.1 Definitions and Basic Properties

3.2 Polynomial Rings over Fields I

3.3 Polynomial Rings that are UFD

3.4 Irreducibility Criterion

3.3 Polynomial Rings over Fields II

Unit IV: Module theory [20 hours]

4.1 Basic definitions and Examples

4.2 Quotient Modules and Module homomorphisms

4.3 Generation of Modules, Direct sums and Free Modules

4.4 The Basic theory of Module over PID

Recommended Book:

David S. Dummit, Richard M. Foote, Abstract Algebra, 2nd Edition, John Wiley and Sons (Indian Edition)

Unit 1: Chapter 7: 7.1 to 7.5
Unit 2: Chapter 8: 8.1 to 8.3
Unit 3: Chapter 9: 9.1 to 9.5
Unit 4: Chapter 10: 10.1 to 10.3, Chapter 12: 12.1

Reference Books:

1. C. Musili, Rings and Modules, 2nd Revised Edition, Narosa Publishing House.
2. Luther and Passi, Algebra II, Narosa Publishing House.
3. Jain and Bhattacharya, Basic Abstract Algebra, 2nd Edition, Cambridge University Press.
4. Joseph Gallian, Contemporary Algebra, 7th Edition, Narosa Publishing House.

Course Code and Title: PSMT-124: PARTIAL DIFFERENTIAL EQUATIONS

Lectures: 60 (Credits- 4)

Course Outcomes:

1. Understand curves and surfaces.
2. Study Laplace equation, Boundary value problem, Cauchy problem and Dirichlet problem.
3. To study Green's function and Heat Conduction problem.
4. Understand wave equation and Kelvin's inversion theorem.

Unit I: First order P.D.E. **[18 Hours]**

1.1Curves and surfaces.
1.2 Genesis of first order P.D.E.
1.3 Classification of integrals.
1.4 Integral surfaces through Given curve.
1.5 Quasi linear Equations
1.6 Non- linear first order P.D.E.

Unit 2: Second order P.D.E. **[22 Hours]**

2.1 Classification of second order P.D.E.
2.2 One Dimensional Wave equation.
2.2.1Vibrations of infinite string.
2.2.2Vibrations of semi-infinite string.
2.2.3Vibrations of String of finite length.
2.3 Laplace's Equation.
2.3.1Boundary value Problems
2.3.2 Maximum and Minimum Principle.
2.3.3The Cauchy problem.
2.3.4The Dirichlet Problem for the Upper Half Plane.
2.3.5The Neumann Problem for the Upper half Plane.
2.3.6The Dirichlet Problem for a circle.
2.3.7 The Dirichlet Exterior Problem for a Circle.
2.3.8 The Neumann Problem for a Circle.
2.3.9 The Dirichlet Problem for a Rectangle.
2.3.10 Harnack's theorem

Unit 3: Green's Function and Heat Conduction Problem [10 Hours]

3.1 Green's function for Laplace equation.
3.2 Solution of Dirichlet Problem for upper half plane by using Green's function.
3.3 Solution of Dirichlet Problem for a Circle by using Green's function.
3.4 Heat Conduction -Infinite Rod Case
3.5 Heat Conduction -Finite rod Case.

Unit 4: Duhamel's Principle and Kelvin's Inversion theorem [10 Hours]

4.1 Wave equation.
4.2 Heat Conduction Problem.
4.3 Families of equipotential surfaces.
4.4 Kelvin's Inversion theorem.

Recommended Books

An Elementary Course in Partial Differential Equations, T Amarnath, Narosa Publication.
Unit 1: Chapter 1: 1.1 to 1.3, 1.9 to 1.11
Unit 2: Chapter 2: 2.2 to 2.4.10
Unit 3: Chapter 2: 2.4.11 to 2.4.13, 2.5.1, 2.5.2
Unit 4: Chapter 2: 2.6.1, 2.6.2, 2.8, 2.9

Reference Books

1. Elements of Partial Differential Equations, Ian Sneddon, Dover Publication
2. An Introduction to Partial Differential Equations, Yehud Pinchor & Jaco Rubinstein, Cambridge University Press.

Course Code and Title: PSMT-125: PROGRAMMING WITH PYTHON:

Lectures: 30 (Credits- 2)

Course Outcomes:

1. Study python on different operating systems, variables, strings and comments.
2. Working with lists and understand difference between lists and dictionaries.
3. Study loops in python.
4. Learn functions, classes, files in python.

Unit I: Getting Started, Variables and Simple Data Types [4 Hours]

Setting Up your Programming Environment, Python on different Operating Systems, Troubleshooting, Running Python Programs from a terminal Variables, Strings, Numbers, comments, The Zen of Python

Unit II: Introducing Lists, Working with Lists [5 Hours]

What is a List? Changing, Adding and Removing Elements, organizing a List, Avoiding Index Errors When Working with Lists, Looping Through an Entire List, Avoiding Indentation Errors, Making Numerical Lists, Working with Part of a List, Tuples, Styling your Code

Unit III: If Statements, Dictionaries [4 Hours]

Conditional Tests, If Statements, Using if Statements with Lists, Styling your If Statements Working with Dictionaries, Looping through a dictionary, Nesting

Unit IV: User Input and While Loops, Functions [6 Hours]

Input() Function**,** Introducing while loops, Using a while Loop with Lists and Dictionaries Defining a Function, Passing Arguments, Return Values, Passing a List, Passing an Arbitrary Number of Arguments, Storing Your Function in Modules, Styling Functions

Unit- V: Classes, Files and Exceptions, Testing Your Code [8 Hours]

Creating and Using a Class, Working with Classes and Instances, Inheritance, Importing Classes, The Python Standard Library, Styling Classes Reading from a file, writing to a File, Exceptions, Storing Data Testing a Function, Testing a class

Unit VI: Numpy, Scipy module **[3 Hours]**

Mathematics using Numpy, Scipy module

Recommended Book:

Python Crash Course by Eric Matthes, no starch press, San Francisco
Part I: Chapter 1 to 11

Reference Books:

1. H. Bhasin: Python Basics, MERCURY LEARNING AND INFORMATION Dulles, Virginia Boston, Massachusetts New Delhi
2. Beginning-Python, Second Edition by Magnus Lie Hetland
3. The Complete Reference Python by Martin C. Brown
4. Head First Python by Patrick Barry
5. Learning Python, O"Reilly by Mark Lutz 5. Python in a Nutshell, O"Reilly by Alex Martelli

Course Code and Title: PSMTP-125: Practical On PROGRAMMING WITH PYTHON:

(Credits- 2)

One practical 4 hrs per week.
Total 12 practicals based on all of the above topics will be conducted.