

## P.G. 1<sup>st</sup> Semester

### Paper: MTH701C (Core) Analysis Credits: 4 = 3+1+0 (48 Lectures)

#### Unit - I

Sequence and series of functions, Uniform Convergence and continuity, Uniform Convergence and Differentiation and integration, Equicontinuous families of functions, The Stone-Weierstrass Theorem, Some special functions: Power series, The Exponential and Logarithmic functions, The Trigonometric functions, Fourier series.

[12Lectures]

#### Unit - II

Directional derivatives and its continuity, The total derivatives in terms of partial derivative, Matrix of Linear functions, Jacobian Matrix, Chain Rules, Mean-Value Theorem, Sufficient conditions of differentiability, Sufficient condition for equality of mixed partial derivatives, Taylor's theorem in  $\mathbb{R}^n$ , Implicit function, Inverse function Theorem, Implicit function Theorem, Extremum problems and Extremum problem with Lagrange's multipliers.

[14Lectures]

#### Unit - III

Bounded Variations, Total Variations, Continuous Functions of Bounded Variations.

Reimann-Stieltjes Integral: Definition and existence, Properties, Vector valued function, Integration of Vector valued function, rectifiable curves.

[10Lectures]

#### Unit - IV

Set functions, Construction of Lebesgue measure, Measure space, Measurable functions, Simple functions, Integration: Lebesgue Monotone Convergence theorem, Lebesgue dominated convergence theorem, Integration of complex valued function, Function of Class  $L_2$ , Reisz-Fischer Theorem.

[12Lectures]

### Books Recommended

1. W. Rudin, Principles of Mathematical Analysis(3<sup>rd</sup> Edition), McGraw Hill Education 2017.  
[for Unit I, III,IV]
2. T. M. Apostol, Mathematical Analysis, Narosa, 2002. [for Unit II]

## Books for Reference

1. R. G. Bartle and D. R. Sherbert , Introduction to Real Analysis (3rd edition) , John Wiley & Sons, Inc., New York, 2000.
2. H.H. Sohrab, Basic Real Analysis(2<sup>nd</sup> Edition ),Birkhäuser,2003

**Paper: MTH702C (Core)**  
**Linear Algebra**  
**Credits: 4 = 3+1+0 (48 Lectures)**

### Unit– I

The dimension formula, matrix of a linear operator, eigen values and eigen vectors, characteristic polynomial, orthogonal matrices and rotations, diagonalization, Jordan canonical form.

[12Lectures]

### Unit– II

Determinant functions, permutations and the uniqueness of determinants, additional properties of determinants, Cramer’s rule.

[12Lectures]

### Unit– III

Bilinear form, symmetric form, Hermitian form, orthogonality, Euclidean spaces and Hermitian spaces, spectral theorem, conics and quadrics, skew-symmetric form.

[12Lectures]

### Unit– IV

Linear algebra in ring: modules, free modules, diagonalizing integer matrices, generators and relations, Noetherian rings, structure of Abelian groups, applications to linear operators.

[12Lectures]

## Books recommended:

1. M. Artin, Algebra(2nd edition),PHI Learning, 2011
2. K.Hoffman &R.Kunze, Linear Algebra(2nd edition), Prentice Hall India ,2015

## Books for Reference

1. G. Strang , Linear Algebra and Its Applications, Cengage Learning, 2007
2. P.K.Saikia , Linear Algebra, Pearson, 2009

**Paper: MTH703C (Core)**  
**Mathematical Methods**  
**Credits: 4 = 3+1+0 (48 Lectures)**

Unit – I

Integral Equation: Definition of integral Equation and classifications, reduction of ordinary differential equations into integral equations. Fredholm integral equations with separable kernels, Eigen values and Eigen functions, method of successive approximation. Iterative scheme for Fredholm integral equations of second kind.

[10Lectures]

Unit - II

Volterra integral equations of second kind, resolvent kernel of Volterra equation and its results, application of iterative scheme to Volterra equation of the second kind. Convolution type kernels.

[10Lectures]

Unit - III

Introduction to Fourier series; Fourier series for periodic functions; Dirichlet's conditions; Fourier series of even and odd functions; Half range Fourier sine series and cosine series. Fourier integral. Fourier Integral transform. Properties of Fourier transform, Fourier sine and cosine transforms, application of Fourier transform to ordinary and partial differential equations of initial and boundary value problems. Evaluation of definite integrals.

[14Lectures]

Unit - IV

Laplace Transform : Basic properties of Laplace transform, Convolution theorem and properties of convolution, inverse Laplace transform, application of Laplace transform to solution of ordinary and partial differential equations of initial and boundary value problems. Evaluation of definite integrals.

[14Lectures]

**Books Recommendeds**

1. R.P. Kanwal, Linear Integral Equations: Theory and Techniques, Academic Press, New York, 1971
2. F. B. Hilderbrand, Methods of Applied Mathematics, Dover Publications Inc., 1992.
3. I.N. Sneddon, Fourier Transforms, Dover Publications Inc., 2003
4. M.R. Spiegel, Theory and problems of Laplace Transform, McGraw-Hill Education, 1965
5. F. G. Tricomi, Integral Equations, Dover Publications Inc, 1985.
6. L. Debnath, D. Bhatta, Integral Transforms and Their Applications, Chapman and Hall/CRC,, 2014

## Books for Reference

1. S. G. Mikhlin ,Linear Integral Equations (Translated from Russia), Hindustan Book Agency, 1960

### Paper: MTH704C (Core)

#### Mechanics

Credits: 4 = 3+1+0 (48 Lectures)

#### Unit - I

Motion in two dimensions (under finite forces). Motion in two dimensions (under impulsive forces).

[8Lectures]

#### Unit - II

Motion in three dimensions, velocity and acceleration in cylindrical and spherical polar coordinates, motion on cylindrical, spherical and conical surfaces.

[8Lectures]

#### Unit - III

Motion of a rigid body under impulsive forces; Application of Principle of virtual work in impulsive motions; Carnot's theorem; Kelvin's theorem and Bertrand's theorem.

[8Lectures]

#### Unit - IV

Motion of a rigid body about a fixed point; Euler's Geometrical and Dynamical systems; Motion under no external pressure.

[8Lectures]

#### Unit – V

General coordinates, Lagrange's equation of motion for finite and impulsive forces in holonomic systems. Case of conservative forces and theory of small oscillation.

[8Lectures]

#### Unit - VI

Hamilton's equation of motion, Variational methods. Hamilton's principle, and principle of least action.

[8Lectures]

## Books Recommended

1. M. R. Spiegel, Theoretical Mechanics, McGraw Hill Education, 2017
2. H. Goldstein, C. P. Poole, J. L. Safko, Classical Mechanics(3rd edition), Pearson, 2001
3. S. L. Loney, An Elementary Treatise on Dynamics of a Particle and of Rigid Bodies, New Age International Private Limited, 2016
4. F. Chorlton, Text Books of Dynamics, CBS Publisher, 2002

## **Books for Reference**

1. M. Rahman, Rigid Dynamics, New central book agency pvt. Ltd, 2011.

### **Paper: MTH705L (Lab)** **Lab 1: Computer Programming with C** **Credits: 4 = 2+0+2 (32 Lectures)**

#### Unit-I

Revision of fundamentals of C: Data types in C, variables in C, input output statements, constant declaration, arithmetic operators in C, conditional statements, loops. Break statement, the continue statement, the go-to statement. Functions and Recursive functions. Pointers.

#### Unit-II

Arrays: Arrays, declaration of one dimensional arrays, two dimensional arrays. User defined data types: structures, array of structures, unions, enumerated data type.

#### Unit-III

Searching and Sorting: Bubble sort, selection sort, insertion sort, linear search and binary search.

#### Unit-IV

Character array and strings: Arithmetic operations on characters, String-handling functions. Files in C: Defining and opening a file, closing a file. Input/Output operations on files.

## **Lab Work**

Arranging given set of numbers in increasing/decreasing order , Sieve method for primality test, generation of twin primes, solution of congruence using complete residue system, addition, subtraction and multiplication of matrices, transpose, determinant, writing a given number in words using function, operations with strings and sorting, arranging a set of names in alphabetical order, searching a pattern in a given text and replacing every occurrence of it with another given string, solution of transcendental equation (Bisection method, Newton-Raphson method, Regula-Falsi method), Interpolation (Newton forward and backward, Lagrange methods).

## **Books Recommended**

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill, 2004
2. T. Jeyapooan, A first course in programming with C, Vikas Publishing House,2004

**Books for Reference**

1. Y. P. Kanetkar, Let us C , BPB Publication, 2001.
2. M. G.Venkateshmurthy, Programming Techniques through C, Pearson Education, 2002.
- 3.V. Rajaraman, Fundamentals of Computers, Prentice Hall of India, New Delhi, 2002.