Sri Adichunchanagiri First Grade College

Channarayapatna-573116

DEPARTMENT OF MATHEMATICS

LESSON PLAN FOR THE ACADEMIC YEAR 2022-23

Name of the Degree Program : B.Sc. (NEP)

Discipline Course : Mathematics III and IV Sem

Name of the Teacher: Divya

Programme Outcomes (PO): By the end of the program the students will be able to :

PO 1 **Disciplinary Knowledge** : Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects.

PO 2 **Communication Skills**: Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real life problems.

PO 3 **Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.

PO 4 **Problem Solving** : The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modelling ability, problem solving skills.

PO 5 **Research related skills:** The completing this programme develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.

PO 6 **Information/digital Literacy**: The completion of this programme will enable the learner to use appropriate softwares to solve system of algebraic equation and differential equations.

PO 7 **Self – directed learning**: The student completing this program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.

PO 8 **Moral and ethical awareness/reasoning:** : The student completing this program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.

PO 9 **Lifelong learning**: This programme provides self directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.

PO 10 Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

SEMESTER – III

MATDSCT 3.1: Algebra - III and Differential Equations – I

Teaching Hours : 4 Hours/Week Credits: 4

Course Learning Outcomes: This course will enable the students to

- enhance learning in Algebra and Differential Equations.
- apply the concepts of algebra in practical problems.
- solve various differential equations of practical interest.

MATDSCP 3.1: Practical's on Algebra - III and Differential Equations – I

Practical Hours : 4 Hours/Week Credits: 2

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open Source Software (FOSS)* tools for computer programming
- Solve problem on algebra and differential equations studied in **MATDSCT 3.1** by using FOSS software's.
- Acquire knowledge of applications of algebra and differential equations through FOSS

Practical/Lab Work to be performed in Computer Lab (FOSS)

Suggested Software's: Maxima/Scilab /Python/R.

Introduction to the software and commands related to the topic.

1. Generate Cayley's table.
2. Verifying whether given operator is binary or not.
3. Finding identity and inverse elements of a group.
4. Finding left and right cosets of a group.
5. Solving Differential equation using Maxima and plotting the solution.

SL.No	Theory
1.	**UNIT I: Group Theory – I (14 hrs)** Definition and examples of groups – Some general properties of Groups, Subgroups, Group of permutations – Cyclic permutations – Even and odd permutations. Order of an element of a group – Cyclic groups problems and theorems
2.	**UNIT II: Group Theory – II (14 hrs)** Cosets, Index of a group, Lagrange's theorem, consequences, Normal Subgroups, Quotient groups – Homomorphism. – Kernel of homomorphism – Isomorphism - Automorphism – Fundamental theorem of homomorphism, Cayley's theorem.
3.	**UNIT III: Differential Equations – I (14 hrs)** Recapitulation of Definition, examples of differential equations, Formation of differential equations by elimination of arbitrary constants, Differential equations of first order – Separation of variables, equations, Reducible to homogeneous, Exact differential equations, Reducible to exact, Integrating factors found by inspection and the determination of integrating factors, Linear differential equations, Bernoulli's .
4.	**UNIT IV: Differential Equations – II (14 hrs)** Equations of First order and higher degree – Solvable for p, Solvable for x, Solvable y, Clairaut's equations – Singular and General solutions. Ordinary Linear differential equations with constant coefficients – Complementary function – particular integral – Inverse differential operators. Simultaneous differential equations .

SEMESTER – IV

MATDSCT 4.1: Real Analysis – I and Differential Equations – II

Teaching Hours : 4 Hours/Week Credits: 4

Total Teaching Hours: 56 Hours .

Course Learning Outcomes: This course will enable the students to

- enhance learning in Analysis and Differential Equations.
- apply the concepts of analysis in practical problems.
- solve various differential equations of practical interest.

Sl no.	Theory
1.	**UNIT I: Sequences (14 hrs)** Sequence of real numbers – Bounded and unbounded sequences – Infimum and supremum of a sequence – Limit of a sequence – Sum, product and quotient of limits – Standard theorems on limits – Convergent , divergent and oscillatory sequences – Discuss the convergence of x^n, n^n, $(1+\frac{1}{n})^n$ and standard problems – Monotonic sequences and their properties – Cauchy's general principle of convergence.
2.	**UNIT II: Infinite Series (14 hrs)** Infinite series of real numbers – Convergence and Divergence - Oscillation of series – Properties of convergence – Series of positive terms – Geometric series – p – series – Comparison tests – D'Alembert's ratio test – Raabe's test – Cauchy's root test – Leibnitz's test for alternating series.
3.	**UNIT III: Linear differential equations (14 hrs)** Cauchy – Euler differential equations, Solution of ordinary second order linear differential equations with variable coefficients by various methods such as: (i) When a part of complementary function is given. (i) Changing the independent variable. (ii) Changing the dependent variable. (iii) By method of variation of parameters. (iv) Exact method. Total differential equations - Necessary and sufficient condition for the equation Pdx + Qdy + Rdz = 0 to be exact (proof only for the necessary part) – Simultaneous equations of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$.
4.	

	UNIT IV: Partial differential equations (14 hrs) Basic concepts – Formation of a partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form Pp + Qq = R , Standard types of first order non-linear partial differential equations – Charpit's method – Homogenous linear equations with constant coefficient – Rules for finding the complementary function – Rules for finding the particular integral, Method of separation of variables (product method).

PRACTICAL

MATDSCP 4.1: On Number Theory and Calculus – II

Practical Hours : 4 Hours/Week Credits: 2

Totat Teaching Hours: 56 Hours

Course Learning Outcomes: This course will enable the students to

¦ Learn *Free and Open Source Software (FOSS)* tools for computer programming ¦ Solve problem on real analysis and differential equations by using FOSS software's. ¦ Acquire knowledge of applications of real analysis and differential equations through FOSS **Practical/Lab Work to be performed in Computer Lab**

Suggested Software's: Maxima/Scilab//Python/R.

1. Test for convergence, divergence and oscillation sequences.
2. Test for convergence, divergence and oscillation series.
3. Test the convergence of the series using D'Alembert's ratio test and Raabe's test. 4. Programs on Linear differential equations with variable coefficients. 5. Programs on Partial differential equations.

Name of the Degree Program : B.Sc. (CBCS)
Discipline Course : Mathematics - V and VI Sem
Name of the Teacher: Divya

V SEMESTER

DSE – MATH – 01 : REAL ANALYSIS-II AND ALGEBRA - III (3 lecture hours/week: 16 x 3 = 48 HOURS)

Sl No.	Theory
1.	**UNIT I:** Sequences (12 hrs) Sequence of real numbers – Bounded and unbounded sequences – Infimum and supremum of a sequence – Limit of a sequence – Sum, product and quotient of limits – Standard theorems on limits – Convergent , divergent and oscillatory sequences – Standard properties – Monotonic sequences and their properties – Cauchy's general principle of convergence
2.	**UNIT II:** Infinite Series (12 hrs) Infinite series of real numbers – Convergence and Divergence - Oscillation of series – Properties of convergence – Series of positive terms – Geometric series – p – series – Comparison tests – D'Alembert's ratio test – Raabe's test – Cauchy's root test – Leibnitz's test for alternating series. Summation of Binomial, Exponential and Logarithmic series.
3.	**UNIT III**: Rings and Fields (12 hrs) Rings – Examples – Integral Domains – Division rings – Fields – Subrings. Subfields – Characteristic of a ring – Ordered integral domain – Imbedding of a ring into another ring – The field of quotients – Ideals – Algebra of Ideals – Principal ideal ring – Divisibility in an integral domain – Units and Associates – Prime elements
4.	**UNIT IV**: Polynomial rings and Homomorphisms (12 hrs) Polynomial rings – Divisibility – Irreducible polynomials – Division Algorithm – Greatest Common Divisors – Euclidean Algorithm – Unique factorization theorem – Prime fields – Quotient rings – Homomorphism of rings – Kernel of a ring homomorphism – Fundamental theorem of homomorphism – Maximal ideals – Prime ideals – Properties – Eisenstein's Criterion of irreducibility.

UNIT IV: Partial differential equations (14 hrs)

Basic concepts – Formation of a partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$, Standard types of first order non-linear partial differential equations – Charpit's method – Homogenous linear equations with constant coefficient – Rules for finding the complementary function – Rules for finding the particular integral, Method of separation of variables (product method).

PRACTICAL

MATDSCP 4.1: On Number Theory and Calculus – II

Practical Hours : 4 Hours/Week Credits: 2

Totat Teaching Hours: 56 Hours

Course Learning Outcomes: This course will enable the students to

¦ Learn *Free and Open Source Software (FOSS)* tools for computer programming ¦ Solve problem on real analysis and differential equations by using FOSS software's. ¦ Acquire knowledge of applications of real analysis and differential equations through FOSS **Practical/Lab Work to be performed in Computer Lab**

Suggested Software's: Maxima/Scilab//Python/R.

1. Test for convergence, divergence and oscillation sequences.
2. Test for convergence, divergence and oscillation series.
3. Test the convergence of the series using D'Alembert's ratio test and Raabe's test. 4. Programs on Linear differential equations with variable coefficients. 5. Programs on Partial differential equations.

Name of the Degree Program : B.Sc. (CBCS)
Discipline Course : Mathematics - V and VI Sem
Name of the Teacher: Divya

V SEMESTER

DSE – MATH – 01 : REAL ANALYSIS-II AND ALGEBRA - III (3 lecture hours/week: 16 x 3 = 48 HOURS)

Sl No.	Theory
1.	**UNIT I:** Sequences (12 hrs) Sequence of real numbers – Bounded and unbounded sequences – Infimum and supremum of a sequence – Limit of a sequence – Sum, product and quotient of limits – Standard theorems on limits – Convergent , divergent and oscillatory sequences – Standard properties – Monotonic sequences and their properties – Cauchy's general principle of convergence
2.	**UNIT II:** Infinite Series (12 hrs) Infinite series of real numbers – Convergence and Divergence - Oscillation of series – Properties of convergence – Series of positive terms – Geometric series – p – series – Comparison tests – D'Alembert's ratio test – Raabe's test – Cauchy's root test – Leibnitz's test for alternating series. Summation of Binomial, Exponential and Logarithmic series.
3.	**UNIT III**: Rings and Fields (12 hrs) Rings – Examples – Integral Domains – Division rings – Fields – Subrings. Subfields – Characteristic of a ring – Ordered integral domain – Imbedding of a ring into another ring – The field of quotients – Ideals – Algebra of Ideals – Principal ideal ring – Divisibility in an integral domain – Units and Associates – Prime elements
4.	**UNIT IV**: Polynomial rings and Homomorphisms (12 hrs) Polynomial rings – Divisibility – Irreducible polynomials – Division Algorithm – Greatest Common Divisors – Euclidean Algorithm – Unique factorization theorem – Prime fields – Quotient rings – Homomorphism of rings – Kernel of a ring homomorphism – Fundamental theorem of homomorphism – Maximal ideals – Prime ideals – Properties – Eisenstein's Criterion of irreducibility.

VI SEMESTER

DSE – MATH – 02 : ALGEBRA - IV AND COMPLEX ANALYSIS I (3 lecture hours/week: 16 x 3 = 48 HOURS)

Sl.no	Theory
1.	**UNIT I:** Vector Spaces (12 hrs) Vector Spaces – Definition – Examples – Vector subspaces – Criterion for a subset to be a subspace – Algebra of Subspaces – Linear Combination – Linear Span – Linear dependence and linear Independence of vectors – Theorems on linear dependence and linear independence – Basis of a vector space – Dimension of a vector space — Some properties – Quotient spaces – Homomorphism of vector spaces– Isomorphism of vector spaces – Direct Sums.
2.	**UNIT II**: Linear Transformations (12 hrs) Linear transformation – Linear maps as matrices – Change of basis and effect of associated matrices – Kernel and image of a linear transformation – Rank and nullity theorem – Eigen values and Eigen vectors of a linear transformation.
3.	**UNIT III**: Functions of a Complex Variable (12 hrs) Equation to a circle and a straight line in complex form, Limit of a function – Continuity and differentiability – Analytic functions – Singular points – Cauchy-Riemann equations in Cartesian and polar forms – Necessary and sufficient condition for function to be analytic – Harmonic functions – Real and Imaginary parts of an analytic function are harmonic – Construction of analytic function i) Milne Thomson Method – ii) using the concept of Harmonic
4.	**UNIT IV**: Transformations (12 hrs) Definition – Jacobean of a transformation – Identity transformation – Reflection – Translation – Rotation – Stretching – Inversion – Linear transformation – Definitions – The Bilinear transformations – Cross Ratio of four points – cross ratio preserving property – Preservation of the family of straight lines and circles – conformal mappings – Discussion of the transformations $w = z2$, $w = \sin z$. $w = ez$, $w = ½ (z + 1/z)$.

VI SEMESTER

SEC – MATH – 03 : COMPLEX ANALYSIS II AND IMPROPER INTEGRALS (2 lecture hours/week: 16 x 2 = 32 HOURS)

Sl.no	Theory
1.	UNIT I: Complex Integration (16 hrs) The complex Line integral – Examples and Properties – Proof of Cauchy's Integral theorem using Green's Theorem – Direct consequences of Cauchy's theorem – The Cauchy's integral formula for the function and the derivatives – Applications to the evaluations of simple line integrals – Cauchy's Inequality – Liouville's theorem – Fundamental theorem of Algebra.
2.	UNIT II: Improper Integrals (16 hrs) Improper Integrals (definition only) – Gamma and Beta functions and results following the definitions – Connection between Beta and gamma functions – Applications to evaluation of integrals – Duplication formula

Rinya

H.O.D of Mathematics.

Principal

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