MANGALORE UNIVERSITY
DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics Choice Based Credit System (Semester Scheme) Programme from the academic year 2016-17

Preamble

The syllabi for the M.Sc. Mathematics Programme in use at present were introduced from the academic year 2011-2012. As per the directions and guidelines of The University Grants Commission, and also with instructions from The Higher Education Council of Government of Karnataka, The Mangalore University has recently framed the regulations governing the Choice Based Credit System for the two years (four semesters) post graduate degree programmes **(called CBCS-PG)** so as to enable its programmes to be on par with global standards. Hence the following revised and restructured syllabi for the M.Sc. Mathematics Programme has been prepared as per the new regulations of the University. In the syllabi, the first paper in each of the second and the third semesters is an "Open Elective" paper, which is offered only to the students of other departments. Also, to have better flexibility in introducing the courses, additional optional courses are offered under "Soft Core" category. The syllabi takes into consideration the recommendations of U.G.C. Curriculum Development Committee and it is meant to be introduced from the academic year 2016-2017.

Consolidated List of Courses offered:

Hard Core Courses

First Semester:

1. MTH 401 Algebra – I
2. MTH 402 Linear Algebra – I
3. MTH 403 Real Analysis – I

Second Semester:

4. MTH 452 Algebra – II
5. MTH 453 Real Analysis – II
6. MTH 454 Topology

Third Semester:

7. MTH 502 Complex Analysis – I
8. MTH 503 Measure and Integration
9. MTH 504 Multivariate Calculus and Geometry

Fourth Semester:

10. MTP 551 Project Work
11. MTH 552 Complex Analysis – II
12. MTH 553 Functional Analysis

Soft Core Courses

1. MTS 404 Numerical Analysis
2. MTS 405 Number Theory
3. MTS 455 Linear Algebra – II
4. MTS 456 Ordinary Differential Equations
5. MTS 505 Advanced Numerical Analysis
6. MTS 506 Commutative Algebra

7. MTS 507 Graph Theory
8. MTS 508 Lattice Theory
9. MTS 509 Fluid Mechanics
10. MTS 510 Theory of Partitions
11. MTS 554 Partial Differential Equations
12. MTS 555 Advanced Topology
13. MTS 556 Advanced Discrete Mathematics
14. MTS 557 Algebraic Number Theory
15. MTS 558 Calculus of Variations and Integral Equations
16. MTS 559 Mathematical Statistics

Open Elective Courses

1. MTE 451 Discrete Mathematics and Applications
2. MTE 501 Differential Equations and Applications

A. The following shall be the Courses of study in the four semesters M.Sc. Mathematics Programme (CBCS-PG) from the academic year 2016-2017.

I Semester

Course Code	Course	Hard Core/ Soft Core/ Open Elective	Credits
MTH 401	Algebra – I	HC	5
MTH 402	Linear Algebra – I	HC	5
MTH 403	Real Analysis – I	HC	5
MTS 404	Numerical Analysis	SC	4
MTS 405	Number Theory	SC	4

II Semester

In this semester, the course 'MTE 451' is an "Open Elective Course" which is offered only to students of other departments. The other five courses are offered to the students of the department.

Course Code	Course	Hardcore/ Soft Core/ Open Elective	Credits
MTE 451	Discrete Mathematics and Applications	OE	3
MTH 452	Algebra – II	HC	4
MTH 453	Real Analysis – II	HC	4
MTH 454	Topology	HC	5
MTS 455	Linear Algebra – II	SC	4
MTS 456	Ordinary Differential Equations	SC	4

III Semester

In this semester, the course 'MTE 501' is an "Open Elective Course" which is offered only to students of other departments. The other courses are offered to the students of the department. The hard core courses MTH 502, MTH 503 and MTH 504 are compulsory and the student can choose any two soft core courses from MTS 505 to MTS 510. Also a project work, which is compulsory for every student, involves self study to be carried out by the student (on a research problem of current interest or on an advanced topic not covered in the syllabus) under the guidance of a faculty member. Project work shall be initiated in the third semester itself and the project report (dissertation) shall be submitted at the end of the fourth semester.

Course Code	Course	Hard Core/ Soft Core/ Open Elective	Credits
MTE 501	Differential Equations and Applications	OE	3
MTH 502	Complex Analysis – I	HC	5
MTH 503	Measure and Integration	HC	5
MTH 504	Multivariate Calculus and Geometry	HC	4
MTS 505	Advanced Numerical Analysis	SC	4
MTS 506	Commutative Algebra	SC	4
MTS 507	Graph Theory	SC	4
MTS 508	Lattice Theory	SC	4
MTS 509	Fluid Mechanics	SC	4
MTS 510	Theory of Partitions	SC	4

IV Semester

In this semester, the course MTP 551 is a project work which the student has taken up under the guidance of a faculty member in the third semester itself. Each student has to submit a project report (dissertation) at the end of the fourth semester. The hard core courses MTH 552 and MTH 553 are compulsory and the student can choose any two soft core courses from MTS 554 to MTS 559.

Course Code	Course	Hard Core/ Soft Core/ Open Elective	Credits
MTP 551	Project Work	Project	4
MTH 552	Complex Analysis – II	HC	4
MTH 553	Functional Analysis	HC	4
MTS 554	Partial Differential Equations	SC	4
MTS 555	Advanced Topology	SC	4
MTS 556	Advanced Discrete Mathematics	SC	4
MTS 557	Algebraic Number Theory	SC	4
MTS 558	Calculus of Variations and Integral Equations	SC	4
MTS 559	Mathematical Statistics	SC	4

B. Scheme of Instruction and Examination

I Semester

Course Code	Instruction hours per week	Credits	Duration of Exam. in hours	University Exam. Max.Marks	Internal Assessment Max.Marks	Total Marks
MTH 401	5	5	3	70	30	100
MTH 402	5	5	3	70	30	100
MTH 403	5	5	3	70	30	100
MTS 404	4	4	3	70	30	100
MTS 405	4	4	3	70	30	100

II Semester

Course Code	Instruction hours per week	Credits	Duration of Exam. in hours	University Exam. Max.Marks	Internal Assessment Max.Marks	Total Marks
MTE 451	3	3	3	70	30	100
MTH 452	4	4	3	70	30	100
MTH 453	4	4	3	70	30	100
MTH 454	5	5	3	70	30	100
MTS 455	4	4	3	70	30	100
MTS 456	4	4	3	70	30	100

III Semester

Course Code	Instruction hours per week	Credits	Duration of Exam. in hours	University Exam. Max. Marks	Internal Assessment Max. Marks	Total Marks
MTE 501	3	3	3	70	30	100
MTH 502	5	5	3	70	30	100
MTH 503	5	5	3	70	30	100
MTH 504	4	4	3	70	30	100
MTS 505	4	4	3	70	30	100
MTS 506	4	4	3	70	30	100
MTS 507	4	4	3	70	30	100
MTS 508	4	4	3	70	30	100
MTS 509	4	4	3	70	30	100
MTS 510	4	4	3	70	30	100

IV Semester

Course Code	Instruction hours per week	Credits	Duration of Exam. in hours	University Exam. Max.Marks	Internal Assessment Max.Marks	Total Marks
MTP 551	4	4	-	70	30	100
MTH 552	4	4	3	70	30	100
MTH 553	4	4	3	70	30	100
MTS 554	4	4	3	70	30	100
MTS 555	4	4	3	70	30	100
MTS 556	4	4	3	70	30	100
MTS 557	4	4	3	70	30	100
MTS 558	4	4	3	70	30	100
MTS 559	4	4	3	70	30	100

Tutorials: There shall be at least 3 hours of tutorials per week for each course having 5 credits; and the minimum number of hours of tutorials per week for courses with less than 5 credits shall be considered proportionately.

Scheme of evaluation of internal assessment marks

Each Theory course shall carry 30 marks for internal assessment based on two tests of 90 minutes duration each.

Pattern of Semester Examination

1. **Theory Paper**:
   Each question paper for the theory course shall contain EIGHT questions out of which FIVE are to be answered. All questions carry equal marks.
2. **Project Report:**
   The evaluation of a project report is by two examiners as per the regulations.

C. Syllabi of Each Semester

I SEMESTER

MTH 401	Algebra – I	5 Credits (60 hours)

Unit I - Groups and Subgroups: (Ref. [1])

Binary operations, Isomorphic binary operations, Groups, Subgroups, Cyclic groups, Generating sets and Cayley digraphs, Groups of permutations, Orbits, cycles and alternating groups, Cosets and Lagrange's theorem.

15 Hours

Unit II - Product Groups, Homomorphism and Quotient Groups: (Ref. [1])

Direct products and finitely generated abelian groups, Homomorphisms, Factor groups, Factor group computations and simple groups, Isomorphism theorems, Series of groups.

15 Hours

Unit III - Advanced Group Theory: (Ref. [2])

Symmetry of plane figures, Isometries, Isometry of the plane, Finite groups of orthogonal operators on the plane.
Group actions on a set, Applications of group actions to counting, Cayley's theorem, The class equation, p-Groups, Conjugation in the symmetric group, Normalizers, The Sylow theorems, The groups of order 12.

22 Hours

Unit IV - Rings and Fields**:** (Ref. [1])

Definitions of rings, subrings, integral domains, fields and their basic properties, Homomorphisms and Factor Rings, Prime and Maximal Ideals. Fields of quotients of an integral domain, Rings of Polynomials.

8 Hours

References:

1. J. B. Fraleigh - A First Course in Abstract Algebra, Addison Wesley, 7th edition 2003.
2. Michael Artin - Algebra, Prentice Hall of India 2nd edition 2013.
3. I. N. Herstein - Topics in Algebra, John Wiley & Sons, 2nd edition 2006.
4. Joseph A. Gallian - Contemporary Abstract Algebra, Cengage Learning India, 8th edition, 2013.
5. Paul B. Garrett – Abstract Algebra, CRC press, 2007.
6. Thomas W. Hungerford – Algebra, Springer, 2004.
7. David S. Dummit and Richard M. Foote- Abstract Algebra, Wiley, 3rd edition 2004.
8. Serge Lang - Algebra, 3rd Edition, Springer, 2005.

MTH 402	Linear Algebra - I	5 Credits (60 hours)

Unit I - Matrix Operations:
Recapitulation of the basic operations, Block multiplication, Matrix units, Row reduction, The matrix transpose, Permutation matrices, Determinants, Other formulas for Determinant, The Cofactor matrix.

14 Hours

Unit II - Vector Spaces:
Subspaces of R^n, Fields, Vector Spaces, Bases and dimension. Computing with bases, Direct sums, Infinite Dimensional spaces.

18 Hours

Unit III - Linear Operators:
The dimension formula, The matrix of a linear transformation, Linear Operators, Eigenvectors, The characteristic polynomial, Triangular and Diagonal forms, Jordan form.

20 Hours

Unit IV – Applications of Linear Operators:
Orthogonal matrices and Rotations, Cayley-Hamilton Theorem, The matrix exponential,

8 Hours

References:

1. Michael Artin - Algebra, Prentice Hall of India, 2rd Edition, 2013.

2. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence- Linear Algebra, Prentice Hall of India, 2014.
3. K. Hoffmann and R. Kunz - Linear Algebra, Prentice Hall of India, 2rd Edition, 2013.
4. S. Lang - Linear Algebra, Addison Wesley, London, 1970.
5. Larry Smith - Linear Algebra, Springer Verlag, 3rd Edition, 1998.
6. Gilbert Strang - Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006.
7. S. Kumaresan – Linear Algebra- A Geometric Approach, PHI, 2003.

MTH 403	Real Analysis – I	5 Credits (60 hours)

Unit I -

The real and complex number system: Introduction, Ordered sets, Fields, The real field, The extended real number system, The complex field, Euclidean spaces, Inequalities.

Basic topology: Finite, countable and uncountable sets, Metric spaces, Compact sets, Perfect sets, Connected sets.

20 Hours

Unit II - Numerical sequences and Series:

Convergent sequences, Subsequences, Cauchy sequences, Upper and lower limits, Some special sequences, Series, Series of non-negative terms, The number e, The root and ratio tests, Power series, Summation by parts, Absolute convergence, Addition and multiplication of series, Rearrangements.

15 hours

Unit III - Continuity:

Limits of functions, Continuous functions, Continuity and compactness, Continuity and connectedness, Discontinuities, Monotonic functions, Infinite limits and limits at infinity.

15 Hours

Unit IV - Differentiation:

The derivative of a real function, Mean value theorems, The continuity of derivatives, L'Hospital's rule, Derivatives of higher order, Taylor's theorems, Differentiation of vector valued functions.

10 Hours

References:

1. Walter Rudin - Principles of Mathematical Analysis, McGraw Hill, 3rd Edition, 1976.
2. Robert. G. Bartle - The Elements of Real Analysis, Wiley International Edition, New York, 2nd Edition 1976.
3. T. M. Apostal - Mathematical Analysis, Addison /Wesley, Narosa, New Delhi, 2nd Edition, 1985.
4. Ajith Kumar and S. Kumaresan – A basic Course in Real Analysis, CRC Press, 2014.
5. R. R. Goldberg - Methods of Real Analysis, Oxford & I. B. H. Publishing Co., New Delhi, 2nd Edition, 1970.
6. N. L. Carothers – Real Analysis, Cambridge University Press, 2000.
7. Russel A. Gordon- Real Analysis- A first Course, Pearson, 2nd Edition, 2011.

MTS 404	Numerical Analysis	4 Credits (48 Hours)

Unit I- Transcendental and Polynomial Equations:
Introduction, The bisection method, Iteration methods based on first degree equation, Iteration methods based on second degree equation, Rate of convergence, Rate of convergence of Secant and Newton-Raphson method Iteration methods, First order method, Second order method, High order methods. Polynomial equations, Descartes' Rule of Signs, The Birge-Vieta method.

12 Hours

Unit II- System of Linear Algebraic Equations and Eigenvalue problems:
Introduction, Direct methods - Gauss elimination method, Gauss-Jordan method, Triangularization method, Cholesky method. Iteration methods - Jacobi iteration method, Gauss-Seidel iteration method, Convergence analysis, Eigenvalues and eigenvectors. The power method.

12 Hours

Unit III - Interpolation and Approximation:
Introduction, Lagrange and Newton interpolations, Linear and Higher order interpolation, Finite difference operators, Interpolating polynomials using finite differences, Hermite interpolation, Approximations.

12 Hours

Unit IV-
Numerical Differentiation: Introduction, Methods based on Interpolation, Methods based on finite differences, Methods based on undetermined coefficients, Extrapolation methods.
Numerical Integration: Methods based on Interpolation, Newton-Cotes methods, Composite Integration Methods.

12 Hours

References:

1. M. K. Jain, S. R. K. Iyengar - R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, 6th Edition 2012.
2. C. F. Gerald and P. O. Wheatly - Applied Numerical Analysis, Pearson Education, Inc., 1999.
3. A. Ralston and P. Rabinowitz - A First Course in Numerical Analysis, 2nd Edition, McGraw - Hill, New York, 1978.
4. K. Atkinson - Elementary Numerical Analysis, 2nd Edition, John Wiley and Sons, Inc., 1994.
5. P. Henrici - Elements of Numerical Analysis, John Wiley and Sons, Inc., New York, 1964.

MTS 405	Number Theory	4 Credits (48 Hours)

Unit I
Divisibility and Primes (Ref. [1]): Recapitulation of Division algorithm, Euclid's algorithm, Least Common Multiples, Linear Diophantine equations. Prime numbers and Prime-power factorisations, Distribution of primes, Fermat and Mersenne primes, Primality testing and factorization.
Arithmetical Functions (Ref. [2, 1]): The Möbius function and its properties, Euler function, examples and properties, The Dirichlet product of arithmetical functions, Dirichlet inverses and the Möbius inversion formula.

14 Hours

Unit II - Congruences (Ref. [2, 1]):
Recapitulation of basic properties of congruences, Residue classes and complete residue systems, Linear congruences. Reduced residue systems and the Euler-Fermat theorem, Polynomial congruences modulo p and Langrange's theorem, Simultaneous linear congruences, Simultaneous non-linear congruences, An extension of Chinese Remainder Theorem, Solving congruences modulo prime powers.

10 Hours

Unit III - Quadratic Residues and Quadratic Reciprocity Law (Ref. [2]):
Quadratic residues, Legendre's symbol and its properties, Euler's criterion, Gauss lemma, The quadratic reciprocity law and its applications, The Jacobi symbol, Applications to Diophantine equations.

12 Hours

Unit IV - Sums of squares, Fermat's last theorem and Continued fractions (Ref. [1, 3]):
Sums of two squares, Sums of four squares, The Pythagoras theorem, Pythagorean triples and their classification, Fermat's Last Theorem (Case $n = 4$).
Recapitulation of Finite continued fractions, Infinite continued fractions, Representation of irrational numbers, Periodic continued fractions and quadratic irrationals, Solution of Pell's equation by continued fractions.

12 Hours

References

1. G. A. Jones and J. M. Jones, Elementary Number Theory, Springer UTM, 2007.
2. Tom M. Apostol – Introduction to Analytic Number Theory, Springer, 1989.
3. D. Burton; Elementary Number Theory, McGraw-Hill, 2005.
4. Niven, H.S. Zuckerman & H.L. Montgomery, Introduction to the Theory of Numbers, Wiley, 2000.
5. H. Davenport, The Higher Arithmetic, Cambridge University Press, 2008.

II SEMESTER

MTE 451	Discrete Mathematics and Applications	3 Credits (36 Hours)

Prerequisite: Basic Mathematics up to class XII/PU.

Unit I - Number Theory and Cryptography:
Divisibility and Modular Arithmetic, Integer Representations and Algorithms, Primes and Greatest Common Divisors, Solving Congruences, Applications of Congruences, Cryptography.

8 Hours

Unit II - Counting Techniques:
The Basics of Counting, The Pigeonhole Principle Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Applications of Recurrence Relations, Solving Linear Recurrence Relations, Recurrence Relations, Generating Functions, Principle of Inclusion–Exclusion, Applications of Inclusion–Exclusion.

12 Hours

Unit III - Order Relations and Structures:
Product Sets and Partitions, Relations, Properties of Relations, Equivalence Relations, Partially Ordered Sets, Extremal Elements of Partially Ordered Sets, Lattices, Finite Boolean Algebras, Functions on Boolean Algebras, Boolean Functions as Boolean Polynomials.

8 Hours

Unit IV - Groups and Coding Theory:
Binary Operations Revisited, Semigroups, Products and Quotients of Semigroups, Groups, Products and Quotients of Groups, Coding of Binary Information and Error Detection, Decoding and Error Correction.

8 Hours

References:

1. Kenneth H. Rosen - Discrete Mathematics and Its Applications, Tata Mc-Graw-Hill, 7th Edition, 2012.
2. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross-Discrete Mathematical Structures-Prentice Hall, 3rd Edition, 1996.
3. Grimaldi R-Discrete and Combinatorial Mathematics. 1-Pearson, Addison Wesley, 5th Edition, 2004.

MTH 452	Algebra – II	4 Credits (48 hours)

Unit I - Factoring: (Ref [1])
Unique factorization domains, Euclidean domains, Content of polynomials, Primitive polynomials, Gauss lemma, Unique factorization in $R[x]$, where R is a U.F.D., Irreducibility test mod p, Eisenstein's criterion, Gauss primes.

18 Hours

Unit II - Fields: (Ref [1])
Algebraic and transcendental elements, The degree of a field extension, Finding the irreducible polynomial, Ruler and compass constructions, Isomorphism of field extensions, Adjoining roots, Splitting fields, Finite fields, Primitive elements, Algebraically closed fields, The fundamental theorem of algebra.

20 Hours

Unit III - Galois Theory: (Ref [2])
Automorphisms and Fields, Separable Extensions, Galois Theory, Illustrations of Galois Theory, Cyclotomic Extensions, Insolvability of the Quintic.

10 Hours

References:

1. Michael Artin - Algebra, Prentice Hall of India 2nd edition 2013.
2. J. B. Fraleigh - A First Course in Abstract Algebra, Addison Wesley, 7th edition 2003.
3. I. N. Herstein - Topics in Algebra, John Wiley & Sons, 2nd edition 2006.
4. Joseph A. Gallian - Contemporary Abstract Algebra, Cengage Learning India, 8th edition, 2013.
5. Paul B. Garrett – Abstract Algebra, CRC press, 2007.
6. Thomas W. Hungerford – Algebra, Springer, 2004.
7. David S. Dummit and Richard M. Foote- Abstract Algebra, Wiley, 3rd edition 2004.
8. Serge Lang - Algebra, 3rd Edition, Springer, 2005.

MTH 453	Real Analysis – II	4 Credits (48 hours)

Unit I- The Riemann-Stieltjes Integral: (Ref: [1])
Definition and existence of integrals, Properties of integral, Integration and differentiation, Integration of vector-valued functions, Rectifiable curves.
Improper Integrals: (Ref: [3]) Definition, Criteria for convergence, Interchanging derivatives and integrals.

20 Hours

Unit II- Sequences and Series of Functions: (Ref: [1])
Discussion of main problem, Uniform convergence, uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation, Equicontinuous families of functions, The Stone-Weierstrass theorem.

16 Hours

Unit III- Functions of several variables: (Ref: [1])
Differentiation, The contraction principle, The inverse function theorem, The implicit function theorem.

12 Hours

References:

1. Walter Rudin - Principles of Mathematical Analysis, McGraw Hill, 3rd Edition, 1976.
2. Robert. G. Bartle - The Elements of Real Analysis, Wiley International Edition, New York, 2nd Edition 1976.
3. Serge Lang, Analysis I, Addison Wesley Publishing Company 1968.
4. T. M. Apostal - Mathematical Analysis, Addison /Wesley, Narosa, New Delhi, 2nd Edition, 1985.
5. R. R. Goldberg - Methods of Real Analysis, Oxford & I. B. H. Publishing Co., New Delhi, 2nd Edition, 1970.
6. Ajith Kumar and S. Kumaresan – A basic course in real analysis, CRC Press, 2014.

MTH 454	Topology	5 Credits (60 hours)

Unit I - Topological Spaces:
The definition and some examples, Elementary concepts, Open bases and open subbases, Weak topologies, The function algebras $C(X, \mathbb{R})$ and $C(X, \mathbb{C})$.

15 Hours

Unit II - Compactness:
Compact Spaces, Product spaces, Tychonoff's theorem.

15 Hours

Unit III - Separation:
T_1 – Spaces and Hausdorff spaces, Completely regular spaces and Normal spaces, Urysohn's lemma and Tietze extension theorem, The Urysohn imbedding theorem.

15 Hours

Unit IV- Connectedness:
Connected spaces, The components of a space, Totally disconnected spaces, Locally connected spaces.

15 Hours

References:

1. G. F. Simmons - Introduction to Topology and Modern Analysis, Mc-Graw Hill, Kogakusha,1968.
2. J. R. Munkres -Topology, Second Edition, Pearson Education, Inc, 2000.
3. S. Willard - General Topology, Addison Wesley, New York, 1968.
4. J. Dugundji -Topology, Allyn and Bacon, Boston, 1966.
5. J. L. Kelley - General Topology, Van Nostrand Reinhold Co., New York, 1955.

MTS 455	Linear Algebra - II	4 Credits (48 Hours)

Unit I - Bilinear Forms:
Bilinear forms, Symmetric forms, Hermitian forms, Orthogonality, Orthogonal Projection, Euclidean and Hermitian spaces, The spectral theorem, Skew symmetric forms, Summary of results in matrix notation.

24 Hours

Unit II Linear Algebra in a Ring:
Modules, Free modules, Diagonalizing Integer Matrices, Submodule of free modules, Generators and Relations, Noetherian Rings, The structure theorem for abelian groups, Application to linear operators.

24 Hours

References:

1. Michael Artin - Algebra, Prentice Hall of India, 2rd Edition, 2013.
2. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence- Linear Algebra, Prentice Hall of India, 2014.
3. K. Hoffmann and R. Kunz - Linear Algebra, Prentice Hall of India, 2rd Edition, 2013.
4. S. Lang - Linear Algebra, Addison Wesley, London, 1970.
5. Larry Smith - Linear Algebra, Springer Verlag, 3rd Edition, 1998.
6. Gilbert Strang - Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006.
7. S. Kumaresan – Linear Algebra- A Geometric Approach, PHI, 2003.

MTS 456	Ordinary Differential Equations	4 Credits (48 Hours)

Unit I - Linear Differential Equations of Higher Order:
Linear dependence and the Wronskian, Basic theory for linear equations, Method of variation of parameters, Reduction of n^{th} order linear homogeneous equation, Homogeneous and non-homogeneous equations with constant coefficients.

10 Hours

Unit II - Solutions in Power Series:
Second order linear equations with ordinary points, Legendre equation and Legendre polynomials, Second order equations with regular singular points, Bessel equation.

20 Hours

Unit III - Systems of Linear Differential Equations:
Systems of first order equations, Existence and uniqueness theorem. The fundamental matrix, Non-homogeneous linear systems, Linear systems with periodic coefficients.

10 Hours

Unit IV - Existence and Uniqueness of solutions :
Equations of the form $x' = f(t,x)$, Method of successive approximation, Lipschitz condition, Picards theorem, Non uniqueness of solutions, Continuation of solutions.

8 Hours

References:

1. S. G. Deo and V. Raghavendra, Ordinary Differential Equations and Stability Theory, Tata McGraw Hill, 1980.
2. A. Coddington - An Introduction to Ordinary Differential Equations, Prentice Hall of India, 2013.
3. A. Coddington and N. Levinson - Theory of Ordinary Differential Equations, Krieger, 1984.
4. M. W. Hirsh and S. Smale- Differential Equations, Dynamical Systems and Linear Algebra, Academic Press, New York, 1974.
5. V. I. Arnold - Ordinary Differential Equations, MIT Press, Cambridge, 1981.
6. Shepley L. Ross – Differential Equations, Wiley, 2004.

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Semester wise distribution of credits for M.Sc. Mathematics Programme

Sem	Hard Core			Soft Core			Open Elective			Project	Total
	No. of Courses	Credits	Total Credits	No. of Courses	Credits	Total Credits	No. of Courses	Credits	Total Credits		
I	3	5	15	2	4	8					23
II	2	4	13	2	4	8	1	3	3		24
	1	5									
III	1	4	14	2	4	8	1	3	3		25
	2	5									
IV	2	4	8	2	4	8				4	20
Total			50			32			6*	4	86+6*

*Not included for CGPA

Total of Hard Core Credits is 50+4 = 54 and Total Soft Core Credits is 32.

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