KADI SARVA VISHWAVIDYALAYA
GANDHINAGAR

Syllabus for
M.Sc. Mathematics under CBCS

(*2 Years Full Time: 4 Semesters Programme*)

w.e.f 2017

LDRP Campus, Sector – 15, Nr. *KH* – 5 Circle,
Gandhinagar - 382015

BASIC STRUCTURE OF SUBJECTS:

(1) Core/ Principle / Compulsory Courses:

All core courses carry 4 credits in 4 hours per week teaching

List of Courses

[MT-101] Algebra-I	[MT-102] Ordinary Differential Equations
[MT-103] Real Analysis	[MT-104] Advanced Linear Algebra
[MT-201] Algebra-II	[MT-202] Partial Differential Equations
[MT-203] Special Functions	[MT-204] Statistical Methods
[MT-301] Complex Analysis	[MT-302] Topology
[MT-303] Research Methodology	[MT-401] Number Theory
[MT-402] Functional Analysis	[MT-403] Integral Transforms

(2) Elective Disciplinary Courses:

All electives carry 4 credits in 4 hours per week teaching. Choice of electives can be done from the list given below from Group A or Group B:

(a) Group A: Pure Mathematical Group

[MT - 304 A] Functions of Several Variables

[MT - 404 A] Advanced Topology

(b) Group B: Applied Mathematical Group

[MT - 304 B] Advanced Operations Research

[MT - 404 B] Fluid Dynamics

(3) Mathematical Practical's:

All mathematical practical's carry 4 credits in 8 hours per week for practical.

There are three mathematical practicals in the respective semesters.

[MT-105] Mathematical Practical-1

[MT-205] Mathematical Practical-2

[MT-305] Mathematical Practical-3

(4) Soft Skill Based Courses: SSB – Group (SSB-1 to SSB-4)

All soft skill based courses carry 4 credits in 8 hours for practical.

SSB-1 Introduction to SCILAB

SSB-2 Introduction to 'C'

SSB-3 Introduction to PYTHON

KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR									
MASTER OF SCIENCE (MATHEMATICS) PROGRAMME									
CBCS STRUCTURE FOR M.Sc. (MATHEMATICS)									
M.Sc.(MATHEMATICS) SEMESTER - I SYLLABUS W.E.F YEAR: 2017-18									
Sr. No	**Subject Code**	**Name of Subject**	**Total Credit**	**Teaching Scheme (Per Week)**		**Examination Scheme**			
						MID	**External**		**Total**
				Th.	**Pr.**	**Th.**	**Th.**	**Pr.**	**Marks**
1	MT-101	Algebra-I	4	4	-	30	70	-	100
2	MT-102	Ordinary Differential Equations	4	4	-	30	70	-	100
3	MT-103	Real Analysis	4	4	-	30	70	-	100
4	MT-104	Advanced Linear Algebra	4	4	-	30	70	-	100
5	MT-105	Mathematical Practical-1	4	-	8	-	-	100	100
6	SSB-1	Introduction to SCILAB	4	2	4	-	50	50	100
Total			**24**	**18**	**12**	**120**	**330**	**150**	**600**

M.Sc.(MATHEMATICS) SEMESTER - II SYLLABUS W.E.F YEAR: 2017-18									
Sr. No	**Subject Code**	**Name of Subject**	**Total Credit**	**Teaching Scheme (Per Week)**		**Examination Scheme**			
						MID	**External**		**Total Marks**
				Th.	**Pr.**	**Th.**	**Th.**	**Pr.**	
1	MT-201	Algebra-II	4	4	-	30	70	-	100
2	MT-202	Partial Differential Equations	4	4	-	30	70	-	100
3	MT-203	Special Functions	4	4	-	30	70	-	100
4	MT-204	Statistical Methods	4	4	-	30	70	-	100
5	MT-205	Mathematical Practical-2	4	-	8	-	-	100	100
6	SSB-2	Introduction to ‘C’	4	2	4	-	50	50	100
Total			**24**	**18**	**12**	**120**	**330**	**150**	**600**

M.Sc.(MATHEMATICS) SEMESTER - III SYLLABUS W.E.F YEAR: 2017-18									
Sr. No	**Subject Code**	**Name of Subject**	**Total Credit**	**Teaching Scheme (Per Week)**		**Examination Scheme**			
						MID	**External**		**Total Marks**
				Th.	**Pr.**	**Th.**	**Th.**	**Pr.**	
1	MT-301	Complex Analysis	4	4	-	30	70	-	100
2	MT-302	Topology	4	4	-	30	70	-	100
3	MT-303	Research Methodology	4	4	-	30	70	-	100
4	MT-304A / MT-304B	Elective - I	4	4	-	30	70	-	100
5	MT-305	Mathematical Practical-3	4	-	8	-	-	100	100
6	SSB-3	Introduction to PYTHON	4	2	4	-	50	50	100
Total			**24**	**18**	**12**	**120**	**330**	**150**	**600**

M.Sc.(MATHEMATICS) SEMESTER - IV SYLLABUS W.E.F YEAR: 2017-18									
Sr. No	**Subject Code**	**Name of Subject**	**Total Credit**	**Teaching Scheme (Per Week)**		**Examination Scheme**			
						MID	**External**		**Total Marks**
				Th.	**Pr.**	**Th.**	**Th.**	**Pr.**	
1	MT-401	Number Theory	4	4	-	30	70	-	100
2	MT-402	Functional Analysis	4	4	-	30	70	-	100
3	MT-403	Integral Transforms	4	4	-	30	70	-	100
4	MT-404A / MT-404B	Elective - II	4	4	-	30	70	-	100
5	MTPW	Project Work	8	-	16	-	-	200	200
Total			**24**	**16**	**16**	**120**	**280**	**200**	**600**

KADI SARVA VISHWAVIDYALAYA
GANDHINAGAR

Syllabus of
Master of Science
Mathematics
Semester – I

ALGEBRA – 1

M.Sc. 1st SEMESTER

SUBJECT CODE: MT-101

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES:

The objective of this course is

- To be familiar with the definition of various types of groups, and a number of examples and theorems.
- To understand and apply the conceptual structure of group theory.
- To gain skills in problem solving and critical thinking.

Outline of the Course:

Sr. No.	Topic
1	Homomorphism and Isomorphism of Groups
2	Automorphism of Groups
3	Sylow's Theorem
4	Solvable Groups

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
1	**Homomorphism and Isomorphism of Groups:** Definition and basic examples of Group, Sub group, Normal subgroups, Quotient group and Cyclic group. Homomorphism of Group, Fundamental Theorem on homomorphism, Isomorphism of groups, Laws of Isomorphism.	**15**	**25%**
2	**Sylow's Theorems:** Conjugacy relation on a group and its applications, Class Equation, Cauchy's theorem for abelian groups, Cauchy's theorem for finite groups, Sylow's p-subgroup, Sylow's Theorems,	**15**	**25%**
3	**Automorphism of Groups:** Automorphism of a group, Inner Automorphism, External direct product of groups, Inner direct products, Finite Abelian Group.	**15**	**25%**
4	**Solvable Groups:** Subnormal and normal series, Composition series, Nilpotent group, Solvable groups.	**15**	**25%**
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, pre-requisite of the subject will be discussed.
- Attendance is compulsory in lectures and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.
- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

On successful completion of the course, students should be able to

- Differentiate between homomorphism, isomorphism and Automorphism.
- Recognize and apply Sylow's theorem to characterize certain finite groups.
- Determine whether a given set is solvable group or not.

- Use the skills of proof by contradiction, proof by contraposition, proof of set equality, and proof using both forms mathematical induction.

Reference Books:

- "Topics in Algebra" by I. N. Herstein, John Wiley and Sons Inc., 2nd Edition.
- "Advanced Abstract Algebra" by S.K. Pundir, Krishna Prakashan (P) Ltd., Meerut.
- "A First Course in Abstract Algebra" by John B. Fraleigh, Pearson
- "Basic Abstract Algebra" by Bhattacharya, Jain and Nagpal, 2nd Edition.
- "Algebra" by S. Mcclane and G. Birkhoff, 2nd Edition.
- "Basic Algebra" by N. Jacbson, Hind, Pub. Corp, 1984.
- "A first course in Abstract Algebra" by John Fraleigh (3rd Edition), Narossa Publishing House, New Delhi.
- "Contemporary Abstract Algebra" Joseph A. Gallian, Narossa Publishing House, New Delhi.

ORDINARY DIFFERENTIAL EQUATIONS

M.Sc. 1st SEMESTER

SUBJECT CODE: MT-102

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES:

- Identify an ordinary differential equation and its order
- Verify whether a given function is a solution of given ordinary differential equation
- Classify ordinary differential equation in linear and non-linear equations
- Solve first order linear differential equations
- Find solution of separable differential equation and exact differential equation
- Find the general solution of second order linear homogeneous equation with constant coefficient
- Find the numerical solution of ODE using numerical methods.

Outline of the Course:

Unit No.	Topic
1	System of Linear Differential Equations
2	Simultaneous and Exact Differential Equations
3	Non-linear Differential Equations & Series Solution
4	Numerical Solution of ODE

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
1	**System of Linear Differential equation**: Solution methods of differential equations of the first order and first degree. Linear Differential equations of second order with constant coefficients, Method for finding complementary function, Particular integral, General method of finding the particular integral of any function, Cauchy-Euler Homogeneous linear equations, Method of variation of parameters.	**15**	**25%**
2	**Simultaneous and Exact Differential Equations:** Simultaneous Ordinary Differential Equations of First Order, linear differential equation of second order, Exact linear differential equation of nth order**.**	**15**	**25%**
3	**Non-linear Differential Equations:** Non-linear differential equations of particular forms, Total differential equation. **Series solution:** Ordinary and singular point, Series solution near a regular singular point.	**15**	**25%**
4	**Numerical Solution of ODE:** Numerical solution of ordinary differential equations using Euler's method, Runge Kutta method (one stage and two stage)	**15**	**25%**
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, pre-requisite of the subject will be discussed.
- Attendance is compulsory in lectures and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.
- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

On successful completion of the course, students will be able to

- Distinguish between linear, non-linear, partial and ordinary differential equations.
- Recognize and solve variable separable, homogeneous, exact, linear differential equation.
- Find particular solution of initial value problem.
- Solve basic application problem described by first order differential equation.

Reference Books:

1. M.D Raisinghania, Ordinary and Partial Differential Equations, S Chand & Co.
2. H.K. Dass, Advanced Engineering Mathematics, S.Chand
3. Differential Equations, Vol II, Bansal, H.L. and Dhami, H.S.
4. Gupta, Malik and Mittal, Differential Equations, Pragati Prakashan
5. Sharma & Gupta, Differential Equations, Krishna Prakashan Media (P) Ltd.

REAL ANALYSIS

M.Sc. 1st SEMESTER

SUBJECT CODE: MT-103

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES: To provide knowledge of the theory of measurable sets, integration and differentiation of measurable functions.

Outline of the Course:

Unit No.	Topic
1	Lebesgue outer measure
2	Measurable function
3	Integration of non-negative functions
4	Differentiation of measurable functions

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
1	**Lebesgue outer measure:** Algebra and σ- algebra of sets, σ-algebra of Borel sets, Lebesgue outer measure on R, Measurable sets, Lebesgue measure.	**15**	**25%**
2	**Measurable function:** Measurable function, Littlewoods's three principles, Egoroff's theorem, Integral of a simple function, Lebesgue integral of bounded functions, Comparison of Reimann and Lebesgue integration, Bounded convergence theorem.	**15**	**25%**
3	**Integration of non-negative functions:** Integral of non-negative measurable functions, General Lebesgue (integral), Fatou's lemma, Monotone convergence theorem, Lebesgue's convergence theorem, Convergence in measure.	**15**	**25%**
4	**Differentiation of measurable functions:** Differentiation of monotone functions, Functions of bounded variation, Differentiation of an integral, Absolutely continuous functions and indefinite integrals.	**15**	**25%**
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, pre-requisite of the subject will be discussed.
- Attendance is compulsory in lectures and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.
- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

On successful completion of the course, students will be able to

- Identify and formulate the basic concepts and theorems of sigma algebras, measure and abstract measure spaces
- Synthesize techniques that have been developed in the course to solve particular problems and explain the basic concepts and main theorems of Lebesgue and different types of convergence theorems.

Text Book:

- "Real Analysis" by H.L. Ryoden, Macmillan Pub. Co 3rd Ed.

Reference Books:

- "Theory of Functions of a Real Variable"- by I.N. Natansen, Fredrik Pub Co., 1964.
- "Measure Theory"- by P.R. Halmos, East and West Press.
- "Introduction to Real Variable Theory"- by S.C. saxena and S. N Shah Prentice Hall of India 1980.
- "Real and Complex Analysis", Rudin, W., 2nd Edition, Tata McGraw- Hil Publishing Co.,Ltd 1974.

ADVANCED LINEAR ALGEBRA

M.Sc. 1st SEMESTER

SUBJECT CODE: MT-104

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES:

- To provide students with a good understanding of the concepts and methods of linear algebra, described in detail in the syllabus.
- To connect linear algebra to other fields both within and without mathematics.
- To develop abstract and critical reasoning by studying logical proofs and the axiomatic method as applied to linear algebra

Outline of the Course:

Unit No.	Topic
-	Revision
1	Characteristic roots & Diagonalization of Matrices
2	Triangular canonical forms
3	Decomposition theorem & Jordan canonical forms
4	Rational canonical forms & Determinants

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
-	**Revision:** Vector spaces, Subspaces, Bases and dimensions, Dual spaces, Linear transformations.	**05**	**5**
1	**Characteristic roots & Matrices:** The Algebra of Linear Transformation, Characteristic roots, Characteristic vectors, Diagonalization of Matrices.	**20**	**25%**
2	**Triangular canonical forms:** Triangular canonical form and its theorems, Nilpotent linear transformations and its theorems.	**15**	**25%**
3	**Decomposition theorem & Jordan canonical forms:** Trace and transpose, Decomposition theorem, Jordan canonical forms.	**10**	**25%**
4	**Rational canonical forms & Determinants:** Rational canonical forms, Determinants.	**10**	**20%**
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern and the pre-requisite of the subject will be discussed.
- Attendance is compulsory in lectures and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.
- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

On successful completion of the course, students will be able to

- Analyze and evaluate the accuracy of common numerical methods.
- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.

Reference Books:

- Topics in Algebra", 2nd edition, by I N Herstein John Wiley and sons, Student Edition, New York (2004).
- Lenneth Hoffman, Ray Kunze, Linear Algebra, 2nd edition Prentice Hall of India, New Delhi (1971).
- S. K. Pundir, Advanced Abstract Algebra, Krishna Prakashan Media (P) Ltd. Meerut
- P B Bhattacharya, Phani Bhusan Bhattacharya, S K Jain, S R Nagpaul, First course in Steven Roman, Advanced linear algebra, New Age International Ltd Publishers, New Delhi (2008).
- Steven Roman, Advanced linear algebra, 3rd edition, Springer (2008).

MATHEMATICAL PRACTICAL - 1

M.Sc. 1st SEMESTER

SUBJECT CODE: MT-105

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs/ week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
0	8	4	3	100	-	100

LEARNING OBJECTIVES:

- To develop skill of students to solve ODE with the help of Scilab.
- To provide knowledge to student to find nil potency index of given matrix by using Scilab.
- To enhance knowledge of students for finding numerical solutions of ODE using Scilab.

Outline of the Course:

This course contains only problem solving sessions.

Total hours: 120

Detailed Syllabus

Sr. No.	Topics	Practical (Hours)	Weightage
1	Examples on Groups and Sub-groups.	4	30%
2	Examples on Group Homomorphism, Isomorphism and Automorphism.	4	
3	Examples on Sylow's theorems.	6	
4	Examples on Solvable group.	6	
5	Solution methods of differential equations of the first and second order, degree	6	30%
6	Examples on particular integral, Cauchy Euler equations, Method of variation of parameters	6	
7	Examples on linear and non-linear differential equations	6	
8	Examples on ODE with initial conditions and using Taylor series method.	6	
9	Examples on initial value problems using Euler's method and Modified Euler's method	6	
10	Examples on Power series solution	6	
11	Examples on Numerical solution of ODE using 2nd order RK method, 4th order RK method.	6	
12	Examples on Vector Space	6	40 %
13	Examples on Linear combination, Linear Dependent, Linear span.	6	
14	Examples on Linear Transformations.	6	
15	Examples on Eigen values of given matrix.	1	
16	Examples on Eigen vectors of given matrix.	5	
17	Examples on algebraic and Geometric multiplicity.	4	
18	Examples Nilpotent Canonical Form.	6	
19	Examples on Jordan Canonical Form	8	
20	Examples on Rational Canonical Form	8	
21	Examples on Minimum Polynomials.	4	
22	Examples on Determinants.	4	
Total		**120**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, pre-requisite of the subject will be discussed.
- Attendance is compulsory in problem solving practical's.
- Assignments/Surprise tests/Quiz/Seminar may be conducted.

Student Learning Outcomes:

- After finishing the course, the student should be able to use an advanced mathematical tool.
- The student should be able to adopt an applied problem and solve it with Scilab/ Matlab

Reference Books:

- Topics in Algebra by I. N. Herstein, John Wiley and Sons Inc., 2nd Edition.
- "A First Course in Abstract Algebra" by John B. Fraleigh, Pearson
- "Contemporary Abstract Algebra" by Joseph A. Gallian, Narosa Publication
- "Algebra" by S. Mcclane and G. Birkhoff, 2nd Edition.
- "Basic Algebra" by N. Jacbson, Hind, Pub. Corp, 1984. M.D Raisinghania, Ordinary and Partial Differential Equations, S Chand & Co.
- Gerald B Folland, Introduction to Partial Differential Equations, 2nd edition, Prentice – Hall of India (2001)
- Differential Equations, Vol I, Bansal, H.L. and Dhami, H.S.

INTRODUCTION TO SCILAB

M.Sc. 1st SEMESTER

SUBJECT CODE: SSB -1

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme					
Th. Hrs / week	Pr. Hrs/ week	Course credit	UE Hrs		UE Marks		MSE + CIA Marks	Total Marks
			TH.	PR.	TH.	PR.		
2	4	4	2	2	50	50	-	100

LEARNING OBJECTIVES:

- To develop the knowledge of Import/export data, Create and manipulate variables, Program and run simple scripts.
- Use graphics tools to display data and Use of built-in help features.
- To learn the basics of SCILAB as a method of solving problems and to see a few solution techniques you will implement to solve these problems.

Outline of the Course:

Unit No.	Topic
1	Introduction
2	Array and Matrices
3	Programming in SCILAB
4	Menus and Plots

Total hours: 90 [30 (Th.) + 60 (Pr.)]

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
1	**Introduction:** SCILAB Environment, SCILAB Data types, SCILAB Operators, SCILAB Built In Functions.	**7**	**25%**
2	**Arrays & Matrices:** Arithmetic operations with arrays, Polynomial operation using arrays, Matrices &sub matrices, Matrix operations, Working with Polynomials, Working with Linear equations.	**8**	**25%**
3	**Programming In** SCILAB**:** Working with Variables, Assignment statements, Working with Operators, Input and Output, Flow control/ Branching/ Conditional Statements, Loops, Break and Continue, User defined functions, Scripts.	**8**	**25%**
4	**Menus and Plots:** Menus and Dialog boxes, Plotting – 2D and 3D plots, Other graphical primitives, basic statistical functions, Application- Image processing using SCILAB.	**7**	**25%**
Total		**30**	**100%**

Detailed Practical List

Practical related to the followings

Sr. No.	Topics	Practical (Hours)
1	SCILAB Environment: SCILAB interface, Commands & Variables	4Hrs
2	Built in SCILAB Functions	4Hrs
3	Using Vectors, arrays and Matrices	4Hrs
4	Algebraic operations on matrices, Transpose of a matrix, Determinants, Inverse of a matrix.	4Hrs
5	Solving System of linear equations	4Hrs
6	Create polynomials of different degrees and hence find its real roots.	4Hrs
7	Programming with Script in SCILAB.	8Hrs
8	Problem solving using different looping structure using SCILAB	8Hrs
9	Write a script to solve given problem using SCILAB	6Hrs
10	User defined functions	6Hrs
11	Using plots	6Hrs
12	Image processing using SCILAB	2Hrs
Total		**120**

Instructional Method and Pedagogy (Continuous Internal Assessment (CIA) Scheme)

- At the start of course, the course delivery pattern, pre-requisite of the subject will be discussed.
- Attendance is compulsory in Lab.
- Assignments/Surprise tests/Quiz/Seminar may be conducted.

Student Learning Outcomes:

On successful completion of the course, students should be able to

- Solve the problems efficiently using Scilab programming and thus student's logical skills and ability will be developed.

Reference Books:

- Programming in Scilab 4.1 – Vinu V. Das, New Age International Publishers.
- Scilab A Free Software to MATLAB – Er. Hema Ramachandran Achuthsankar S. Nair, S. Chand.

KADI SARVA VISHWAVIDYALAYA
GANDHINAGAR

Syllabus of
Master of Science
Mathematics
Semester – II

ALGEBRA – II

M.Sc. 2nd SEMESTER

SUBJECT CODE: MT-201

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES:

The objective of this course is to provide knowledge of Ring theory, unique factorization domain and field extension.

Outline of the Course:

Sr. No.	Topic
1	Rings and Fields
2	Euclidean Ring and Unique Factorization Domains.
3	Algebraic Extension of a Field
4	Normal and Separable Extension of Fields

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
-	**Revision:** Definition of Ring, Subring, Quotient ring, Ring homomorphism, Integral domain, Ideal, Prime ideal, Maximal ideal, Polynomial ring	**2**	
1	**Ring and Field:** Definition and examples of Field, General theorems on field, Subfield, Necessary and sufficient condition to be a subfield, Characteristic of a ring, Characteristic of a field, Ordered integral domain, Principal ideal, Principal ideal ring, Units and Associates, Embedding of rings	**13**	**25%**
2	**Euclidean Ring and Unique Factorization Domains:** Prime and Irreducible element, Definition and examples of Euclidean ring, Properties of Euclidean ring, Unique factorization theorem, Definition of Unique factorization domain (UFD), Properties of UFD, Polynomial ring over UFD, Field of quotients of a UFD, Eisenstein's criterion of irreducibility.	**15**	**25%**
3	**Algebraic Extension of a Field:** Field, Subfield, Characteristic of a field, Extension of a field, Simple extension of a field, Algebraic extension of a field, Algebraically closed field.	**15**	**25%**
4	**Normal and Separable Extension of Fields:** Root fields, Splitting field or decomposition field, Normal Extension, Separable and inseparable extensions.	**15**	**25%**
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, pre-requisites of the subject will be discussed.
- Attendance is compulsory in lectures and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.

- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

On successful completion of the course, students should be able to

- Identify different types of rings and fields
- Understand basic knowledge of UFD
- Explain the fundamental concepts of field extensions

Reference Books:

- "Advanced Abstract Algebra" by S.K. Pundir, Krishna Prakashan (P) Ltd., Meerut.
- "A First Course in Abstract Algebra" by John B. Fraleigh, Pearson
- "Basic Abstract Algebra" by Bhattacharya, Jain and Nagpal, 2nd Edition.
- "Algebra" by S. Mcclane and G. Birkhoff, 2nd Edition.
- "Basic Algebra" by N. Jacbson, Hind, Pub. Corp, 1984.
- "A first course in Abstract Algebra" by John Fraleigh (3rd Edition), Narossa Publishing House, New Delhi.

PARTIAL DIFFERENTIAL EQUATIONS

M.Sc. 2nd SEMESTER

SUBJECT CODE: MT-202

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES:

The objective of this course is

- To understand the concept of second order partial differential equations.
- Introductions to boundary value problems.

Outline of the Course:

Sr. No.	Topic
1	Introduction of PDE
2	Classification of second order partial differential equations
3	Second order partial differential equations with variable coefficients
4	Boundary value problems

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
1	**Introduction of PDE:** Origin of second order partial differential equations, linear second order partial differential equations with constant coefficients, solutions for f(x; y) to be polynomial, exponential, sin/cos functions, general method for homogeneous equations.	**15**	**25%**
2	**Classification of second ordered partial differential equations:** Classification of second order partial differential equations and canonical form. Non-linear second order partial differential equations, solution by Monge's method, special case and general case.	**15**	**25%**
3	**Second order partial differential equations with variable coefficients:** Second order partial differential equations with variable coefficients, method of changing variables for special type of equations. Separation of variable Method: solution of three special equations – Laplace, Wave and diffusion equation. Solution of these equations in different coordinate systems.	**15**	**25%**
4	**Boundary value problems:** Dirichlet boundary value problems, Neumann boundary value problems, Maximum and minimum principles, Harnack's theorem, Green's function.	**15**	**25%**
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, pre-requisites of the subject will be discussed.
- Attendance is compulsory in lectures and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.
- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

On successful completion of the course, students will be able to

- Recognize some standard types of partial differential equations.
- Know the techniques for solving second order partial differential equations.
- Identify and solve Dirichlet boundary value problems and Neumann boundary value problems

Reference Books:

- Differential Equations, JPH Pub., J.L. Bansal , H.S. Dhami
- Amarnath, T., Elementary Course in Partial Differential Equations, Narosa Publ. House, New Delhi, 1997.
- Sneddon, I. N., Elements of Partial Differential Equations, McGraw- Hill Publ. Co., 1957.
- Grewal, B. S. and Grewal, J. S., Higher Engineering Mathematics, (36th Edition), Khanna Publ., New Delhi, 2000.
- Raisinghania, M. D. Advanced Differential Equations, S. Chand & Co., 1995.
- Phoolan Prasad and Ravindran, R., Partial Differential Equations, Wiley Eastern.

SPECIAL FUNCTIONS

M.Sc. 2nd SEMESTER

SUBJECT CODE: MT-203

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES:

- The objective of the course is to introduce some special functions that appear in different areas of applied mathematics.

Outline of the Course:

Sr. No.	Topic
1	Bessel's Function
2	Legendre's Function
3	Hypergeometric Function
4	Hermite and Chebyshev Polynomials

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
1	**Bessel's Equations:** Definition and general solution of Bessel's equation, Integration of Bessel's equation for n = 0, Definition of $J_n(x)$, Recurrence formulae of $J_n(x)$, Generating function for $J_n(x)$.	**10**	**25%**
2	**Legendre's Equation:** Definition and general solution of Legendre's equation, Definition of $P_n(x)$ and $Q_n(x)$, Generating function of $P_n(x)$, Laplace's definite integral for $P_n(x)$, Orthogonal properties of $P_n(x)$, Recurrence formulae for $P_n(x)$, Beltrami's result, Christoffel's expansion, , Christoffel's summation formula, Rodrigue's formula, Legendre's function of second kind, Recurrence formula for $Q_n(x)$, Relation between $P_n(x)$ and $Q_n(x)$, Christoffel's second summation formula.	**17**	**25%**
3	**Hypergeometric Function:** Definition of Hypergeometric series, Particular cases of Hypergeometric series, Solution of Hypergeometric equation, Integral formula for hyper geometric function, Kummer's theorem, Gauss theorem, Vandermonde's theorem, Differentiation of Hypergeometric function, The confluent Hypergeometric function, Integral representation of the confluent Hypergeometric function, Differentiation of confluent Hypergeometric function, Continuous Hypergeometric function.	**15**	**25%**
4	**Hermite Polynomial:** Hermite differential equation, Solution of Hermite equation, Hermite's polynomials, Generating function, Other forms of Hermite polynomials, To find first few Hermite polynomials, Orthogonal properties of Hermite polynomials, Recurrence formulae for Hermite polynomials. **Chebyshev Polynomials:** Chebyshev's differential equation, Chebyshev polynomials, To prove that $T_n(x)$ and $U_n(x)$ are independent solutions of Chebyshev's equation, Relation for $T_n(x)$ and	**18**	**25%**

	$U_n(x)$, To find first few terms of Chebyshev polynomials, Generating function, Orthogonal properties of Chebyshev polynomials, Recurrence formulae for $T_n(x)$ and $U_n(x)$.		
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, pre-requisites of the subject will be discussed.
- Attendance is compulsory in lectures and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.
- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

On successful completion of the course, students will be able to

- Apply and understand the application of Bessel's and Legendre's functions in coordinate system.
- Solve differential equations using power series method.
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Reference Books:

- Differential equations with application and historical notes, George F Simmons Tata McGraw – Hill, Publishing Co. Ltd., New Delhi, 1974.
- Special Functions, J. N. Sharma and R. K. Gupta, Krishna Prakashan Media (P) Ltd. Meerut
- An introduction to Ordinary Differential Equations, E.A Coddington., Prentice-Hall of India Private Ltd., New Delhi, 2001.
- Elementary Differential Equations (3rd Edition), W. T Martain and E. Relssner, Addison Wesley Publishing Company, inc 1995.
- Theory of Ordinary Differential Equations, E. A Codington and N Levinson, Tata McGraw hill Publishing co Ltd., New Delhi, 1999.

STATISTICAL METHODS

M.Sc. 1Ind SEMESTER

SUBJECT CODE: MT-204

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
4	0	4	3	70	30	100

LEARNING OBJECTIVES:

The objective of this course is

- To provide an understanding of statistical concepts like measurements of location and dispersion, probability, probability distributions, sampling, estimation, hypothesis testing, regression, correlation analysis, multiple regression and business/economic forecasting.

Outline of the Course:

Unit No.	Topic
1	Descriptive Statistics and Correlation
2	Probability & Probability Distribution
3	Statistical Inference
4	Regression Analysis

Total hours: 60

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weightage
1	**Descriptive Statistics and Correlation:** Introduction to Statistics, Applications in Business & Economics, Data Summarizing Qualitative & Quantitative Data, Exploratory Data Analysis, The Stem and leaf Display, Cross tabulation & Scatter Diagrams, Measures of location, Mean, Median, Mode, Percentiles, Quartiles, Measures of variability, Range, Inter quartile range, Variance, Standard deviation, Coefficient variation, Measures of distribution shape, Relative location and detecting outliers, Measures of association between two variables, Covariance, Correlation.	**15**	**25%**
2	**Probability & Probability Distribution:** Basic probability concepts, Experiment, Sample space, Events, Exclusive events, Exhaustive events, Independent events, Dependent events, Methods for assigning probability: Classical method, Relative frequency method, Subjective method, Events and their Probability, Addition rule (not to be proved or derived), Conditional probability, Multiplication rule (not to be proved or derived), Baye's theorem (statement only not to be proved or derived), Random variable, Discrete and continuous random variable, Expected value and variance of random variable, Probability distribution: Binomial distribution, Poisson distribution, Normal distribution.	**15**	**25%**
3	Statistical Inference: Sampling methods, Sampling distribution, Central limit theorem (statement only), Point and interval estimation, Sampling distribution of sample mean, Sampling distribution of sample proportion, Hypothesis tests: Null and alternative hypothesis, Type I & II errors, One and two tails test, Rejection rule using p-value and critical value approach, Test of hypothesis about population mean (known), Test of hypothesis about population and proportion, Sampling distribution and test of hypothesis about difference between two population means(known and unknown), Sampling distribution and test of hypothesis about difference between two population and proportions analysis of variance.	**15**	**25%**

4	Regression: Introduction to Regression, Simple linear Regression Model, Least Square Method, Coefficient of Determination, Correlation Coefficient, Model Assumptions, Residual Analysis, Validating Model Assumptions, Outliers and Influential Observations, Using the Estimated Regression Equation for Estimation and Prediction.	**15**	**25%**
Total		**60**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern and the pre-requisites of the subject will be discussed.
- Attendance is compulsory in lectures which and will be included in the overall internal evaluation.
- One internal exam will be conducted as a part of mid semester evaluation.
- Assignments based on course content will be given to the student for each unit/topic and will be evaluated at regular interval and will be included in the overall internal evaluation.
- Surprise tests/ Quiz/ Seminar may be conducted and will be included in the overall internal evaluation.

Student Learning Outcomes:

After completing this course the student will learn to perform the following:

- How to calculate and apply measures of location and measures of dispersion to grouped and ungrouped data cases.
- How to apply discrete and continuous probability distributions to various business problems.
- Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.
- Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.
- Compute and interpret the results of Bivariate and Multivariate Regression and Correlation Analysis, for forecasting and also perform ANOVA and F-test..

Reference Books:

- Anderson, Sweeney, Williams, "Statistics for business and economics ", 9th edition, Cengage Publication.
- S.P. Gupta, "Statistical Method" Sultan Chand and Sons 37th edition (2008).

MATHEMATICAL PRACTICAL-2

M.Sc. 2nd SEMESTER

SUBJECT CODE: MT-205

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme			
Th. Hrs / week	**Pr. Hrs / week**	**Course credit**	**UE Hrs**	**UE Marks**	**MSE + CIA Marks**	**Total Marks**
0	8	4	3	100	0	100

Learning Objectives:

- To develop skills of students to solve PDE.
- Understand the importance of Laplace, Wave and diffusion equation in different coordinate systems.
- To understand mathematical statistics and perform practical's on statistical software.

Outline of the Course:

This course contains only problem solving sessions.

Total hours: 120

Detailed Syllabus

Sr.No.	Topics	Practical (Hours)	Weightage
1	Some theorems and examples on Rings	6	25%
2	Some theorems and examples on Field.	4	
3	Some theorems and examples on Euclidean ring and unique factorization domain	6	
4	Some theorems and examples on extension of fields	4	
5	Examples on solution of first order partial differential equations	4	25%
6	Examples on solution of non-linear second order partial differential equations	8	
7	Examples on second order partial differential equations with variable coefficients	8	
8	Examples on solution of three special equations – Laplace, Wave and diffusion equation in different coordinate systems	8	
9	Examples on Solution of partial differential equations with boundary value problems	8	
10	Examples on Bessel's function	8	25%
11	Examples on Legendre's function	8	
12	Examples on Hypergeometric function	8	
13	Examples on Chebyshev polynomials and Hermite polynomials	8	
14	To find measures of central tendency	4	25%
15	To find measures of dispersion	4	
16	Examples on Probability.	8	
17	Examples on expected value.	4	
18	Fitting a binomial distribution	4	
19	Fitting a poison distribution	4	
20	Fitting a normal distribution	4	
Total		**120**	**100%**

Instructional Method and Pedagogy

- At the start of course, the course delivery pattern, Pre-requisites of the subject will be discussed.
- Attendance is compulsory in lab.
- Assignments based on course content will be given to the student for each unit/topic

Student Learning Outcomes:

On successful completion of the course, students should be able to

- Understand about the concept of topic and its application on a statistical package.
- Developing programs or codes for solving partial differential equation.

Reference Book:

- Advanced Abstract Algebra" by S.K. Pundir, Krishna Prakashan (P) Ltd., Meerut.
- "A First Course in Abstract Algebra" by John B. Fraleigh, Pearson
- "Basic Abstract Algebra" by Bhattacharya, Jain and Nagpal, 2nd Edition.
- Differential Equations, JPH Pub., J.L. Bansal , H.S. Dhami
- Amarnath, T., Elementary Course in Partial Differential Equations, Narosa Publ. House, New Delhi, 1997.
- Sneddon, I. N., Elements of Partial Differential Equations, McGraw- Hill Publ. Co., 1957.
- Grewal, B. S. and Grewal, J. S., Higher Engineering Mathematics, (36th Edition), Khanna Publ., New Delhi, 2000.
- Raisinghania, M. D. Advanced Differential Equations, S. Chand & Co., 1995.
- Special Functions, J. N. Sharma and R. K. Gupta, Krishna Prakashan Media (P) Ltd. Meerut
- An introduction to Ordinary Differential Equations, E.A Coddington., Prentice-Hall of India Private Ltd., New Delhi, 2001.
- Elementary Differential Equations (3rd Edition), W. T Martain and E. Relssner, Addison Wesley Publishing Company, inc 1995.
- Anderson, Sweeney, Williams, "Statistics for business and economics ", 9th edition, Cengage Publication.
- S.P. Gupta, "Statistical Method" Sultan Chand and Sons 37th edition (2008).

Programming in 'C'

M.Sc. 2nd SEMESTER

SUBJECT CODE: SSB-2

Teaching Scheme (Credits and Hours)

Teaching Scheme			Evaluation Scheme					
Th. Hrs / week	Pr. Hrs/ week	Course credit	UE Hrs		UE Marks		MSE + CIA Marks	Total Marks
			TH.	PR.	TH.	PR.		
2	4	4	2	2	50	50	-	100

LEARNING OBJECTIVES:

- To develop programming logic and skills for writing programs using C

Outline of the Course:

Unit No.	Topic
1	Introduction to 'C' Language
2	Conditional Statements and Loops
3	Arrays and Functions
4	Structures And Unions

Total hours: 120

Detailed Syllabus

Unit No.	Topics	Lectures (Hours)	Weight age
1	**Introduction To 'C' Language:** Character Set, Variables and Identifiers, Built **i**n Data Types, Variable Definition, Arithmetic Operators and Expressions, Constants and Literals, Simple Assignment Statement, Basic Input/ Output Statement, Simple 'C' Programs.	7 hr	**25%**
2	**Conditional Statements And Loops:** Decision Making Within a Program, Conditions, Relational Operators, Logical Connectives, If Statement, If-Else Statement, **Loops:** While Loop, Do While, For Loop, Nested Loops, Infinite Loops, Switch Statement, Structured Programming.	8hr	**25%**
3	**Arrays:** One Dimensional Arrays, Array Manipulation, Searching, Insertion, Deletion of an Element from an Array, Two Dimensional Arrays, Strings as Array of Characters, **Functions:** Standard Library of C Functions, Prototype of A Function, Return Type, Function Call, Block Structure, Passing Arguments To A Function, Call By Reference, Call By Value, Recursive Function.	8 hr	**25%**
4	**Structures And Unions:** Structure Variables, Initialization, Structure Assignment, Unions. **File Processing:** Concept of Files, File Opening in Various Modes and Closing of a File, Reading from a File, Writing onto a File	7 hr	**25%**
Total		**30**	**100%**

Detailed Practical's List

Practical's related to the following topics:

Sr.No.	Topics	Practical (Hours)
1	Write Simple 'C' program to learn basic structure, printing and taking user inputs.	4
2	Write C' programs to learn identifiers, literals, variables and constants	
3	Write C' programs for basic arithmetic operation between variables	
4	Write C' programs based on different data types	4
5	C Programming Examples on different types of Operators	6
6	Write C' programs of conditional statements (if, if…else, switch… case, Ternary operators	6
7	Write C' programs of Control Loops (While, do….while, for loop)	6
8	Write C' programs on Learning single dimensional Arrays	4
9	Write C' programs on Learning two dimensional Arrays	4
10	Write C' program to handle Matrix operations	4
11	C Programming Examples on User-define Functions	6
12	Sample C Programming Examples on Strings handling	4
13	C Programming Examples on Mathematical Functions	4
14	Write C Programs based on structure and union	4
15	Write C programs for file handling	4
Total		**60**

Instructional Method and Pedagogy (Continuous Internal Assessment (CIA) Scheme)

- At the start of course, the course delivery pattern and the pre-requisites of the subject will be discussed.
- Attendance is compulsory in Lab.
- Assignments/Surprise tests/ Quiz/ Seminar may be conducted.

Student Learning Outcomes:

On successful completion of the course, students should be able to

- Solve the problems efficiently using C programming.
- Logical ability will be developed.

Reference Books:

- Programming in ANSI C - Balaguruswami, TMH
- C The Complete Reference - H. Sohildt, TMH
- Let us C - Y. Kanetkar, BPB Publication