MANONMANIAM SUNDARANAR UNIVERISTY,
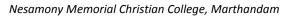TIRUNELVELI-12
SYLLABUS
PG - COURSES – AFFILIATED COLLEGES
Course Structure for M.Sc. Mathematics
(Choice Based Credit System)

(with effect from the academic year 2021-2022 onwards)

Semester-III				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
3	Core	ADVANCED ALGEBRA - I	ZMAM31	4
3	Core	GRAPH THEORY	ZMAM32	4
3	Core	MEASURE AND INTEGRATION	ZMAM33	4
3	Core	TOPOLOGY - I	ZMAM34	4
3	Elective - 2	1. ALGEBRA NUMBER THEORY 2. CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS 3. PYTHON PROGRAMMING - PRACTICALS	ZMAE31/ ZMAE3/ ZMAE33	4

Total Marks: 100   Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **15 marks**
 3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored
in. The **assignment** for 5 marks and Seminar for 5 marks

The break up for internal assessment shall be:
Written test- 15 marks; Assignment -5 marks; Seminar-5 Marks Total - 25 marks

B. **Scheme of External Examination**
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

➢ **Conversion of Marks into Grade Points and Letter Grades**

S.No.	Percentage of Marks	Letter Grade	Grade Point	Performance
1	90 - 100	O+	10	Outstanding
2	80 - 89	O	9	Excellent
3	70 - 79	A+	8	Very Good
4	60 - 69	A	7	Good
5	55 - 59	B+	6	Above Average
6	50 - 54	B	5	Pass
7	0 - 49	RA	-	ReAppear
8	Absent	AA	-	Absent

➢ **Cumulative Grade Point Average (CGPA)**

$$CGPA = \frac{\Sigma\,(GP \times C)}{\Sigma C}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

➢ **Classification**
a) First Class with Distinction   : CGPA $\geq$ 7.5*
b) First Class   : CGPA $\geq$ 6.0
c) Second Class   : CGPA $\geq$ 5.0 and $<$ 6.0
d) Third Class   :   CGPA$<$ 5.0

ADVANCED ALGEBRA – I

Objective: The aim of the paper is to introduce Linear Transformations and some types of forms in vector spaces.

Prerequisite: Basic knowledge in vector spaces and Matrices.

Outcome: Gained knowledge about the concepts of various transformations, types of matrices and its properties.

Text Book: **Topics in Algebra**, I.N.Herstein(Second Edition) Wiley Eastern Limited.

Book for Reference:
1. A course in Abstract algebra ($3rd$Edition)- Vijay.K.Khanna, S.K. Bhambri – Vikas Publishing House – NewDelhi.
2. Fields and Rings – Kaplemsky, Irving (Second Edition) – University of Chicago – Chicago – (1972).

Unit I:
Vector spaces: Dual spaces- Inner product space- modules
Sections: 4.3 –4.5.

Unit II:
Linear transformations: The Algebra of linear transformations – Characteristic roots – Matrices.
Sections: 6.1 – 6.3.

Unit III:
Canonical Forms: Triangular form – Nilpotent form – Jordan form
Sections: 6.4 -6.6

Unit IV:
Matrices:Canonical Forms – Rational Canonical Form –Trace and transpose– Determinants.
Sections: 6.7 – 6.9

Unit V:
Transformations: Hermitian, unitary and normal transformations,Real Quadratic Forms.
Section: 6.10 (Up to Lemma 6.10.11), 6.11

GRAPH THEORY

Objective: The aim of the paper is to introduce the theory of graphs.
Prerequisite: Basic knowledge in undergraduate level Graph Theory.
Outcome: Gained knowledge in connectivity, matching and coloring in graphs.

Text Book: **Graph Theory with Applications**, H.J.A. Bondy and Murthy, The MacMillan Press Limited.

Unit I:
Graphs and Subgraphs.
Chapter 1: Section: 1.1 – 1.8

Unit II:
Trees – Connectivity.
Chapter 2: Section: 2.1 – 2.5. and Chapter 3: Section 3.1 – 3.3

Unit III:
Euler tour – Hamilton cycle – Matching.
Chapter 4: Section: 4.1 – 4.3, Chapter 5: Section 5.1 – 5.3

Unit IV:
Edge colouring– Independent sets – Cliques
Chapter 6:Section6.1, 6.2 and Chapter 7: Section 7.1–7.3.

Unit V:
Vertex Colouring.
Chapter 8:Section8.1 – 8.5.

MEASURE AND INTEGRATION

Objective: The aim of the paper is to introduce Lebesgue Measure and Lebesgue Integration.
Prerequisite: Basic knowledge in limits continuity and integration.
Outcome:Gained knowledge in Lebesgue Measure and Lebesgue integration.

Text Book: Real Analysis, H.L.Royden, P.M.Fitzpatrick, Fourth Edition, PHI Learning Private Ltd.

Book for Reference:
Real Analysis Third Edition (PHI)-H.L.Royden Prentice Hall of India Private Limited –New Delhi (2006).

Unit I:
LebesgueMeasure: Lebesgue Measure – Lebesgue Outer Measure- The
- Algebra of Lebesgue Measurable sets –Outer and Inner Approximation
of Lebesgue Measurable sets – Countable Additivity, Continuity and the
Borel – Cantelli Lemma.
Chapter 2: Section 2.1 – 2.5. Problems: Chapter 2: 1 – 12 and 17

Unit II:
**Lebesgue Measurable functions and Sequential Pointwise Limits
and Related Theorems**:Lebesgue Measurable functions– Sums, Product and
Compositions. Sequential pointwise Limits and Simple Approximation– Littlewood's
Three Principles, Egoroff'sTheorem and Lusin's Theorem
Chapter 3: Section 3.1 – 3.3.Problems: Chapter3: 1 – 3

Unit III:
LebesgueIntegration: Lebesgue Integration – The Riemann Integral – The Lebesgue
Integral of a bounded Measurable function over a set of finite Measure – The
Lebesgue Integral of a Measurable non – negative
function.
Chapter 4: Section 4.1 – 4.

Unit IV:
Lebesgue Integral and Differentiability:The general Lebesgue Integral– Countable
Additivity and Continuity of Integration.Differentiation and Integration – Continuity
of monotone functions– Differentiability of monotone function: Lebesgue's theorem –
Functions of bounded variations: Jordan's theorem.
Chapter 4: Section 4.4 & 4.5 Chapter 6: Section 6.1 – 6.3

Unit V:
Absolutely continuous functions and Signed Measures: Absolutely continuous
functions – Integrating Derivatives: Differentiating Indefinite Integrals. Measure and
Integration – Measures and Measurable sets – Signed Measures: The Hahn and Jordan
Decompositions – The Caratheodory measure induced by an outermeasure – The
constructionof outer measure
Chapter 6: Section 6.4 & 6.5 Chapter 17: Section 17.1 – 17.4

TOPOLOGY – I

Objective: The aim of the paper is the introduction about topological spaces.
Prerequisite: Basic knowledge in Set Theory and Analysis.
Outcome: Gained knowledge about topological spaces and its properties.

Text Book: Topology (Second Edition), James R. Munkres, Prentice –Hall of India

Books for Reference:
1. Introduction to General Topology – K.D Joshi Willey Eastern Limited (1986)
2. Topology – K.Chandrasekara Rao, Narosa Publishing House New Delhi (2009)

Unit I
Topological spaces: Topological spaces – Basis for a Topology –The Order Topology – The subspace Topology- Closed sets and limit points.
Chapter 2: Sections: 12-14 and 16,17.
Problems: Section 13: 1, 4, 16: 4, 6, and 17: 1,11-13

Unit II
Product Topology: The Product Topology on X×Y–Continuous functions – Product topology
Chapter 2: Section 15, 18,19. Problems: Section 18: 2,3 and 19: 1-3.

Unit III
Metric Topology
Chapter 2: Section 20, 21. Problems: Section 20:1-3 and 21:1, 2.

Unit IV
Some Spaces in Topological Spaces: Connected spaces–Compact Spaces.
Chapter 3: Sections: 23,26. Problems: Section 23: 2-4 and 26: 3, 6.

Unit V
Compactness: Limit point compactness – Local compactness.
Chapter 3: Section 28, 29. Problems: Section 29: 2,3.

ALGEBRAIC NUMBER THEORY

Objective: The aim of the paper is to introduce some special equations, quadratic fields etc

Prerequisite: Basic knowledge in Number theory

Outcome:After learning this paper ,the student can understand the notion of some special equations, Infinite continued functions etc.

Text book: **An introduction to the Theory of Numbers** – Ivan Nivan and Herbert S. Zukerman – II edition, Wiley Eastern Ltd.Chapter 5,6 and 9 (except 5.13, 5.14, 7.7, 7.8 and 7.9)

Book for reference: Elements of Number Theory – Kumaravelu and Suseela Kumaravelu (2002), Raja Shankar Printers, Sivakasi (V edition)

Unit I:

Diophantine equations: Diophantine equations – The equation ax+by=c
– Positive solutions – Other linear equations.

Unit II:

Some special equations: The equation $x^2 + y^2 = z^2$ - The equation $x^4 + y^4 = z^2$ – The equation $4x^2 + y^2 = n$

Unit III:

Infinite continued functions: The equations $ax^2 + by^2 + cz^2 = 0$ - Infinite continued functions – Irrational numbers.

Unit IV:

Quadratic Fields: Approximation to irrational numbers – Algebraic integers.

Unit V:

Unique Factorization– Units in quadratic fields.

CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

Objective:The aim of the paper is to introduce the working knowledge of a number of facts and techniques which are useful in various fields of applications

Prerequisite: Basic knowledge in Matrix Theory, Quadratic forms and Coordinate Transformations

Outcome: After learning this paper the student can understand Integral Equations, Linear Equations, Iterative methods for solving equations.

Text Book: **Methods of Applied Mathematics**, Francis B. Hildebrand, sections 2.1 to 2.11, 3.1 to 3.9 and 3.11.

Unit I

Calculus of Variations and Applications Maxima and Minima – The simplest case – Illustrative examples-The variational notation-the more general case.

Unit II

Constraints and Lagrange's Multipliers–Variable end points-Strum Lioville problems-Hamilton's principles-Lagrange equations

Unit III

Integral Equations – Introduction –Relation between differential and integral equations – The Green's function-Alternative definition of Green's function.

Unit IV

Linear Equations in cause and effect- The influence function –Fredholm equations with separable kernels – Illustrative Examples.

Unit V

Hilbert Schmidt theory – Iterative methods for solving equations of second kind-Fredholm theory.

PYTHON PROGRAMMING– PRACTICALS

Objective: The aim of the paper is to give practical skill in Python Programming.
Prerequisite: Basic knowledge in C- Programming.
Outcome: Gained the skill of solving Mathematical problems using Python Programming.

Text Book:
1. Allen B. Dowley, "Think Python: How to Think Like a Computer Scientist", 2nd Edition.
2. Wes McKinney, "Python for Data Analysis: DataWrangling with Pandas, NumPy, and Ipython", O'Reilly, 2nd Edition, 2018.
3. Jake VanderPlas, "Python Data Science Hand Book: Essential Tools for working with Data", O'Reilly, 2017.

Reference Books:
1. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4nd Edition, 2009.

LIST OF PRACTICALS IN PYTHON PROGRAMMING:
1. Find minimum/maximum in a list / guess an integer in given range
2. Distance between two points
3. Find GCD
4. Sum an array of numbers
5. Linear search
6. Binary search.
7. Find the numbers which are divisible by n in a given range
8. Print first n Fibonacci numbers
9. Selection sort
10. Insertion sort
11. Merge sort
12. Count word frequencies
13. Generate adjacency matrix of any graph on n vertices
14. Find degree of vertices from given adjacency matrix of the graph
15. Find odd number in given array/ Replace odd numbers with giveninteger in the given array
16. Compute multiplication of two 3x3 matrices
17. Compute mean and standard deviation of given array
18. Create a Bar plot/Pie chart for comparing three features