

# 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		4				
3	Core	Graph Theory		4				
3	Core	Measure and Integration		4				
3	Core	Topology - I		4				
3	Elective - 2	<ol> <li>Algebra Number Theory</li> <li>Calculus of Variations and Integral Equations</li> <li>Python Programming - Practicals</li> </ol>		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	0+	10	Outstanding
2	80 - 89	0	9	Excellent
3	70 - 79	A+	8	Very Good
4	60 - 69	А	7	Good
5	55 - 59	B+	6	Above Average
6	50 - 54	В	5	Pass
7	0 - 49	RA	-	ReAppear
8	Absent	AA	-	Absent

#### <u>Cumulative Grade Point Average (CGPA)</u>

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

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

#### > Classification

c) Second Class

a)	First Class with Distinction	:	CGPA ≥ $7.5*$
b)	First Class	:	$CGPA \ge 6.0$

- : 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:**

- 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: Chapter 3: 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 construction of 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

