



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-IV				
Part	Subject Status	Subject Title	Subject Code	Credit
3	Core	ADVANCED ALGEBRA II	ZMAM41	4
3	Core	COMPLEX ANALYSIS	ZMAM42	4
3	Core	FUNCTIONAL ANALYSIS	ZMAM43	4
3	Core	TOPOLOGY II	ZMAM44	4
3	Core	PROJECT	ZMAP41	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 **1 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**

- First Class with Distinction : CGPA  $\geq$  7.5\*
- First Class : CGPA  $\geq$  6.0
- Second Class : CGPA  $\geq$  5.0 and  $<$  6.0
- Third Class : CGPA  $<$  5.0



## ADVANCED ALGEBRA II

**Objective:** To Gain knowledge in Field theory and Galois Theory.

**Pre requisite:** Knowledge of Groups, Rings and Elementary properties of Fields.

**Outcome:** Understand the application of Galois Theory in Theory of Equations and Geometry

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

### Books for Reference:

1. **A course in Abstract Algebra** (3<sup>rd</sup> Edition) – Vijay.K.Khanna, S.K.Bhambri-Vikas Publishing House-New Delhi.
2. **Modern Algebra**-Surjeetsingh and Qazizameerudin-Vikas Publishing House-New Delhi.
3. **Fields and Rings**- Kaplinsky, Irving (Second Edition)-University of Chicago-Chicago- (1972).

**Unit 1:** Extension fields: Extension fields  
Sections:5.1. Problems:5.1(1-5, 8)

**Unit II:** Roots of polynomials. More about roots  
Sections: 5.3, 5.5. Problems:5.5(1-3)

**Unit III:** Elements of Galois Theory  
Sections:5.6

**Unit IV:** Finite fields: Finite fields -Wedderburn's theorem (First proof only)  
Sections:7.1 ,7.2 (Theorem 7.2.1-First proof only)

**Unit V:** Some special theorems: A theorem of Frobenius-Integral quaternions and the Four-square theorem. Sections:7.3,7.4.



# COMPLEX ANALYSIS

**Objective:** The aim of the paper is to introduce the concepts of Complex Mappings and Complex Integrations

**Prerequisite:** Basic knowledge in Complex Analysis.

**Outcome:** Gained knowledge about Conformal Mapping, Analytic functions, Integral Formula and Complex Integrations.

**Text Book:Complex Analysis** – Lars V. Ahlfors – Tata McGraw Hill (Third Edition)

**Book for Reference:**

Foundations of Complex Analysis – S.Ponnusamy – Narosa Publishing House 2015 (Second Edition).

**Unit I:** Analytic functions:Analytic functions–Polynomials Rational Functions - Power series

Chapter 2: Section 2.1.2 – 2.1.4&Section2.2 .4

Problems: Chapter 2:2.1.2 (1,4,5,7) 2.2.4 (2- 6).

**Unit II:** Conformal mappings: Linear Transformations–the linear group-The Cross ratio-Symmetry

Chapter 3: Section3.2.3, 3.3.1 – 3.3.3,

Problems: Chapter 3: 3.3.1 (4); 3.3.2 (1,4) 3.3.3 (1,2,4);

**Unit III:** **Complex Integration:** Line integrals –Line integrals as functions of arc - Cauchy’s theorem for a Rectangle -Cauchy’s theorem in a disk

Chapter 4: Section4.1.1, 4.1.3 - 4.1.5

**Unit IV:** **Cauchy’s Integral formula:** Index of a point with respect to closed curve– The integral formula - Higher derivatives -Local Properties of Analytical Functions: Removable Singularities -Taylor’s Theorem-Zeros and Poles

Chapter 4: Section4.2.1- 4.2.3; 4. 3.1 – 4.3.2

Problems: Chapter 4: 4.2.2 (1-3)

Problems:Chapter 4:4. 2.3 (1), 4.3.2(2 – 4)

**Unit V:** **The Calculus of Residues:**The Residue theorem-The Argument Principle– Evaluation of definite integrals.

Chapter 4: Section4.5.1 – 4.5.3

Problems:Chapter 4: 4.5.2(1-3) ,4.5.3 (1, 3(a- g))



# FUNCTIONAL ANALYSIS

**Objective:** The aim of the paper is to introduce the algebraic structure in Analysis.

**Prerequisite:** Basic knowledge in Metric Space, Analysis, Algebra and Topology.

**Outcome:** After learning this paper the student can understand the notion of Banach Spaces and Hilbert Spaces.

**Text Book:** Introduction to Topology and Modern Analysis- G.F.IMMONS, McGraw-Hill International Editions

## Books for Reference:

1. Functional Analysis - Second Edition (2011), TataMcGrawHillEducation Private Ltd. (New Delhi) – WalterRudin.
2. Functional Analysis – K.ChandrasekaraRao, Narosa Publishing House (2009) New Delhi.

**Unit I:**      **BanachSpaces:** Banach Spaces- The definition and someexamples- Continuous linear transformations- The HahnBanach Theorem  
Chapter 9:Sections 46, 47, 48.Problems: Section 46(1,2), 47(1,2) 48(1).

**Unit II:**      **Imbedding:** The Natural Imbedding of  $N$  in  $N^{**}$ - The open mapping theorem  
Chapter 9: Sections 49, 50Problems: Section 49 (2,3), 50 (2,3)

**Unit III:**      Hilbert Spaces: Conjugate of an operator -Hilbert Spaces-The Definition and some simple properties- Orthogonal compliments  
Chapter 9:Section 51, Chapter 10: Sections 52, 53  
Problems: Section 51 (1,3) 52 (4,6), 53 (1-3).

**Unit IV:**      The Conjugate space and adjoint: Orthonormal sets-The conjugate space  $H^*$ Chapter10:Sections54,55,56. Problems:Section54(1,5) 55(1,2), 56(2-4).

**Unit V:**      Operators: Self adjoint operators- Normal and Unitary operators-projections.  
Chapter 10:Sections57,58,59.Problems:Section 57(1,2),58(1,3), 59(1,4).



## TOPOLOGY- II

**Objective:** The aim is to introduce the concepts of Normal and Regular Spaces .

**Prerequisite:** Basic Knowledge in Set theory, Analysis, Topology and Functions in Topological Spaces

**Outcome:** Improves the standard of understanding Set theory, Analysis and Topology and pave the way to do Research in these areas.

**Text Book: Topology** (Second edition), James R. Munkres, Printice – Hall of India

**Books for reference:**

1. **Introduction to General Topology** – K.D. Joshi Wiley Eastern Limited (1986)
2. **Topology** – K.Chandrasekara Rao Narosa Publishing House 2009 ( New Delhi)

**Unit I:**        **Separation axioms.:** The countability axioms – Separation axioms.  
Chapter 4: Sections 30, 31.  
Problems: Section 30: 2,3 and Section 31: 1-3.

**Unit II:**        The Urysohn lemma:Normal spaces – The Urysohn lemma.  
Chapter 4: Sections 32, 33.  
Problems: Section 32: 1, 3, 4 and Section 33: 1-2.

**Unit III:**       Urysohn and Tietz extension theorem:The Urysohn metrization theorem  
– The Tietz extension theorem.  
Chapter 4: Sections 34, 35.  
Problems: Section 34: 1, 3 and Section 35: 1, 3.

**Unit IV:**        The Tychonoff theorem:TheTychonoff theorem–Local finiteness.  
Chapter 5: Sections 37 and Chapter 6: Section 39  
ProbleSectionms: Section 37: 1,2 and Section 39: 3,5.

**Unit V:**        **Baire Spaces:**  
Chapter 8: Section 48, Problems: Section 48: 1,3,4,6



## **PROJECT**

- Project credit is increased, to enrich the research interest and to create innovative ideas among students.
- Since after Post graduation, the students may pursue research and hence they are expected to participate in seminars, workshops and in conferences.

