SYLLABUS

MANONMANIAM SUNDARANAR UNIVERISTY, TIRUNELVELI-12

PG - COURSES – AFFILIATED COLLEGES

Course Structure for

M.Sc Mathematics

(Choice Based Credit System) (with effect from the academic year 2017- 2018 onwards)

Semester-IV				
Part	Subject Status	Subject Title	Subject Code	Credit
3	Core	Functional Analysis	PMAM41	4
3	Cor	Complex Analysis	PMAM42	4
3	Cor	Advanced Algebra – II	PMAM43	4
3	Core	Topology - II	PMAM44	4
3	Project	Project	PMAP41	8





FUNCTIONAL ANALYSIS

Objective:

- To gain knowledge about Banach Spaces, Hilbert Spaces and Banach Algebra.
- To use algebraic structure in Analysis.

Prerequisite:

Basic knowledge of Metric Spaces, Topology and Sequences.

Outcome:

Graduates will have a strong foundations and in depth understanding of the current topics related with functional Analysis, Spectral Theory, Approximation Theory.

UNIT 1:

BanachSpaces: Banach Spaces- The definition and some examples-Continuous linear transformations- The Hahn Banach Theorem
Chapter 9 Sections 46, 47, 48.
Problems: Section 46 (1-4), 47 (1-3) 48 (1).

UNIT 2:

Imbedding :

The Natural Imbedding of N in N**- The open mapping theorem **Chapter 9** Sections 49, 50 **Problems**: Section 49 (1-3), 50 (2,3)

UNIT 3:

Hilbert Spaces:

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

UNIT 4:

The Conjugate space and adjoint:

Orthonormal sets-The conjugate space H*- The Adjoint of an operator- Self adjoint operators

Chapter 10 Sections 54, 55, 56, 57 Problems: Section 54 (1,5) 55 (1-3), 56 (1-4), 57 (1,2)

UNIT 5:

Spectral Theory:

Normal and Unitary operators- projections, Finite dimensional spectral theory-Determinants and the spectrum of an operator- The spectral theorem **Chapter** 10 Sections 58, 59, Chapter 11 Sections 61, 62



Problems: Section 58, 59, 61, 62 (1-5).

Text Book:

Introduction to Topology and Modern Analysis- G.F. SIMMONS-McGraw-Hill International Editions

Books for Reference:

- 1. Functional Analysis Second edition (2011), Tata MC Graw Hill Education Private Ltd. (New Delhi) Walter Rudin.
- 2. Functional Analysis K.ChandrasekaraRao, Narosa Publishing House (2009) New Delhi.



COMPLEX ANALYSIS

Objectives:

- To gain advanced knowledge about Complex functions and Analytic functions as mappings.
- To understand the concept of Analyticity Conformality, Linear Transformation and Complex Integration.

Prerequisite:

Basic knowledge of concepts of Differentiation and Integration for functions of real variables further in UG level they level the fundamental Ideas and theorems about Complex plane power series residues.

Outcome:

• Acquistation of solving problems in Complex Integration and boundary value problems.

Unit I:

Analytic functions :

Analytic functions – Polynomials – Power series- Abel's limit theorem. **Chapter 2**: Sec 1.1 - 1.4, Sec 2.4 & 2.5. **Problems**: Chapter 2: 1.2 (1,4,5,7) 2.4 (2-6).

Unit II:

Conformal mappings :

Conformal mappings - Linear transformations –the linear group – the cross ratio- Symmetry – line integrable – line integrable as functions of arc. **Chapter 3**: Sec 2.3, 3.1 - 3.3, Chapter 4 : Sec 1.1 - 1.3(1,3,4,5). **Problems**:Chapter 3: 3.1 (4); 3.2 (1,4) 3.3 (1,2,4);

Unit III:

Cauchy's theorem for Rectangle :

Cauchy's theorem for Rectangle – Cauchy's theorem in a disc, Cauchy's Integral formula, Index of a point – The integral formula. **Chapter 4**: Sec 1.4 & 1.5, 2.1& 2.2

Problems:Chapter 4 : 2.2 (1-3)

Unit IV:

Higher derivatives - Taylor's Theorem :

Higher derivatives -Taylor's Theorem – Zeros and Poles – The local mapping – The maximum principle and the general statement of Cauchy's Theorem (Statement only).

Chapter 4: Sec 2.3, 3.1 - 3.4 and 4.4. **Problems**:Chapter 4 : 2.3 (1), 3.2(2 - 4)

Unit V:



Calculus of Residues:

Calculus of Residues - The Residue theorem - The Argument Principle -Evaluation of definite integrals. **Chapter 4**: Sec 5.1 – 5.3 **Problems**:Chapter 4: 5.2(1-3), 5.3 (1, 3(a-g))

Text:

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).





ADVANCED ALGEBRA II

Objectives:

Gain knowledge in fields in the theory of numbers, the theory of equations and Galois theory .

Prerequisite:

Knowledge of Groups, Rings and Elementary properties of fields.

Outcome:

Understand the application of Galois theory in theory of equations and Geometry.

Unit I:

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

Unit II:

Roots of polynomials : Roots of polynomials – More about roots.

Sections: 5.3, 5.5 **Problems:** 5.5(1-3)

Unit III:

Elements of Galois theory.: 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.

Text Book:

Topics in Algebra(Second edition) Wiley Eastern Limited - I.N. Herstein

Book for Reference:



- 1. A course in Abstract algebra (3rd edition)-Vijay.K.Khanna,S.K.Bhambri Vikas Publishing House –Newdelhi.
- 2. Modern Algebra –Surjeetsingha and Qazizameerudin- Vikas Publishing House –Newdelhi.
- 3. Fields and Rings –Kaplemsky ,Irving (Second edition)-University of Chicago-Chicago -(1972).



TOPOLOGY II

Objective:

- Gain knowledge in separation axioms in Topological Spaces.
- Understanding the concepts of Normal and Regular Spaces.

Prerequisite:

- Basic Knowledge in Set theory and Analysis at Undergraduate level.
- Knowledge in first course 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.

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 Tychonofftheorem :

TheTychonoff theorem – Local finiteness. **Chapter 5:** Sections 37 and Chapter 6: Section 39 **Problems:** Section 37: 1,2 and Section 39: 3,5.

Unit V:

Baire Spaces.: Baire Spaces. Chapter 8: Sections 48. Problems: Section 48: 1, 3, 4, 6.

Text Book:



Topology (Second edition), James R. Munkres, Printice - Hall of India

Books for reference:

Introduction to General Topology – K.D. Joshi Wiley Eastern Limited (1986) Topology – K.ChandrasekaraRaoNarosa Publishing House 2009 (New Delhi)



PROJECT

Objective:

- To provide training in scientific skills.
- To prepare students for professional training programme or entry level jobs in any area of Mathematics.

Prerequiste:

• Students should be able to understand and interpret the literature in their areas of research.

Outcome:

At the end of the project the students should have increased

- Their capacity to think critically
- Their ability to design analyse and execute an experiment.
- Their confidence and ability in communication skills(in writing and oral)
- To acquiring the literature collection methods and interpreting the date of their scientific equipment etc.

