MANONMANIAM SUNDARANAR UNIVERISTY,
TIRUNELVELI-12

SYLLABUS

UG - COURSES – AFFILIATED COLLEGES

Course Structure for M. Sc. Mathematics
(Choice Based Credit System)
(with effect from the academic year 2023-2024 onwards)

Semester-III				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	CORE VII	COMPLEX ANALYSIS	WMAM31	5
III	CORE VIII	PROBABILITY THEORY	WMAM32	4
III	CORE IX	TOPOLOGY	WMAM33	5
III	CORE X	CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	WMAM34	4
III	ELECTIVE V	MATHEMATICAL PYTHON THEORY	WMAE32	4
III	SEC II	PROGRAMMING IN C++	WMASE33	2
III		INTERNSHIP / INDUSTRIAL ACTIVITY /FIELD VISIT/ RESEARCH KNOWLEDGE UPDATION ACTIVITY / LITERACY INTERNSHIP REPORT TO BE SUBMITTED TO THE DEPARTMENT		2

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

A. **Scheme for internal Assessment**:
Maximum marks for written test: **20 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.

The break up for internal assessment shall be:
Written test- 20 marks; Assignment -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	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

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

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

- **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

COMPLEX ANALYSIS

Objectives of the Course

- To Study Cauchy integral formula, local properties of analytic functions, general form of Cauchy's theorem and evaluation of definite integral and harmonic functions.

UNIT-I

Analytic functions: Analytic functions- Polynomials-Rational functions-Power Series
Chapter 2: Section 2.1.2-2.1.4, 2.2.4
Problems: Chapter 2: 2.1.2 (1,4,5,7), 2.2.4(2-6)

UNIT-II

Cauchy's Integral Formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. Local Properties of analytic Functions: Removable Singularities-Taylor's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.
Chapter 4: Section 2 : 4.2.1 to 4.2.3,Chapter 4 : Section 3 : 4.3.1 to4. 3.4

UNIT-III

The general form of Cauchy's Theorem : Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Multiply connected regions - Residue theorem - The argument principle.
Chapter 4: Section 4: 4.4.1 to 4.4.7(except 4.4.6), Chapter 4: Section 5: 4.5.1 and 4.5.2

UNIT-IV

Evaluation of Definite Integrals and Harmonic
Functions Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.
Chapter 4: Section 5 : 4.5.3, Chapter 4 : Sections 6 : 4.6.1 to 4.6.3

UNIT-V

Harmonic Functions and Power Series Expansions:
Schwarz theorem - The Reflection principle - Weierstrass theorem – Taylor's Series – Laurent series.
Chapter 4: Sections 6.4.6.4 and 4.6.5, Chapter 5 : Sections 4.6.1 to 4.6.3

Reference Books

1. H.A. Presfly, Introduction to complex Analysis, Clarendon Press, Oxford, 1990.
2. J.B. Conway, Functions of one complex variables Springer - Verlag, International, Student Edition, Narosa Publishing Co.1978
3. E.Hille, Analytic function Theory (2 vols.), Gon & Co, 1959.
4. M.Heins, Complex function Theory, Academic Press, New York,1968.

Website and e-Learning Source

1. http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2. http://www.opensource.org , http://en.wikipedia.org

PROBABILITY THEORY

Objectives of the Course

- To introduce axiomatic approach to probability theory, to study some statistical characteristics, discrete and continuous distribution functions and their properties, characteristic function and basic limit theorems of probability.

UNIT-I

Random Events and Random Variables: Random events– Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.

Chapter 1: Sections 1.2 to 1.7

Chapter 2 : Sections 2.1 to 2.9

UNIT-II

Parameters of the Distribution : Expectation-

Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.

Chapter 3 : Sections 3.1 to 3.8

UNIT-III

Characteristic functions: Properties of characteristic functions – Characteristic functions and moments – semi-invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.

Chapter 4 : Sections 4.1 to 4.7

UNIT-IV

Some Probability distributions: One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – Normal - Gamma – Beta – Cauchy and Laplace (continuous) distributions.

Chapter 5 : Section 5.1 to 5.10 (Except 5.3)

UNIT-V

Limit Theorems : Stochastic convergence – Bernaulli law of large numbers – Convergence of sequence of distribution functions – de Moivre-Laplace Theorem– Lindberg Theorem – Lapunov Theroem - Poisson, Chebyshev, Khintchine Weak law of large numbers

Chapter 6: Sections 6.1 to 6.4, 6.7, 6.8 and 6.11

Recommended Text

1. M. Fisz, Probability Theory and Mathematical Statistics, John Wileyand Sons, New York, 1963.

Reference Books

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972
2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.
3. R. Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996.
4. V.K.Rohatgi, An introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print)
5. S.I. Resnick, A Probability Path, Birhauser, Berlin,1999.
6. B.R. Bhat , Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi, 1999

Website and e-Learning Source

1. http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2. http://www.opensource.org, http://www.probability.net

TOPOLOGY

Objectives

- To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms.

UNIT-I

Topological spaces: Topological spaces – Basis for a topology – The order topology – The product topology on X x Y – The subspace topology – Closed sets and limit points.

Chapter 2 : Sections 12 to 17

UNIT-II

Continuous functions: Continuous functions – the product topology – The metric topology.

Chapter 2 : Sections 18 to 21

UNIT-III

Connectedness: Connected spaces- Components and Local Connectedness

Chapter 3 : Sections 23& 25.

UNIT-IV

Compactness : Compact spaces – Limit Point Compactness – Local Compactness.

Chapter 3 : Sections 26 to 29(except 27).

UNIT-V

Countability and Separation Axiom: The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohn Metrization Theorem

Chapter 4 : Sections 30 to 34.

Recommended Text

1. James R. Munkres, Topology (2nd Edition) Pearson Education Pvt.Ltd., New Delhi-2002(Third Edition Reprint)

Reference Books

1. James R. Munkres, Topology (2nd Edition) Pearson Education Pvt. Ltd., New Delhi 2002 (Third Indian Reprint)
2. H.K Pathak and J.P Chauhan, Topology, Shree Shiksha Sahitya Prakashan Publisher, Reprint 2023-2024.
3. J.Dugundji ,Topology , Prentice Hall of India, New Delhi, 1975.
4. George F.Sinmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co., 1963
5. J.L. Kelly, General Topology, Van Nostrand, Reinhold Co., New York
6. L.Steen and J.Subhash, Counter Examples in Topology, Holt, Rinehart and Winston, New York, 1970.
7. S.Willard, General Topology, Addison - Wesley, Mass., 1970

Website and e-Learning Source

1. http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2. http://www.opensource.org, http://en.wikipedia.org

CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

Objectives of the Course

- The aim of the paper is to introduce some of the most fundamental Algebraic Structures like inner product space, Determinants, etc'

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 endpoints - Sturm Liouville 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 – Ilustrative Examples.

UNIT-V

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

Recommended Text

1. Methods of Applied Mathematics, Francis B. Hildebrand, sections 2.1to 2.11,3.1 to 3.9 and 3.11.

MATHEMATICAL PYTHON - THEORY

Objectives

- To demonstrate Problem Solving Techniques, Algorithmic Problem Solving , Understanding of basic Python and Python functions in mathematical problem solving

UNIT-I

PROBLEM SOLVING TECHNIQUES: Problem solving Techniques – Algorithm, flowchart, pseudocode, programming; Algorithms: properties, quality (time, space); building blocks of algorithms - statements, state, control flow, functions, notation (pseudo code, flow chart, programming language)

UNIT-II

ALGORITHMIC PROBLEM SOLVING: Algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion), pseudocode for some Mathematical Problems – greatest of two numbers, print n natural numbers, greatest common divisor, fibonacci sequence upto n terms. Practical applications of algorithms.

UNIT-III

INTRODUCTION TO PYTHON: Introduction to Python, Python interpreter, Modes of Python Interpreter, Values and Data Types, Variables, Keywords, Identifiers, Statements and Expressions, Input and Output, Comments, Docstring, Lines and Indentation, Quotation, Tuple Assignment, Operators and Types of Operators, Operator Precedence.

UNIT-IV

PYTHON FUNCTIONS: Functions, Types of function, Function definition (Sub program), Flow of Execution, Function Prototypes, Parameters and Arguments; Modules; Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-else-if); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion.

UNIT-V

STRING, LISTS, TUPLES IN PYTHON: Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value.

Recommended Text

1. Allen B. Dowley, Think Python: How to Think Like a Computer Scientist, 2nd Edition.

Reference Books

1. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, O'Reilly, 2nd Edition, 2018.

2. Jake VanderPlas, Python Data Science Hand Book: Essential Tools for working with Data, O'Reilly, 2017.
3. Wesley J. Chun, Core Python Programming, Prentice Hall, 2006.
4. N.Safina Devi and C.Devamanoharan, Algorithmic Problem Solving and Python- A Beginner's Guide, Francidev Publications, 2023.

Website and e-Learning Source

1. http://www.programmer-books.com/introducing-data-science-pdf/
2. http://www.CS.uky.edu/~keen/115/haltermanpythonbook.pdf
3. http://math.ecnu.edu.cn/~lfzhou/seminar/IJoelGeusl Datasciencefrom Scratch First Princ.pdf

PROGRAMMING IN C++

Objectives

- To provide fundamental knowledge on C++ programming for formulating algorithms

UNIT-I

Structure of C++ program – Tokens – Keywords –Identifies and constants- all data types – Constants – all variables – All operators- Manipulator.
Chapter 2 : Sec : 2.6
Chapter 3 : Sec : 3.1 – 3.18
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UNIT-II

All Expressions – Conversion – Operator overloading – Operator Precedence – Control Structures- Functions in C++ - Introduction – Main Function – Function Prototyping- Return by reference
Chapter 3, Sec: 3.19 -3.24
Chapter 4, Sec : 4.1 – 4.5

UNIT-III

Inline Functions – arguments – Function overloading – all functions classes and Objects.
Chapter 4 , Sec: 4.6 -4.11
Chapter 5, Sec: 5.1 – 5.5

UNIT-IV

Nesting of member functions – Private member function – Arrays with in a class and Objects – Friendly function – Returning Objects – Pointers to members – Local Classes
Chapter 5, Sec 5.7 – 5.19

UNIT-V

Constructors and Destructors – Operator over loading and Type conversions.
Chapter 6 & 7.

Recommended Text

1. E.Balagurusamy, Object Oriented Programming with C++ , 4th Edition, The McGraw- Hill Company, New Delhi, 2008.

Reference Books

1. V.Ravichandran, Programming with C++, Second Edition Tata McGraw- Hill, New Delhi, 2006.

Internship / Industrial Activity /Field visit/ Research Knowledge updation Activity / Literacy

Learning Objectives

- CO1 To enhance student to work as team work.
- CO2 To equipped the student with the skill and desire to solve societal problems
- CO3 To developed work ethic.
- CO4 To improve communication skill and responsibilities among students
- CO5 To explore, experience and apply the academic knowledge in ground

Methods of Evaluation

Internal Evaluation
Certificate from the Organisation 25 Marks
Viva Voce Examination 25 Marks

External Evaluation

Internship report 50 Marks
Total 100 Marks