APPENDIX – AE25

MANONMANIAM SUNDARANAR UNIVERSITY
Directorate of Distance and Continuing Education

M.Sc. Mathematics

(Effective from the Academic Year 2016 – 2017 onwards)

First year

S.No. Paper	Credits
1.1 Advanced Abstract Algebra	8
1.2 Real Analysis	8
1.3 Differential Equations	6
1.4 Fuzzy Mathematics and Statistics	6
1.5 Graph Theory and Combinatorics	6

Second Year

1.1 Programming in C and Numerical Methods	6
1.2 Measure theory and Complex Analysis	8
1.3 Topology and Functional Analaysis	8
1.4 Operations Research	6
1.5 Mechanics	6
Total No. of Credits	**68**

1.1 Advanced Abstract Algebra

Unit I : **Groups** – A counting principle – Normal subgroups and Quotient groups – homomorphism – isomorphism – Cayley's theorem – permutation groups.[Sections 2.6-2.10]

Unit II : Another counting principle – Sylow's Theorems – Direct products. [Sections 3.11-3.13]

Unit III : **Rings** – homomorphism – Ideals and quotient rings – Field of quotients of an integral domain – Polynomial rings – Polynomial rings over rational field. [Sections 3.4-3.10]

Unit IV : **Vector spaces** – Linear transformation and bases – Algebra of linear transformations – Characteristic roots – [Sections 4.1,4.2,6.1,6.2,6.3&6.8] – canonical form - triangular form – trace & tanspose.

Unit V: Extension fields – roots of polynomials – more about roots. [Sections 5.1,5.3 & 5.5]

Text : Topics in Algebra (Second Edition)
By I.N. Herstein – Willey Indian Edition.

1.2 Real Analysis

Unit I : **Basic topology** – Metric spaces – compact sets – perfect sets – connected sets - convergent sequences – subsequences – upper and lower limits – some special sequences. [Chapter 2-2.1 to 2.45, chapter 3-3.1 to 3.20]

Unit II : Series – Series of non-negative terms – The number e – The root and ratio tests – Power series – summation by parts – Absolute convergence – Addition and multiplication of series. [Chapter 3-3.21 to 3.50]

Unit III : Continuity and Differentiation - Limit of functions – Continuous functions – Continuity and compactness – Continuity and connectedness – Monotonic functions – Infinite limits and limits at infinity – Differentiation – Mean value theorems – Continuity of Derivatives – L'Hospital rule – Taylor's theorem. [Chapter 4-4.1 to 4.34 & Chapter 5.1 to 5.15]

Unit IV : The Riemann–Steiltjes integral and Sequences and series of functions – Existence of the integral – Properties of the integral – Integration and Differentiation – Integratin of vector–valued functions - Uniform convergence – Uniform convergence and continuity – Uniform convergence and intergration. [Chapter 6-6.1 to 6.25 & Chapter 7-7.1 to 7.16]

Unit V: Uniform Convergence and differentiation – Equicontinuity – Equicontinuous families of functions – Stone Weierstrass' theorem – some special functions. [Chapter 7-7.17 to 7.26 & Chapter 8.1 to 8.6]

Text : Rudin – Principles of Mathematical Analysis (Tata McGrows Hill) Third Edition, Chapters 2 to 8.

1.3 DIFFERENTIAL EQUATIONS

Unit I : Second order linear equations – The general solution of a homogeneous equation – Use of a known solution to find another – The method of variation of parameters – Power series solution – Series solution of a first order equation.
Unit II : Second order linear equations – Ordinary points – regular singular points – Legendre polynomials .
Unit III : Bessel functions and Gamma functions – Linear systems – Homogeneous linear systems with constant coefficients – The method of successive approximation – Piccard's theorem.
Unit IV : Partial Differential Equations – Cauchy's problem for first order equations – Linear equations of first order – Nonlinear partial differential equations of first order – Cauchy's method of characteristics – Compatible system of first order equations.
Unit V: Charpit's method – special types of first order equations – Solutions satisfying given conditions – Jacobi's method – Linear Partial Differential Equations with constant coefficients – Equation with variable coefficients.
Tests: G.F. Simmons, Differential Equations (Torta McGrow Hill)sections 14,15, 16,19 26-29, 32-35, 37,38,55 and 56.
I.N, Senddon, Elements of Partial Differential Equations, (Mc-Grow Hill) Chapter 2 sections 1-4, 7-13, Chapter 3 sections 1,4 and 5.

1.4 FUZZY MATHEMATICS AND STATISTICS

Unit I : The concept of Fuzziness – Some Algebra of fuzzy sets.
Unit II: Fuzzy quantities- Logical aspects of fuzzy sets.

Unit III: Distribution of random variables.
Unit IV: Conditional Probability and stochastic independence – Some special distributions
Unit V: Distributions of Functions of random variables – Limiting Distributions.

Texts: H.T. Nguyen and E.A. Walker, A first course in Fuzzy Logic (Second Edition) CRC Chapters 1 to 4.

R.V. Hagg and A.T. Craig, Introduction to Mathematical Statistics (fourth Edition) Macmillan, Chapters 1 to 3, Chapter 4 (except section 4.6) and Chapter 5.

1.5 GRAPH THEORY AND COMBINATORICS

Unit I: Graphs and subgraphs- Trees- Cut edges - Cut vertices - Cayley's formula.
Unit II: Connectivity - Blocks - Euler tours and Hamilton cycles: Euler tours – Hamilton cycles.
Unit III: Matchings - Edge colorings.
Unit IV: Independent sets and cliques -Vertex colorings .
Unit V : Permutations and Combinations -Generating functions -The principle of inclusion and exclusion.

Text BookS:

1. **J.A.Bondy and U.S.R.Murty, Graph theory with Applications, North Holland, Amsterdam, 1982.**

Unit I: Chapter 1 (except 1.8,1.9), Chapter 2 (except 2.5)
Unit II : Chapter 3 (except 3.3.), Chapter 4 (except 4.3 and 4.4)
Unit III: Chapter 5 (except 5.4 and 5.5), Chapter 6 (except 6.3)
Unit IV: Chapter 7 (except 7.4 and 7.5) Chapter 8 (except 8.6)

2. **C.L. Liu, Introduction to Combinatorial Mathematics, McGraw-Hill, Inc. 1968.**

Unit V: Chapter 1 (except 1.7, 1.8)
Chapter 2 (except 2.6, 2.7, 2.8)
Chapter 4 (only sections 4.1 & 4.2)

2.1 PROGRAMMING IN C AND NUMERICAL METHODS

Unit I: Overview of C – Constants, variables and data types-operators and expressions-managing input and output operations –decision making, branching and looping –arrays-handling of character strings-user defined functions.
Unit II : Structures and unions – Pointers- file management in C
Unit III: Interpolation: Lagrange Interpolation - Newton's Divided Difference Interpolation. Numerical solutions of ordinary differential equations –Taylor's series method-Picard method-Euler's method.
Unit IV: Runge-kutta fourth order method-Predictor –corrector methods – Milne's method.
Unit V: Ordinary Differential equation: Boundary Value problem –Finite difference method and finite difference method.

Text Books:

1**. E. Balagurusamy**, Programming in ANCI C, Chapter 1 to Chapter 12.

2. **M. K. Jain, S. R. K Iyengar and R. K. Jain**, Numerical methods for scientific and engineering computation (second edition)

2.2 MEASURE THEORY AND COMPLEX ANALYSIS

Unit I : Lebesgue Measure – Outer measure- Measurable sets and Lebesgue Measure – Measurable functions – Little wood's three principles.

Unit II: Lebesgue Integral – The Riemann integral – The Lebesgue integral of a bounded function over a set of finite measure – the integral of a non negative function – the general Lebesgue integral.

Unit III: Complex numbers –Analytic functions – Elementary Theory of Power series .

Unit IV: Cauchy's theorem – Cauchy's integral formula – singularities.

Unit V: Taylor's theorem – Maximum principle – The calculus of Residues .

Texts: Royden – Real Analysis Third Edition(PHI) Chapter 3(Excluding section 3.4) Chapter 4(excluding section 4.5). Ahlfors – Complex analysis(Tata – McGraw Hill) Third Edition, Chapter 1, Chapter 2, sections 1 and 2. Chapter 4 sections 1,2,3 and 5.

2.3 TOPOLOGY AND FUNCTIONAL ANALYSIS

Unit I : Set Theory and Logic – Topological spaces – closed sets and limit points.

Unit II: Continuous functions – Product topology- metric topology – Quotient topology

Unit III: Connectedness and compactness

Unit IV: The Countability Axioms – The separation Axioms- Normal spaces – The Urysohn Lemma.

Unit V: Banach Spaces

Text: 1. James R.Munkres- Topology (Second Edition) Chapters1,2,3,4 (Sections 30,31,32,33)
2.G.F. Simmons, introduction to Topology and Modern Analysis (Mc. Graw Hill)
Chapter 9.

2.4 OPERATIONS RESEARCH

Unit I : Linear Programming – Simplex method – Transportation and its variation

Unit II: Network Models – CPM – PERT

Unit III : Integer Programming

Unit IV: Inventory models – Dicision Analysis and Games

Unit V: Queueing Models.

Text: Taha – Operations Research – An Introduction (sixth Edition) PHI, Chapters 2,3,5,6,9,11,14 and 17.

2.5 MECHANICS

Text: Classical Mechanics , H.Goldstein, Second edition, Addition Wesley.

Unit 1: Mechanics of particle - Mechanics of a system of particles, Constrsints.

(Chapter 1: Sections 1, 2 and 3)

Exercise Problems : Chapter 1 (1 to 5 and 8 to 10)

Unit 2: D' Alemberts principle and Lagrange's equations - Velocity dependent potentials and the dissipation functions - Simple applications of Lagrangian formulation.

(Chapter 1: Sections 4, 5 and 6)

Exercise problems : Chapter 1 (11, 13, 16 to 20, 22)

Unit 3: Hamilton's principle - Some techniques of the calculus of variations - Derivation of Lagrange's equations from Hamilton's principle to non - holonomic systems - Conservation theorems and symmetry properties.

(Chapter 2 : Sections 1 to 4 and 6)

Exercise problems : Chapter 2 (1 to 3, 8, 9, 11, 15 and 16)

Unit 4: The two - body central force problem - Reduction to the equivalent one - body problem - The equivalent motions and first integrals - Virial theorem - The equivalent one - dimensional problem and classification equation for the orbit and integrable power law potentials.

Chapter 3 : (Sections 1 to 5)

Exercise problems : Chapter 3 (1 to 4, 6 and 7)

Unit 5: Condition for closed orbits - The Kepler problem - Inverse square law of force - The motion in time in the Kepler problem - The Laplace - Runge - Lenz vector.

(Chapter 3 : Sections 6 to 9)

Exercise problems : Chapter 3 (8, 14 and 16).
