

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

M.Sc. (Sem.I & II) Revised syllabus to be implemented from the academic Year 1992-93.

MATHEMATICS

UNIVERSITY COURSES

Semester - I

- MT 101 : Advanced Calculus.
MT 102 : Topology I
MT 103 : Algebra I
MT 104 : Differential Equations
MT 105 : Classical Mechanics

OR

- MT-106 : Computer Programming (Fortran-77)

Semester - II

- MT 201 : Measure and Integration
MT 202 : Topology II
MT 203 : Algebra II
MT 204 : Complex Analysis
MT 205 : Mathematical Methods I

OR

- MT 206 : Programming and Numerical Methods.

SEMESTER-I

MT-101 : Advanced Calculus-

Functions of Several variables :

Linear transformations of Euclidean n-space Differentiability of functions of several variables. The Chain rule, Partial functions, Inverse and Implicit function theorem, Jacobians, Derivatives of higher order.

Integration of differential forms -

Integration, Primitive mappings, Partitions of Unity, Change of variables, differential forms, Basic K-forms and their product, Change of variable. Simplexes of chains, Stoke's Theorem, Closed and Exact forms, Vector Analysis, Integrals of 1 form and 2 forms in R^3 . Stoke's Formula, Divergence Theorem.

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Prescribed Books :-

1. Walter Rudin : Principles of Mathematical Analysis.
(Mc Graw Hill, International Student, 3rd Edition)

Recommended Books :-

- 1) T.M. Apostol - Mathematical Analysis (Revised Edition)
(Addison-Wesley).
- 2) M. Spivak - Calculus of Manifolds.
(W.P. Benjamin, Inc. New York).
- 3) Nickerson, Spencer and Steenrod - Advanced Calculus.
- 4) A. Devinatz - Advanced Calculus (Holl, Rinhardt and Winton).

MT-102 : Topology-I

- 1) Partially ordered sets, well ordered sets, Axiom of Choice, Zorn's Lemma, Well ordering principle.
- 2) Metric spaces, Open spheres, Open sets, Topological Spaces.
(Chap 19,20 Simmons book).
- 3) Sequences of Metric spaces, Cauchy sequences, Convergence.
- 4) Completions, Baire's theorem, Completion of Metric Spaces.
- 5) Continuity, homeomorphism, isometry.
- 6) Compactness, Totally bounded sets, Arzela Ascoli theorem.
- 7) Contraction principle, Existence theorem for differential equations.
- 8) Connectedness, finite product of connected spaces.

REFERENCES :-

- 1) G.F. Simmons : Introduction to topology & modern analysis,
Mc Graw Hill. (Tokio-Japan)
- 2) R.P. Munkres Topology, A first course.
(Prentice Hall of India, New Delhi) (1984).
- 3) J. Dieudonne : Foundations of modern analysis (Revised edition)
(Academic Press).
- 4) Royden H.L. Real analysis.

MT-103 : Algebra-I

Review of groups, subgroups, homomorphisms, Class Equation, Cauchy Theorem, Lagrange's Theorem, Sylow Theorems.
Rings, ideals quotient rings, Polynomial Rings, Euclidean domains, principal ideal domains, Unique factorisation domains.
Noetherian rings, Hilbert Basis Theorem.

Prescribed books :-

1. N.S. Gopalkrishnan, University Algebra, Wiley-Eastern, 1988.

REFERENCES :-

1. I.N. Herstein, Topics in Algebra, Wiley-Eastern, 1988.
2. N.Jacobson, Basic Algebra, Vol.I Hindustan Publishing Corporation, 1984.

MT-104 : Differential Equations-

1. Power Series Solution :- Linear equations and power series, Ordinary points and singular points. Solutions near an ordinary point, Regular singular point, Indicial equation.
2. Legendre & Bessel's Functions & their applications.
3. P.D.E. of Second order :- Origin, applications in physics, characteristic curves of second ordered equations, characteristics of equations in three variables, solutions of linear Hyperbolic, parabolic and elliptic equations of separation of variables.

Prescribed Books :-

1. Snedden : Elements of Partial differential equations.
2. Simmons : Differential Equations.

Recommended Books :-

1. Arfken : Mathematical Methods for Physics.
New York : Academic Press.
2. Cousant & Hilbert : Methods of Mathematical Physics.
Vol.I & Vol.II, New York, Interscience.
3. Churchill & Brown : Fourier Series & Boundary value Problem.

MT-105 Classical Mechanics

D'Alemberts Principle and Lagranges' equations and examples Hamilton's principle, Extension of Hamilton's principle to nonholonomic systems. Orthogonal transformations. The Cayley-Klein parameters and related quantities. Finite rotations. Rate of change of a vector. Inertia tensor and its eigenvalues. Moment of inertia, Principal axis transformation. The heavy symmetrical top with one point fixed.

Legendre transformations and the Hamiltons equations of motion, Darivation of Hamilton's equations from variational Principle. The principle of least action.

The equations of canonical transformation. Poisson bracket and other canontial invariants.

Prescribed Book :-

- 1) H. Goldstein : Classical Mechanics, (Addison Welley) Chapters 1, 2, 4, 5, 8, 9.

Recommended Books:-

1. Corben and Steble-Classical Mechanics (John Wiley Press).
2. Landon and Lifschitz- Mechanics. (Pergamman Press).
3. Marion : Classical Dynamics (Academic Press).
4. Sudarsan & Mukunda - Classical Mechanics.

OR

MT-106 : Computer Programming in Fortran-77

The flow chart concept, Fortran-77 programming, Integer and real operations, control statements, structured if else-then, if-while statements, Do and Do while loops, Arrays, Input and output operations, Formats, Subroutines and function subprograms, logic and complex operations, Real operations in double precision, construction of some programs, Additional features of Fortran.

Prescribed Book :

1. SCHAUM SERIE : FORTRAN PROGRAMMING.

Reference Book :

1. V. Rajaramanna : Programming Fortran-77.

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SEMESTER - IIMT-201: MEASURE & INTEGRATION

Cantor set, Cantor-like sets and Lebesgue function, Lebesgue outer measure. Measurable sets, algebra, Regularity of measure, complete measure, Measurable functions, Borel sets and Measurability.

Integration of non-negative functions of real variables. Fatou's lemma. Lebesgue monotone convergence theorem. The general integral lebesgue dominated convergence theorem. Comparison of Riemann and Lebesgue integrals.

Derivatives. Functions of bounded variation, Positive, negative and total variation, continuity a.e. and differentiability a.e. of a function of B.V. Properties of the function of B.V. Properties of the derivative of the function of B.V. Absolutely continuous functions vitali covering theorem, Fundamental theorem of integral calculus L_p spaces. Holders and Minkinski's inequalities Completeness of L_p spaces.

Convergence in measure, Convergence in mean of order p , almost uniform convergence, Egoroff's theorem, Implications among these.

PRESCRIBED BOOKS :

1. Debarra, G. Measure theory and Integration. Wiley Eastern, New Delhi.
2. Rayden, H.L., Real Analysis, 3rd Edition, Maxwell Mc Millan international Edition.

REFERENCE BOOKS :

1. Randdph, J.L. : Basic Real and Abstract Analysis, Academic Press.
2. Berbarion, S.K.: Measure theory and Integration, Mc Millan.

MT-202 : TOPOLOGY II

1. Topological spaces, Basis for topology. The order topology, Subspace topology. Closed sets and limit points, continuous functions, Homeomorphism. Product topology. The quotient Topology.
2. Connected spaces : Components and Path components, Local connectedness. Compact spaces, Local compactness, News, One point compactification.
3. The countability axioms. The separation axiom Urysohn lemma, Urysohn Metrization theorem.
4. Tychonoff Theorem, Completely Regular spaces.

PRESCRIBED BOOK :

J.R. Munkres: Topology (A first course,)
Prentice Hall of India Ltd.

REFERENCE BOOKS :

1. K.D. Joshi : Introduction to General Topology,
(Wiley Estern)
2. Willard : General Topology (Addison Wesley)
3. B.T. Simmon : Fundamentals of Topology
(Mc Millan International Edition)

MT-203 : Algebra-II

Modules : Sub modules, R-homomorphism, Isomorphism, Direct sum of modules, Free modules, Rank, Projective modules.

Structure Theorems for finitely generated modules over a PID.

Application to group theory, Jordan & Rational canonical forms, Local rings, Localization of rings and modules, Primary decomposition for modules.

Prescribed Books :-

N.S. Gopalkrishnan : University Algebra (Wiley Eastern Ltd.)
commutative Algebra.
Oxonian Press Pvt.Ltd.

Reference Books :-

1. I.N. Herstein : Topics in Algebra (IBH)
2. S.Lang : Algebra (Addison Wesley).
3. Dr. Mufili : Introduction to Rings & Modules.

MT-204 : COMPLEX ANALYSIS,

Topology of C , Open, connected subsets, Components of Open sets, Uniform convergence of sequences and series of functions, Wier-strass M-test, power series, radius of convergence.

Analytic functions, exponential functions, branch of logarithm, Cauchy Riemann equations, harmonic functions Harmonic conjugate.

Path, smooth path, piecewise smooth paths, conformal map, mobius transformation, Symmetry, principle and orientation principle.

Riemann - stieltjes Integral and complex integral. Line integral of a continuous function along rectifiable paths, Fundamental theorem of calculus for line integrals.

Power series, expansion of an analytic function, Fundamental theorem of Algebra, Liouville's theorem, Maximum modulus principle,

MT-204 : Com

index (winding number) of a curve around a point, Cauchy's theorem and Cauchy's integral formula, Morera's theorem.

Homotopic version of Cauchy's theorem and simple connectivity. Logarithmic derivatives of $f(z)$. The open mapping theorem, the argument principle, Meromorphic functions, Rouché's theorem.

Singularities, classification of singularities, Poles and essential singularities, singular point, Laurent's series development, Casorati-Weierstrass's theorem, Residues and evaluation of integrals, Schwarz's Lemma.

Prescribed books :

1. J.B. Conway : Functions of one complex variable (Springer-verlag Graduate text)
2. Walter Rudin : Real and Complex Analysis (McGraw Hill Book Company, New York).

REFERENCE BOOKS :

1. H. Silverman : Complex variables (Houghton Millan & Co.)
2. J.E. Marsden : Basic Complex Analysis (Freeman & Co.)
3. L.V. Ahlfors : Complex Analysis (Mc Graw Hill, New York)

MT-205 MATHEMATICAL METHODS-I

1. Linear Boundary Value Problem - Wave Equation, Heat Equation, Laplace's Equation in Cartesian, Cylindrical and Spherical co-ordinates.
2. Principle of Superposition. Series solutions, separation of variables, Certain types of initial value problems. General solutions of partial differential equations.
3. Orthogonality of functions in the space of piece wise continuous functions on an interval (a,b) .
Generalized Fourier series. Approximation in the mean. Closed and complete orthonormal sets, Sturm-Liouville Problems. Orthogonality of the eigen functions and their uniqueness.
4. Boundary value problems involving
 - (i) the wave equation
 - (ii) heat equation
 - (iii) Dirichlet problem.
5. Temperature in a long cylinder, Heat transfer at the surface of the cylinder, Vibration of circular membrane.

- 6. Dirichlet problems in spherical regions, study Temperatures in a hemisphere.

Prescribed Book :

R.V.Churchill & J.W.Brown,
 Fourier Series and Boundary value problems.
 (Mc Graw Hill International.)

Recommended Books :

- 1. Mary L.Bose - Methods of Mathematical Physics
- 2. N.N. Lebedev - Special functions & their applications.
 (Prentice Hall)

MT-206 : PROGRAMMING AND NUMERICAL METHODS

Characterization of problems that can be solved by computers.

Model of Pascal Machine- concept of program and data, Input and output introductions.

Types, memory as specialized data storage unit, expressions, their types and properties of arithmetic and logical operators.

Problem reducing through decomposition, sequential decomposition, sequential compositions and conditional composition. Recursion and iteration, Primitive actions : assignment statements, input/output statements.

Programs based on sequential and conditional composition Functional abstraction and procedural abstraction. Among types and iterative programs, character strings, Scalar and Subrange types and case statement, Record types and files.

Organisation of a computer and its functioning. Role of operating system software. Concept of linking, Paradigms of programming in aid of problem solving.

Introduction to data structures - concept of Stacks, Queues and lists and their implementations, conversion of simple recursive procedures into iterative procedures.

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