FACULTY OF ARTS

SYLLABUS

MASTER OF ARTS

(MATHEMATICS)

JODHPUR NATIONAL UNIVERSITY

JODHPUR

M.A. Mathematics

M.A. PREVIOUS

Paper I	**Topology**
Paper II	**Real and Complex-Analysis**
Paper III	**Differential Equations**
Paper IV	**Abstract Algebra**

M.A. FINAL

Paper V	**Operations Research**
Paper VI	**Fluid Mechanics**
Paper VII	**Computational Numerical Analysis**
Paper VIII	**Mathematical Statistics**
Paper IX	**Environmental Studies Industry Based**

PREVIOUS

Paper I TOPOLOGY

Unit -I

Countable and uncountable sets, Infinite sets and the Axiom of choice. Cardinal numbers and its airthmetic. Schroeder -Bernstein theorem. Cantor's theorem and the continum hypoinsis, Zorn's lemma. Wellordring theorem. Definition and examples of topological spaces. Closed sets. Cosure. Dense sebsets. Neighbourhoods. Interior, exterior and boundary. Accumulation points abd derived sets.

Unit -II

Bases and sub-bases. Subspaces and relative topology. First and second Countable spaces. Lindelof's theorems, Separable spaces, Second Countability and Separability. Separation axioms T0,T1,T2 their Characterizations and basic properties. Urysohn's lemma. Tietze extension theorem.

Unit-III

Compactness, Continuous functions and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness and one point compactification. Compactness in metric spaces. Equivalence of compactness, countable, and sequential compactness in metric spaces.

Unit -IV

Connected spaces. Connectedness on the real line. Components. Locally connected spaces. Tychnoff product topology in terms of stantard sub- base and its characterizations. projection maps. Separation axioms and product spaces. Connectedness and product spaces. Compactness and product soaces (Tychonoff's theorem).

Unit -V

Countability and product spaces.Embedding and metrization. Embedding lemma and Tychonoff embedding. The Urysohn metrization theorem. Nets and filters. Topology and convergence of nets. Hausdroffness and nets. Compactness and nets. Filters and their convergence.

Paper II Real and Complex-Analysis

Unit-I

Riemann-Stieltjes integral, properties of Integral and Differentiation. Point wise and uniform convergence of sequence & series of functions. Cauchy criterion, Weirstrass M-test, Abel and Dirchlet test for Uniform Convergence. Uniform Convergence and continuity.

Unit-II

Measurable sets , Lebesgue outer measure and measurability, measurable functions. Borel and Lebesgue measurability. Non measurable sets.

Unit-III

Algebra of Complex numbers. Analytic functions, Sterographic projection of complex numbers, Holomorphic complex valued functions and their inverse, Cauchy- Reimann equations ,Power series.

Unit-IV

conformal mapping. Bilinear transformations.their properties and classification, Special transform w = z2 , z =, w = , z = c Sin w, complex integration ,Cauchy Theorem and integral formula,Poisson's integral formula,Tayler's and Laurents series,Morera's Theorem. Lioville's Theorem, Maximum modulus principle, Minimal modulus principle , Schwarz's Lemma.

Unit-V

Classification of Singularities. Branch Points, Reimann Theorem on remov able Singularity, open mapping theorem Casoratti-Weirstrass theorem. meromorphic functions, The argument principle. Roche's Theorem, Residues, Cauchy's residue theorem; evaluation of integrals, branches of many valued function with reference to arg z, log z , za

Paper III Differential Equations

Unit-I

Examples of PDE. Classification.Canonical forms,Nonlinear First Order PDE-Complete Integrals, Envelopes,Method of solving Second order PDE -separation of variable and Cauchy's problem.

Unit-II
Laplace's, Heat Equation and Wave Equation upto three dimension in cartesion coordinates and upto two dimension in polar coordinates, their fundamental solutions by variable separation.

Unit-III
Moment and product of Inertia-principal axes and Momental Ellipsoid, D'Alembert's principle, Motion about a fixed axis, (General equation of motion).

Unit-IV
Existence and uniquencss of solution dy/dx = f(x y), Canonical transformation of PDE. Sturm Liouville Boundary Value Problems. Green's function. Cauchy problems and characteristics

Unit-V
Fredholm and Volterra types Linear Integral Equations of the first and second kinds, Solution of Fredholm Integral Equations with separable Kernels

Paper IV Abstract Algebra

Unit-I
Homomorphism theorems on groups, conjugate elements, classes and class equation of a finite group, Sylows Theorem. Cauchy's theorem for finite Abelian group, Normal and Subnormal series. Composition series. Jordan-Holder Theorem. Solvable groups.

Unit-II
Ideals, Principal Ideal rings, Division and Euclidean algorithm for polynomials over a field, Euclidean rings and domains, unique factorization theorems, unique factorization domains.Finite field extension, Algebraic and Transcendental extensions, Separable and Inseparable extensions, Normal extensions, Perfect field, Galois extensions, Elements of Galois theory.

Unit-III
Linear transformations, Range, Kernel, Rank- nullity theorem, Singular and nonsingular transformations, Vector space of linear transformations. Linear functional, Dual and bidual of a Vector space, Annihilators, Invariance, Projections, Adjoint of a linear transformations

Unit-IV

Matrix representation of a linear transformation, Change of Basis. Transition matrix, Similarity, Eigen values and Eigen vectors for a linear transformation, Cayley- Hamilton Theorem,Minimal polynomial and minimal equation, Canonical forms, Diagonalization, Reduction to triangular form, Nilpotent transformations. Index of nilpotency. Jordan blocks and Jordan Canonical form.

Unit-V

Bilinear form, its matrix representation and rank, Symmetric and skew symmetric bilinear forms, Quadratic form associated with a bilinear form, Symmetric matrix associated with a quadratic form.
Diagonalization of a quadratic form. Hermitian form and its matrix representation. Positive definite Hermitian form.
Inner product spaces, Cauchy-Schwartz inequality, orthogonal vectors. Orthogonal complements, orthonormal sets and bases, Bessel's inequality for a finite orthonormal set. Gram Schmidt orthogonalisation process.

FINAL

Paper V Operations Research

Unit -I

Linear Programming :- Simplex methods. Theory of simplex method. Duality, Dual Simplex methods. Sensitivity analysis

Unit -II

Game Theory :- Two person Zero sum game, Games with mixed Strategies, Solution of Linear programming. Integer Programming,

Unit -III

Network Analysis :- Shortest Path Problem minimum spenning tree Problem, Maximum flow problem, minimum cost flow problem.
Dynamic Programming :- Deterministic models

Unit -IV

Inventory problems and their analytical structures. Simple deterministic problems. Squencing Nonlinear Programming :- One and multivariable unconstrained Optimization, K.T. Canditions for Constrained Optimization.

Unit -V

Quadratic programming, Queing System :- Steady state solution of queing model, : M/M/1, M/M/1 with limited waiting space, M /M/C, M/M/C with limited waiting space.

Paper VI Fluid Mechanics

Unit -I

Kinematics-Lagrangian methods. Equation of Continuity. Boundary surfaces. Stream lines, Path lines and streak lines, Velocity potential, Irrotational and rotational motion. Vortex Lines.Equations of Motion- Lagrange's and Euler's equations of motion Bernouli's theorem, Equation of motion by flux method.

Unit -II

Equations referred to moving axes. Impulse reactions. Stream function, Irrotational motion in two-dimensions. Complex velocity potential. Sources. Sinks, Doublets and their images. Conformal mapping. Milne-Thomson circle theorem.

Unit -III

Two-dimensional Irrotational motion product by motion of circualr. co- axial and elliptic clyinders in an infinite mass of liquid. Kinetic energy of liquid. Theorem of Blasius. Motion of a sphere through a liquid at rest at infinity. Liquid streaming past a fixed sphere. Equation of motion of a sphere. Stoke's stream function.Vortex motion and its elementary properties, Kelvin's proof of permanence. Motions due to circular and rectilinear vortices.

Unit -IV

Fluid Properties : General properties of Newtonian and Non- newtonian and plastic fluids Stress components in realfluid, Relations between rectangle components of stress. Connection between stresses and gradients of velocity, Navier- stoke equations of motion.

Unit -V

Plane Poiseuille and Couette flows between two paralled plates. Theory of Lubrication. Flow through tubes of uniform cross section in form of circle, annulus and equilateral triangle under constant pressure gradient, Unsteady flow over a flat plate.Reynolds number, Prandit's boundary layer. Boundary layer equations in two dimensions. Blasius solution, Boundary layer thickness.Displacement thickness. Karman Integral Conditions. Separation of boundary layer flow.

Paper VII Computational Numerical Analysis

Unit-I

Sets and Proposition:-Cardinality. Mathematical Induction. Principle of inclusion and exclusion. Pigeon hole principle. Graph Theory :- Graphs. planer graph. Eulerian and Hamiltonian Graph. Directed Graphs
Trees :- Binary Tree. Binary Search Tree

Unit-II

Lattices :- Lattice and algebraic structure. duality. distributed and complemented lattice. partially ordered sets.
Boolean Algebra :-Boolean functions and expression, propositional calculus. Design and Implementalion of digital networks, Application to switching and Logic circuits.

Unit-III

Solutions of Equations :-Bisection. Secant Regulafalsi, N- R Method.Chebshev method, Acceleration of convergence, N- R Method for non linear equation. Roots of a polynomial equation -Bairstaw and Birge- Veta method, Graeffe's root square method . Curve Fitting and Approximation :Least square principle, Chebshev Approximation.

Unit-IV

Linear Equations :- Direct method, Gauss, Gauss- Jorda Chobesky Partioned, Triangularisation,Iterative method ,Jacobi, Gauss-Seidal and Relaxation Methods, Matrix inversion and eigen value problem- Power methods, Jacobi method ,complex eigen values,

Unit-V

Numerical Solution of Ordinary Differemial Equation :-Iterative methods Picards, Eulers and improved
Eular methods. Runge-Kutta methods. Predictor Corrector methods, Stability analysis , Difference methods for BVP(Boundary Value Problems)

Paper VIII Mathematical Statistics

Unit -I

Random Variable, Moment Generating Function (MGF) Probability inequalities (Tchebyshef, Markov, Jenson), Convergence in Probability and in distribution, weak law of large numbers and central limit theorem for independent, indentically distributed random variable with finite variance, marginal and conditional distribution in multivariate case, Covariance matrix and Correlation Coefficient (Product moment- Partial and multiple), Regression.

Unit -II

Probability Distributions :- Bernouli, Binomial, Multinomial Hypergeometic, Geometric, Poission Distribution, Probability Distributions : Uniform, Exponential, Cauchy, Gamma, Beta and Normal distribution.

Unit -III

Sampling Distribution:- t, F, Chi- Square distribution as sampling distibution , Standard errors and large Sampling distribution. Distribution of order statistics and range.

Theory of Statistics:- Methods of estimation, maximum liklihood method, method of moments, minimum chi square menthod, least square method.

Unit -IV

Unbiasedness, efficiency, Consistency, Cramer Rao inequality.

Satistical Method :- Test of Mean variance in normal distribution one Population and two Population cases, related confidance intervals, Tests of Product Moment, Partial and multiple Corelation Cofficients, Comparision of K. Linear regression, Fitting Polynomial regression, related tests.

Unit -V

Analysis of discrate data : Chisquare test of goodness of fit, Contingency table

Analysis of variance:- one way and two way classification, large sample tests through normal approximation,

Non-Parametric tests, Sign test, Median test, rank correlation and test of independence.

PAPER IX INDUSTRIAL BASED ENVIRONMENTAL STUDIES

UNIT – 1

Environment – Definition – Scope – Structure and function of eco system's procedures, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chain, food web and ecological pyramids - concepts of sustainable development.

UNIT – 2

Natural resources: Renewable – air, water, soil, land and wildlife resources. Non-renewable – mineral, coal, oil and gas. Environmental problems related to the extraction and use of natural resources.

UNIT – 3

Biodiversity – Definition – values – consumption use, productive social, ethical, aesthetic and option values threats to biodiversity – Hotspots of bio diversity – conservation of bio-diversity: In-situ Ex-situ. Bio-wealth – national and global level.

UNIT – 4

Environmental pollution : Definition – causes, effects and mitigation measures – Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution – Nuclear hazards – solid wastes acid rain – climate change and global warming environmental laws and regulations in India – Earth summit.

UNIT – 5

Population and environment – Population explosion – Environment and human health – HIV / AIDS – Women and child welfare – Resettlement and Rehabilitation of people, role of information technology in environmental health – Environmental awareness.