DIRECTORATE OF DISTANCE EDUCATION

SYLLABUS

M.Sc. Course in Mathematics

VIDYASAGAR UNIVERSITY
MIDNAPORE - 721102

M.Sc. Syllabus in Applied Mathematics and Occanology and Computer Programming

VIDYASAGAR UNIVERSITY

M.Sc. Part - I

M.Sc.Part - I Course : 500 marks

First Paper:	Group- A	Real Analysis (40 marks)
	Group- B:	Functions of Complex Variables (30 marks)
	Group- C:	Ordinary Differentail Equations (30 marks)
Second Paper:	Group- A:	Algebra (50 marks)
	Group - B:	Functional Analysis (50 marks)
Third Paper:	Group - A:	Probability and Statistics (30 marks)
	Group- B:	Numerical Analysis (40 marks)
	Group- C:	Introduction to computing (30 marks)
Fourth Paper:	Group- A:	Prindciple of Mechanics (50 marks)
	Group-B :	Partial Differential Equation (50 marks)
Fifth Paper:	Group- A:	Mechanics of Continuous Media (50 marks)
	Group- B:	Practical (50 marks)

M.Sc Part - II Course : 500 marks.

Sixth Paper:	Group A:	Computer Science II (50 marks).
	Group B:	Computer Science. Parctical (50 marks)
Seventh Paper:	Group A :	Electromagnetic Theory (25 marks)

Group B: Any one of the following subjections: Gas dynamics Quantum Mechanics, Fuzzy sets and its application in R.Computer

Science - III, wave dynamics,

Conspectional.....Applicant Statistics

(25 marks each.)

Group C: Flecid Mechanics (30 marks)

Group D: Magneto hydro-dynamics(20 marks)

Eighth paper : Group A: Mathematical Method (50 marks)

Group B: Elements of Optimization and O.R(50 marks) for students with or as special paper/Dynamical Oceanography and Meterology (50 marks) for students with or as special paper.

Ninth and Tenth Paper: (100 marks each): Any one of the following of subjects:

(a) Operations Reserach: (OR)

Ninth paper - Advance optimization and O.R.- I

Tenth Paper- Advance oplimization and O.R - II

(b) Oceanography and Meterology : (OM)

Ninth Paper - Dynamical Oceanography

Tenth Paper - Group A: Dynamical Meterology (75 marks)

Group B: Dynamical Meterology Practical (25 marks)

Subjects to be offered in any particular year will be decided by the department .

(VIII) Group - A: 50

Group - B: OR (50)

OM (50)

(IX) OR & OM

(100) (100)

(X) OR & OM

(100) (75)

M.Sc. Syllabus in Applied Mathematics with Oceanology and Computer Programming

Vidyasagar University

PAPER - 1

Group - A

Real Analysis **(Marks - 40)**

1. Functions of bounded variation & its simple properties. Total variation & its additive property. Variation function & its properties. Necessary & sufficient conditions for a function to be bounded variation.

2. Riemann stieltjes intedgrals: Definition as limit of a sum. Its properties. R-S integrals with monotonic integrators. First and second mean value theorems. R-S integrals with function of bounded variation as integrator. Reduction of R-S integrals to a Riemann integral. R-S integral with step function as integrator. Euler's summation formula. Differentiation under the integral sign. Multiple integral. Interchanging the order of integration.

3. Measurable sets. Concept of Lebesgue measure. Inner & outer measure Its simple properties. Set of measure zero. Cantor set. N.P Measurable function: Definition. Modulus of measurable function is measurable. Every continuous function is measurable. Sum, difference, product and quotient of measurable functions are measurable. Statements of Lusin and Egoroff's theorems. Lebesgue integral: Definition. Basic simple properties Relation between Lebesgue integral and Riemann integral. Lebsegue integral of a bounded function over a set A of finite measure. Simple properties. Lebesgue integral for unbounded functions: Bounded convergence theorem for a sequence of functions. Fatou's lemma. Classical Lebesgue.

GROUP - B

(PAPER - 1)

Functions of Complex Variables

(Marks - 30)

1. Complex numbers. The complex plane. Functions of a complex variable Limit. Continuity. Differentiability. The definition of an analytic function. Cauchy-Riemann differential equation. Construction of analytic function.

2. Complex integration. Jordan arc, Contour. Rectifiable arcs. The absolute value of a complex integral. Cauchy's theorem. Cauchy's integral formula. The derivatives of an analytic function. Cauchy's inequalities. Morera's theorem. Liouville's theorem. Taylor's and Laurent's series. Maximum modulus principle.

3. Singularities: Zero of an analytic function. Different types of singularties. Poles. Isolated, Removal and Essential singularities.

4. Residues: Residue at pole. Residue at infinity. Cauchy residue theorem. Number of poles and zeros of an analytic function. Rouche's theorem.

5. Contour integration: Evaluation of integrals using contour integration.

6. Conformal representation: Conformal transformation. Mobius transformation or Bilinear transformation. Mapping properties of important functions.

GROUP - C (PAPER - 1)

Ordinary Differential Equations

(Marks - 30)

1. Differential equation. Homogeneous linear differential equations. Fundamental system of integrals. Singularity of a linear differential equation. Solution in the neighbourhood of a singularity. Regular

integral, Equation of Fuchsian.

2. Hypergeometric equations. Hypergeometric functions. Series solution near zero. one and infinity. Integral formula for the hypergeometric function. Differentiation of hypergeometric function. The confluent hypergeometric function. Integral represention of the confluent hypergeometric function.

3. Legendre equation: Legerdre functions. Generating function. Legendre functions of the first kind and second kinds. Laplace integral. Orthogonal properties of Legendre polynomials. Rodrigue's formula. Schlaefli's integral.

4. Bessel equation: Bessel function. Series solution of Bessel equation. Contour integral solutions. Integrals representations of Bessel functions. Hankel functions. Recurrence relations. Asymptotic expansion of Bessel functions.

PAPER - II

GROUP - A

Algebra

(50- Marks)

Groups. Morphism of groups Quotient groups. Fundamental theorem on homorphism of groups. Isomorphism theorems. Automorphism. Solvable groups and theorems on them. Direct product. Conjugacy, Conjugate classes. Class equation. Theorems on finite groups-Cauchy's theorem. Sylow's theorem

Rings. Integral domian. Fields. Skew fields. Quotient rings. Morphism of rings. Ideals (Prime and maxiaml). Isomorphism theorem. Euclidean domain. Principal Ideal domain. Unique Factorisation domain. Polynomial Rings.

Partially and totally ordered set. Lattice. Complete Lattice.

Distributive Lattice. Complements.

Elements of Graph Theory. Eularian and Hamiltonian Graphs. Trees. Planar Graphs. Distance and Centre. Duals. cut sets and cut vertices. Bipartite Graphs. Colouring and matching. four colour theorem (statement only). Directed Graphs and weighted Graphs. Matrix representation of graphs. Important algorithms Shortest spanning. treeprime's algorithm. Shortest path problem. Dijkstra's algorithm.

Group - B (Paper - II)

Functional Analysis

(50-Marks)

Metric space. Open and closed sets. Convergence limits. Cauchy-sequence. Complete metric spaces. The Bolzano-Weirstrass theorem. The Cantor Intersection theorem. The Heine-Borel covering theorem. Completion of metric space. Nested sphere theorem. Barie's theorem. Compact metric spaces. Total boundedness, Equi-continuous family of functions. Arzela's theorem. Contraction mapping. Banach fixed point theorem. Its application to find solution of a system of algebraic linear, differential and integral equation. Definition of topological spaces. Hausdorffspace Seperable space. Example of separable and non separable space.

Linear metric space, Examples. Normed linear spaces. Examples. Norm is continuous operator. ANLS is complete if every absolutely convergent series is convergent.

Bounded linear transformation. Set of all bounded linear transformation B(X,Y) from NLS X into NLS. Y is a NLSB. (X,Y) is a Banach space if Y is a Banch space. Statement of Hahn-Banach theorem. Theorems obtained as application of Hahn-Banach theorem. Open mapping theorem. Closed Graph Theorem. Banach Steinhaus

theorem.

Inner product space and Hilbert space. projection theorem. Cauchy-schwarz inequality. Inner product is a continuous operator. Relation between IPS and NLS. Definition of uniformuly convex space. Every IPS is uniformly convex. Pythogorian theorem for n vectors. Gram-schmidt orthogonalisation process. Bessels inequality. Parseval's identity. Reisz representation theorem for bounded linear functional on a Hibert space. Definition of adjoint operator. Simple theorems. Definition of Normal. Unitary and positive operators. Related simple theorems.

PAPER - III

GROUP - A

Probability and Statistics

(Marks - 30)

Stochastic Process:

Markov chains with finite and countable state space. Classification of states. Limiting behaviour of n state transition probabilities.

Stationary distribution. Branching process. nodonwalk. Gambler's ruin.

Markov processes in continuous time. Poisson's process. Partial correlation. Multiple correlation. Advanced theory of Linear Estimation.

GROUP - B

Numerical Analysis

Error propagation in a finite difference table. Symbolic operations and their relations. Central difference formulae of Stirling, Bessel and Everett. Inverse interpolation, Cubic spline interpolation. Numerical differentiation Numerical integration by Simpson 3/ 8

rule, Rombergrule, Gauss - Legendre, and Gauss - Tchebyshev quadrature. Techebyshev polynomials, Minimax property. Curve fitting by least squares. Use of orthogonal polynomial. Solution of system of equations: Direct and iterative methods, Newton - Raphson method of solving a system of non-linear algebraic equations and criterion of convergence, Convergence and rate of convergence of iterative schemes. Matrix iteration. Eigen-value problem. Power method. Jacobi's method. Jacobi-seidel method.

Ordinary Differential Equations:-

Runge _ kutta methods. Predictor corrector method with error term. stability. Solution of boundary value problem for linear second order equations.

Finite difference scheme for the linear equations with first order partial derivatives. Mixed problem for the heat equation. The wave equation. Finite element method and its illustration by a simple example.

GROUP - C
(PAPER III)
Introducing to Computing

(30 marks)

Prerequisite/Recapitualation: Different number system - Decimal, Binary, Octal, Hexa-decimal number. Decimal to Binary, Octal, Hexa-decidml and Binary to Decidml, Octal, Hexa-decimal Conversion. Addition and subtraction of binary numbers. Postulates of Boolean Algebra. Basic theorems. Boolean Functions and truth tables. Canonical Forms of Boolean functions. Algorithm and Fow-chart.

(a) Computer Fundamentals: Bit, Byte Nibble, Basic structure of computer - I/O Unit, ALU, CU, Memory Unit. Peripheral devices.

Different types of I/O unite. Line Printer. Dot Matrix Printer. Desk-Jet Laser. Floopy-disk. CTD. Winchester Disk. Memory Devices-ROM & RAM.

(b) Digital Technique:

(i) Data representation: Binary Coded Decimal Numbers. Hamming Code for Error correction. Alphanumderic Codes.

(ii) Arithmetic Operation: Complement representation of Numbers. Addition /Subtraction in One's and Two's complement Notation. Binary Multiplication Multiplication of signed numbers. Binary Division. Arithmetic with BCD numbers. Floating point Representation of Numbers. Floating point Addition/Subtraction.

(iii) Algebra for Digital System: Logic gates. Simplifying Boolean expressions by Veitch Karnaugh Map method.

(iv) Combinatorial circuit design procedure and implementation by Binary operators and logic gates.

(c) Programming in C: Introduction, Basic structures. Character set. Keywords. Identifiers. Constants Variable-type declaration Execution of some sample C programes. Operation: Arithmetic Relational. Logical and assignment. Increment and decrement. Conditional.

Operator precedence and associativity. Arithmetic expression. Evaluation and type conversion. Character reading and writing. Formated input and output. Decision making (branching and looping) Simple and nested IF; IF - ELSE: WHILE - DO; FOR, Arrays one and two dimension. String handling with arrays-reading and writing; Concatenation: Comparision: String handling functions, User defined funcdtions-need; simple examples; call-by-value and call-by-reference function & their uses; Return values and their types: Nesting of functions; Recursion.