VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BELLARY

REGULATIONS, SCHEME AND SYLLABUS
(Approved in the BOS meeting held on 04-04-2013)

For M.Sc. MATHEMATICS COURSE
(Semester System – CBCS REGULATION)

With effect from
Academic year 2013-14 Onwards

SYLLABUS (CBCS) SCHEME (With Effective from July 2013)

	PAPER CODE	SUBJECT	MARKS ALLOTMENT		TOTAL	CREDIT
			EXAM	CA		
SEMESTER -I						
HARD CORE	MSM 1.1	ALGEBRA	70	30	100	05
	MSM 1.2	REAL ANALYSIS-I	70	30	100	05
	MSM 1.3	TOPOLOGY	70	30	100	05
SOFT CORE (ANY TWO)	MSM 1.4	ORDINARY DIFFERENTIAL EQUATIONS	70	30	100	04
	MSM 1.5	COMPLEX ANALYSIS	70	30	100	04
	MSM 1.6	FUZZY SETS AND FUZZY SYSTEM	70	30	100	04
	TOTAL				**500**	**23**
SEMESTER-II						
HARD CORE	MSM 2.1	LINEAR ALGEBRA	70	30	100	05
	MSM 2.2	RAEL ANALYSIS-II	70	30	100	05
	MSM 2.3	NUMERICAL ANALYSIS-I	70	30	100	05
	MSM 2.4	LAB-I	35	15	50	03
SOFT CORE (ANY TWO)	MSM 2.5	DISCRETE MATHEMATICS	70	30	100	04
	MSM 2.6	PARTIAL DIFFERENTIAL EQUATION	70	30	100	04
	MSM 2.7	DIFFERENTIAL GEOMETRY	70	30	100	04
OEC	MSM 2.8	FOUNDATION OF MATHEMATICS	35	15	50	02
	TOTAL				**600**	**28**
SEMESTER-III						
HARD CORE	MSM 3.1	FUNCTIONAL ANALYSIS	70	30	100	05
	MSM 3.2	NUMERICAL ANALYSIS-II	70	30	100	05
	MSM 3.3	FLUID MECHANICS-I	70	30	100	05
	MSM 3.4	LAB-II	35	15	50	03
SOFT CORE (ANY TWO)	MSM 3.5	OPERATOR ALGEBRA'S AND OPERATOR THEORY	70	30	100	04
	MSM 3.6	OPERATIONS RESEARCH	70	30	100	04
	MSM 3.7	MATHEMATICAL METHODS	70	30	100	04
OEC	MSM 3.8	STATISTICAL TECHNIQUES	35	15	50	02
	TOTAL				**600**	**28**
SEMESTER –IV						
HARD CORE	MSM 4.1	MEASURE THEORY	70	30	100	05
	MSM 4.2	DISCRETE FOURIER AND WAVELET TRANSFORMS	70	30	100	05
	MSM 4.3	GRAPH THEORY	70	30	100	05
	MSM 4.4	FLUID MECHANICS-II	70	30	100	05
	TOTAL				**400**	**20**

SEMESTER –I
MSM 1.1 ALGEBRA -1

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Recapitulation: (Groups, Subgroups, Cyclic groups, Normal Subgroups, Quotient groups, Homomorphism, Types of homomorphisms).Permutation groups, symmetric groups, cycles and alternating groups, dihedral groups, Isomorphism theorems and their related problems, Automorphisms, Inner automorphisms, groups of automorphisms and inner automorphisms and their relation with centre of a group. **8hrs**

Group action on a set, Orbits and Stabilizers, The orbit-stabilizer theorem, The Cauchy Frobenius lemma, Conjugacy, Normalizers and Centralizers, Class equation of a finite group and their applications. Sylow's groups and subgroups, Sylow's theorems for a finite group, Applications and examples of p-Sylow subgroups. **12hrs**

Solvable groups, Simple groups, Applications and examples of solvable and simple groups, Jordan –Holder Theorem. **6hrs**

PART-B

Recapitulation: Ring and its properties, Integral domain, division ring, field**.** Homomorphisms of rings, Kernel and image of Homomorphisms of rings, Isomorphism of rings, Ideals and Quotient rings, Fundamental theorem of homomorphism of rings, **8hrs**

Theorems on principal maximal and prime ideals, Field of quotients of an integral domain, Imbedding of rings. Euclidean rings, Prime and relatively prime elements of a Euclidean ring, Unique factorization theorem, Fermat's theorem, Polynomial rings, The division algorithm. **12hrs**

Polynomials over the rational field, Primitive polynomial, Content of a polynomial. Gauss lemma, Eisenstein's criteria, Polynomial rings over commutative rings, Unique Factorization Domains. **6hrs**

Text Books:

1. N.Herstien. Topics in Algebra, 2nd Edition, Vikas Publishing House, 1976,
2. Surjeet Singh and Qazi Zameeruddin, Modern Algebra, Vikas Publishing House, 1994,
3. N. Jacobson Basic Algebra-I, HPC, 1984,:

References:

1. M. Artin ,Algebra, Prentice Hall of India, 1991,.
2. Darek F. Holt, Bettina Eick and Eamonaa. Obrien. Handbook of computational group theory, Chapman & Hall/CRC Press, 2005.
3. J. B. Fraleigh, A first course in Algebra, 3rd Edition, Narosa, 1996, J. B. Fraleigh.

Pattern of Question Paper: The Question paper contains 2 sections namely, Part-A and Part-B each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each part.

MSM 1.2 REAL ANALYSIS-1

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Finite and infinite sets. Denumerable and Non denumerable sets, Countable and Uncountable sets. Equivalent sets. Concept of Cardinal numbers, Schroeder-Bernstein theorem, Cardinal number of a power set-Addition of cardinal numbers, Exponential of cardinal numbers, Examples of Cardinal Airthmetic, Cantor's theorem, Card X<Card P(X), Relations connection N_0 and C. Continuum Hypothesis. Zorn's lemma. **12 Hrs**

Real number system, Ordered sets, Fields, Real field, Extended real number system, least upper bound property of R. Basic Topology, Metric spaces, Compact sets, Perfect sets, Connected sets, R as complete metric space. . **14 Hrs**

PART-B

Limits of function, Continuous function, Continuity and Compactness. Continuity and Connectedness, Discontinuity, Monotonic functions, Infinite limits and limits at infinity. **12 Hrs**

Differentiation and Integration: The derivative of a real function, Mean Value theorems, the continuity of derivatives, derivatives of higher order, Taylor's theorem, Differentiation of vector valued functions. The Riemann-Steilje's Integral: Definition and existence of the integral, Properties of the integral, Integration and Differentiation, Integration of vector valued function **14Hrs**

Text Books:

1. Walter Rudin ,Principles of Mathematic Analysis : . 3rd ed. McGraw Hill Book Co. New York (1986).
2. H. L.Royden ,Real Analysis(Second edition). The McMillan Co. New York(1968).

References:

1. Methods of Real Analysis: R.R. Goldberg
2. Mathematical Analysis : T.M.Apostal

Pattern of Question Paper: The Question paper contains 2 sections namely, Part-A and Part-B each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each part.

MSM 1.3: TOPOLOGY

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Topology: Definition and examples Open and closed sets. Neighbourhoods and Limit Points. Closure, Interior and Boundary of a set. Relative topology. Bases and sub-bases. Continuity and Homeomorphism, Pasting lemma. Connected spaces: Definition and examples, connected sets in the real line**.** **12Hrs**

Compact spaces, Compact sets in the real line, limit point compactness, sequential compactness and their equivalence for metric spaces. Locally Compact spaces, compactification. The axioms of countability: First axiom countable space, Second

countable space, Separability metric spaces and the Lindelof space and their equivalence for metric spaces

14Hrs

PART-B

Separation axioms: T_0–space and T_1 spaces –definitions and examples, the properties are hereditary and topological. Characterisation of T_0 - and T_1 –spaces. T_2- space, unique limit for convergent sequences, Regularity and the T_3–axiom. Characterisation of regularity, Metric spaces are T_2 and T_3. **10 Hrs**

Complete regularity, Normality and the T_4 - axiom, Metric space is T_4, compact Hausdorff space and regular lindelof spaces are normal. Urysohn' s Lemma, Tietze' s Extension Theorem, Complete normality and the T_5 -axiom. **10hrs**

Local finiteness, Paracompactness, Normality of a paracompact space, Metrizability, Urysohn metrization theorem. **6Hrs**

Text Books:

1. J .R. Munkres, Topology, 2nd Ed., Pearson Education (India), 2001.
2. W.J. Pervin, Foundations of General Topology - Academic Press, 1964.
3. G. F. Simmons, Introduction to Topology and Modern Analysis (McGraw-Hill International Edition).

References:

1. Princeton, 1955, G J .L. Kelley, General Topology, Van Nostrand.
2. J . Dugundji, Topology - Prentice Hall of India, 1975.

Pattern of Question Paper: The question paper contains 2 sections namely; Part-A, Part-B containing 4 questions in each part. Five full questions are to be answered out of 8 questions, choosing at least 2 from each Part.

MSM 1.4: ORDINARY DIFFERENTIAL EQUATIONS

Max.Marks: 70+30 **Credits-04**
Total: 52 hrs

PART-A

Linear equations of second order, Homogeneous equations and general solutions. Green function's, Variation of parameters, Initial value problems, Wronskian. Boundary value problems, Sturm Liouville theory; Oscillation theorems, Homogeneous equation of order 2, Initial value problems, Non- Homogeneous equations. **18 Hrs**

PART-B

Power series solutions: solution near an ordinary point and a regular singular point , Frobenius method , Hypergeometric equation. Laguerre, Hermite and Chebyshev equation and their polynomial solutions (with standard properties). **16 Hrs**

PART-C

Existence and Uniqueness theorems, First order systems, Existence of solution to 1^{st} order equation.Linear system of Homogeneous and non-Homogeneous equations (Matrix method), Non-Linear equations- Autonomous systems-Phase plane-Critical points stability- Liapunov direct method-Bifurcation of plane autonomous systems. **18 Hrs**

Text Books:

1. Eural A. Coddington, An introduction to Ordinary Differntial Equations.
2. C.F.Simmons, Differential Equations, TMH Edition, New Delhi, 1974.

References:

1. M.S.P. Eastham.Theory of Ordinary differential equations, Van Nostrand London.1970.
2. S.L.Ross. Differential equations (3^{rd} edition), John Wiley & Sons, New York, 1984.
3. E.D.Rainville P.E.Bedient. Elementary Differential equations, McGraw Hill, New York, 1969.
4. E.A.Coddington and N.Levinson. Theory of ordinary differential equations, McGrawHill, 1955 .
5. A.C.King, J.Billingham and S.R.Otto. Differential equations, Cambridge, Unoversity press 2006.

Pattern of question paper: The Question paper consists of sections A,B and C, with 3 questions each in sections A and B, and 2 questions in section C. Five full questions out of eight questions are to be answered choosing at least one from each part.

MSM 1.5: COMPLEX ANALYSIS

Max.Marks: 70+30 **Credits-04**

Total: 52 hrs

PART-A

Analytic functions, Harmonic conjugates, Elementary functions, Mobius Transformation, Conformal mappings, Cauchy' s Theorem and Integral formula, Morera' s Theorem, Cauchy' s Theorem for triangle, Cauchy's Theorem in a disk, Zeros of Analytic function. The index of a closed curve, counting of zeros. Principles of analytic Continuation. Liouville' s Theorem, Fundaments theorem of algebra. **14hrs**

Series, Uniform convergence, Power series, Radius of convergences, Power series representation of Analytic function, Relation between Power series and Analytic function, Taylor' s series, Laurent' s series. **12hrs**

PART-B

Rational Functions, Singularities, Poles, Classification of Singularities, Charecterisation of removable Singularities, poles. Behaviour of an Analytic functions at an essential singular point. **12 Hrs**

Entire and Meromorphic functions.The Residue Theorem, Evaluation of Definite integrals, Argument principle, Rouche' s Theorem, Schwartz lemma, Open mapping and Maximum modulus theorem and applications, Convex functions, Hadmard's Three circle theorem. Phragmen-Lindelof theorem. **14 Hrs**

Text Books:

1. J . B. Conway. Functions of one complex variable, Narosa, 1987.
2. L.V. Ahlfors, Complex Analysis, McGraw Hill, 1986, L.V. Ahlfors.

References:

1. Analystic functions, Springer, 1970, R. Nevanlinna.
2. E. Hille, Analytic Teory, Vol. I, Ginn, 1959.
3. S. Ponnaswamy, Functions of Complex variable, Narosa Publications.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 1.6: FUZZY SETS AND FUZZY SYSTEM

Max.Marks: 70+30 **Credits-04**

Total: 52 hrs

Basic Concepts of Fuzzy Sets: Introduction. Crisp set, Fuzzy sets, types of Fuzzy sets, basic, concepts, properties of a cuts, representation of Fuzzy sets, extenstion principle of Fuzzy sets. **(20 Hours)**

Operationson Fuzzy Sets: Types of operations Fuzzy complements, Fuzzy intersections, t-norms. Fuzzy unions; t-co-norms, combinations of operations, aggregation operations **(20 Hours)**

Fuzzy Arithemetic: Fuzzy numbers.Linguistic variables. Arithematicoperations on Fuzzy numbers. Lattice of Fuzzy numbers, Fuzzy equations. **(12 Hours)**

REFERNCES:

1. George J.Klor.and Yuan Fuzzy sets and Fuzzy logic, Theory and Applications. PHI. George J.Klir and Tina a. Fotger. Fuzzy sets unceratinity and information, PHI(1994)
2. Kaufmann, A., Introduction to the Theory of Fuzzy subsets-vol. Academic press(1975)
3. Driankov D, and others. An Introduction to Fuzzy control.
4. B.Kosko & others, Fuzzy logic with engineering Applications. PHI

SEMESTER-II

MSM 2.1 LINEAR ALGEBRA

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART –A

Linear Equations: Fields, System of linear equations, Matrices and Elementary row operations, Row- reduced Echelon matrices. **4Hrs**

Vector Spaces: Definition and Examples of Vector spaces, Subspaces, Linear span, Linear independence, dependence and their basic properties. Basis of vector spaces. Existence theorem for bases. Dimension of a space, Sums of subspaces. Quotient space and its dimension. **15Hrs**

Linear Transformations: Definition and Examples. Algebra of Linear transformations, Rank and Nullity theorem. Singular and non-singular linear transformations, Isomorphism. **7Hrs**

PART-B

Representation of Transformation by Matrices, Change of basis. Dual space. Bidual space and natural isomorphism. Transpose of a linear transformation. Eigenvalues and Eigen vectors of a linear transformations, Cayley-Hamilton Theorem. Minimal polynomial. Canonical forms, diagonal form, triangular form, Jordan form. **26Hrs**

Text Books:

1. I.N. Herstein : Topics in Algebra, 2nd Edition, Vikas Publishing House, 1976.
2. Gilbert Strang, Linear Algebra and its applications, Pearson.

References:

1. K. Hoffman and R. Kunze, Linear Algebra, PHI.
2. N. Jacobson : Basic Algebra-I, HPC, 1984.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 2.2 REAL ANALYSIS-II

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Sequences and series of functions: Pointwise and uniform Convergence, Cauchy Criterian for uniform convergence, Weierstrass m-Test, uniform Convergence and continuity Uniform convergence and Riemann-Steiltje's Integration, Uniform convergence and Differentiation. Uniform convergence and bounded variation—equicontinous families functions, Uniform convergence and boundedness, the stone weierstrass theorem and approximation of continuous function. Illustration of theorem with examples properties of power series, exponential and logarithmic function trignometric functions. Topology of $\mathbf{R}^n$, Hein-Borel Theorem, Bolzano weierstrass theorem, continuity compactness and uniform continuity. **28 Hrs**

PART-B

Functions of several variables, continuity and Differentiation of vector-valued functions, Linear transformation of $\mathbf{R}^k$ properties and invertibility, Directional derivative, Chain rule, partial derivative, Hessain Matrix. The Inverse Functions theorem and its illustrations and examples. The implicit function theorem and illustrations and examples. The rank theorem illustration and examples. **24Hrs**

Text Books:

1. W.Rudin : Principles of Mathematical Analysis, McGraw Hill, 1983.
2. T.M.Apostol: Mathematical Analysis, 2nd edition, Narosa,1988

References:

1. S.Goldberg : Methods of Real Analysis, Oxford & IBH 1970.
2. J.Dieudonne : Treatise on Analysis, Vol-1, Academic press.1960

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part

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MSM 2.3: NUMERICAL ANALYSIS-I

Max.Marks: 70+30 **Credits-05**

Total: 52 hrs

PART - A

Nonlinear Equations in One Variable: Fixed point iterative method – convergence Criterion -Aitken's Δ 2- process -Sturm sequence method to identify the number of real roots – Newton - Raphson's methods convergence criterion Ramanujan's Method-Bairstow's Method. **13 hrs**

Linear and Nonlinear system of Equations: Gauss Eliminations with Pivotal Strategy Jacobi and Gauss Seidel Iterative Methods with convergence criterion.LU decomposition methods – (Crout's, Cholesky and DeLittle methods) – consistency and ill conditioned system of equations- Tri-diagonal system of equations – Thomas Algorithm. Iterative methods for Nonlinear system of equations, Newton Raphson, Quasi Newton and Over Relaxation methods for Nonlinear system of Equations . **13 hrs**

PART – B

Interpolation: Lagrange, Hermite, Cubic-spline's (Natural, Not a Knot and Clamped) - and error of interpolation. Bivariate interpolation. Orthogonal polynomials , Grams Schmidth Orthogoralization procedure and least square, Chebyshev and Rational function approximation. **13 hrs**

Numerical Integration: Gaussian quadrature, Gauss-Legendre, Gauss-Chebeshev formulas, Gauss Leguree, Gauss Hermite and Spline intergration– Integration over rectangular and general quadrilateral areas and multiple integration with variable limits. **13 hrs**

Text Books:

1. M. K. Jain, S. R. K.Iyengar and R.K.Jain : Numerical methods for scientific and engineering computation, Wiley Eastern Ltd. 1993, Third Edition.
2. D.V. Griffiths and I.M. Smith, Numerical Methods for Engineers, Blackwell Scientific Publications (19991).
3. S.S. Sastry : Introductory methods of Numerical analysis, Prentice- Hall of India, New Delhi, 1998.

References:

1. S.C.Chapra, and P.C. Raymond: Numerical Methods for Engineers, Tata Mc Graw Hill, New Delhi, 2000.
2. R.L.Burden, and J.Douglas Faires : Numerical Analysis, P.W.S. Kent publishing Company, Boston , 1989 Fourth edition.
3. C.F.Gerald, and P.O. Wheatley : Applied Numerical Methods, Low- priced edition, Pearson Education Asia 2002, Sixth Edition.
4. Paruiz Moin: Fundamentals of Engineering Numerical analysis, Cambridge University Press (2006).

Pattern of Question Paper :The Question paper contains 2 sections namely Part –A, & Part-B containing 4 questions each from Part-A & Part-B. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each part.

MSM 2.4-Lab-I

Max.Marks:35+15= 50 **Credits-03**

Introduction to computers, Basic structure of computer, problem solving steps, Algorithm and flowchart. C-essentials, basic structure of a C-program, Character set, constants and variables, data types, declaration of variables, Assignment statement, Symbolic constants, arithmetic operators, Assignment operators, Increment and decrement operator, Conditional operator, Arithmetic expressions-evaluation, Input/output operations: Reading/Writing a character, Formatted input/output. Decision making and branching: IF statement, If ELSE, nested if…else statement, Else if ladder, Switch statement, the?: operator, GOTO statement, Decision making and looping: The while loops, do statement, for statement, Jump in loops, Arrays: One Dimensional arrays, Two Dimensional arrays and Multidimensional array.

Practical Programs

1. Sum to n-terms: Sine/Cosine series
2. Factorial of a number
3. Solution of a quadratic equation (incorporating all the conditions)
4. Check whether a given number is prime or not.
5. Fixed-point iterative method
6. Bisection Method
7. Newton-Raphson Method
8. Lagrange's interpolation
9. Numerical Integration-Trapezoidal Rule
10. Simpson's 1/3rd and 3/8th rules and Weddle's rule.
11. Sort the N integers in an Ascending Order or Descending Order.
12. Fibonacci Series
13. Generate the N prime numbers.
14. GCD of two integers.
15. Print the even numbers from 1 to 100.

References:

1. Peter Norton's, Introduction to computers, Peter Norton, McGraw-Hill Technology Education.
2. E Balaguru Swamy, Programming in ANSI C, Tata McGraw-Hill Publishing Company Limited.

3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education Inc.
4. P. B. Kotur, Computer Concepts and C Programming. Yeshwanth Kanetkar, Let us C.

MSM 2.5 DISCRETE MATHEMATICS

Max.Marks: 70+30 **Credits-04**
Total: 52 hrs

PART-A

Lattice theory: Partially ordered sets, lattice, Distributive Lattice, Complements, Demorgan's Laws, Boolean Expressions, Boolean Functions, Propositional Calculus, Logical Connectives, Truth values and tables. The principle of inclusion-Exclusion, generating functions: Ordinary generating function and exponential generating functions, A counting technique. Reccurence relation: First-Order Relations, Second-Order linear Homogeneous relations, Third order and higher order linear Homogeneous relations, Linear Non-Homogeneous relations of second and higher orders. **26 hours**

PART-B

Introduction of graph theory, types of graphs, Basic terminology, Subgraphs, Representing graphs as incidence matrix and adjacency matrix, Graph isomorphism. Connectedness in simple graphs, Paths and cycles in graphs and diagraphs. Euler and Hamiltonian paths, Necessary and sufficient conditions for Euler circuits and paths in simple, undirected graphs. Hamiltonicity: noting the complexity of hamiltonicity. Travelling Salesman's Problem, Nearest neighbor method. Distance in graphs: Eccenttricity, Radius Diameter, Center, Periphery, Planarity, in graphs, Euler's Polyhedron formula, Kuratowski's theorem (statement only), Weighted graphs, Vertex connectivity, Edge connectivity, Covering independence. Trees, Rooted trees, Binary trees, Trees as models, Properties of trees, Minimum spanning trees, Minimum spanning trees, Prims and Kruskul Algorithms. **26 Hrs**

Text Books:

1. J.P.Trimblesy and R.Manohar, Discrete Mathematical structure with applications
2. C.L.Liu, Elements of Discrete Mathematical.
3. B. Kolman, R.C.Busby&S.Ross, Discrete Mathematical structure.

References:

1. F.Harary: Graph theory, Addison-esley,1969.
2. G.Chartrand and Ping Zhang: Introduction to graph theory, McGrawHill, International edition (2005).
3. J.A.Bondy and V.S.R.Murthy: Graph theory with applications, Macmillan, London.
4. D.B.West, Introduction to graph theory, Pearson Education Asian, 2nd Edition,2002.
5. Stepen B.Wicker and Saejoon Kim. Fundamentals of codes, Graphs and iterative decoding Kluwer Academic Publishers,2002.

Pattern of Question Paper: The Question paper contains 2 sections namely, Part-A and Part-B each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each part.

MSM 2.6: PARTIAL DIFFERENTIAL EQUATIONS

Max. Marks: 70+30 **Credits-04**
Total: 52 hrs

PART-A

Basic concepts and definitions of PDE: Domain of Partial Differential Equations, Continuous dependence on data(initial conditions , boundary conditions, ill-posed and well posed problems, liner super position principle. The Cauchy problem of first order PDE, geometrical interpretation- The method of characteristics for semi-linear, quasi linear and non linear Partial Differential Equations of first order PDE' s, complete integrals of special non linear equations-Applications to dynamic, discontinuous solution and shockwaves.

13 Hrs

The method of characteristics, the Cauchy Problem of 2^{nd} order PDE' s classification of 2^{nd} order linear PDE' s – Canonical forms for hyperbolic, parabolic and elliptic PDE' s . Homogenous and non Homogenous PDE' with constant coefficient-variable coefficient-Monge's Method- Variational Principles Euler Lagrange Equations weak generalized solution, Linear differential operator and its adjoint operator. **13 Hrs**

PART-B

Laplace Equation- BVP- Method of separation of variable and transforms. Dirchlet' s and Neumann' s Problems for a rectangle and for circle- solution in cylindrical and spherical polar co-ordinates- Green' s function method. **10 hours**

The wave equation- solution by Method of separation of variable and transforms, s Green' s function method. The diffusion equation : solution by Method of separation of variable and transforms. Green' s function method. **10 Hrs**

solution non linear PDE' s, successive approximation method, similarity methods and solutions and simple special techniques for non linear PDE's . **6Hrs**

Text Books:

1. F.John: Partial Differential Equations, Springer,1971.
2. F.Treves; Basic linear Partial Differential Equations, Academics 1975.
3. Garabedian : Partial Differential Equations.
4. L.C.Evan: Partial Differential Equations(AMS) American Mathematical Society Providence Rhode Island.

References:

1. I.N.Sneddon: Elements of Partial Differential Equations.McGraw hill,1975.
2. M.G.Smith: Introduction to the theory of Partial Differential Equations.Van Nastrand. 1967.
3. Shankar Rao: Partial Differential Equations.
4. L.Debnath : nonlinear Partial Differential Equations for scientists and engineers Brik Hauser (1997) and Bartin.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 2.7 : DIFFERENTIAL GEOMETRY

Max.Marks: 70+30 **Credits-04**
Total: 52 hrs

PART-A

Calculus on Euclidean Space: Euclidean space. Natural coordinate functions. Differentiable functions. Tangent vectors and tongent spaces. Vector fields. Directional derivatives and their properties. Curves in E^3. Velocity and speed of a curve. Reparametrization of a curve. 1-forms and Differential forms. Wedge product of forms. Mappings of Euclideon spaces. Derivative map. **13 Hrs**

Frame Fields **:** Arc length parametrization of curves. Vector field along a curve. Tangent vector field, Normal vector field and Binormal vector field. Curvature and torsion of a curve. The Frenet formulas Frenet approximation of unit speed curve and Geometrical interpretation. Properties of plane curves and spherical curves. Arbitrary speed curves. Cylindrical helix Covariant derivatives and covariant differentials. Cylindrical and spherical frame fields. Connection forms. Attitude matrix. Structural equations. Isometries of E^3 - Translation, Rotation and Orthogonal transformation. The derivative map of an isometry. **13 Hrs**

PART-B

Calculus on a Surface: Coordinate path. Monge path. Surface in E^3. Special surfaces-sphere, cylinder and surface of revolution. Parameter curves, velocity vectors of parameter curves, Patch computation. Parametrization of surfaces-cylinder, surface of revolution and torus. Tangent vectors, vector fields and curves on a surface in E^3. Directional derivative of a function on a surface of E^3. Differential forms and exterior derivative of forms on surface of E^3. Pull back functions on surfaces of E^3. **13 Hrs**

Shape Operators: Definition of shape operator. Shape operators of sphere, plane, cylinder and saddle surface. Normal curvature, Normal section. Principal curvature and principal direction. Umbilic points of a surface in E^3. Euler's formula for normal curvature of a surface in E^3. **13 Hrs**

Text Books:

1. Barrett O' Neil : Elementary Differential Geometry. Academic Press, New York and London, 1966.
2. T.J.Willmore : An introduction to Differential Geometry. Clarendon Press, Oxford 1959.

References:

1. D.J.Struik : Lectures on Classical Differential Geometry, Addison Wesley, Reading, Massachusetts, 1961.
2. Nirmala Prakassh: Differential Geometry- an integrated approach. Tata McGraw-Hill, New Delhi, 1981.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out any sections. Five full questions in all out of eight questions are to be answered. Choosing atleast 2 from each Part.

MSM 2.8 FOUNDATION OF MATHEMATICS (OEC-I)

Max.Marks: 35+15 **Credits-02**

PART-A

Matrix Algebra: Definition, types of matrix, transpose of a matrix, determinants, properties of determinants, co-factors matrix, adjoint matrix, inverse of a matrix, singular & non-singular matrix.

The solution of a system of Equations: The solution of a system of equations using, matrix Inversion method: Gauss Elimination Method, Gauss Jordan Method, Triangularisation Methods, Choleskey Method, L-U Decomposition Method, Some applications like input-output analysis.

PART-B

Differential Calculus Limits: Definitions and Examples, Theorems on Limit. Continuity: Continuous and Discontinuous functions, Differentiation Rules of differentiation, Maximum and minimum of function of two variables. Applications of Maxima and minima of functions.

Integration; Definition, Rules of integration, Definite and Indefinite integration, some applications.

Text Books:

1. Santinarayana, Differential Calculus.
2. J.E.Weber, Mathematical Analysis.

References:

1. Jain M.K, & Jan R.K. Numerical Methods for Scientific &Engineering Computation.
2. S.S.Sastry ,Elements of Numerical Methods.

SEMESTER-III

MSM 3.1 FUNCTIONAL ANALYSIS

Max. Marks: 70+30 **Credits-05**

Total: 52 hrs

PART-A

Recapulation of Metric spaces: Normed linear spaces. Banach Spaces : Definition and examples. Quotient Spaces. Convexity of the closed unit sphere of a Banach Space. Examples of normed linear spaces which are not Banach. Holder' s inequality. Minkowski's inequality. Linear transformations on a normed linear space and characterization of continuity of such transformations. Linear functionals , The conjugate space N*. **10 hrs**

The set *B (N, N')* of all bounded linear transformations of a normed linear space N into normed linear space *N '* . The natural imbedding of N into N**. Reflexive spaces. Hahn - Banach theorem and its consequences, Projections on a Banach Space. The open mapping theorem and the closed graph theorem. The uniform boundedness theorem. The conjugate of an operator, properties of conjugate operator. **16 Hrs**

PART-B

Inner product spaces, Hilbert Spaces: Definition and Examples, Schwarz' s inequality. Parallelogram Law, polarization identity. Convex sets, a closed convex subset of a Hilbert Space contains a unique vector of the smallest norm. Orthogonal sets in a Hilbert space. Bessel' s inequality. orthogonal complements, complete orthonormal sets, Orthogonal decomposition of a Hilbert space. Characterization of complete orthonormal set. Gram-Schmidt orthogonalization process. **13Hrs**

The conjugate space H*of a Hilbert space H. Representation of a functional f as f(x)= (x, y) with y unique. The Hilbert space H*. Interpretation of T* as an operator on . Self-adjoint operators, Positive operators. Normal operators. Unitary operators and their properties. Projections on a Hilbert space, Invariant subspace. Orthogonality of projections. Eigen values and eigen space of an operator on a Hilbert Space. Spectrum of an operator on a finite dimensional Hilbert Space. Finite dimensional spectral theorem.

13 Hrs

Text Book:

1. G. F. Simmons: Introduction to Topology and Modern Analysis (McGraw-Hill Intl. Edition).

References:

1. G. Backman and L. Narici : Functional Analysis (Academic).
2. B. V. Limaye : Functional Analysis (Wiley Eastern).
3. P.R. Halmos : Finite dimensional vector paces, Van Nostrand, 1958.
4. E. Kreyszig : Introduction to Functional Analysis with Applications, John Wiley & Sons

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 3.2: NUMERICAL ANALYSIS-II

Max. Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Numerical solution of ordinary differential equations: Initial value problems- Picard's and Taylor series methods- Euler' s Method-Higher order Taylor methods-Modified Euler' s method-Runge Kutta methods of second and fourth order- Multistep method- The Adams- Moulton method- Milne's method stability- (Convergence and Truncation error for the above methods).Boundary-value problems- Second order finite difference method-linear shooting method. **26 hrs**

PART-B

Numerical solutions of partial differential equations: Difference methods for Elliptic partial differential equations- Difference schemes for Laplace and Poisson' s equations. Iterative methods of solution by Jacobi and Gauss Siedel methods- Solution techniques for rectangular and quadrilateral regions. Difference methods for parabolic equations in one – dimension-methods of Schmidt, Laasonen, Crank-Nicolson and Dufort. Frankel. Stability and convergence analysis for Schmidt and Crank-Nicolson methods-A.D.I.method for two-dimensional parabolic equation. Explicit finite difference scheme for hyperbolic equations-Wave equation in one dimension. **26 Hrs**

Text Books:

1. M.K.Jain: Numerical solution of differential equations, Wiley Eastern (1979). Second Edition.
2. S.S.Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India, New Dehli (1988).
3. M.K.Jain, S.R.K.Iyengar and R.K.jain : Numerical methods for scientific and Engineering computation, Wiley Eastern (1993).

References

1. S.C. Chapara,and P.C.Raymond : Numerical Methods for Engineers, Tata Mc Graw Hill, New Delhi (2000)
2. R.L.Burden, and J . Douglas Faires: Numerical Analysis, P.W.S.Kent Publishing Company, Boston (1989), Fourth edition.
3. G.D. Smith : Numerical Solutions of partial differential equations second edition London, Oxford university Press (1978).
4. Paruiz moin : Fundamentals of Engineering Numerical analysis, Cambridge university press (2006).
5. C.F.Gerald and P.O.Wheatley : Applied Numerical Methods, Low-priced edition, Pearson Eduation Asia (2002), Sixth Edition.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 3.3- FLUID MECHANICS-I

Max.Marks: 70+30 **Credits-05**

Total: 52 hrs

PART - A

Algebra of Tensors:-Co ordinate transformations, Cartesian tensors, Basic properties, Transpose-Symmetric and Skew tensors, Gradient, Divergence and curl in tensor calculus, integral theorems. **13 Hrs**

Kinematics of Fluids in motion:-Methods of describing fluid motion, velocity of a fluid particle, material, local and convective derivatives, acceleration of a fluid particle, equation of continuity by Euler method, equation of continuity by Lagranges method, equation continuity of a liquid flow through a channel or pipe, Boundary conditions, Conditions at a surface, stream line, path line, streak lines, Difference between stream line and path line, velocity potential, Vorticity vector, Rotational and irrotational motion, Annular velocity: Illustrative examples.

13 Hrs

PART-B

Equations of motion of inviscid fluids:-Eulers equation of motion, Equation of motion of an inviscid fluid, equation motion under impulsive forces, Energy equation, Lagranges hydrodynamical equation; Bernoulli's equation, Pressure equation, Application of Bernoulli's equation. **13 Hrs**

Motion in two-dimensions sources and sinks. Stream function, physical significance, spin components, irrotational motion in two-dimensions, complex potential, source and sinks in two dimensions, complex potential due to a source, Doublet in two dimensions, Images, Image of a doublet with respect to a line, The Milne-Thomson circle theorem, Blarius theorem. **13Hrs**

Text Books:

1. D.S. Chandrasekharaiah and L. Debnath: Continuum Mechanics, Academic Press,1994.
2. A.J.M. Spencer: Continuum Mechanics, Longman, 1980.

References:

1. P. Chadwick : Continuum Mechanics, Allen and Unwin, 1976.
2. L.E. Malvern : Introduction to the Mechanics of a Continuous Media, PrenticeHall,1969.
3. Y.C. Fung, A First course in Continuum Mechanics, Prentice Hall (2^{nd} edition), 1977.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 3.4: Lab-II

Max. Marks:35+15=50 **Credits-03**

User-defined Functions: The form of C Function, Return Values and their types, calling a function, Category of Functions: No arguments and no return values, arguments but no return values, argument with return values. Recursion. Functions with arrays.

Structures and Pointers: Structure definition, giving values to members, structure

initialization, comparison of structure variables, arrays within structures. Understanding pointers, accessing the address of the variable, declaring and initializing pointer, accessing a variable through its pointer, pointer and arrays, pointer and functions.

Practical Programs List

1. Sum of two matrices.
2. Difference of two matrices.
3. Product of two matrices.
4. Transpose of matrices.
5. Sparse matrices.
6. Gauss-Elimination method.
7. Gauss-Siedel method.
8. Runge-Kutta second order method.
9. Runge-Kutta fourth order method.
10. Runge-Kutta method for second order differential equation.
11. Predictor-correction methods-Adam-Bashfourth, Adams-Moultor methods.
12. BVP solution of lapalce‘s equation an a rectangle with dirichlet boundary condition.
13. Solution of one-dimensional parabolic equation (Temperature changes in rod)-Schmidt and crank-Nicolson schemes.
14. Bubble Sort
15. Inverse matrix (Adjoint).
16. Gauss Jordan.
17. Jacobian iteration method.

References:

1. Peter Norton’s, Introduction to computers, Peter Norton, McGraw-Hill Technology Education.
2. E Balaguru Swamy, Programming in ANSI C, Tata McGraw-Hill Publishing Company Limited.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education Inc.
4. P. B. Kotur, Computer Concepts and C Programming. Yeshwanth Kanetkar, Let us C.

M.SM. 3.5: OPERATOR ALGEBRAS AND OPERATOR THEORY

Max.Marks: 70+30 **Credits-04**
Total: 52 hrs

PART-A

Banach Algebras: Definition and elementary properties of the spectrum, spectral radius formula, Banach Algebras and invertible group; the spectrum; multiplicative linear functionals; the Gelfand transform and applications; maximal ideal spaces . C*-algebras: C*-algebras; commutative C*-algebras; the spectral theorem and applications; polar decomposition; positive linear functionals and states; H*-algebras. **26 Hrs**

PART-B

Semi-inner-product related results. Special classes of operators: compact operators, Fredholm operators, bounded selfadjoint, normal and unitary operators and their spectral theory. Von Neumann Algebras: Topologies on B(H); Existence of projections; the Double Commutant Theorem; the Kaplansky density theorem. **26Hrs**

Text Books:

1. R. V. Kadison and J. R. Ringrose, Fundamentals of the theory of operator algebras. Vol. I, reprint of the 1983 original, Graduate Studies in Mathematics, 15, Amer. Math. Soc. Providence, RI, 1997.
2. G. J. Murphy, C*-algebras and operator theory, Academic Press, Boston, MA, 1990.
3. R. G. Douglas, Banach algebra techniques in operator theory, second edition, Graduate Texts in Mathematics, 179, Springer, New York, 1998.
4. W. Zelazko, Banach algebras, translated from the Polish by Marcin E. Kuczma, Elsevier Publishing Co., Amsterdam, 1973.
5. J. B. Conway, A Course in Functional Analysis, Springer-Verlag, New. York, 1985.
6. N. Dunford & J. T. Schwartz, Linear Operators, Vol. I, II,Interscience, New York, 1963.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 3.6: OPERATIONS RESEARCH

Max.Marks: 70+30 **Credits-04**

Total: 52 hrs

PART-A

Linear Programming: Basic concepts, convex sets, open and closed half spaces, simplex, formulation of Linear Problem(LPP), feasible solution, basic feasible solution, optimal solution, graphical method, simplex method, big-M method. **(16 Hours).**

Transportation Problem(TP): Mathematical formulation, existence of feasible solutions, transportation table, initial basic feasible solution ; North-west corner rule, row minima method , column minima method , matrix minima method, . **(10 Hours)**

PART-B

Assignment Problem: Mathematical formulation, assignment algorithm, routing problem, traveling salesman problem. **(6 Hours)**

Networks: Network minimization, shortest route problem, shortest route algorithms for acyclic networks, maximal flow problem. **(10 Hours)**

Integer Programming: Methods of integer programming problems; Cutting method, search method, mixed integer programming problem. **(10 Hours)**

Text Books:

1. Hamdy A. Taha Operations Research, Macmillam,(1989)
2. Kanti Swarup, P.K. Gupta and Mamohan, Operations Research, S. Chand & Sons, (1980)
3. S.Kalavathy, Operations Research, Vikas(2001)
4. S.D. Sharma, Operations Research.
5. G.Hadley, Linear Programming, Narosa Publishing House, New-Delhi,(1987).

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 3.7: MATHEMATICAL METHODS

Max.Marks: 70+30 **Credits-04**
Total: 52 hrs

PART-A

Integral Transforms: General definition of Integral transforms, Kernels, etc. Development of Fourier integral, Fourier transforms – inversion, illustration on the use of integral transforms, Laplace, Fourier, Hankel and Mellin transforms to solve ODEs and PDEs - typical examples. **14 hrs**

Integral Equations: Definition, Volterra and Fredholm integral equations. Solution by separable kernel, Neumann's series resolvent kernel and transform methods, Convergence for Fredholm and Volterra types. Reduction of IVPs BVPs and eigenvalue problems to integral equations. Theory of Symmetric Kernels. **12 hrs**

PART-B

Asymptotic Methods: Asymptotic expansion of functions, power series as asymptotic series, Asymptotic forms for large and small variables. Uniqueness properties and Operations. Asymptotic expansions of integrals; Method of integration by parts (include examples where the method fails), Laplace method and Watson's lemma, method of stationary phase and steepest descent. **11 hrs**

Perturbation method: Regular and singular perturbation methods: Parameter and co-ordinate perturbations. Regular perturbation solution of first and second order differential equations involving constant and variable coefficients. Include Duffings equation, Vanderpol oscillator, small Reynolds number flow. Singular perturbation problems, Matched asymptotic expansions, simple examples. Linear equation with variable coefficients and nonlinear BVP's. Problems involving Boundary layers. **15hrs**

Text Books:

1. I.N. Sneddon – The use of Integral Transforms, Tata Mc Graw Hill, Publishing Company Ltd, New Delhi, 1974
2. R.P. Kanwal: Linear integral equations theory and techniques, Academic Press, New York, 1971
3. C.M. Bender and S.A. Orszag – Advanced mathematical methods for scientists and engineers, Mc Graw Hill, New York, 1978

References:

1. H.T. Davis – Introduction to nonlinear differential and integral equations, Dover Publications, 1962.
2. A.H. Nayfeh – Perturbation Methods, John Wiley & sons New York, 1973
3. Don Hong, J. Wang and R. Gardner. Real analysis with introduction to wavelets and applications, Academic Press Elsevier (2006)
4. R.V. Churchill: Operational Mathematics, Mc. Graw Hill, New York, 1958

Pattern of Question paper pattern: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions, choosing at least 2 from each part.

MSM 3.8: STATISTICAL TECHNIQUES (OEC)

Max.Marks: 35+15 **Credits-02**

PART-A

Statistical Methods: Curve fitting by the method of least squares: y=a+bx, y=a+bx+cx^2, y=ax^b , y=ab^x, y=ae^{bx},Correlation and Regression. Probability: Addition rule, conditional probability, Multiplication rule, Baye's theorem.

PART-B

Random Variables (Discrete and continuous) p.d.f., c.d.f., Bernoulli's theorem, Binomial Distribution, Poisson distribution, Normal and Exponential Distribution.Concepts of joint probability- Joint probability distribution, Discrete and independent random variables. Expectation, Covariance, Correlation coeffient.

Text Books:

1. Dr. B.S.Grewal, Higher Engineering mathematics (36th Edition- Khanna publishers).
2. Seymour Lipschutz, Probability (Schaum' s series, Chapters 5 and 7)

References:

1. B.V.Ramana, Higher Engineering mathematics (Tata Mc Graw Hill).

2. Glyn James, Advanced modern Engineering mathematics by Glyn James Pearson Education.

IV SEMESTER
MSM 4.1: MEASURE THEORY

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Sigma algebras, open subsets of the real line. F_σ and G_δ sets, Borel sets, Outer measure of a subset of R ' Lebesgue outer measure of a subset of R Existence, non-negativity and monotonicity of Lebesgue outer measure; Relation between Lebesgue outer measure and length of an interval; Countable subadditivity of Lebesgue outer measure; translation invariance. **9 hrs**

(Lebesgue) measurable sets, (Lebesgue) measure; Complement, union, intersection and difference of measurable sets; denumerable union and intersection of measurable sets; countable additivity of measure; The class of measurable sets as a algebra, the measure of the intersection of a decreasing sequence of measurable sets. **9 hrs**

Measurable functions; Scalar multiple, sum, difference and product of measurable functions. Measurability of a continuous function and measurability of a continuous image of measurable function. Convergence pointwise and convergence in measures of a sequence of measurable functions. **8 hrs**

PART – B

Lebesgue Integral; Characteristic function of a set; simple function; Lebesgue integral of a simple function; Lebesgue integral of a bounded measurable function; Lebesgue integral and Riemann integral of a bounded function defined on a closed interval; Lebesgue integral of a non-negative function; Lebesgue integral of a measurable function; Properties of Lebesgue integral. **7 hrs**

Convergence Theorems and Lebesgue integral; The bounded convergence theorem; Fatou's Lemma: Monotone convergence theorem; Lebesgue convergence theorem. **6 Hrs**

Differentiation of Monotone functions. Vitali covering lemma. Functions of Bounded variation. Differentiability of an integral. Absolute continuity and indefinite integrals. **6 hrs**

Lp spaces. Holder and Minkowski inequalities. Convergence and completeness, Riesz – Fischer Theorem. Bounded linear functionals Riesz representation theorem and illustrative examples. **7 hours**

Text Books:

1. H. L. Royden : Real Analysis, Macmillan, 1963

References:

1. P.R. Halmos : Measure Theory, East West Press, 1962
2. W. Rudin : Real & Complex Analysis, McGraw Hill , 1966
3. I.K.Rana. An introduction to measure and integration, Narosa publishing House(1997)
4. K.P.Gupta. Measure Theory, Krishna Prakashan Media (P) Ltd, II, Shivaji Road, Meerut (U.P) India.

Pattern of Question paper pattern: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions, choosing at least 2 from each part.

MSM 4.2: DISCRETE FOURIER AND WAVELET TRANSFORMS

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Inner product spaces. Linear transformations and Matrices, Unitary transformations, Projection operators. Gram- Schmidt orthogonalization. Finite Fourier transform, Discrete periodic signals and convolution, Fast Fourier transform and applications. Haar wavelets, Multiresolution analysis of Haar wavelets. Applications of Haar wavelets to signal compression. **26hrs**

PART-B

Daubechies wavelets, Multi resolution analysis of Daubechies wavelets. Application of Daubechies wavelets. Comparison of Fourier and wavelet transforms. Wavelet transform for two dimensional signals. **26hrs**

Text Books:

1. G.Bachman, L. Narili, E. Backenstein, Fourier and Wavelet Analysis, Springer, 2005.
2. J.C.Goswami, Andrew .K.Chan, Fundamentals of Wavelets, John Wiley and Jms, Inc.

References

1. G.Kaiser, A Friendly guide to Wavelets, Birkhauser, Boston.
2. S.Mallat. A wavele tour of signal Processing.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 4.3 : GRAPH THEORY

Max.Marks: 70+30 **Credits-05**
Total: 52 hrs

PART-A

Connectivity :- Cut- vertex, Bridge, Blocks, Vertex-connectivity, Edge-connectivity and some external problems, Mengers Theorems, Properties of n-connected graphs with respect to vertices and edges. **8hrs**

Planarity:- Plane and Planar graphs, Euler Identity, Non planar graphs, Maximal planar graph Outer planar graphs, Maximal outer planar graphs, Characterization of planar graphs , Geometric dual, Crossing number. **7hrs**

Colorability :- Vertex Coloring, Color class, n-coloring, Chromatic index of a graph, Chromatic number of standard graphs, Bichromatic graphs, Colorings in critical graphs, Relation between chromatic number and clique number/independence number/maximum degree, Edge coloring, Edge chromatic number of standard graphs Coloring of a plane map, Four color problem, Five color theorem, Uniquely colorable graph. Chromatic polynomial. **11 Hrs**

PART-B

Matchings & factorization:- Matching- perfect matching, augmenting paths, maximum matching, Hall' s theorem for bipartite graphs, the personnel assignment problem, a

matching algorithm for bipartite graphs, Factorizations, 1-factorization, 2-factorization. Partitions-degree sequence, Havel's and Hakimi algorithms and graphical related problems. **12Hrs**

Directed Graphs:- Preliminaries of digraph, Oriented graph, indegree and outdegree, Elementary theorems in digraph, Types of digraph, Tournament,Cyclic and transitive tournament, Spanning path in a tournament, Tournament with a hamiltonian path, strongly connected tournaments. **8Hrs**

Domination concepts and other variants:- Dominating sets in graphs, domination number of standard graphs, Minimal dominating set, Bounds of domination number in terms of size, order, degree, diameter, covering and independence number, Domatic number, domatic number of standard graphs. **6Hrs**

Text Books:

1. F. Harary: Graph Theory, Addison - Wesley,1969.
2. G.Chartrand and Ping Zhang: Introduction to Graph Theory. McGrawHill, International edition (2005)

References:

1. D.B.West, Introduction to Graph Theory,Pearson Education Asia, 2nd Edition, 2002.
2. Charatrand and L. Lesnaik-Foster: Graph and Digraphs, CRC Press (Third Edition).
3. T.W. Haynes, S.T. Hedetneime and P. J . Slater: Fundamental of domination in graphs, Marcel Dekker. Inc. New York.1998.
4. J . Gross and J . Yellen: Graph Theory and its application, CRC Press LLC, Boca Raton, Florida, 2000.
5. Norman Biggs: Algebraic Graph Theory, Cambridge University Press (2nd Ed.)1996.
6. Godsil and Royle: Algebraic Graph Theory: Springer Verlag.
7. N. Deo: Graph Theory: Prentice Hall of India Pvt. Ltd. New Delhi – 1990.
8. J .A.Bondy and V.S.R.Murthy: Graph Theory with Applications, Macmillan, London.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.

MSM 4.4: FLUID MECHANICS –II

Max. Marks: 70+30 **Credits-05**

Total: 52 hrs

PART-A

Basic concept of real fluid , continuum hypothesis, general motion of a fluid element, Stress & strain components in a real fluid. Relation between stress & strain components. Geometrical interpretation of the components of strain. Thermal conductivity of fluid, Fourier law of hear conduction, Navier-stoke equation & energy equation. Vorticity equation in viscous flow, analogy between vorticity equation & heat conduction equation.

Dynamic similarity: Principles of similarity, Buckingham's pi-theorem & its applications/ Physical significances of non- dimensional numbers **(26 Hours)**

PART-B

Exact Solutions: Poiseuille and Coutte flows between two parallel, flow between two co axial cylinders and their temperation distributions, flow through tubes of uniform cross section in form of an elliptic and equilateral triangles under constant pressure gradients, stroke's first and second problems, flow in convergent and divergent channels.
Laminar Boundary Layers: Prandtl's boundary layer concept. Derivation of two dimensional boundary layer equation for velocity & temperature by order magnitude approach. Boundary layer thickness, Displacement thickness, Energy thickness, boundary layer flow past a fiat plate- Blasius solution, boundary layer separation ,Von-Mises transformations Von-Karman momentum integral equation. **26 hours**

References:

1. W.H.Besaint and A.S. Ramsey, A treatise of Hydrodynamics, part II, CBS publishers, Delhi, 1958.
2. G.K. Batchelor, A introduction to Fluid Mechanics, Foundation Books, New Delhi,1994.
3. F.Chorlton, Text book of Fluid Dynamics, CBS publishers, Delhi, 1985.
4. A.J.Chorin and A. Marsden. A mathematical introduction to Fluid Dynamics, Springer- Verlag, New Yark,'1993.
5. L.D.Landau and E.M. Lipschitz, Fluid Mechanics ,Pergamon press, London, 1995.
6. H.Schlichting, Boundary Layer Theory, McGraw Hill Book company, New York,1979.
7. R.K.Rathy, A introduction to Fluid Dynamics, Oxford and IBM Publishing company- New Delhi,1976.
8. A.D.Young, Boundary Layers AJAA Education series, Washington DC 1989.
9. S.W.Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Private Limited, New Delhi, 1976.
10. L.Popenhead. Laminar Boundary Layer , Clearan don press Oxfoed,.
11. S.I.Pai. vipcoup flow theory vol.1; Laminar flow ,D Von Moptrand comp.
12. C.S. Yin. Dynamic of non-homogenous fluid. McMillan, New York,1965.
13. C.C.Lin. Theory of Hydrodynamics stability, Cambridge University Press.

Pattern of Question Paper: The question paper contains 2 sections namely, Part-A and Part-B and each part contains 4 questions. Five full questions are to be answered in all out of 8 questions choosing atleast 2 from each Part.