VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. Applied Mathematics

Scheme of Teaching and Examination

Semester – I

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	ext	Int	Ext	Int	Ext
AM – 101	Real Analysis	4	--	4	30	70	--	--	30	70
AM – 102	Ordinary Differential Equations	4	--	4	30	70	--	--	30	70
AM – 103	Linear Algebra	4	--	4	30	70	--	--	30	70
AM – 104	Numerical Analysis	4	--	4	30	70	--	--	30	70
AM – 105	Mechanics	4	--	4	30	70	--	--	30	70
AM – 106	C++	4	4	4	18	42	12	28	30	70
	Total	24	04	28	168	392	12	28	180	420

Semester – II

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	ext	Int	Ext	Int	Ext
AM – 201	Complex Analysis	4	--	4	30	70	--	--	30	70
AM – 202	Partial Differential Equations	4	--	4	30	70	--	--	30	70
AM – 203	Functional Analysis	4	--	4	30	70	--	--	30	70
AM – 204	Fluid Dynamics	4	--	4	30	70	--	--	30	70
AM – 205	Modeling And Simulation	4	--	4	30	70	--	--	30	70
AM – 206	Mathematical Software	4	4	4	18	42	12	28	30	70
	Total	24	04	28	168	392	12	28	180	420

Semester – III

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	ext	Int	Ext	Int	Ext
AM – 301	Theory of Algorithm	4	--	4	30	70	--	--	30	70
AM – 302	Integral Equation	4	--	4	30	70	--	--	30	70
AM – 303	Optimization	4	--	4	30	70	--	--	30	70
AM – 304	Advanced Functional Analysis	4	--	4	30	70	--	--	30	70
AM – 305	Computational Fluid Dynamics	4	--	4	30	70	--	--	30	70
AM – 306	Applied Statistics	4	4	4	18	42	12	28	30	70
	Total	24	04	28	168	392	12	28	180	420

Semester – IV

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
		L	P	Total	Th.		Pr.		Total	
					Int	Ext	Int	Ext	Int	Ext
AM – 401	Image Processing	4	--	4	30	70	--	--	30	70
AM – 402	Wavelet Analysis	4	--	4	30	70	--	--	30	70
AM – 403	Digital Signal Processing	4	--	4	30	70	--	--	30	70
AM – 404	Fuzzy Modeling	4	--	4	30	70	--	--	30	70
AM – 405	Advanced Optimization	4	--	4	30	70	--	--	30	70
AM – 406	Practical based on Matlab	--	4	4	--	--	30	70	30	70
	Total	20	04	24	150	350	30	70	180	420

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 101: Real Analysis

Syllabus to be offered at M. Sc. Applied Mathematics Sem - I w.e.f. June 2010-11

L	T	P
4	1	0

Prerequisite
The extended real numbers, sequences of real numbers, open and closed sets of real numbers axioms for the real number, continuous functions, borel sets.

Lebesgue measure
Introduction, outer measure, measurable sets and lebesgue measure, non measurable sets, measurable function, littlewood's three principles.

Lebesgue integral
Riemann integral, lebesgue integral of a bounded function over a set of finite measure, integral of a non negative function, general lebesgue integral

Differentiation and integration
Differentiation of monotone functions, functions of a bounded variation, Differentiation of an integral, absolute continuity, convex functions.

Measure and integration
Measures spaces, measurable functions, integrations, general convergence theorem, signed measures, the Random – Nikodym theorem. The L^P – Spaces.

Measures and outer Measures
Outer measures and measurability, the extension theorem, the lebesgue Stieltjes iintegral, Product measure, integral operators, caratheodory outer measure, hausdroff measure

References:

1. H. L. Royden, Real Analysis, Macmillan publication, 1993.
2. Walter Rudin, Principles of mathematical analysis, McGraw Hill, 1976.
3. T. M Apostol, Mathematical Analysis, Narosa publishing house ,1985.
4. G.de. Barra, Measure theory and Integration, Wiley Eastern limited,1981.
5. I. P. Natanson, Theory of Functions of real variable,Fredrick Unger pub.1961.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 102: Ordinary Differential Equations

Syllabus to be offered at M. Sc. Applied Mathematics Sem - I w.e.f. June 2010-11

L	T	P
4	1	0

- Mathematical modeling by means of ordinary differential equations
- Reduction of nth order equation into first order systems
- Existence and uniqueness of solution of a nonlinear system of ordinary differential equations, Lispschitz condition, Gronwall's lemma.
- Phase plane Analysis
- Linearization of nonlinear systems
- Autonomus and nonautonomus Linear system Theory: Linear Dependence and independence of solution, Wronskian.
- Transition matrix(fundamental matrix) for a linear system, solution of a nonlinear system by variation of parameters method, computation of transition matrix , eigenvalue method, Peano-Backer series method.
- Discrete dynamical systems
- Stability of dynamical systems, Lyapunov, exponential and asymptotic stability and their characterization.
- Sturm -Liouville equations, Eigenvalue problems
- Series solution of non-autonomous systems, Bessel and Legandre series, Frobenius method.

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References:

1. S.L. Ross: Differntial equations, Blaisdell publishing company, First edition, 1964
2. Birkhoff G and Rota G.C.: Ordinary differential equations, Boston, 1962
3. Coddington E. A and N. Levinson: Theory of ordinary differential equations, McGraw-Hill, New York, 1955.
4. Saber N. Elaydi: An introduction to Differential Equations, Springer-verlag, Second edition, 1995
5. Arnold V.I: Ordinary Differential Equations, Prentice- Hall of India,

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 103: Linear Algebra

Syllabus to be offered at M. Sc. Applied Mathematics Sem - I w.e.f. June 2010-11

L	T	P
4	1	0

Linear operator

Functions linear operators, null space and range, rank and nullity theorem, operator inverses, application to matrix theory, computation of null space and range of a matrix, matrix of an operator, change of basis and similar matrices.

Inner product spaces

Basics of inner product space, orthogonal sets fourier coefficients and partial identity gram-schmidt process QR factorization, approximation and orthogonal projection, equivalence of the problems, normal equations projection operators, orthogonal complements, applications to an approximations and matrix theory fredholm alternative theory, matrix representation of an inner products, orthogonal change of bases, rank of gram matrix

Diagonalizable linear operators

eigen values and eigen vectors, spectrum and eigen spaces of an operator, thoritical computation using determents, property of the characteristic polynomial, geometric and algebric multiplicity, diagonalizable operator and their computational advantages, similarity to a diagonal matrix, function of a diagonalizable operator, function of matrices, general properties of function of diaglonalization operator, minimaul polynomial, first order matrix differential operator, decoupling the differential eauation, estimates of eigen values, gershgorin's theorem

References:

1. J. T. Scheick, Linear algebra with application, Mc- Hill international addition, 1997.
2. Krishnamurthy, Mainra & Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., N.Delhi.
3. I. H. Sheth : Linear Algebra, Nirav Prakashan.
4. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000.
5. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co.(Student Ed.).
6. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 104: Numerical Analysis

Syllabus to be offered at M. Sc. Applied Mathematics Sem - I w.e.f. June 2010-11

L	T	P
4	1	0

- Computer Arithmetic: Floating point numbers and round off errors, Absolute and relative errors.
- Polynomial Interpolation: Hermite's interpolation formula with error analysis, Richardson interpolation, splines and spline interpolation ,Aitken extrapolation
- Numerical differentiation, Gaussian quadrature, Romberg integration, adaptive quadrature
- Solution of system of Linear equations:
    - Matrix inversion, Jordan's method, Escalator method and iterative method.
    - The LU and Cholesky factorizations
    - Pivoting and constructing an algorithm based on Gaussian elimination method
    - Solution of equations by iterative methods(Jacobi's method, Gauss-Seidel method)
    - Steepest descent and Conjugate gradient methods.
- Algebraic Eigen value problem :
- Properties of eigen values and eigen vectors
- Power method
- Inverse power method
- Jacobi's method, Given's method
- Schur and Gershgorins theorem
- Orthogonal factorization
- QR algorithm for eigen value problem
- Eigen values of complex matrix and complex eigen vectors
- Approximation:

Different types of approximation, Least square polynomial approximation, Polynomial approximation by use of orthogonal polynomials, approximation with Chebyshev polynomials.

- Numerical Solution of ODE: single step method-Runge Kutta methods, Multistep method - Milne Simpson's method.
- System of non linear equations: Newton Raphson's method

References:

1. C.E. Froberg: Introduction to Numerical Analysis, Addision Wesley publishing Company, sixth edition, 1981.
2. S.S. Sastri: Introductory Methods of Numerical Analysis, Prentice Hall of India, New Delhi, 1997.
3. E.V. Krishnamurthy and S.K.Sen: Computer based numerical Algorithms, East – West press Pvt. Ltd. 1976
4. Conte S.D and Carl deboor: Elementary Numerical Analysis: an algorithmic approach,Mc Graw Hill company, Third edition, 1981
5. M.K. Jain: Numerical analysis for scientists and Engineers,New Age International Ltd. Publishing, 1992

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 105: Mechanics

Syllabus to be offered at M. Sc. Applied Mathematics Sem - I w.e.f. June 2010-11

L	T	P
4	1	0

FUNDAMENTALS OF PHYSICS

- Measurement
- Motion in one dimension: Displacement, Velocity, Acceleration, Equation of motion with constant acceleration.
- Motion in two dimension and three dimensions: Displacement, Velocity, Acceleration, Projectile Motion, Uniform circular motion, Relative motion in two and three dimension
- Newton Laws of motion (with examples), Friction and centripetal forces
- Kinetic energy and work ,Work done by weight, Work done by variable force, Work-kinetic energy theorem, Work done by spring force, Power, Potential energy and conservation of energy, Electric potential energy, Gravitational potential energy, Conservation of energy
- System of particles: Newton Laws for system of particle, Linear Momentum and Newton's second Law, Conservation of linear momentum, collision, Impulse and linear momentum, Elastic and Inelastic collision in one dimension, Collision in two dimension
- Rotational motion: Angular displacement, Angular velocity and Angular acceleration, Equation of motion for constant angular acceleration, Torque, Newton second law in angular form
- Elasticity
- Planets and satellites: Kepler’s law

- **Oscillations and wave theory**
- Oscillations: Energy, SHM, Energy in SHM, damped simple harmonic motion, forced oscillations and resonance, Simple pendulum
- Waves: Types of waves, wavelength, frequency, period, angular frequency, Superposition of waves
- Sound waves: Doppler effect
- **Heat and Thermodynamics**
  - Thermodynamics : Zeroth Law of Thermodynamics
  - The Celsius, Kelvin and Fahrenheit scales
  - Thermal expansion: Linear expansion and volume expansion
  - Specific heat

- First law of Thermodynamics
- Conduction, convection, radiation
- Kinetic theory of Gases and second law of Thermodynamics: Ideal gases, Internal energy, the Adiabatic expansion of an ideal gases, Entropy, Second law of thermodynamics, Entropy in the real world, Engines, Refrigerators

- **Electromagnetism**
  - Electric charge, Conductors and insulators, Coulomb's law.
  - Electric field, Electric field due to a point charges, Electric field due to an electric dipole, Gauss law.
  - Electric Potential, Equi-potential surfaces, Calculation of Potential from field, Potential due to a point charge
  - Capacitors, Capacitance, Capacitors in series and parallel, Capacitor with a Dielectrics.
  - Moving charges and electricity, Currents, Semi conductors, Super conductors., Electric current, Current density, Resistance and Resistivity, Ohms law.
  - Circuits: Work, energy, emf, power, Ameter and voltmeter, RC circuits, Kirchoff's law
  - The Magnetic field, definition of B, Hall effect, Torque on a current loop, Magnetic dipole.
  - Magnetic field due to current, Amperes law, solenoids.
  - Faraday's law, Lenz's law, Inductance and inductors, self inductance, RL circuits, energy stored in magnetic fields
  - Maxwell's equations: magnetic moments, magnates, Paramagnetism, diamagnetism, ferromagnetism, Maxewell's equations
  - Geometric optics : Plane mirrors, spherical mirrors, thin lenses
  - Wave optics : Interference and diffraction .

References:

1. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, Sixth edition, John Wiley and Sons, New York, 1998.
2. J.B. Serway, Fundamental of Physics McGraw-Hill, New-york,

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 106: C++

Syllabus to be offered at M. Sc. Applied Mathematics Sem - I w.e.f. June 2010-11

L	T	P
4	1	4

Introduction

Algorithms and Flowchart, Types of Languages, Introduction to C Language

C Fundamentals

Identifiers, Data Types, Constants and Variables, Arrays

Operators and Expressions

Arithmetic Operators, Unary Operators, Relations Operators, Logical Operators Assignment Operators, Conditional Operators, Library Functions, Expressions, Evaluation of Expression

Data Input and Output

Single Character input and output, The scanf function, The printf function, Gets and Puts functions

Control statements

The While Statement, do-while statement, for statement, if – else statement, switch statement, break statement, continue statement, goto statement

Functions

Introduction to functions, Function definition, Accessing function, Passing arguments to function, Recursive function

Arrays

Defining an array, Processing an array, Multi dimensional arrays, Passing array to a function, Arrays and Strings

Structures and Unions

Defining a structure, Processing a structure, Unions

References:

1. C++ programming Language – karnighan & Ritchie – TMH
2. 'C++' Odyssy 6th Volume – Vijay Mukhi – PHI
3. Programming in 'C++' – Stephan Kochan – CBS
4. Mastering turbo C++- Kelly and Bootle – BPB
5. C++ language Programming Byron Gottfried – TMH

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 201: Complex Analysis

Syllabus to be offered at M. Sc. Applied Mathematics Sem - II w.e.f. June 2010-11

L	T	P
4	1	0

Basic of complex Numbers:

Analytic Functions:
Functions, limits and continuity, differentiability Power series as an analytic function, Exponential and Trigenometric functions, Complex logarithms, Inverse functions, Zeros of analytic functions.

Complex Integration:
Curves in the complex plane, Basic properties of complex Intergral, winding number or index of a curve, couchy-Gaursat Thorem, Homotopy version of Cauchy's theorem, Morea's theorem, Cauchy Integral Formula, Laurent series, The maximum modulus priniciple, Schwartz's lemma, Liouville's theorem.

Singularities:
Isolated and non-isolated singularities, removable singularities poles, singularities at infinity, Aralytic continuations.

Residues and evalutation of certain integrals:
Residue at a finite point, residue at a point at infinity, residue theorem, no of zeros and poles, rouchae's theorem, integrals of type $\int_{\alpha}^{2\pi+\alpha} R(\cos\theta, \sin\theta)\, d\theta$, integrals of type $\int_{-\infty}^{\infty} f(x)\, dx$, integrals of type $\int_{-\infty}^{\infty} g(x)\cos(mx)\, dx$, singularity in real axes, more on using rectangular curves, estimation of sums

References:

1. S. Ponnuswamy, foundation of complex analysis, Narosa publishing house, 1997.
2. S. Lang, Complex Analysis, Addition Wesley, 1997.
3. J. N. Sharma, Functions of a Complex Variable, Krishna Prakashan, 2000.
4. H. A. priestly, introduction to comnplex analysis, Clarendon Press, 1990.
5. J. B. Conway, Functions of one complex variable, Springer- verlag, 1980.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 202: Partial Differential Equations

Syllabus to be offered at M. Sc. Applied Mathematics Sem - II w.e.f. June 2010-11

L	T	P
4	1	0

- Introduction to PDE, Modelling Problems related to PDE.
- General PDE, Classification of PDE -hyperbolic, elliptic and parabolic PDE
- Boundary conditions, well-posed problem, The Cauchy-Kowalewski theorem for existence and uniquness of solutions to PDE
- **Hyperbolic PDE**
    - Scalar first order Partial differential equations, Characteristics, Charpits method, Weak Solutions., Quasi-linear first order equations and quasi-Linear systems of partial differential equations, weak solutions, shocks and refractions, Burgers equation, Non-uniqueness and entropy conditions, Wave equation
- **Elliptic PDE**
    - Solution of Laplace equation using separable variable technique, fundamental solution, Mean value theorem., Strong Maximum Principle, uniqueness and regularity, Energy Methods, Sobolev spaces and Lax-Milgram lemma.
- **Parabolic PDE**
    - Solution of Heat equation using Fourier Transform method, Mean Value Theorem, Maximum Principle, Regularity, Uniqueness., Semigroup approach

References:

1. Strauss W. A: Partial differential equations, An Introduction, Wiley, John and sons 1992.
2. Renardy and Rogers: An introduction to PDE's, Springer-Verlag, 1999.
3. Smoller: Shock Waves and reaction-diffusion equations, second edition, 1994.
4. Kevorkian: Partial Differential equations, Wadsworth and Brooks/ cole
5. F.John: Partial differential equations McGraw-Hill, New-york,

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 203: Functional Analysis

Syllabus to be offered at M. Sc. Applied Mathematics Sem - II w.e.f. June 2010-11

L	T	P
4	1	0

Metric Spaces

Metric space, Examples of Metric Space, Open sets, Closed sets , Neighborhood, Convergence, Cauchy sequence, Completeness, Completion of metric space.

Normed Spaces and Banach Spaces

Vector Space, Normed Space, Banach Space, Properties of Normed spaces, Finite Dimensional normed space and subspaces, Compactness and finite dimension, Linear operators, Bounded and continuous liner operators, Linear functionals, Linear operators and functionals on a Finite dimensional spaces, Normed spaces of operators, Dual spaces

Inner Product Spaces , Hilbert Spaces

Inner Product space, Hilbert space, Properties of Inner product Space, Orthogonal compliments and direct sums, Orthonormal sets and sequences, Series related to orthonormal sequences and sets, Total orthonormal sets and sequences, Representation of functionals on Hilbert spaces, Hilbert adjoint operator, Self adjoint unitary and normal operator.

Fundamental theorems for Normed and Banach spaces

Zorn's Lemma, Hahn – Banach theorem, Hahn – Banach theorem for complex vector spaces and normed spaces, applications to Bounded linear functionals on C [a , b], Adjoint operator, Reflexive spaces, Category theorem and uniform boundedness theorem, Strong an weak convergence, Convergence of sequences of operators and functionals, Weak convergence, Open mapping theorem, Closed linear operators, Closed Graph theorem.

References:

1. E. Kreyszig: Functional Analysis and its application, John Wiley and sons.
2. B.V. Limaye : Functional Analysis ,Wiley Eastern Ltd.
3. G.F. Simmons : Introduction to Topology and Modern Analysis, McGraw - Hill.
4. J.N. Sharma & A Vashistha :Functional Analysis.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 204: Fluid Dynamics

Syllabus to be offered at M. Sc. Applied Mathematics Sem - II w.e.f. June 2010-11

L	T	P
4	1	0

- Vectors and Tensors:
- Flow Kinematics
- Flow descriptions (Lagrangian, Eulerian, Material derivative)
- Motion of Fluid particles(rate of dilation, rate of shear, rate of rotation)
- Conservation Laws
- Reynold's transport theorem
- Conservation of mass
- Conservation of momentum
- Conservation of energy
- Navier-stokes equation
- Non dimensionalization of the Navier-stokes equation
- Special form of conservation laws
- Euler equation for inviscid gas dynamics
- Parabolic boundary condition for N S equation
- Vorticity and Circulation
- The vorticity transport equation and Helmholtz's vorticity.
- Kelvin's circulation theorem.
- Potential equation
- Laplace Equation for irrotational flows
- Incompressible inviscid irrotational flows
- Velocity potential and stream function in 2d and 3d
- Complex velocity potential
- Simple planer flows
- Incompressible Viscous flows
- Boundary layer equations

References:

1. Batchelor G.K.: An Introduction to Fluid Dynamics, Cambridge University Press,1999.
2. Emanuel G: Analytical Fluid Dynamics, CRC Press, Boca Raton, Second Edition, FL, 1999.
3. Panton R.L., Incompressible Flows, Wiley Interscience, 1984
4. Currie I.G.: Fundamental Mechanics of Fluids, McGraw-Hill, New-york, 1993.
5. Chorin: Mathematical introduction to Fluid Mechanics, Springer Verlag, Fourth Edition

AM 205: Modeling & Simulation

Syllabus to be offered at M. Sc. Applied Mathematics Sem - II w.e.f. June 2010-11

L	T	P
4	1	0

- Needs and Techniques of mathematical modeling: Idea of mathematical modeling, need for mathematical modeling, steps in mathematical modeling, Characteristics of mathematical modeling ,Interpretation
- Models in mechanical vibration :Spring mass system, pendulum problems
- Models in population dynamics:One species model, logistic model, growth model in time delays ,Predator-Prey models,Volterra-Lotka models
- Models of chemical processes, Electrical network and Diffusion processes
- Traffic flow models

COMPUTATIONAL MODELING

- Modeling dynamical systems: differential equations and their numerical solution, linear and non–linear dynamics, stability, convergence, attractors.
- Physical systems: System types and characteristics behaviour, Continuous-time,discrete – time and discrete -event systems, linear and non linear systems
- Exploration of behaviour through simulation:

Developing simulations of dynamical systems using Matlab: representation and visualization of simulation experiments, analyzing behavioural characteristics for a range of classes of physical and computational systems eg. Predictor- prey models, evolutionary systems and cellular systems

References:

1. J.N.Kapur: Mathematical modelling ,Wiley eastern Ltd.,1994.
2. M.M. Gibbons : A concrete approach to Mathematical modeling , John Wiley and sons, 1995.
3. H. Neunzert and A.H. Siddiqui: Topics in Industrial Mathematics, Kluwer Academic Publishers, London, 2000
4. P. E. Wellstead : Introduction to Physical system modeling, Academic Press, 1979.
5. Richard Haberman: Mathematical Models, Practice- Hall Inc., NJ, 1979.
6. Jery Banks, John S., Carson II, Barry Nelson and David M.Nicol,:Discrete – Event system simulation , Prentice hall, 2001

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 206: Mathematical Software

Syllabus to be offered at M. Sc. Applied Mathematics Sem - II w.e.f. June 2010-11

L	T	P
4	1	4

Introduction

Introduction to Matlab, variable and array, subarrays, displaying output data, data files operation on array, hierarchy of operation on array, built in function in Matlab

Plotting

Introduction to plotting, graph window, two dimensional plot, multiple plot, components of graph(legend, title,),graphical image, commet, 3D graph, additional plotting features Subplots, polar plots,

Branching statement and program design

The if construct, switch construct, The try-catch construct , relational operators, logic operators, logical functions

Loops

The while loop, The for loop, The break and continue statements, Nesting loops.

User defined function

Introduction to Matlab functions, variable passing in Matlab(pass by value), preserving data between calls to functions, sub functions, private function, nested function

References:

1. Chapman Stephen: Matlab programming for engineers, Thompson learning, 2004.
2. Rudra Pratap: getting started with Matlab, oxford university press, 2004

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM - 301 Theory of Algorithm

Syllabus to be offered at M. Sc. Applied Mathematics Sem - III w.e.f. June 2010-11

L	T	P
4	1	0

- Logic

Propositional and predicate logic, propositions, predicates and quantifiers, quantifier and logical operators, rules of inference, methods of proof and logical verification of computer programs.

- Theory of algorithms

Problems and instances algorithms, characteristics of algorithms, concepts of test data, efficiency of algorithms, theoretical, empirical and hybrid approaches to measure efficiency, time complexity, space complexity, asymptotic notations, solving recurrences using characteristics equations, examples of simple algorithm and their analysis

- Graph theoretic algorithms and computer programs

Recape the concepts and definitions of graph and trees as data structure , some basic algorithms, representation of graphs, breath first search, topological search, heap sort algorithm connectedness and assumptions, Lattice theory, Boolean algebra

- Theory of Computation

Models in computer science, finite state automata, their use and properties, Deterministic finite automata, non deterministic finite automata, regular languages and their unions, finite state transducers, Push down automata, context free languages, turning machine and computing by turing machines.

References:

1.Harry R. Lewis and Christosh H. Papadimitriou. Elements of the theory of computation, Prentice Hall of India. 1996

2.V.Aho,J.E.Hoperoft and J.D. Vilman The design and analysis of Computer algorithms. 1974

3.Thomas H. Cormen Leiserson and Rivest Introduction to algorithm, Prentice Hall of India, 1998

4.Dino Mandrioli, Carlo Ghezzi : Theoretical foundations of computer science, John-Wiley and sons, 1987

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM – 302: Integral Equations

Syllabus to be offered at M. Sc. Applied Mathematics Sem - III w.e.f. June 2010-11

L	T	P
4	1	0

Variational problems with fixed boundary

The concepts of variational parameter, and its properties, variational forms of functional form, function depends on Higher order derivatives, functionals dependent on function of several independent variables, variational problem in parametric forms, application to the problems of mechanics, variational problems leading to an integral equation or differential difference equations, theorem of Dubois'Reymond stochastic calculus of variation,

Variational problem with moving boundary

Functional of the form $I(y(x)) = \int_{x_1}^{x_2} F(x, y, y')dx$, variational problem with a moveable boundary for a functional dependent on two function, one sided variation, reflection and refraction of extremals, diffraction of light rays

Variational problem with subsidiary conditions

Constrains of the form, isoperimetric problems, problems of Mayer & Bolza, equilibrium problem for elastic bodies- castigliano's principle, problems of electro static

References:

1. A. S. Gupta, calculus of variation with applications, prentice-hall India,1997.
2. J. David Logan, applied mathematics, john wiley and sons, 1997.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM - 303: Optimization

Syllabus to be offered at M. Sc. Applied Mathematics Sem - III w.e.f. June 2010-11

L	T	P
4	1	0

- Optimization problems in engineering and industries
- Optimization problem formulation
- Classification of optimization problem
- Classical optimization techniques : Single variable optimization, Multivariable optimization, Constraint optimization, Lagrangain multiplier method, Khun-Tucker conditions
- Single variable optimization techniques:
- Bracketing method - Exchaust search
- Region elimination method - Interval halving method, Golden section method
- Interpolation method - Quadratic interpolation method
- Gradient base methods - Newton-Raphson method, bisection method
- Multivariable optimization techniques:
- Univariate method
- Direct Search method - Simplex search method, Powells conjugate direction method
- Gradient base methods - steepest descent method, conjugate gradient method
- Variable matrix method
- Constraint linear optimization problem
- Overview of linear optimization problem
- Sensitivity analysis
- Quadratic programming - Wolf's modified simplex method, Bailes methods
- Integer programming problem - Gomorys cutting plane method, branch and bound techniques

References:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.
2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.
3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984
4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM – 304 Advanced Functional Analysis

Syllabus to be offered at M. Sc. Applied Mathematics Sem - III w.e.f. June 2010-11

L T P
4-1-0

Fundamental Theorems for Normed and Banach Spaces:

Zorn's Lemma, Hahn-Banach Theorem, Hahn-Banach Theorem for Complex Vector Spaces and Normed Spaces, Application to Bounded Linear Functionals on C[*a,b,*], Adjoint Operator, Reflaxive Spaces, Category Theorem. Uniform Boundedness Theorem, Strong and Weak Convergence, Convergence of Sequences of Operators and Functionals, Application to Summibality of Sequences, Numerical Integration and Weak* Convergence, Open Mapping Theorem, Closed Linear Operators. Closed Graph Theorem,

Further Applications : Approximation Theory:

Approximation in Normed spaces, Uniqueness, Strict Convexity, Uniform Approximation, Chebyshev Polynomials, Approximation in Hilbert Space, Splines,

Spectral Theory of Linear Operators in Normed Spaces:

Spectral Theory in Finite Dimensional Normed Spaces, Basic Concepts, Spectral Properties of Bounded Linear Operators, Further Properties of Resolvent and Spectrum, Use of Complex Analysis in Spectral Theory, Banach Algebras, Further Properties of Banach Algebras.

References:

1. Kreyszig E. : Introductory Functional Analysis with applications, Wiley India, 2006
2. Simmons G. F. : Introduction to Topology and Modern Analysis. McGraw Hill
3. Siddiqui A. H. : Functional Analysis, P.H.I.
4. Sudarshan Nanda : Functional Analysis, Wiley Eastern Pvt. Ltd.
5. Day M.M. : Normed Linear spaces, Springer
6. Limaye B.V. : Functional Analysis, New Age International Pvt. Ltd.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM - 305: Computational Fluid Dynamics

Syllabus to be offered at M. Sc. Applied Mathematics Sem - III w.e.f. June 2010-11

L	T	P
4	1	0

- Introduction to CFD, Applications;
- Governing equations and assumptions, Equation types, Model equations, potential flow, Heat conduction, Wave equation, Burgers equation, Euler equations.
- Finite Differences, Algorithms, Errors and Accuracy, Consistency, Stability and Convergence, Finite Volumes, Explicit algorithms, Implicit algorithms, Numerical boundary conditions, Method of lines, Shock Jump Relations, Shock capturing.
- One dimensional Euler equations, Lax – Wendroff Scheme, Mc-Cormack Scheme, Implicit - method, Pseudo One Dimensional Euler Equations, boundary conditions, Flux – Splitting, Artificial viscosity, Flux limiters.
- Multidimensional Euler equations, Lax- Wendroff and Mc-Cormack schemes, stability of multidimensional schemes, Operator splitting Implicit algorithms, Beam - Warming algorithm.
- Practicals : Numerical methods for discretizing fluid flow equations: Finite differences, finite element and finite volume method.

References:

1. R. J. Leveque: Numerical methods for conservation Laws, Birkhauser Verlag, Basel, 1992.
2. J. D. Anderson: Computation Fluid dynamics, Mc-Graw – Hill, New York, 1995.
3. H. K. Versteeg and W. Malasekera: An Introduction to Computational Fluid Dynamics: The finite volume method, Longman Scinetific and technical Essex, England, 1995.
4. J. Chorin and J. E. Marsden: A Mathematical Introduction to Fluid Mechanics
5. P. D. Lax: hyperbolic systems of conservation laws and mathematical theory of shock waves, 1973.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM - 306: Applied Statistics

Syllabus to be offered at M. Sc. Applied Mathematics Sem - III w.e.f. June 2010-11

L	T	P
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- **Probability :**

Basic concepts, Sample space, Discrete probability ,Simple theorems on probability, Independence of events, Bayes theorem. Discrete and continuos random variable, Binomial, Poisson and Normal distributions, expectation and moments, Chebyshev's inequality, central limit theorem.

- **Statistics:**

Data analysis , measures of central tendency, measures of dispersions, curve fitting, regression, correlation, chi-square test of goodness of fit, contingency tables, confidence interval for mean , variance. One population case, two population case, testing of hypotheses, small samples and large samples, sampling techniques, Simple random sampling with and without replacement, stratified sampling.

control charts for variables and attributes, acceptance sampling by attributes, simple, double and sequential sampling plans, Design of experiments

Stochastic processes:

Markov chains with finite and countable state space, classification of states, limiting behavior of n-step transition probabilities, Continuos Markov process.

References:

1. Berry and Lindgren: Statistics theory and methods , second edition, Duxburg, Boston, 1996

2. Hastings: Probability and statistics, Addision Wesley Longman, Boston, 1997.

3. Hogg and Tannis: Probability and Statistical inference, sixth edition, Prentice-Hall, Upper Suddle River, New Jersey, 2000

4 S.C.Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan chand and sons, 2000

5. S.,P.Gorden and F.S. Gorden: Contemporary Statistics, a computer approach, 1994

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM - 401 Image Processing

Syllabus to be offered at M. Sc. Applied Mathematics Sem - IV w.e.f. June 2010-11

L	T	P
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Introduction

Fundamentals of Image Processing, Applications of Image Processing, Automatic Visual Inspection System, Remotely Sensed Scene Interpretation, Biomedical Imaging Techniques, Defense surveillance, Content-Based Image Retrieval, Moving-Object Tracking, Image and Video Compression, Human Visual Perception, Human Eyes, Neural Aspects of the Visual Sense, Components of an Image Processing System, Digital Camera

Image Formations and Representation

Introduction, Image formation, Illumination, Reflectance Models, Point Spread Function, Sampling and Quantization, Image Sampling, Image Quantization, Binary Image, Geometric Properties, Chain code representation of a binary object, Three-Dimensional Imaging, Stereo Images, Range Image Aquisition, Image file formats

Colors and Color Imagery

Introduction, Perception of Colors, Color Space Quantization and Just Noticeable Difference, Color Space and Transformation, CMYK, NTSC or YIQ Color, YCbCr Color, Perceptually Uniform Color, CIELAB color, Color Interpolation or Demosaicing, Nonadaptive Color Interpolation Algorithms, Adaptive algorithms, A Novel Adaptive Color Interpolation Algorithm,

Image Transformations

Introduction, Fourier Transforms, One-Dimensional Fourier Transform, Two-Dimensional Fourier Transform, Discrete Fourier Transform (DFT), Transformation Kernels, Matrix Form Representation, Properties, Fast Fourier Transform, Discrete Cosine Transform, Walsh-Hadamard Transform (WHT), Karhaunen-Loeve Transform or Principal Component Analysis, Covariance Matrix, Eigenvectors and Eigenvalues, Principal Component Analysis, Singular Value Decomposition

References:

1. Tinku Acharya & Ajoy K. Ray, ‘Image Processing ,Principles and Applications’ WILEY- INTERSCIENCE
2. Gonzalez & Woods, “Digital image processing” Pearson Eduction second edition

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM - 402 Wavelet Analysis

Syllabus to be offered at M. Sc. Applied Mathematics Sem - IV w.e.f. June 2010-11

L	T	P
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- From Fourier Analysis to Wavelet analysis
- Time Frequency Analysis
- Continuous Wavelet Transform
- Discretizing the Wavelet Transform
- Frames
- Frames of Wavelets
- A necessary condition (Admissibility of the mother wavelet)
- The dual frame
- Examples of Tight frames, The Mexican hat function, a modulated Gaussian
- Frames for the Windowed Fourier transform
- Time-Frequency Density
- Orthonormal Wavelet bases
- Multi Resolution Analysis
- Riesz bases of scaling function
- The Battle-Lemaire waveltes
- Regularity of Orthonormal wavelet bases
- Orthonormal Bases of Compactly Supported Wavelets with Examples
- Regularity of Compactly Supported Wavelets
-

References:

1. Ingrid Daubechies: Ten Lectures on Wavelets, OBMS-NSF SIAM, Philadelphia, 1992.

2. Charles K. Chui An introduction to wavelets, Academic Press, 1992

3. G. Kaiser, Friendly Guide to wavelets, Birkhauser Boston 1994.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 403: Digital Signal Processing

Syllabus to be offered at M. Sc. Applied Mathematics Sem - IV w.e.f. June 2010-11

L	T	P
4	1	0

INTRODUCTION:

DISCRETE-TIME SIGNALS AND SYSTEMS:

Introduction, Discrete-Time Signals: Sequences, Discrete-Time systems, Linear Time-Invariant Systems, Properties of Linear Time-Invariant Systems, Linear Constant-Coefficient Difference Equations, Frequency-Domain Representation of Discrete-Time Signals and Systems, Representation of Sequences by Fourier Transforms, Symmetry Properties of the Fourier Transform, Fourier Transform Theorems, Discrete-Time Random Signals.

THE Z-TRANSFORM:

Introduction, Z-Transform, Properties of the Region of Convergence for the Z-Transform, The Inverse Z-Transform, Z-Transform Properties.

SAMPLING OF CONTINUOUS - TIME SIGNALS:

Introduction, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of a Bandlimited Signal from its Samples, Discrete-Time Processing of Continuous-Time Signals, Continuous-Time Processing of Discrete-Time Signals, Changing the Sampling Rate Using Discrete-Time Processing, Multirate Signal Processing, Digital Processing of Analog Signals, Oversampling and Noise Shaping in A/D and D/A Conversion.

TRANSFORM ANALYSIS OF LINEAR TIME-INVARIANT SYSTEMS:

Introduction, The Frequency Response of LTI Systems, System Functions for Systems Characterized by Linear constant-coefficient Difference Equations, Frequency Response for Rational System Functions, Relationship between Magnitude and Phase, All-Pass Systems, Minimum Phase Systems, Linear Systems with Generalized Linear Phase.

References:

1. oppenheim A. V., Schafer & Buck “Discrete Time Signal Processing” Pearson education 2006
2. crochiere & rabiner “multirate Digital Signal Processing” Pearson education 2006
3. oppenheim A. V., Schafer, “Digital Signal Processing” Pearson education 2006

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 404: Fuzzy Modeling

Syllabus to be offered at M. Sc. Applied Mathematics Sem - IV w.e.f. June 2010-11

L	T	P
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Introduction:

Basic concepts of Fuzzy sets theory, Basic concepts of Fuzzy subsets, operations on fuzzy sets, fuzzy relationship, the extension principle and Fuzzy arithmetic, measures of fuzziness

Aggregation Operations on fuzzy sets

Intersection and union of fuzzy sets, weighted union and intersections, nonmonotonic fuzzy operations, mean aggregation operators, ordered weighted averaging operators, fuzzy measures and integrals

The theory of approximating reasoning

Primary elements of the AR system, semantics of the AR system, Deduction in AR, minimal solution and projections, binary logic in AR, functional representations

Introduction to fuzzy logic control

Besic concepts, basic reasoning algorithm, on the relationship to PI, PD, and PID control, design of FLC, extension of the FLC

Fuzzy system models

Linguistic models as a tool for complex systems representation, general framework for inference from a fuzzy model, constructive linguistic models and destructive linguistic models, problem of defuzzification, multiple variable linguistic model, Models of dynamical systems, quasilinear and quasinonlinear fuzzy models

References:

1. Yager R.R. and Filev D.P., “Essentials of fuzzy modeling and control” Wiley New York
2. Zimmermann H.J.,“Fuzzy set theory and its applications” Allied Publication
3. Klir. G.K. & Yuan B., “Fuzzy sets and logic” Prentice Hall of india New Delhi 1995

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 405: Advanced Optimization

Syllabus to be offered at M. Sc. Applied Mathematics Sem - IV w.e.f. June 2010-11

L	T	P
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- General Constraint optimization problem:
- Direct search method
- Random search method
- Complex search method
- Montc Carlo method
- Penelty function method(Interior and Exterior)
- Sequential linear Programming techniques(Frank-Wolfe method)
- Feasible direction methods-Gradient projection method
- Augmented Lagrangian method
- Non traditional optimization algorithms
- Genetic algorithms
- Simulated annealing methods
- Multistage optimization problems
- Dynamic programming problems techniques
- Project scheduling problems : bar charts, mile stone charts, Fulkerson's rule, Critical Path Method(CPM), project evaluation and review techniques (PERT)

References:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.
2. S.D. Sharma: Operations Research, Kedar Nath, Ram Nath & Co.
3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984
4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm
5. H.A. Taha :Operation research an Introduction
6. Kalyanmoy Deb : Optimization for Engineering Design, Algorithms and
7. Examples Prentice-Hall of New Delhi, India, 2000
8. Srinath L.S.:PERT and CPM : Principles and Applucations ,2nd edition ,1975.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

AM 406: Practical based on Matlab

Syllabus to be offered at M. Sc. Applied Mathematics Sem - IV w.e.f. June 2010-11

L	T	P
0	1	4

- **Practical based on Image processing using Matlab**
- **Practical based on Wavelet using Matlab**
- **Practical based on Digital Signal Processing using Matlab**

References:

1. Chapman Stephen: Matlab programming for engineers, Thompson learning, 2004.
2. krishnamurthy E. V. and Sen S. K. “Programming in Matlab” East – West Press 2003
3. Rudra Pratap: getting started with Matlab, oxford university press, 2004