Department of Mathematics

Veer Narmad South Gujarat University, Surat

2 – Year Postgraduate Course in M. Sc. (Applied Mathematics)

ADMISSION CRITERIA & PROCEDURE

1. **As Per University Norms**

Eligibility for admission

Candidate desirous to take admission in two years course of M.Sc. applied mathematics must have passed graduation Examination from any recognized university and must have opted mathematics as a principle subject

Fees Structure

(a) Rs. 5000/- (per term) Higher payment

(b) Rs. 700/- (Approx.) university regular fees including P.G. enrollment

(c) Rs. 500/- (refundable) Library caution Money

MAXIMUM INTAKE

1. Total number of seats for admission in the programme will be 30
2. Admission will be confirmed only by paying the prescribed fees.

COURSE DURATION

1. The total course consists of 2 years.
2. In each academic year teaching (including practical) will be imparted.
3. In both the year, there will be 6 theory and one practical course work, each of 100 marks.
4. in practical in both the years, general Viva of 30 marks will be compulsory.

YEAR WISE TEACHING AND EXAMINATION BREAK UP

As per university rules and regulation

EVALUATION

As Per University Criteria

STANDARD OF PASSING/CLASS

As per University criteria

1. Theory Papers

   A student has to secure at least 40 % marks in each theory paper to pass the subject, (i.e. Each Paper is a separate Head of passing).

2. Practical Subjects

   To pass the practical Examination a student must secure 40 % marks in each practical (practical work &. viva-voce).

3. A student will be declared pass in a year, if he/she passes in all the theory and practical papers of that Year.

4. Passing standard in General viva is 40 %.

5. A student will be awarded degree of M. Sc. only after passing all the Examinations including theory/practical/ General Viva.

6. Classes shall be awarded at the end of the year on the basis of

   (A) Aggregate of marks obtained by the candidate in the external evaluations of that particular year.

   (B) Aggregate of marks (Internal and External) obtained by candidate in the year Examinations of that particular year.

7. Students will be allowed to join next higher year only after he/she clears the lower year.

MARKING SCHEME

External Examination of 70 marks and the internal Examination of 30 marks for each theory and practical

Tentative Proposed Teaching Scheme

Year – I

Subject code	Subject	Scheme of Teaching				Scheme of Examination				
		L	T	P	Total	Th.		Pr.		Total
						Int.	Ext.	Int.	Ext.	
AM-101	Real & complex Analysis	4	1	--	5	30	70	--	--	100
AM-102	Ordinary differential equation	4	1	--	5	30	70	--	--	100
AM-103	Applied linear algebra	4	1	--	5	30	70	--	--	100
AM-104	Functional analysis	4	1	--	5	30	70	--	--	100
AM-105	Numerical analysis	4	1	--	5	30	70	--	--	100
AM-106	Basic fluid dynamics	4	1	--	5	30	70	--	--	100
AM-107	Practical Using Matlab	--		4	4	--	--	30	70	100
	Total	24	6	4	34	180	420	30	70	700

Year – II

Subject code	Subject	Scheme of Teaching				Scheme of Examination				
		L	T	P	Total	Th.		Pr.		Total
						Int.	Ext.	Int.	Ext.	
AM-201	Partial differential equation	4	1	--	5	30	70	--	--	100
AM-202	Mathematical modeling of dynamical system	4	1	--	5	30	70	--	--	100
AM-203	Digital image processing and discrete – time signal processing	4	1	--	5	30	70	--	--	100
AM-204	Neural network and fuzzy logic	4	1	--	5	30	70	--	--	100
AM-205	Optimization technique	4	1	--	5	30	70	--	--	100
AM-206	Mathematical physics	4	1	--	5	30	70	--	--	100
AM-207	Practical	--		4	4	--	--	30	70	100
	Total	24	6	4	34	180	420	30	70	700

AM - 101: Real & Complex Analysis

L	P	T	Total
4	0	1	5

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, Little wood'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, Lebesgue Convergence Theorem, Monotone Convergence Theorem, Fatau's Lemma, Generalised Lebesgue Convergence Theorem

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, Signed Measures, The L^p – Spaces, Summable Series

Basic Of Complex Numbers:

Analytic Functions:
Functions, Limits and Continuity, Differentiability Power Series as an Analytic Function, Exponential and Trigonometric 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, Analytic 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. 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.
6. S. Ponnuswamy, Foundation of Complex Analysis, Narosa Publishing House, 1997.
7. S. Lang, Complex Analysis, Addition Wesley, 1997.

AM - 102: Ordinary Differential Equation

L	P	T	Total
4	0	1	5

Basic concepts

Definition and terminology, linear and non-linear differential equations, solution of differential equation, foundation of differential equation

Differential Equation of first order

Equations of first order but not of the first degree

Application of first order differential equation

Higher order linear differential equation

Solution of homogeneous linear Differential equations of order n with constant coefficient, Solution of non-homogeneous linear Differential equations with constant coefficient by means of polynomial Operator, Application of higher order differential equation

System of liner differential equation and their application

Definition and solution, solution of system of liner equations with constant coefficient, an equilateral Triangular system, some application, motion of a projectile, central force system, newton's law of gravitational, vibration of coupled system, multiple loop electric circuit**,**

Reference:

1. Zafar Ahsan, "Differential Equaiton and Their applications" PHI
2. Deo S. G., Lakshmikanthan V., Raghvendra V.. Ordinary Differential Equations. "Tata Me Graw Hill.
3. Shair Ahmad, Rama Mohan Rao, Ordinary Differential Equations, East-Wast Press Private Limited.
4. E. A. Coddinglon. An Introduction To Ordinary Differential Equations, Prentice Hall Of India.

5. E. D. Rainville. P. E. Bendrant & R. E. Bendrant. Elementary Differential Equations. Prentice Hall Of India.

AM-103: Applied Linear Algebra

L	P	T	Total
4	0	1	5

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 parseval Identity Gram-Schmidt Process QR Factorization, Approximation And Orthogonal Projection problems, Equivalence Of The Problems, Normal Equations Projection Operators, Orthogonal Complements, Applications To An Approximations And Matrix Theory Fredholm Alternative Theorem, 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, Theoretical Computation Using Determents, Property Of The Characteristic Polynomial, Geometric And Algebraic 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, Minimal Polynomial, First Order Matrix Differential Operator, Decoupling The Differential Equation, Estimates Of Eigen Values, Gershgorin's Theorem

Normal Operators

Adjoint And Classification Of An Operator, Spectral Theorem, Application To Matrix Theory, Extremum Principles For Hermition Operators, Power Method, Inverse Power Method

References:

1. J. T. Scheick, Linear Algebra with Application, Mc- Hill International Addition, 1997.
2. S. Biswas Matrix Algebra, New Age Ii Edition 1997.
3. A. R. Rao Linear Algebra Tata – Mc-Graw-Hill 1996.

AM – 104: Functional Analysis

L	P	T	Total
4	0	1	5

Pre-Requisite

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.

Banach Fixed Point Theorem and Its Applications.

Banach Fixed Point Theorem, Application Of Banach Theorem To Linear Equations, Application Of Banach Theorem To Differential Equations, Application Of Banach Theorem To Integral Equations,

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.

AM – 105 Numerical Analysis

L	P	T	Total
4	0	1	5

Errors in numerical computation

Solution of algebraic and Transcendental equation

Curve fitting: Least square, b-spline

Numerical differentiation and Integration

Matrix and linear system of equations

LU and cholesky factorization

Algebraic Eigen value problem, properties of eigen values, eigen vectors, power method, inverse power method, given's method,

Numerical solution of Ordinary Differential equation

Numerical solution of partial differential equations

Reference:

1. S.S. Sastry Introductory Methods of numerical Analysis, forth addition, PHI
2. S. balachandra Rao, c. K. Shantha, Numerical methods with Programes in Basic, Fortran,University Press.,
3. M.K.Jain, Numerical analysis for scientists and Engineers, New Age International Ltd.
4. C. E. Froberg, Introduction to numerical analysis, Addison Wesley Publishing com. Sixth Ed.

AM-106 Basic Fluid Dynamics

L	P	T	Total
4	0	1	5

Introduction

General description of fluid mechanics, fluid properties, regimes in the mechanics of fluid

Fluid Static and Relative Motion of Liquids

Fluid Static, fundamental equation of fluid statics, application of hydrostatics equation, application of aerostatic equation, forces on submerged surfaces, hydrostatics Lift- buoyancy, stability of submerged and floating bodies, relative motion of fluids, uniform translation acceleration, uniform rotation.

Kinematics of Fluid

Method of describing of fluid motion, translation, rotation and rate of deformation, stream lines, path lines, streak lines, the material derivative and acceleration, vortices.

General Theory of Stress And Strain

Nature of stresses, Transformation of stress component, Nature of strain, Transformations of strain, Relation between stress and strain.

Fundamental Equation of Flow of Viscous Compressible Fluids.

The equation of continuity, equation of motion, the energy equation, the equation of state, the fundamental equation of cylindrical coordinate, the fundamental equation of spherical coordinate

Reference:

1. S.W.Yuan, Foundation of Fluid Mechanics,
2. William S.J. Introduction to Fluid Mechanics
3. Batchlor G. K., An Introduction to Fluid Dynamics, Cambridge University Press.

AM-107 Practical Using Matlab

L	P	T	Total
0	4	1	5

- Basic Features :
- Variables, Comments, Punctuations, Matlab Workspace, Simple Math, Complex Numbers, Mathematical Functions.
- Script M-Files :

Files And Directory Management, File I/O Arrays And Array Operation, Relational And Logical Operations, Set, Bit And Base Conversion Function, Character Strings, String Function, Time Functions, Cell Arrays And Structures.

- Control Structures : For Loops, While Loops, If-Else-End, Switch-Case Statements, Function M-Files, Command Function Duality, Inline Functions, Debugging Tools.
- Numerical Linear Algebra :

System Of Linear Equations, Matrix Functions, Sparse And Special Matrices

- Polynomials :

Roots, Operators On Polynomials

- Object Oriented Programming
- 2-D And 3-D Graphics

Reference:

1. Rudra Pratap: Getting Started With Matlab, Saunders,1996.
2. Desmond J. Higham And Nicolas J. Higham: Matlab Guide, Siam, 2000.

3. Duane Hanselman And Bruce Littlefield: Mastering Matlab-6: A Comprehensive Tutorial and Reference, Prentice Hall, 2001.

4. Delores M. Etter: Engineering Problem Solving With Matlab, Prentice Hall, 1993.