VEER NARMAD SOUTH GUJARAT UNIVERSITY

Tentative Teaching Scheme

Semester – I

Subject code	Subject	Scheme of Teaching				Scheme of Examination		
		L	T	P	Total	Th. (Ex + In)	Pr. (Ex + In)	Total (Ex + In)
M-101	Algebra	4	1	--	5	100 (70+30)	--	100 (70+30)
M-102	Real Analysis	4	1	--	5	100 (70+30)	--	100 (70+30)
M-103	Complex analysis	4	1	--	5	100 (70+30)	--	100 (70+30)
M-104	Ordinary differential equation	4	1	--	5	100 (70+30)	--	100 (70+30)
M-105	Topology	4	1	--	5	100 (70+30)	--	100 (70+30)
	Total	20	5	--	25	500	--	500

Semester – II

Subject code	Subject	Scheme of Teaching				Scheme of Examination		
		L	T	P	Total	Th. (Ex + In)	Pr. (Ex + In)	Total (Ex + In)
M-201	Functional analysis	4	1	--	5	100 (70+30)	--	100 (70+30)
M-202	Numerical Analysis	4	1	--	5	100 (70+30)	--	100 (70+30)
M-203	Programming in C/C++ &Mathematical Software	4	1	4	5	70 (42+28)	30 (18+12)	100 (70+30)
M-204	Partial differential equation	4	1	--	5	100 (70+30)	--	100 (70+30)
M-205	Mechanics	4	1	--	5	100 (70+30)	--	150 (70+30)
	Total	20	5	4	29	470	30	500

M - 101: Algebra

L	P	T	Total
4	0	1	5

Normal group
Conjugacy and G-sets

Normal Series and Conjugacy and G.Sets:
Normal series, solvable groups, Nilpatent groups.

Permutation Groups :
Cyclic decomposition, Alternating group A_n, Simplicity of An.

Structure Theorems of Groups:
Direct Products, Finitely generated abelian groups, Invariants of finite abelian group, Sylow theorems, Groups of orders P^2 & pq.

Modules and Vector Spaces:
Definitions and examples, submodules and direct sums, R-hommomorphisms and quotient modules, completely reducible modules

Noetherian and Artinian Modules and Rings:
Hom_R ($\oplus$Mi, $\oplus$Mi), Noetherlan and artinian modules

References:

1. Bhattacharya P. B. Basic Abstract Algebra, 2nd Edition Cambridge University Press, 1995.
2. Artin M. Algebra, Prentice Hall, Englewoodcliffs NJ,. 1991.
3. Chon P.N. Algebra Vol. I & Ii, John Wiley 1974.

M - 102: Real Analysis

L	P	T	Total
4	0	1	5

Prerequisite
Algebra of a Sets, Sigma Algebra of Sets, Borel Sets.

Lebesgue Measure
Introduction, Outer Measure, Measurable Sets and Lebesgue Measure, Non Measurable Sets, Measurable Function, Littlewood's Three Principles.

Lebesgue 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.

Measure and Integration
Measures Spaces, Measurable Functions, Integrations, Signed Measures, The L^p – Spaces, Holder's - Minkowsky's & swertz inequality.

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.

M - 103: Complex Analysis

L	P	T	Total
4	0	1	5

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, 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. 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.

M - 104: Ordinary Differential Equation

L	P	T	Total
4	0	1	5

Basic Concepts and Linear Equations of the First Order:

Introduction, How Differential Equations Arise, Classification, Initial And Boundary Value Problems, Definition Of Solutions, Purpose Of Theoretical Considerations,

Linear Differential Equations of Higher Order.

Higher Order Equations, a Modeling Problem, Linear Indepence, Equation with Constant Coefficients, Equation with Variable Coefficients, Wronskian, Variation of Parameters, Some Standard Methods.

System of Linear Differential Equations:

Introduction, System of First Order Equation, Model for Arms Competition between two Nations, Existence and Uniqueness Theorem, Fundamental Matrix, Non-Homogeneous Linear System, Linear Systems With Constant Coefficients, System With Periodic Coefficients.

Existence and Uniqueness of Solutions:

Introduction, Preliminaries, Successive Approximations, Picard's Theorem, Some Examples, Continuation And Dependence on Initial Conditions, Existence of Solutions, Existence and Uniqueness of Solutions of Systems.

Reference:

1. Deo S. G., Lakshmikanthan V., Raghvendra V.. Ordinary Differential Equations. "Tata McGraw Hill.
2. Shair Ahmad, Rama Mohan Rao, Ordinary Differential Equations, East-Wast Press Private Limited.
3. E. A. Coddinglon. An Introduction to Ordinary Differential Equations, Prentice Hall of India.
4. E. D. Rainville. P. E. Bendrant & R. E. Bendrant. Elementary Differential Equations. Prentice Hall Of India.
5. Deo S.G.,Raghvendra V,Ordinary Differential Equation And Stability Theorem, Tata Mc Graw Hill.

M – 105: Topology

L	P	T	Total
4	0	1	5

Topological Spaces,

Topological Spaces Definitions and Examples. Open Sets and Closed Sets and Their Properties Including Interior Points, Limit Points, Boundary Points, Open Bases and Open Subbases, First and Second Countable Spaces. Continuous Mappings, Homeomorphism.

Compactness and Connectedness

Compact Spaces and their Properties, Heine Borel's Theorem, Product of Spaces and Tychonol'f S Theorem. Compactness of Metric Spaces, Sequentially Compact Spaces

Separation

T_1 Spaces, Housdorff Spaces. Completely Regular Spaces, Normal Spaces, Connected Spaces. Connectedness of Real Line **R,** Properties of Connected Spaces

References:

1. George F. Simmons - Topology and Modern Analvsis. McGraw Hill.
2. James Mapkres -- Topology (a First Course).Printice Hall.
3. V Dugundju -Topology.
4. I. M. Murdeshwar - General Topology. Second Edition.
5. J. L Kelley, General Topology. Van Nostrond Princeton N.J.

M - 201: 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.

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.

M - 202: Numerical Analysis

L	P	T	Total
4	0	1	5

- Computer Arithmetic: Floating point numbers and round off errors, Absolute and relative errors.
- Polynomial Interpolation: Hermite's interpolation formula with error analysis, splines and spline interpolation.
- Numerical differentiation, Gaussian quadrature, Romberg integration.
- Solution of system of Linear equations: Matrix inversion, Jordan's method, Escalator method and iterative method, 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).
- 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
- Approximation:
- 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

Reference Books:

1. S.S. Sastri: Introductory Methods of Numerical Analysis, Prentice Hall of India, New Delhi, 1997.
2. M.K. Jain: Numerical analysis for scientists and Engineers,New Age International Ltd. Publishing, 1992
3. E.V. Krishnamurthy and S.K.Sen: Computer based numerical Algorithms, East – West press Pvt. Ltd. 1976

M - 203: Programming in C/ C^{++} & Mathematical Software

L	P	T	Total
4	4	1	9

Introduction to the Operating Systems

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

Matlab

- 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.
- 2-D And 3-D Graphics

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
6. Getting Started with Matlab 7 - Rudra Pratap - OX
7. Matlab programming for Engineers - Stephen J. chapman - Thomson Learning

M - 204: Partial Differential Equation

L	P	T	Total
4	0	1	5

- Basic Definition

First Order Equations

- The Cauchy Problem for Quasi-Linear Equations
- Week Solution for Quasi-Linear Equations
- General Nonlinear Equations

Principles For Higher – Order Equations

- The Cauchy Problem
- Second Order Equations in Two Variables
- Linear Equations and Generalized Solutions

The Wave Equations

- The One Dimensional Wave Equations
- Application to the Cauchy Problem
- The three Dimensional Wave Equation
- Energy Methods

The Laplace Equation

- Introduction to Laplace Equations
- Potential Theory and Greens Functions
- Existence Theory
- Eigen Values of The Laplacian

The Heat Equations

- The Heat Equation in a Bounded Domain
- The Pure Initial Value Problem
- Regularity and Similarity
- Application to Fluid Dynamics

References:

1. R.C. Mcoweon – Partial Differential Equations Methods and Applications. Pearson Equation
2. I.N. Sneddon – Elements of Parital Differential Equation. McGraw Hill Co.
3. Phoolen Prasad - Partial Differential Equations. Willey Eastern Ltd.

M - 205: Mechanics

L	P	T	Total
4	0	1	5

- General Principles
- Kinematics of Particles
- Kinematics of Rigid Bodies
- Dynamics of Particles
- Dynamics of Rigid Bodies
- Work and Energy Methods Applied to Particles
- Work and Energy Methods Applied to Rigid Bodies
- Impulse and Momentum Applied to Rigid Bodies
- Impulse and Momentum Applied to Particles
- Mechanical Vibrations
- Langrangian and Hamiltonian Dynamics
- Hamilton – Jacoby Theory, Action – Angle Variables.

References:

1. F. Chorlton: Text Books of Dynamics.
2. H.Goldstein: Classical Mechanics.
3. R. G. Takwali & P.S. Puranik: Introduction to Classical Mechanics.
4. Marion Andthronton: Classical Dynamics of Particles and Systems