Re-Accredited by NAAC with 'A' Grade
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન ગણિતશાસ્ત્ર વિષય ચલાવતી અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓને તથા ડિપાર્ટમેન્ટના વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૦ થી અમલમાં આવનાર M.Sc. Sem-I, II,III,IV (Mathematics)નાં અભ્યાસક્રમ બનાવવા બાબતે ચર્ચા કરતા ગણિતશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા.૦૫/૧૦/૨૦૧૯ નાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીચે મુજબ ભલામણ કરેલ છે. જે ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલે તેની તા.૩૦/૬/૨૦૨૦ ની સભાના ઠરાવ **ક્રમાંકઃ૩૦** અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

ગણિતશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા.૦૫/૧૦/૨૦૧૯ નાં ઠરાવ ક્રમાંકઃ ૨

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૦ થી અમલમાં આવનાર M.Sc. Mathematics Sem-I, II, III, IV નો અભ્યાસક્રમને UGC Guideline પ્રમાણે Unit wise તૈયાર કરેલ અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૩૦/૦૬/૨૦૨૦ ની સભાનાં ઠરાવ ક્રમાંકઃ ૩૦

:: આથી ઠરાવવામાં આવે છે કે, ગણિતશાસ્ત્ર વિષયની અભ્યાસસમિતિએ તેની તા.૦૫/૧૦/૨૦૧૯ ની સભાના ઠરાવ ક્રમાંક : ૨ અન્વયે ભલામણ કરેલ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ મંજૂર કરેલશૈક્ષણિક વર્ષ ૨૦૨૦ થી અમલમાં આવનાર M.Sc. Mathematics Sem-I, II, III, IV નો UGC Guideline પ્રમાણે Unit wise તૈયાર કરેલ અભ્યાસક્રમ મંજૂર કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંક : એકે./પરિપત્ર/૫૮૦૭/૨૦૨૦
તા. ૧૫–૦૭–૨૦૨૦

R-B P.K
ઈ.ચા. કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન ગણિતશાસ્ત્ર વિષય ચલાવતી અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટનાં વડાશ્રી.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - I
Effective from June 2020
PGMTH-101: Real Analysis – I

L: T: P
4 0 0

UNIT-1

Sequence of functions, Series of functions, Uniform Convergence, Uniform Convergence and Continuity.

UNIT-2

Uniform Convergence and Integration, Uniform Convergence and Differentiation, Equicontinuous families of Functions, The Stone-Weierstrass theorem.

UNIT-3

Algebra of sets, σ Algebra, the extended real numbers, Open and closed sets of real numbers, Borel sets, Outer measure, Measurable sets and Lebesgue measure.

UNIT-4

A non-measurable sets, Measurable function, Littlewoods's three principles.

References:

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER – I
Effective from June 2020
PGMTH-102: Complex Analysis – I

L: T: P
4 0 0

UNIT-1

Complex Numbers, Triangle Inequality and its Applications, Polar and Exponential forms, Powers and Roots, Region in the Complex Plane, Extended Complex Plane.

UNIT-2

Functions of a Complex variables, Limits, Continuity, Differentiability, Cauchy-Riemann Equations, Analytic functions, Harmonic functions.

UNIT-3

Exponential function, Trigonometric functions, Hyperbolic functions, Multi valued function and its branches, Logarithmic function, Complex Exponents, Inverse Trigonometric and Hyperbolic functions.

UNIT-4

Contour Integral, Primitives, Cauchy-Goursat Theorem, Extension of Cauchy-Goursat Theorem, Winding Number, Cauchy Integral formula, Consequences of Cauchy Integral formula, Concept of Maximum Moduli of functions.

References:

1. H. S. Kasana: "Complex Variables – Theory and Applications", 2nd Edition (2006), PHI, N. Delhi.
2. J. N. Sharma:"Functions of a Complex Variable", Krishna Prakashan, 2000.
3. S. Ponnuswamy: "Foundation of Complex Analysis", Narosa Publishing House, 1997.
4. S. Lang:"Complex Analysis", Addition Wesley, 1997.
5. H. A. Priestly: "Introduction to Complex Analysis", Clarendon Press, 1990.
6. J. B. Conway:"Functions of one Complex Variable", Springer-Verlag, 1980.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - I
Effective from June 2020
PGMTH-103: Topology – I

L: T: P
4 0 0

UNIT-1

Topological Space, Relative Topology, Continuity and Homeomorphism, Metrizable space, Open and Closed sets, Closure of a set, Neighborhood of a point, Isolated point, limit point, Derived set, Interior of a set, Boundary of a set, Perfect set.

UNIT-2

Dense and Nowhere dense sets, Open Base and Open sub-base, First and second countable spaces, Lindelof's theorem, Separable spaces, Weak topologies.

UNIT-3

Compact spaces: Cover, Sub-cover, open cover, Basic and sub-basic open cover, countable open cover, Continuity and Compactness, Finite intersection property, Heine-Borel theorem, Product of Spaces, Projection mappings and its continuity, Open and closed sub-base for product space.

UNIT-4

Tychonoff's theorem, Generalized Heine-Borel theorem, locally compact space, Compactness for metric spaces: Sequentially Compact Metric Space, Bolzano-Weierstrass Property (BWP), Totally bounded Space, Ascoli's theorem.

References:

1. George F. Simmons:"Introduction to Topology and Modern Analysis", McGraw-Hill Book Co., 1963.
2. James R. Munkres:"Topology : A First Course", Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
3. J. Dugundji: "Topology", Allyn and Bacon, 1966 (Reprinted in India by Prentice Hall of India Pvt. Ltd.).
4. K. D. Joshi:"Introduction to General Topology", Wiley Eastern Ltd., 1983.
5. J. Hocking and G. Young:"Topology", Addison-Wesley, Reading, 1961.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - I
Effective from June 2020
PGMTH – 104: Abstract Algebra – I

L: T: P
4 0 0

UNIT-1

Group Theory: Conjugate of an element, class equation, and Cauchy theorem, Sylow's theorem, Direct Products, Fundamental theorem of Finite Abelian Groups.

UNIT-2

Ring Theory: Primitive polynomials, Guass's lemma, the Eisenstein criterion, polynomial rings over commutative rings, unique factorization domain.

UNIT-3

Modules: Modules, sub-modules, finitely generated module, Direct sum of sub-modules, Homomorphism and quotient modules, Fundamental theorem of R-homomorphism.

UNIT-4

Completely reducible modules, Schur's lemma, Free modules.

References:

1. I. N. Herstein: Topics in Algebra 4thEd., John Wiley Sons.
2. P. B. Bhattacharya: Basic Abstract Algebra 2ndEd., Cambridge University Press.
3. Artin M.:Algebra, Prentice Hall, Englewood, Cliffs NJ.
4. J. A. Gallian: Contemporary Abstract Algebra, Narosa Publishing House.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER – I
Effective from June 2020
PGMTH-105: Ordinary Differential Equations – I

L: T: P
4 0 0

UNIT-1

Basic concepts and Linear Equations of the first order: Introduction, Formation of Differential Equations, Classification, Initial and Boundary Value Problems, Definition of Solutions, First Order Linear Equation, Exact Equations, Separable Equations.

UNIT-2

Linear Differential Equations of Higher Order: Introduction, Higher Order Differential Equations, Linear Independence, Equations with Constant Coefficients, Equations with Variable Coefficients.

UNIT-3

Wronskian, Variation of Parameters, Some Standard Methods: (i) Method of Undetermined Coefficients, (ii) Reduction of the order of equation, Method of Laplace Transforms.

UNIT-4

Solutions in Power Series: Introduction, Second Order Linear Equations with Ordinary Points, Legendre Equation and Legendre Polynomials, Second Order Equation with Regular Singular Point, Properties of Bessel Functions.

References:

1. S. G. Deo, V. Lakshmikantham, V. Raghvendra: Text Book of Ordinary Differential Equations (Second Edition),Tata McGraw Hill Pub. Co. Ltd, New Delhi, 1997.
2. Coddington E. A., Levinson N.: Theory of Ordinary Differential Equations, Mc Graw Hill, 1955.
3. Hartmann P.: Ordinary Differential Equations,John WileyInternational, 1964.
4. Somasundaram D.: Ordinary Differential Equations,Narosa, 2001.
5. Mandal C. R.: Ordinary Differential Equations,PHI,2003.
6. Rai B., Freedmanm H. I., Chaudhary D. P.:A Course in Ordinary Differential Equations, Narosa, 2002.
7. King A. C., Otto R.,Billingham J.: Differential Equations, Cambridge, 2005.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - I
Effective from June 2020
PGMTH-106: Numerical Analysis – I

L: T: P
4 0 0

UNIT-I

Bisection method, Iteration method based on first and second degree equation, Rate of convergence, General iteration Methods, System of nonlinear equations, Methods for complex roots.

UNIT-2

Polynomial equations, Choice of iterative method, Direct Methods, Error analysis for direct root methods, Iteration methods.

UNIT-3

Eigen values and Eigenvectors, Bound on Eigen values, Jacobi method for symmetric matrices, Givens method for arbitrary Matrices, Power method, Inverse power method.

UNIT-4

Lagrangian and Newton interpolations, Finite difference operators, Interpolating polynomials, Hermite interpolation, Piecewise and Spline interpolations.

References:

1. M. K. Jain, S. R. K. Iyenger, R. K. Jain: "Numerical Methods for scientific and engineering computations", VI – edition, New Age International Publishers
2. Philips and Taylor: "Theory and Applications of Numerical Analysis Academic Press", 1996
3. Gourdin and Boumhart: "Applied Numerical Analysis", P.H.I., 1996
4. A. S. Householder: "Theory of Matrices in Numerical Analysis", Blarsedell - New York.
5. Jacques and Colin: "Numerical Analysis", Chapman & Hall, New-York, 1987.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

SYLLABUS FOR M.Sc. (MATHEMATICS)

SEMESTER – II

Effective from June 2020

PGMTH-201: Real Analysis – II

L: T: P
4 0 0

UNIT-1

The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a non-negative function,

UNI -2

The general Lebesgue integral, Lebesgue convergence theorem, monotone convergence theorem, Fatou's lemma, Generalized Lebesgue convergence theorem.

UNIT-3

Differentiation of monotone functions, Functions of a bounded variation, Differentiation of an Integral, Absolute continuity, Convex functions.

UNIT-4

L^p Spaces, The Minkowski and Holder inequalities.

References:

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

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SYLLABUS FOR M.Sc. (MATHEMATICS)

SEMESTER - II

Effective from June 2020

PGMTH-202: Complex Analysis – II

L: T: P
4 0 0

UNIT-1

Sequence of Functions, Series of Functions. Power Series, Uniform convergence of power series, Taylor series, Zeros of Analytic functions, Laurent Series, Integration and Differentiation of power series, Multiplication and Division of power series.

UNIT-2

Classification of Singularities, Residues, Poles and Zeros, Behaviour of functions and infinity, Meromorphic functions, Open mapping theorem, Partial fraction expansions, Regular points and singularities.

UNIT-3

Estimation of sums, Definite Integrals involving Sines and Cosines, Improper integrals, Integration along indented Contours, Other types of Contours.

UNIT-4

Conformality Theorem, Bilinear Transformation, Special Bilinear Transformations, Exponential Transformation, Trigonometric Transformation.

References:

1. H. S. Kasana: “Complex Variables – Theory and Applications”, 2nd Edition (2006), PHI, N. Delhi.
2. J. N. Sharma: “Functions of a Complex Variable”, Krishna Prakashan, 2000.
3. S. Ponnuswamy: “Foundation of Complex Analysis”, Narosa Publishing House, 1997.
4. S. Lang:“Complex Analysis”, Addition Wesley, 1997.
5. H. A. Priestly: “Introduction to Complex Analysis”, Clarendon Press, 1990.
6. J. B. Conway:“Functions of one Complex Variable”, Springer-Verlag, 1980.

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SYLLABUS FOR M.Sc. (MATHEMATICS)

SEMESTER - II

Effective from June 2020

PGMTH – 203: Topology – II

L: T: P
4 0 0

UNIT-1

Separation Axioms: T_1 and T_2 Spaces, Regular, Completely regular and Normal spaces, Uryshon's lemma and Tietze's extension theorem.

UNIT-2

Connected Space, Continuity and connectedness, Disconnected spaces, Product of connected spaces, Connectedness of R^n and C^n.

UNIT-3

Component of space, Theorems and examples on component spaces.

UNIT-4

Totally Disconnected Space: Definition and examples, Theorems and examples on totally disconnected spaces**.** Locally Connected space: Definition and examples, Theorems related to locally connected spaces.

References:

1. George F. Simmons: "Introduction to Topology and Modern Analysis", McGraw-Hill Book Co., 1963.
2. James R. Munkres: "Topology : A First Course", Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
3. J. Dugundji: "Topology", Allyn and Bacon, 1966 (Reprinted in India by Prentice Hall of India Pvt. Ltd.).
4. K. D. Joshi: "Introduction to General Topology", Wiley Eastern Ltd., 1983.
5. J. Hocking and G. Young: "Topology", Addison-Wesley, Reading, 1961.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

SYLLABUS FOR M.Sc. (MATHEMATICS)

SEMESTER - II

Effective from June 2020

PGMTH – 204 Abstract Algebra – II

L: T: P
4 0 0

UNIT-1

Extension fields, Finite extension field, Algebraic extension, Algebraic number.

UNIT-2

Roots of polynomials, splitting fields, Uniqueness of Splitting fields, Construction with Straightedge and compass.

UNIT-3

More about roots, Simple extension, Fixed fields, Elementary symmetric functions, normal extension, Galois group, The fundamental theorem of Galois theory.

UNIT-4

Solvable Groups, Solvability by Radicals, Abel's Theorem, Finite Fields.

References:

1. I. N. Herstein: Topics in Algebra 4thEd., John Wiley Sons.
2. P. B. Bhattacharya: Basic Abstract Algebra 2ndEd., Cambridge University Press.
3. Artin M.:Algebra, Prentice Hall, Englewood, Cliffs NJ.
4. J. A. Gallian: Contemporary Abstract Algebra, Narosa Publishing House.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

SYLLABUS FOR M.Sc. (MATHEMATICS)

SEMESTER - II

Effective from June 2020

PGMTH-205 : Ordinary Differential Equations – II

L: T: P
4 0 0

UNIT-1

Systems of Linear Differential Equations: Introduction, Systems of First Order Equations, Model for Arms Competition between Two Nations, Existence and Uniqueness Theorem

UNIT-2

Fundamental Matrix, Non homogeneous Linear Systems

UNIT-3

Linear Systems with Constant Coefficients, Linear Systems with Periodic Coefficients

UNIT-4

Existence and Uniqueness of Solutions: Introduction, Preliminaries, Successive Approximations, Picard's Theorem.

References:

1. S. G. Deo, V. Lakshmikantham, V. Raghvendra: Text Book of Ordinary Differential Equations (Second Edition),Tata McGraw Hill Pub. Co. Ltd, New Delhi, 1997.
2. Coddington E.A., Levinson N.: Theory of Ordinary Differential Equations, Mc Graw Hill, 1955.
3. Hartmann P.: Ordinary Differential Equations, John Wiley International, 1964.
4. Somasundaram D.: Ordinary Differential Equations, Narosa, 2001.
5. Mandal C.R.: Ordinary Differential Equations, PHI,2003.
6. Rai B., Freedmanm H.I., Chaudhary D.P.: A Course in Ordinary Differential Equations, Narosa, 2002.
7. King A.C., Otto R., Billingham J.: Differential Equations, Cambridge, 2005.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

SYLLABUS FOR M.Sc. (MATHEMATICS)

SEMESTER - II

Effective from June 2020

PGMTH-206: Numerical Analysis – II

L: T: P
4 0 0

UNIT-1

Numerical differentiations, Optimum choice of step-length, Extrapolation methods, Partial differentiations.

UNIT-2

Numerical Integrations, Methods based on interpolations, Methods based on Undetermined coefficients, Composite integration methods, Romberg Integration.

UNIT-3

Ordinary Differential Equations (Initial Value Problem): Difference equations, Single step methods, Stability analysis of single step methods, Multistep methods, Stability analysis of Multistep methods.

UNIT-4

Ordinary Differential Equations (Boundary Value Problem): Shooting method, Finite difference methods.

References:

1. M.K. Jain, S.R.K. Iyenger, R.K. Jain: "Numerical Methods for scientific and engineering computations", VI – edition, New Age International Publishers
2. Philips and Taylor: "Theory and Applications of Numerical Analysis Academic Press", 1996
3. Gourdin and Boumhart: "Applied Numerical Analysis", P.H.I., 1996
4. A.S. Householder: "Theory of Matrices in Numerical Analysis", Blarsedell - New York.
5. Jacques and Colin: "Numerical Analysis", Chapman & Hall, New-York, 1987.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS OF M. Sc. (MATHEMATICS)

SEMESTER-III

Effective from June-2020

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS FOR M. Sc. (MATHEMATICS)
Effective from June-2020

Semester	Subject Paper Number (PGMTH)	Subject Name	Lecture per Week	Credit	Marks
*III	301	Functional Analysis-I	4	4	100 (70-External +30 Internal)
	302	Differential Equations	4	4	
	303	Calculus of Variations	4	4	
	304	Advanced Linear Algebra-I	4	4	
IV	401	Functional Analysis-II	4	4	100 (70-External +30 Internal)
	402	Differential Geometry	4	4	
	403	Integral Equations	4	4	
	404	Advanced Linear Algebra-II	4	4	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III
Effective from June 2020
PGMTH–301:Functional Analysis – I

L: T: P
4 0 0

UNIT-1

Metric Space, Further Examples of Metric Spaces, Examples. Completeness proofs

UNIT-2

Vector Space, Normed Space, Banach Space, Further Properties of Normed Spaces, Finite Dimensional Normed Space and Subspaces, Compactness and Finite Dimension.

UNIT-3

Linear Operators, Bounded and Continuous Linear Operators, Linear Functionals, Linear Operators and Functionals on Finite Dimensional Spaces, Normed Spaces of Operators, Dual space.

UNIT -4

Inner Product space, Hilbert space, Further Properties of Inner Product Spaces, Orthogonal complements and Direct sums.

References:

1. E. Kreyszig: Introductory Functional Analysis with applications, 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.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III
Effective from June 2020
PGMTH–302: Differential Equations

L : T : P
4 0 0

UNIT-1

Surfaces and Curves in Three Dimensions, Simultaneous Differential Equations of the First Order and the First Degree in Three Variables, Methods of Solutions of $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Orthogonal Trajectories of a System of Curves on a Surface, Pfaffian Differential Forms and Equations, Solution of Pfaffian Differential Equations in Three Variables.

UNIT-2

Partial Differential Equations, Origins of First-Order Partial Differential Equations, Linear Equations of the First Order, Integral Surfaces Passing through a Given Curve, Surfaces Orthogonal to a Given System of Surfaces,

UNIT-3

Nonlinear Partial Differential Equations of the First Order, Compatible Systems of First-order Equations, Charpit's Method, Special Types of First order Equations, Solutions Satisfying Given Conditions, Jacobi's Method.

UNIT-4

Linear Partial Differential Equations with Constant Coefficients, Equations with Variable Coefficients, Separation of Variables, Nonlinear Equations of the Second Order.

References:

1. Sneddon I.N.: Elements of Partial Differential Equations, McGraw Hill, International Editions, 1957
2. ZafarHasan: Differential Equations and their applications, Second Edition, PHI, 2009.
3. IyengarS.N.:Differential Equations, Anmol Publications, 2000
4. Sharma, Gupta: Differential Equations, Krishna Prakashan Media, 1997- 98.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III
Effective from June 2020
PGMTH–303: Calculus of Variations

L : T : P
4 0 0

UNIT-1

The concept of Variation and its properties, Fundamental lemma of Calculus of Variation, Euler's Equation.

UNIT-2

Functionals dependent on several functions of independent variable, Functionals dependent on Higher-Order derivatives, Functionals dependent on functions of several independent variables, Variational problems in parametric form.

UNIT-3

Variation of Functional with moving boundary, Variational problem with a movable boundary for a functional dependent on two functions, One-Sided Variations, Reflection and Refraction of Extremals.

UNIT-4

Field of Extremals, Jacobi Condition, Weirstrass Function, Legendre Condition, Second Variation, Canonical Equations and Variational Principles.

References:

1. A.S. Gupta:"Calculus of Variations with Applications", Prentice Hall of India Pvt. Ltd., New Delhi.
2. Robert Weinstock: "Calculus of Variations with Applications to physics".
3. ElsGok L. D.: "Calculus of Variation".
4. Mariano Giaquinta, Stefan Hildebrandt: "Calculus of Variations-I", Springer Science & Business Media, 2004

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III
Effective from June 2020
PGMTH–304: Advanced Linear Algebra – I

L : T : P
4 0 0

UNIT-1

Vector Space, Homeomorphisms, Quotient Space, Internal Direct Sum, External Direct Sum, Linear Independence and Basis.

UNIT-2

Hom (V, W), dimension of Hom (V, W), Dual Space of Vector Space, Second Dual, Annihilator of subspace, Dimension of an annihilator of a subspace and its application to homogeneous linear equations.

UNIT-3

Algebra, Algebra of linear transformations $A(V)$, Relation between algebra A and $A(V)$, Minimal Polynomial for linear transformation, Regular and Singular linear transformations, Rank of linear transformation,

UNIT-4

Characteristic Roots and Characteristic Vectors, Algebra of Matrices, Quadratic form, Rank and Signature of Quadratic forms.

References:

1. I.N. Herstein: Topics in Algebra 4th Ed., John Wiley Sons.
2. Kenneth Hoffman and Ray Kunze: Linear Algebra, Eastern Economy Editions.
3. D. S. Dummit and R. M. Foote: Abstract Algebra, John Wiley & Sons, 2004.
4. N. Jacobson: Lectures in Abstract Algebra Vol. I (1951),II(1952), Van Nostrand Co., New York.

VEER NARMAD SOUTH GUJARAT UNIVERSITY , SURAT
SYLLABUS FOR M. Sc. (MATHEMATICS)
SEMESTER: III
Group of Optional Papers
Effective from June-2020

Structure:

SEM-III

GROUP	PAPER NO.	TITLE OF PAPER	
GROUP – 1	PGMTH3001	Fluid Dynamics	
	PGMTH3002	Mathematical Software	Practical
GROUP – 2	PGMTH3003	Linear programming	Practical
	PGMTH3004	Operation Research	Practical
GROUP-3	PGMTH3005	Integral Transforms-I	
	PGMTH3006	Advanced Integral Transforms-I	
GROUP-4	PGMTH3007	Advanced Number Theory-I	
	PGMTH3008	Analytic Number Theory	
GROUP-5	PGMTH3009	Special Functions-I	
	PGMTH3010	Advanced Special Functions-I	

THEORY LECTURE : 4

PAPER WITH PRACTICAL : THEORY (4) + PRACTICAL (4)

Marking scheme :

1. All papers except paper with practical
   Internal exam (30) + External Exam(70) = Total (100)
2. Practical paper
   Theory: 18 (Internal) 42(External)
   Practical: 12 (Internal) 28(External)
   Total: 30 (Internal) 70(External)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH–3001 : Fluid Dynamics

L : T : P
4 0 0

- UNIT 1
  Vector Concept of Fluid Dynamics
  Scalar and vector properties, cross product and dot product of vectors, magnitude and direction of a vectors, gradient, curl and divergent operators,

- UNIT 2:
  fluid Statics
  Basic Definitions of fluid, Pascal's law, basic property of a static fluid, pressure at the vertical level, Equality of pressure at the same level, General equation for the variation of pressure, Buoyancy

- UNIT 3:
  Kinematics of fluid
  - Flow descriptions (Lagrangian, Eulerian, Material derivative)
  - Motion of Fluid particles(rate of dilation, rate of shear, rate of rotation)
  - Uniform flow, non-uniform, steady, unsteady flow
  - One, two and Three Dimensional Flow
  - Rotational and irrational flow
  - Laminar and turbulent flow
  - Line of flow(Stream line, Path line, Strake line, Time line)

- UNIT 4:
  Dynamics of fluid
  Velocity of a fluid particle at a point, stream tube, Euler Equation, Bernoulli Equation
  Conservation Laws, Potential equation, Reynold's transport theorem, Conservation of mass, Conservation of momentum, Conservation of energy ,Navier-stokes equation

Reference Books:

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH–3002 :Mathematical Software

L : T : P
4 0 4

UNIT 1:

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

UNIT 2:

Plotting

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

UNIT 3:

Programming

The if construct, switch construct, The try-catch construct, relational operators, logic operators, logical function, while loop, for loop, The break and continue statements, Nesting loops.

UNIT 4:

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

Reference books:

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH–3003 :Linear Programming

UNIT-1

Linear Programming:

General Linear Programming Problem (LPP), Canonical and Standard Form of LPP, Graphical Method, Simplex Method, Fundamental Properties of the Solution, Degeneracy in LPP, Solution of LPP using Simplex Method, Concept of Duality, Fundamental Theorem of Duality, Properties of Duality, Revised Simplex Method.

UNIT-2

Dynamic Programming:

Introduction, Recursive Equation Approach, Characteristic of Dynamic Programming, Solution of Discrete Dynamic Programming Problem, Solution of LPP by Dynamic Programming.

UNIT-3

Integer Programming:

Introduction, All and Mixed Integer Programming problems (IPP), Gomory's All- IPP Method, All-IPP Algorithm, The Branch and Bound Techniques.

UNIT-4

Post-optimality Analysis:

Sensitivity Analysis, Discrete Change in the Cost-vector, in Requirement-vector and in the Coefficient matrix, Structural Changes in LPP.

Reference:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.

2. S.D. Sharma: Operations Research, KedarNath, Ram Nath& Co.

3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984.

4. J. K. Sharma: Operation Research: Theory and Applications, Macmillan India Ltd., Third Edition, 2007.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH–3004 :Operations Research

UNIT-1

Inventory Control:

Introduction to Various Types of Inventory Problems, Method with known Demand Function, Economic Order Quantity (EOQ), Deterministic Inventory Problems when Shortages are Allowed Deterministic Inventory Problems when Shortages are Not Allowed, EOQ Problems with Price Breaks.

UNIT-2

PERT – CPM:

Introduction to Network with Basic Components, Rules of Network Construction, Time Calculation in Network, CPM - PERT, PERT Calculations, Advantages of PERT-CPM, Project Cost, Time Cost, Optimization Algorithm, Resource Allocation and Scheduling.

UNIT-3

Transportation Problem:

Definition of Transportation Problem, Basic Feasible Solution (BFS) to Transportation Problem, Different Methods for Finding BFS to the Transportation Problem, Method of Finding Optimum Solution to the Transportation Problem, Degeneracy for Transportation Problem, Unbalanced Transportation Problem.

UNIT-4

Simulation:

Introduction, Why Simulation, Methodology of Simulation, Generation of Random Numbers.

Reference:

1. Operations research by KantiSwarup, P.K.Gupta and Nan Mohan. S.Chand& Sons, New Delhi. Seventh Edition, 1994.

2.Operation Research: Theory and Applications by J. K. Sharma, Macmillan India Ltd., Third Edition, 2007.

3. Operations Research by S.D. Sharma. KedarnathRamnath Pub.1998. Merrut.

4. Optimization Methods in Operation Research and System Analysis by K. V. Mittal and C. Mohan, New Age International Publishers, Third Edition, 1996.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020
PGMTH –3005: Integral Transform – I

UNIT -1:

Laplace Transforms:

- Introduction and definition of Laplace transforms with examples,
- Existence condition and basic properties of Laplace transforms,
- The convolution theorem and properties of convolution,
- Differentiation and integration of Laplace transforms,

UNIT-2

Inverse Laplace Transforms:

- The inverse Laplace transforms and examples,
- Tauberian theorem and Watson's lemma,
- Laplace transforms of fractional integrals and fractional derivatives,

UNIT-3

Finite Laplace Transforms:

- Introduction,
- Definition of finite Laplace transforms with examples,
- Basic operational properties of finite Laplace transforms,

UNIT-4

Applications of Laplace Transforms

- Application of Laplace transforms to ordinary and partial differential equations;
- Initial and boundary value problems and Integral equations;
- Evaluation of definite integral

References:

1) LokenathDebnath: Integral Transform and their applications, CRC Pub., 1995.

2) Ian Sneddon : The use of Integral Transform. TMIH, 1979.

3) B. Davies : Integral Transforms and their applications, Springer - Verlag, 1978.

4) Boss M. L. : Mathematical Methods in Physical Sciences, John Wiley & Sons, 1983.

5) Andrews, L. G. & Shivamoggi B. K. : Integral Transforms for Engineers, PHI, 2003.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH –3006: Advance Integral Transform – I

UNIT-1

Hankel Transforms:

- Introduction and definition of Hankel transform
- Examples on Hankel Transform
- Operational properties of the Hankel transform

UNIT-2

Finite Hankel Transforms:

- Introduction and definition of the finite Hankel transforms.
- finite Hankel transforms of some elementary functions.
- Basic operational properties with examples,

UNIT-3

Application Hankel transforms:

- Application of Hankel transforms to partial differential equations
- Applications of finite Hankel transforms.

UNIT-4

Hilbert and Stieltjes Transforms (HST):

- Introduction and definition of HST with examples,
- Basic operational properties of HST,
- Hilbert transform in the complex plane and its applications,
- Inverse theorem for Stieltjes transform and its application,
- Asymptotic expansion of the one sided Hilbert transform,
- The generalized Stieltjes transform,
- Basic properties of the generalized Stieltjes transforms with applications.

References:

1) LokenathDebnath: Integral Transform and their applications, CRC Pub., 1995.
2) Ian Sneddon : The use of Integral Transform. TMIH, 1979.
3) B. Davies :Integral Transforms and their applications, Springer - Verlag, 1978.
4) Boss M. L. : Mathematical Methods in Physical Sciences, John Wiley & Sons, 1983.
5) Andrews, L. G. & : Integral Transforms for Engineers, PHI, 2003. Shivamoggi B. K.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH – 3007 Advance Number Theory – I

L T P
4-1-0

UNIT-1:

Primitive Roots and Indices: The order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots.

UNIT-2:

The theory of indices.

The Quadratic Reciprocity Law: Euler's criterion, The Legendre symbol and its properties, Gauss' Lemma.

UNIT-3:

Quadratic Reciprocity and Quadratic Reciprocity law, Quadratic congruence with composite moduli.

UNIT-4:

Fibonacci numbers: The Fibonacci sequence, Identities involving Fibonacci numbers.

References:

1. David M. Burton : Elementary Number Theory, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 7th edition, 2012.
2. S.G.Talang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi.
3. Neville Robbins : Beginning Number Theory, Narosa Pub. House, New Delhi,2ndEd., 2006.
4. I. Niven, S. Zuckerman, L. Montgomery: An Introduction to the Theory of Numbers,6th edition, John Wiley and Sons, Inc., New York, 2003.
5. George Andrews : Number Theory, The Hindustan Pub. Corp., New Delhi.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH – 3008: Analytic Number Theory

L T P
4-1-0

UNIT-1:

Arithmetical functions and Dirichlet multiplication: The Dirichlet product of two arithmetical functions (a.f.) and group structure w.r.t. this product, The Mangöldt function, Multiplicative a.f., the inverse of a completely multiplicative a.f., Liouville's function $\lambda(n)$, the divisor functions $d(n)$and $\sigma_\alpha(n)$, generalized convolution.

UNIT-2:

Averages of Arithmetical Functions: The big oh notation, Euler's summation formula, Some elementary asymptotic formulas, the average order of divisor functions $d(n)$and $\sigma_\alpha(n)$.

UNIT-3:

The average order of functions$\phi(n), \mu(n), \Lambda(n)$, Lattice points visible from the origin, the partial sums of a Dirichlet product, applications to $\mu(n)$ and $\Lambda(n)$.

UNIT-4:

Some elementary theorems on the distribution of prime numbers: Chebyshev's functions $\psi(x)$ and $\vartheta(x)$, Abel's identity, relation between $\psi(x), \pi(x)$and $\vartheta(x)$, equivalent forms of prime number theorem, lower and upper bounds for $\pi(n)$and p_n.

References:

1. Tom M.Apostol : Introduction to Analytic Number Theory, Narosa Pub. House,New Delhi, 1998 Ed.
2. Mc Carthy P.J. : Introduction to Arithmetical function, Springer-Verlag, NewYork, 1986.
3. K. Chandrashekharan : Introduction to Analytic Number Theory, Springer-Verlag, New York, 1968.
4. Hua L.K. : Introduction to Number Theory, Springer-Verlag, New York, 1982.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH–3009 (Special Functions-I)

L : T : P
4 0 0

UNIT-1

Definition of an Infinite product, A necessary condition for convergence, The associated series of logarithms, Absolute convergence, Uniform convergence.

UNIT-2:

The Euler or Mascheroni constant γ, The Gama function, A series for $\Gamma(z)'/\Gamma(z)$,Evaluation of $/\Gamma(1)$ and $\Gamma(1)'$, The Euler product for $\Gamma(z)$, The difference equation $\Gamma(z+1)= z\,\Gamma(z)$.The order symbols o and 0, Evaluation of certain infinite products, Euler integral for $\Gamma(z)$,

UNIT-3

The Beta function, The value of $\Gamma(z)\,\Gamma(1-z)$, The factorial function, Legendre's duplication formula, Gauss' multiplication theorem, A summation formula due to Euler, The behaviour of $\log(z)$ for large z .

UNIT-4:

The function F(a, b; c; z), A simple integral form, F(a, b; c; 1) as a function of the parameters, Evaluation of F(a, b; c; 1), the contiguous function relations, The hypergeometric differential equation, Logarithmic solutions of the hypergeometric equation, F(a, b; c; z) as a function of its parameters, Simple transformations, Relation between functions of Z and 1-Z, A quadratic transformation, other quadratic transformations, a theorem due to Kummer, Additional properties.

Reference:

1. E. D. Rainville, Special Functions, McMillan, New York, 1990.
2. I. N. Sneddon, Special functions of Mathematical Physics and Chemistry, Oliver Boyd.
3. N. N. Lebdev, Special Functions and their applications, Dover Pub. 1972.
4. R. K. Saxena and D. C. Gokhroo, Special Functions, Khanna Pub.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - III Effective from June 2020

PGMTH–3010 : Advanced Special Functions-I

L : T : P
4 0 0

UNIT-1 : GENERALIZED HYPERGEOMETRIC FUNCTIONS:

The function pFq , The exponential and binomial functions, A differential equation, Other solutions of the differential equation, The contiguous function relations, A simple integral, The pFq with unit argument, Saalschutz' theorem, Whipple's theorem, Dixen's theorem, Contour integrals of Barns' type, The Barns' integrals and the function pFq , A useful integral.

UNIT-2 :BESSEL FUNCTIONS:

Remarks, Definition of Jn(z), Bessel's differential equation, Differential recurrence relations, A pure recurrence relations, A generating function, Bessel's integral, Index half of an integer, Modified Bessel functions, Neumann polynomials, Neumann series.

UNIT-3 : THE CONFLUENT HYPERGEOMETRIC FUNCTION:

Basic properties of the ${}_1F_1$, Kummer's first formula, Kummer's second formula.

UNIT-4 : GENERATING FUNCTIONS:

The generating function concept, Generating functions of the form G($2xt - t^2$), sets generated by $e^t \psi(xt)$, the generating functions $A(t)\exp(-xt(1-t))$, another class of generating functions, Boas and Buck generating functions, An extension.

Reference:

1. E. D. Rainville, Special Functions, McMillan, New York, 1990.
2. I. N. Sneddon, Special functions of Mathematical Physics and Chemistry, Oliver Boyd.
3. N. N. Lebdev, Special Functions and their applications, Dover Pub. 1972.
4. R. K. Saxena and D. C. Gokhroo, Special Functions, Khanna Pub.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - IV
Effective from June 2020
PGMTH–401: Functional Analysis – II

L: T: P
4 0 0

UNIT -1

Total Orthonormal Sets and Sequences, Representation of Functionals on Hilbert Spaces, Hilbert-Adjoint Operator, Self-adjoint, Unitary and Normal Operators.

UNIT -2

Zorn's Lemma, Hahn-Banach theorem, Hahn-Banach Theorem for Complex Vector Spaces and Normed Spaces.

UNIT -3

Adjoint Operator, Reflexive Spaces, Category theorem, Uniform Boundedness Theorem.

UNIT -4

Strong and Weak convergence, Convergence of Sequences of operators and Functionals, 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.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - IV
Effective from June 2020
PGMTH–402 : Differential Geometry

L : T : P
4 0 0

UNIT-1

Tangent, Principal Normal, Curvature, Binormal, Torsion, Serret-Frenet formulae.

UNIT-2

Helices, Spherical indicatrix of tangent, Involutes, Evolutes, Bertrand curves.

UNIT-3

Surfaces, Tangent Plane, Normal, Fundamental Forms; First Fundamental Form, Second Fundamental Form.

UNIT-4

Characteristic, Envelope, Edge of regression, Developable Surfaces, Osculating developable.

References:

1. Whetherburn C.E. : Differential Geometry of 3-D, Radha Publishing, Calcutta.
2. T.J. Willmore: An Introduction to Differential Geometry, Oxford University Press(India).
3. Bansilal:Differential Geometry, 1994 Atma Ram and sons, Allahabad.
4. S.C. Mittal and D. C. Agrawal : Differential Geometry, Krishna Publication, 1976
5. S. Kumaresan : A Course in Differential Geometry and Lie Groups, Hindustan Book Agency, 2002
6. Sinha B.B. : An Introduction to Modern Differential geometry,Kalyani Publishers, New Delhi, 1982

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - IV
Effective from June 2020
PGMTH–403: Integral Equations

L : T : P
4 0 0

UNIT-1

Integral equations, Classification of integral equations, Solution of integral equations, Some examples related to solutions of integral equations, Leibnitz's Rule (for differentiation under integral sign), Important formula for converting a multiple integral into a single ordinary integral, Classification of kernels, Regularity Conditions, Inner or Scalar product of functions.

UNIT -2

Method of converting IVP into Volterra integral equation, Alternative method of converting IVP into Volterra integral equation, Method of converting BVP into Fredholm integral equation.

UNIT -3

Eigenvalues and Eigen functions, Solution of homogeneous Fredholm integral equations of second kind with Separable kernel, Solution of Fredholm integral equations of second kind with Separable kernel.

UNIT -4

Iterated Kernels, Resolvent kernels, An Important theorem on kernels, Solution of Fredholm integral equations of second kind by successive substitution, Solution of Volterra integral equations of second kind by successive substitution.

References:

1. M. D. Raisinghania: Integral Equations and Boundary Value Problems, S. Chand & Co., New Delhi (2007).
2. Shanti Swarup: Linear Integral Equations, Krishna Prakashan, Meerut.
3. Sudir K. Pundir and RimplePundir: Integral Equations and Boundary Value Problems, PragatiPrakasan, Meerut (2005).
4. Ram P. Kanwal: Linear Integral Equations Theory and Technique, Academic Press, Birkhäuser, New York (2013).
5. Cordumenau, C., Integral Equations and Appplications, Cambridge University Press, 1991

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - IV
Effective from June 2020
PGMTH–404 :Advanced Linear Algebra – II

L : T : P
4 0 0

UNIT -1

Similar linear transformations, Triangular form, Nilpotent transformations, Invariants.

UNIT -2

Jordan Canonical form, Rational Canonical form, Companion Matrix.

UNIT -3

Trace and its properties, Transpose and its properties, Symmetric and Skew Symmetric matrices, Adjoint and Hermitian Adjoint, Determinants and its properties, Cramer's rule, Characteristic roots, Secular equation, Cayley-Hamilton theorem.

UNIT -4

Hermitian transformation and its properties, Unitary transformation and its properties, Normal transformation and its properties.

References:

1. I.N. Herstein: Topics in Algebra 4thEd., John Wiley Sons.
2. Kenneth Hoffman and Ray Kunze: Linear Algebra, Eastern Economy Editions.
3. D. S. Dummit and R. M. Foote: Abstract Algebra, John Wiley & Sons, 2004.
4. N. Jacobson: Lectures in Abstract Algebra Vol. I (1951),II(1952), Van Nostrand Co., New York.

SYLLABUS FOR M. Sc. (MATHEMATICS)

SEMESTER : IV

Group of Optional Papers

Effective from June-2020

Structure :

SEM-IV

GROUP	PAPER NO.	TITLE OF PAPER	
GROUP – 1	PGMTH4001	Computational Fluid Dynamics	Practical
	PGMTH4002	Mathematical Modelling	
GROUP – 2	PGMTH4003	Non-Linear programming	Practical
	PGMTH4004	Advanced Operation Research	Practical
GROUP-3	PGMTH4005	Integral Transforms-II	
	PGMTH4006	Advanced Integral Transforms-II	
GROUP-4	PGMTH4007	Advanced Number Theory-II	
	PGMTH4008	Introduction to Partition Theory and Cryptography	
GROUP-5	PGMTH4009	Special Functions-II	
	PGMTH4010	Advanced Special Functions-II	

THEORY LECTURE : 4

PAPER WITH PRACTICAL : THEORY (4) + PRACTICAL (4)

Marking scheme

1. All papers except paper with practical

Internal exam (30) + External Exam(70) = Total (100)

2. Practical paper

Theory: 18 (Internal) 42(External)

Practical: 12 (Internal) 28(External)

Total: 30 (Internal) 70(External)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - IV Effective from June 2020

PGMTH–4001: Computational Fluid Dynamics)

L : T : P
4 0 4

UNIT -1

Introduction and Classification of PDE's

Introduction to PDEs', Types of PDEs', Classification of PDEs', Introduction to CFD, Applications, Scope of CFD, Governing equations and assumptions, Equation types, Model equations, Discretization of the Domain, Numerical boundary conditions

UNIT -2

Heat Equation

Introduction to heat Equations, Schmidt method, Richardson Method, Crack- Nicolson method, Du-fort Franek method,stability of schemes, convergence of scheme

UNIT -3

Wave Equations

One dimensional Euler equations, Lax – Wendroff Scheme, Mc-CormackScheme, 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,

UNIT -4

Laplace and poison Equation

Finite Differences, Algorithms, Errors and Accuracy, Consistency, Stability and Convergence, Implicit algorithms,

- Practical: Numerical methods for discretizing fluid flow equations: Finite differences

Reference Books:

1. R. J. Leveque: Numerical methods for conservation Laws, BirkhauserVerlag,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 FluidDynamics: 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 hock waves, 1973.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. (MATHEMATICS)
SEMESTER - IV Effective from June 2020

PGMTH–4002: Mathematical Modelling

L : T : P
4 0 0

UNIT -1: Introduction to Mathematical modelling

Needs and Techniques of mathematical modelling: Idea of mathematical modelling, need for mathematical modelling, Advantages and Disadvantages of Model, steps in mathematical modelling, Characteristics of mathematical modelling,Interpretation

UNIT -2: Model of Linear Algebra

Modeling Explorations, Input-Output Economies, Traffic Networks, Balancing Chemical Equations

UNIT -3: First Order Models

Models for Birth, Death, and Immigration, Difference Equations and Differential Equations, Stability and Equilibria, Euler's Method: Numerical Solutions for Differential Equations, Classifying Difference and Differential Equations, Modelling Explorations with Difference and Differential Equations

UNIT -4: Second Order Models

Modelling Oscillations, Homogeneous Linear 2nd Order Differential Equations, Forced Oscillations, Energy in Mass Spring Systems, Modelling Explorations with 2nd Order Differential Equations

Reference Books:

1. J.N.Kapur: Mathematical Modelling, Wiley eastern Ltd., 1994.
2. M.M. Gibbons: A concrete approach to Mathematical Modeling, John Wileyand sons, 1995.
3. H. Neunzert and A.H. Siddiqui: Topics in Industrial Mathematics, KluwerAcademic 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.

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PGMTH–4003: Non – Linear Programming

UNIT -1

One - Dimensional Non- Linear Programming Methods:

Unimodal Function, Unrestricted Search, Exhaustive Search, Dichotomous Search, Interval Halving Method, Fibonacci Search, Golden Section Method, Comparison of Elimination Methods, Quadratic Interpolation, Direct Search Method.

UNIT -2

Classical Optimization Methods:

Unconstraint Optimization, Constrain Multi - Variable Optimization with Equality Constrains, Constrain Multi - Variable Optimization with Inequality Constrains.

UNIT -3

Non- Linear Programming Methods:

Introduction, General Non - Linear Programming Problems, Graphical Solution Method, Quadratic Programming, Application of Quadratic Programming, Separable Programming.

UNIT -4

Geometric Programming:

Introduction, Geometric – Arithmetic Mean Inequality, Unconstrained Geometric Programming Problem, Constrained Geometric Programming Problem.

References:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.
2. S.D. Sharma: Operations Research, KedarNath, Ram Nath& Co.
3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984.
4. J. K. Sharma: Operation Research: Theory and Applications, Macmillan India Ltd., Third Edition, 2007.

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PGMTH–4004 : Advanced Operations Research

UNIT -1

Queuing Theory:

Definition and Characteristic of a Queuing System, Poisson Process and Exponential Distribution, Classification of Queues, Detailed Study of M/M/1 and M/M/s Queuing Models.

UNIT -2

Sequencing Problems:

Problems of Sequencing, Problems with n-jobs and 2-machines, Problems with n-jobs and 3-machines, Problems with n-jobs and m-machines.

UNIT -3

Theory of Replacement:

Introduction, Replacement of Equipment that Deteriorate Gradually, Replacement of Equipment that Fails completely, Other Replacement Problems.

UNIT -4

Games and Strategies:

Introduction, Two-person Zero-Sum Games, The Maximum-Minimum Principle, Games Without Saddle Points-Mixed Strategies.

References:

1. Kantiswarup, P.K.Gupta and Manmohan: Operations Research ,Sultan chand and Sons.
2. S.D. Sharma: Operations Research, KedarNath, Ram Nath& Co.
3. S. S. Rao: Optimization Theory and Applications, Wiley Eastern, 1984.
4. J. K. Sharma: Operation Research: Theory and Applications, Macmillan India Ltd., Third Edition, 2007.

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PGMTH –4005 Integral Transform – II

UNIT -1 Complex Fourier Transforms:

- Introduction,
- Basic concepts and definitions,
- The Fourier Integral formulae.
- Definition and examples of Fourier transforms,
- Basic properties of Fourier transforms,
- Inversion of Fourier transforms

UNIT -2: Fourier Cosine and sine Transforms

- Definitions of Fourier cosine and sine transforms with examples,
- Properties of Fourier cosine and sine transforms,
- Proof of basic Properties of Fourier cosine and sine transforms,

UNIT -3: Finite Fourier transform and finite fourier Cosine and Sine Transforms:

- Introduction and definition of finite cosine and sine transforms with examples,
- Basic properties of finite Fourier cosine and sine transforms
- Inversion of finite Fourier transforms, finite Fourier cosine and sine transforms.

UNIT -4: Applications of Fourier Transforms:

- Applications of Fourier transforms to solve partial differential equations,
- Applications of Fourier cosine and sine transforms to partial differential equations
- Evaluation of definite integrals.
- Applications of finite Fourier transforms, finite Fourier cosine and sine transforms.
- Basic properties of finite Fourier cosine and sine transforms

References:

1) LokenathDebnath: Integral Transform and their applications, CRC Pub., 1995.
2) Ian Sneddon : The use of Integral Transform. TMIH, 1979.
3) B. Davies : Integral Transforms and their applications, Springer - Verlag, 1978.
4) Boss M. L. : Mathematical Methods in Physical Sciences, John Wiley & Sons, 1983.
5) Andrews, L. G. & : Integral Transforms for Engineers, PHI, 2003. Shivamoggi B. K.

M.Sc. [Mathematics] Semester : IV
PGMTH –4006 Advance Integral Transform – II
Unit wise Syllabus

UNIT-1 Mellin Transforms:

- Introduction and definition of Mellin transforms with examples,
- Basic operational properties.
- Inverse Mellin transforms.
- Mellin transforms of the Weyl fractional integralsand derivatives
- Convolution theorems for Mellin Transforms

UNIT -2 Applications of Mellin Transforms:

- Applications of the Mellin transforms to solve BVP
- Application of Mellin transforms to summation of series.

UNIT -3: Z-Transforms:

- Introduction,
- Dynamic linear systems and Impulse response,
- Definition of the Z-transforms and examples,
- Basic operational properties,

UNIT -4: Inverse Z Transforms and Applications:

- The inverse Z-transform and examples,
- Application of Z-transforms to finite difference equations.

References:

1) LokenathDebnath: Integral Transform and their applications, CRC Pub., 1995.

2) Ian Sneddon : The use of Integral Transform. TMIH, 1979.

3) B. Davies : Integral Transforms and their applications, Springer - Verlag, 1978.

4) Boss M. L. : Mathematical Methods in Physical Sciences, John Wiley & Sons, 1983.

5) Andrews, L. G. & Shivamoggi B. K. : Integral Transforms for Engineers, PHI, 2003.

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PGMTH – 4007 :Advance Number Theory – II

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4-1-0

UNIT- 1:

Continued fractions: Simple continued fractions, finite and infinite continued fractions, uniqueness, representation of rational and irrational numbers as simple continued fractions, rational approximation to irrational numbers.

UNIT-2:

Diophantine equations: Diophantine equation $ax + by = c$ and its positive solutions, Pell's equation, Continued fraction solution of Pell's equation.

UNIT-3:

Pythagorean equation $x^2 + y^2 = z^2$, the case $n = 4$ in Fermat's Last Theorem.

UNIT -4:

Representation of integers as sum of squares: Necessary and sufficient conditions for a positive integer to be represented as the sum of two squares, Fermat's theorem, positive integers represented as difference of two squares, integers that are not expressible as the sum of three squares, Euler's identity, primes represented as the sum of four squares, Lagrange's theorem.

References:

1. David M. Burton : Elementary Number Theory, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 7thedition, 2012.
2. S.G.Talang : Number Theory, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 5th reprint, 2004.
3. Neville Robbins : Beginning Number Theory, Narosa Pub. House, New Delhi, 2nd Ed., 2006.
4. Martin Erickson, Anthony Vazzana : Introduction to Number Theory, Chapman & Hall/CRC, New York, 2008 Ed.
5. I. Niven, S.Zuckerman & L. Montgomery: An Introduction to the Theory of Numbers, 6th edition, John Wiley and Sons, Inc., New York, 2003.
6. George Andrews : Number Theory, The Hindustan Pub. Corp., New Delhi.

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PGMTH – 4008: Introduction to Partition Theory and Cryptography

L T P
4-1-0

UNIT-1:

Partition theory: An introduction, generating functions, partitions into exactly k parts, recurrence relations for $p(n,k)$ and $P(n,k)$ and relation between them, an inequality for $p(n,k)$.

UNIT-2:

Graphs of partitions, Euler's identity, a recursion formula for $p(n)$,Durfee's identity, two line partitions, the formula for $R(A,B)$.

UNIT-3:

Cryptography: Cesar Cipher, Vigenère cipher, Autokey cipher, Hill's cipher, RSA algorithm.

UNIT-4:

Knapsack problem, Superincreasing knapsack problem, Knapsack cryptosystem, An application of primitive roots to cryptography.

References:

1. Hansraj Gupta: Selected Topics in Number Theory, Abacus Press, England, 1980 Ed.
2. Tom M. Apostol : Introduction to Analytic Number Theory, Narosa Pub. House, New Delhi, 1998 Ed.
3. George Andrews, Kimmo Eriksson : Integer Partitions, Cambridge Univ. Press, UK, 2004 Ed.
4. David M. Burton : Elementary Number Theory, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 7th edition, 2012.
5. Martin Erickson, Anthony Vazzana : Introduction to Number Theory, Chapman & Hall/CRC, New York, 2008 Ed.

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PGMTH–4009 : Special Functions-II

L : T : P
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UNIT-1:

Orthogonal polynomials, Simple set of polynomials, Orthogonality, an equivalent condition for Orthogonality, zeros of orthogonal polynomials , Expansion of polynomials, The three term recurrence relations, The Christoffel-Darboux formula, Normalization; Bessel's inequality.

UNIT-2:

Legendre polynomials, A generating function, differential recurrence relations, The pure recurrence relations, Legendre's differential equation, The Rodrigues formula, Bateman's generating function, Additional generating functions,

UNIT-3:

Hypergeometric forms of Pn(X), Brafman's generating functions, Special properties of Pn(X), More generating functions, Laplace's first integral form, Some bounds on Pn(X), Orthogonality, An expansion theorem, Expansion of X^n , Expansion of analytic functions,

UNIT-4:

Hermite polynomials**:** Definition of Hn(x), Recurence relations, The Rodrigues formula, Other generating functions, Integrals, The Hermite polynomial as a 2F0 , Orthogonality, Expansion of polynomials, More generating functions.

Reference:

1. E. D. Rainville, Special Functions, McMillan, New York, 1990.
2. I. N. Sneddon, Special functions of Mathematical Physics and Chemistry, Oliver Boyd.
3. N. N. Lebdev, Special Functions and their applications, Dover Pub. 1972.
4. R. K. Saxena and D. C. Gokhroo, Special Functions, Khanna Pub.

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SEMESTER - IV Effective from June 2020

PGMTH–4010 :Advanced Special Functions-II

L : T : P
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UNIT-1:

Laguerre polynomials:The polynomial Ln(X), Generating functions, Recurrence relations, The Rodrigues formula, The differential equation, Orthogonality, Expansion of polynomials, Special properties, Other generating functions, The simple Laguerre polynomials.

UNIT-2

The Jacobi polynomials, Bateman's generating functions, The Rodrigues formula, Orthogonality, Differential recurrence relations, The pure recurrence relations, Mixed relations,

UNIT-3:

Appell's functions of two variables, An elementary generating functions, Brafman's generating functions, Expansion in series of polynomials.

UNIT-4:

Elliptic functions: Doubly periodic functions, Elliptic functions, Elementary properties, Order of an elliptic function, The Weierstrass function P(Z), Other elliptic functions, A differential equation for P(Z), Connection with elliptic integrals.

Reference:

1 E. D. Rainville, Special Functions, McMillan, New York, 1990.

2 I. N. Sneddon, Special functions of Mathematical Physics and Chemistry, Oliver Boyd.

3 N. N. Lebdev, Special Functions and their applications, Dover Pub. 1972.

4 R. K. Saxena and D. C. Gokhroo, Special Functions, Khanna Pub.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus for M.Sc. (Mathematics)

Scheme of Teaching and Examination

Semester – I

Effective from June 2020

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
PGMTH		L	P	Total	TH		PR		TOTAL	
					Int.	Ext	Int.	Ext	Int.	Ext
101	Real Analysis-1	4	__	4	30	70	---	---	30	70
102	Complex Analysis-1	4	__	4	30	70	---	---	30	70
103	Topology -1	4	__	4	30	70	---	---	30	70
104	Abstract Algebra-1	4	__	4	30	70	---	---	30	70
105	ODE-1	4	__	4	30	70	---	---	30	70
106	Numerical Analyis-1	4	__	4	30	70	---	---	30	70

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Syllabus for M.Sc. (Mathematics)

Scheme of Teaching and Examination

Semester – II

Effective from June 2020

Subject Code	Subject	Scheme Of Teaching			Scheme Of Examination					
PGMTH		L	P	Total	TH		PR		TOTAL	
					Int.	Ext	Int.	Ext	Int.	Ext
201	Real Analysis-2	4	__	4	30	70	---	---	30	70
202	Complex Analysis-2	4	__	4	30	70	---	---	30	70
203	Topology -2	4	__	4	30	70	---	---	30	70
204	Abstract Algebra-2	4	__	4	30	70	---	---	30	70
205	ODE-2	4	__	4	30	70	---	---	30	70
206	Numerical Analyis-2	4	__	4	30	70	---	---	30	70