VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. MATHEMATICS (EVENING)
SEMESTER – I
Effective from June 2024

M. Sc. Sem – I (Mathematics)						
Theory Paper/Practical	Teaching schedule Hrs/week	Exam Schedule			Total Marks	Credit
		Duration	Internal Marks	External Marks		
Theory papers:						
1: Core Paper-I PGMTH-101: - Advanced Real Analysis	4	3	30	70	100	4
2: Core Paper-II PGMTH-102: Ordinary Differential Equations	4	3	30	70	100	4
3: Core Paper-III PGMTH-103: Topology	4	3	30	70	100	4
4:Inter/Multi-Disciplinary Elective Paper PGMTH -1042 Operation Research PGMTH -1043 Integral Transforms-I PGMTH -1044 Advanced Number Theory PGMTH -1045 Special Functions-I	4	3	30	70	100	4
5. Practical based on 101 to 104 PGMTH -105 : Practical	12	10-15	50	100	150	6
6. Skilled based elective paper / swayam/other moac courses (Course can be taken from any faculty) PGMTH-106 Vedik Mathematics	2	0	20	30	50	2
		Total	190	410	600	24

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. Mathematics (EVENING)

Semester: I
Effective from June 2024
PGMTH-101: Advanced Real Analysis

L T P
4-0-0

Unit-I
Algebra of sets, σ Algebra, the extended real numbers, Open and closed set of real numbers, Borel sets, Lebesgue outer measure.

Unit II
Measurable sets and Lebesgue measure, Non-measurable set, Measurable function, Littlewoods's three principles (only statements).

Unit-III:
Riemann integral, Lebesgue integral of a bounded function over a set of finite measure, Bounded convergence theorem, Integral of a non-negative function.

Unit-IV:
Fatou's lemma, Monotone convergence theorem, General Lebesgue integral, Lebesgue convergence theorem, Generalized Lebesgue convergence theorem.

Reference Books:

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

SYLLABUS FOR M.Sc. Mathematics (EVENING)

SEMESTER – I Effective from June- 2024

PGMTH-102 : Ordinary Differential Equations

L: T: P
4 0 0

UNIT-1

Linear Differential Equations of Higher Order: Equations with Variable Coefficients, Wronskian, Variation of Parameters, Some Standard Methods: (i) Method of Undetermined Coefficients (ii) Reduction of the order of equation

UNIT-2

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

UNIT-3

Systems of Linear Differential Equations: Introduction, Systems of First Order Equations, Existence and Uniqueness Theorem, Fundamental Matrix

UNIT-4

Non homogeneous Linear Systems, Linear Systems with Constant Coefficients, Linear Systems with Periodic Coefficients

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 (EVENING)

SEMESTER – I Effective from June- 2024

PGMTH-103 Topology

L: T: P

4 0 0

UNIT-1

Topological Spaces: Definition and some examples, Metrizable space, Relative Topology, Continuity and Homeomorphism. Some elementary concepts: Open and Closed sets, Closure of a set, Isolated point, limit point, Derived set.

UNIT-2

Interior of a set, Boundary of a set, Perfect set, Dense and Nowhere dense sets. Open base and Open sub-base, First and second countable spaces, Lindelof's theorem, Separable spaces.

UNIT-3

Compact space, Continuity and compactness, Finite intersection property, Heine-Borel theorem, Product topology (definition) and projection mapping (definitions), Tychnoff's theorem (only statement), Locally compact space.

UNIT-4 Separation Axioms: T_1 and T_2 Spaces, Regular, completely regular and Normal spaces, Urysohn's lemma, Tietze's extension theorem (Without proof).

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.

ELECTIVE PAPER

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. Mathematics (EVENING)

SEMESTER – I Effective from June- 2024

PGMTH-1042-Linear Programming

L : T : P
4 0 0

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.

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

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

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.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

SYLLABUS FOR M.Sc Mathematics (EVENING)

SEMESTER – I Effective from June- 2024

PGMTH-1043-INTEGRAL TRANSFORMS-I

L: T: P

4 0 0

UNIT-1: Laplace Transforms:

- Introduction and definition of Laplace transforms with examples
- Existence condition for Laplace transforms
- Basic properties of Laplace transforms
- The convolution theorem and properties of convolution

UNIT-2Laplace Transforms:

- Differentiation and integration of Laplace transforms
- The inverse Laplace transforms and examples
- Tauberian theorem
- Watson's lemma

UNIT-3 Finite Laplace Transforms:

- Introduction
- Definition of finite Laplace transforms and examples
- Basic operational properties of finite Laplace transforms
- Applications to Finite Laplace Transforms
- Tauberian theorems

UNIT-4 Applications of Laplace Transforms

- Applications of Laplace transforms to ordinary differential equations
- Applications of Laplace transforms to partial differential equations
- Initial and boundary value problems
- Solutions to Integral equations

References:

1) Lokenath Debnath: 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.
M.Sc. Mathematics (EVENING)

SEMESTER – I Effective from June- 2024

PGMTH-1044- Advance Number Theory

L T P
4-0-0

Unit I: Primitive Roots

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

Unit II: Indices and Quadratic Congruence

The theory of indices, Solution of the congruences of the type $ax^n \equiv b\ (mod\ p)$ and $x^n \equiv a\ (mod\ n), \gcd(a,n) = 1$.
Quadratic Congruence, Euler's criterion, Quadratic residues.

Unit III: Quadratic Congruence

The Legendre symbol and its properties, Gauss' Lemma, Law of quadratic reciprocity, Quadratic residues and primes, Quadratic congruence with composite moduli.

Unit IV: Numbers of special forms

Perfect numbers, Mersenne primes, Amicable numbers, Fermat numbers, 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, 2nd Ed., 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.
M.Sc Mathematics (EVENING)

SEMESTER – I Effective from June- 2024

PGMTH–1045 (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 $(z)'$ (z) ,Evaluation of (1) and (1)′, The Euler product for (z) , The difference equation $(z+1) = z\ (z)$, The order symbols o and 0, Evaluation of certain infinite products, Euler integral for (z) ,

UNIT-3

The Beta function, The value of (z) $(1- z)$, 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 theparameters, Evaluation of F(a, b; c; 1), the contiguous function relations, The hypergeometricdifferential equation, Logarithmic solutions of the hypergeometric equation, F(a, b; c; z) as afunction of its parameters, Simple transformations, Relation between functions of Z and 1-Z, Aquadratic 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 (EVENING)

Semester: I
Effective from June 2024

Skill based Elective Course:
PGMTH-106 : Vedic Mathematics

Unit I:

Ekadhikena Purvena sutra, Nikhilamnavatascaramam Dasatah sutra, Urdhvatiryagbhyam sutra, Paravartya Yojayet sutra.

Unit II:

Sunyam Samya Samuccaye sutra, Anurupye Sunyamanyat sutra, Sankalana Vyavakalanabhyam sutra, Puranapuranabhyam sutra, Yavadunam Tavadunikrtya Varganca Yojayet sutra.

Unit III:

Calana Kalanabhyam sutra, Ekanyunena Purvena sutra, Anurupyena sutra, Adyamadyenantyamantyena sutra, Gunita Samuccayah :Samuccaya Gunitah sutra

Syllabus is covered from the following reference books:

1. Vandana Singhal: Vedic Mathematics for All Ages – A Beginners Guide,Motilal Banarsidass, 2014.
2. Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaja: Vedic Mathematics: Sixteen Simple Mathematical Formulae from The Vedas.
3. V. S. Agrawal: Vedic Mathematics, Motilal Banarsidass publisher private limited, New Delhi, 1970 Ed.
4. Rajesh Kumar Thakur: Advanced Vedic Mathematics, Rupa Publications India, 2019.
5. Rajesh Kumar Thakur: The Essentials of Vedic Mathematics, Rupa Publications India, 2013.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

M. Sc. Sem – II (Mathematics)						
Theory Paper/Practical	Teaching schedule Hrs/week	Exam Schedule			Total Marks	Credit
		Duration	Internal Marks	External Marks		
Theory papers:						
1: Core Paper-I PGMTH-201- Advanced Abstract Algebra	4	3	30	70	100	4
2: Core Paper-II PGMTH-202- Complex Analysis	4	3	30	70	100	4
3: Core Paper-III PGMTH-203-Partial Differential Equations	4	3	30	70	100	4
4:Inter/Multi-Disciplinary **Elective Paper** PGMTH -2042 Operation Research PGMTH -2043 Advanced Integral Transforms-I PGMTH -2044 Analytic Number Theory PGMTH -2045 Special Functions-II	4	3	30	70	100	4
5. Practical based on 101 to 104 PGMTH -205 :Practical	12	10-15	50	100	150	6
6. Skilled based elective paper / swayam/other moac courses (Course can be taken from any faculty) PGMTH- 106 Mathematics For Competitive Examination	2	0	20	30	50	2
		Total	190	410	600	24

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

PGMTH-201 : Advanced Abstract Algebra

L T P
4-0-0

Unit-I

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

Unit II

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

Unit-III

Extension fields, Finite extension field, Algebraic extension, Algebraic number, Roots of polynomials.

Unit-IV

Splitting fields, Uniqueness of Splitting fields, Construction with straightedge and compass, More about roots, Simple extension. Elements of Galois theory: Group of automorphisms of a field and their fixed fields, Normal extension, Galois group and its examples.

Reference Books:

1. I. N. Herstein: Topics in Algebra 4thEd., John Wiley Sons.
2. P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul: Basic Abstract Algebra, 2nd Ed., 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.
M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

PGMTH-202- Complex Analysis

L: T: P

4 0 0

UNIT-1

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

Elementary Functions:Exponential function, Trigonometric functions, Hyperbolic functions

UNIT-2

Complex Integration: Contour Integral, Primitives, Cauchy-Goursat Theorem, Extension of Cauchy-Goursat Theorem, Cauchy Integral formula, Consequences of Cauchy Integral formula, Concept of Maximum Moduli of functions.

UNIT-3

Series Expansions: Power Series, Uniform convergence of power series, Taylor series, Zeros of Analytic functions, Laurent Series

UNIT-4

Singularities and Residues: Classification of Singularities, Residues, Poles and Zeros, Behavior of functions and infinity, Meromorphic functions, Open mapping theorem

References:

1.H. S. Kasana: “Complex Variables – Theory and Applications”, 2nd Edition (2005), PHI Learning Private Limited, 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.
M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

PGMTH–203 (Partial Differential Equations)

L : T : P
4 0 0

UNIT-1

Ordinary Differential Equations in More than Two Variables:

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 of the First Order:

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

Partial Differential Equations of the Second Order:

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
   Sharma, Gupta: Differential Equations, Krishna Prakashan Media, 1997- 98.

ELECTIVE PAPERS

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

PGMTH–2042 Operations Research

L : T : P
4 0 0

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.

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.

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

Theory of Games
Revision: Two-person zero-sum game, Pure strategies, Mixed Strategies.
The rules of dominance, Solution methods for Games without Saddle point: Algebraic method, Arithmetic method, Matrix method, Linear Programming method.

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.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

PGMTH –2043 ADVANCED INTEGRAL TRANSFORMS-I

L : T: P

4 0 0

UNIT-1 Hankel Transforms:

Introduction , Hankel transform and Examples, Operational properties of the Hankel transform

UNIT-2 Finite Hankel Transforms:

Introduction , Definition of the finite Hankel transform and examples, Finite Hankel transforms of some elementary functions, Basic operational properties of the finite Hankel transform

UNIT-3 Applications of Hankel transforms:

Applications of Hankel transforms to partial differential equations, Applications of finite Hankel transforms

UNIT-4 Hilbert and Stieltjes Transforms:

Introduction and definition of Hilbert transform and examples, Basic properties of Hilbert transform, Definition of Stieltjes transforms and examples, Basic properties of Stieltjes transforms, Inverse theorem for Stieltjes transforms, Applications of Stieltjes transforms, The generalized Stieltjes transform, Basic properties of the generalized Stieltjes transform

References:

1) Lokenath Debnath: 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.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

PGM TH-2044-Analytic Number Theory

L T P
4-0-0

Unit I:

Arithmetical functions and Dirichlet multiplication

Basic introduction of the Möbius function $\mu(n)$ and the Euler totient function $\phi(n)$, relation connecting μ and ϕ. The Dirichlet product of two arithmetical functions (a.f.) and group structure w.r.t. this product, the Mangöldt function $\Lambda(n)$, Multiplicative a.f., the inverse of a completely multiplicative a.f.

Unit II:

Dirichlet multiplication and averages of Arithmetical functions

Liouville's function $\lambda(n)$, the divisor functions $d(n)$ and $\sigma_\alpha(n)$, the generalized convolutions. The big oh notation, Euler's summation formula, some elementary asymptotic formulas, the average order of divisor functions $d(n)$and $\sigma_\alpha(n)$, the average order of functions $\phi(n), \mu(n), \Lambda(n)$.

Unit III:

Averages of Arithmetical Functions and Chebyshev's functions

Distribution of lattice points visible from the origin, the partial sums of a Dirichlet product, applications to $\mu(n)$ and $\Lambda(n)$. Chebyshev's functions $\psi(x)$and $\vartheta(x)$, relation between $\psi(x), \pi(x)$and $\vartheta(x)$, Abel's identity.

Unit IV:

Elementary theorems on the distribution of prime numbers

Equivalent forms of prime number theorem, lower and upper bounds for $\pi(n)$and p_n, Shapiro's Tauberian theorem and its applications, an asymptotic formula for the partial sums $\sum_{p\leq x}\left(\frac{1}{p}\right)$, the partial sums of function $\mu(n)$.

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, New York, 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.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

PGMTH–2045 : Special Functions-II

L : T : P
4 0 0

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 ${}_2F_0$, 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.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – II Effective from June- 2024

Skill based Elective Course:

Paper: PGMTH – 206,
Mathematics for Competitive Examinations

Unit I:
Arithmetical Ability-I: HCF and LCM of numbers, Decimal Fractions, Average, Surds and Indices, Problems on Ages.

Unit II:
Arithmetical Ability-II: Time and Work, Time and Distance, Permutation and Combination, Percentage, Ratio and Proportion.

Unit III:
Mensuration, Trigonometry: Area, Volume, Surface areas, Heights and Distances.

Syllabus is covered from the following reference books:

1. R. S. Aggrawal: Quantitative Aptitude, S. Chand Co., 2022.
2. Mamta Patel: Text book for Competitive Examinations, Victor Publications, Surat, 2001.
3. Arun Sharma, Madhukar Kumar Bhagat, Abhijit Guha: General Studies for Civil Services Preliminary Examination, GS Paper-II, McGraw Hill Edu (India) Pvt. Ltd., Chennai, 2019.
4. R. S. Aggrawal: Arithmetic, Subjective and Objective for Competitive Examinations, S. Chand, April 2017.
5. Disha Experts: Speedy Arithmetic for all Competitive Exams, Disha Pub. Inc., 2021.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. MATHEMATICS (EVENING)
SEMESTER – III
Effective from June 2024

M. Sc. Sem – III (Mathematics)						
Theory Paper/Practical	Teaching schedule Hrs/week	Exam Schedule			Total Marks	Credit
		Duration	Internal Marks	External Marks		
Theory papers:						
1: Core Paper-I PGMTH-301: - Functional Analysis-I	4	3	30	70	100	4
2: Core Paper-II PGMTH-302: Advanced Numerical Analysis	4	3	30	70	100	4
3: Core Paper-III PGMTH-303: Calculus of Variation	4	3	30	70	100	4
4:Inter/Multi-Disciplinary Elective Paper PGMTH -3042 Advanced Operation Research PGMTH -3043 Advanced Integral Transforms-I PGMTH -3044 Diophantine equations PGMTH -3045 Advanced Special Functions-I	4	3	30	70	100	4
5. Practical based on 301 to 304 **PGMTH -305** : Practical	12	10-15	50	100	150	6
6. **Skilled based elective** paper / swayam/other moac courses PGMTH: 306 **Basicsof Financial Mathematics**	2	0	20	30	50	2
		Total	190	410	600	24

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH- 301 : Functional Analysis – I

L : T : P
4 0 0

Unit- 1

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

Unit-2

Vector Space, Normed Space, Banach Space, Further properties of Normed Spaces, Finite Dimensional Normed Spaces and Subspaces, Compactness and Finite Dimension, Linear Operators

Unit-3

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, Properties of Inner Product Spaces, Orthogonal Complements and Direct Sums, Orthogonal Sets and Sequences

Syllabus is covered from the following reference books:

1. E. Kreyszig: Introductory Functional Analysis with applications, John Wiley and Sons.
2. B.V. Limaye: Functional Analysis, New Age International Limited, Publishers
3. G.F. Simmons: Introduction to Topology and Modern Analysis, Tata McGraw - Hill.
4. A. R. Vashistha & J.N. Sharma : Functional Analysis, Krishna Prakashan Media (P) Ltd.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH-302: Advanced Numerical Analysis

L : T : P
4 0 0

UNIT-I

Transcendental and Polynomial Equations

Direct Methods (Introduction) , Iterative Methods (Muller Method, Chebyshev Method), Rate of convergence (Definition), First and second order General Iteration Methods

System of Linear Algebraic Equations

Introduction, Direct Methods (Cramer Rule, Gauss Elimination Method, Gauss-Jordan Elimination Method, Triangularization Method), Iteration methods (Jacobi Iteration Method, Gauss-Seidel Iteration Method)

UNIT-2

Eigen values Problems

Eigen values and Eigenvectors, Jacobi method for symmetric matrices, Power method, Inverse power method.

Numerical differentiation

Methods based On Interpolation (Non-uniform Nodal Points, Uniform Nodal Points), Optimum Choice of Step Length

UNIT-3

Numerical Integration

Methods based on interpolations (Newton-Cotes Method), Methods based on Undetermined coefficients (Newton-Cotes Method, Gauss Quadrature Method, Gauss-Legendre Integration Method, Gauss-Chebyshev Integration Method)

UNIT-4

Numerical Solution of Ordinary Differential Equations:

Initial Value Problem,Single step methods (Explicit Runge-Kutta Methods)

Boundary Value Problem Finite Difference Methods: linear Second Order Differential Equations, Solution of Tridiagonal System

Syllabus is covered from the following reference books:

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.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH–303 :Calculus of Variations

L : T : P
4 0 0

UNIT-I

Variational Problems with Fixed Boundaries:

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

UNIT-II

Functionals

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-III

Variational Problems with Moving Boundaries:

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-IV

Sufficient Conditions for an Extremum:

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

Syllabus is covered from the following reference books:

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".
   ElsGok L. D.: "Calculus of Variation".
3. Mariano Giaquinta, Stefan Hildebrandt: "Calculus of Variations-I", Springer Science & Business Media, 2004

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH–3041 : Fluid Dynamics

L : T : P
4 0 0

- UNIT I
  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 II:
  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 III
  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 IV
  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

Syllabus is covered from the following 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.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH- 3042: Advanced Operations Research

L : T : P
4 0 0

Unit I

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 II

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 III

Theory of Replacement:

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

Unit IV

Information Theory

Introduction, Communication Processes, A Measure of Information, Measure of other Information Quantities, Channel Capacity, Efficiency and Redundance.

Syllabus is covered from the following reference books:

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.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH- 3043 : Advanced Integral Transforms – I

L : T : P
4 0 0

UNIT 1

Introduction, Definition of the Z-transforms and examples, Basic operational properties of Z-transforms, Summation of Infinite series

UNIT 2

The inverse Z-transform and examples, Applications of Z-transforms to Finite Difference Equations

UNIT 3

Introduction, Definition of Mellin transforms and examples, Basic operational properties of Mellin Transforms

UNIT 4

Applications of the Mellin transforms, Application of Mellin transforms to summation of series

Syllabus is covered from the following reference books:

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH – 3044 Diophantine equations

L : T : P
4 0 0

Unit I:

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 II:

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

Unit III:

Fermat's equation: Diophantine equations $x^2 + y^2 = z^2$ and its solutions, Fermat's equation$x^n + y^n = z^n$ for the cases $n = 3, 4$, Fermat's Last Theorem.

Unit IV:

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.

Syllabus is covered from the following reference books:

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, 5th reprint, 2004.
3. S. K. Pundir, R. Pundir: Theory of Numbers, Pragati Prakashan, Meerut, 6th edition, 2019.
4. Neville Robbins: Beginning Number Theory, Narosa Pub. House, New Delhi, 2nd edition, 2006.
6. George Andrews: Number Theory, The Hindustan Pub. Corp., New Delhi.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

PGMTH–3045 :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,ThepFq with unit argument, Saalschutz' theorem, Whipple's theorem, Dixen'stheorem,Contour integrals of Barns' type, The Berns' 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($2xt - t^2$), setsgenerated by *et* ψ (xt) , the generating functions $A(t)\exp(-xt(1-t))$, another class ofgenerating functions, Boas and Buck generating functions, An extension.

Syllabus is covered from the following reference books:

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.
M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – III Effective from June- 2024

Skill based Elective Course:
Paper: PGMTH – 306
Basics of Financial Mathematics

Unit I:
Interest and interest rate: Origin of the concept of interest, Various forms of interest rate,
Accumulation with simple and compound interest: Meaning and significance of simple and compound interest, formulae, Calculations undersimple and compound interest rates, simple and compound interest rates with equivalency, effective rate of interest.

Unit II:
Present value: Present value, net present value and future value, their interpretation.
Annuities: Annuities, Calculating value of regular annuity, simple applications of regular annuities (up to 3 periods).

Unit III:
Tax: Tax, Calculation of tax and simple application of tax calculation in goods and service tax, income tax.
Bills: Bills, Tariff rates, fixed charge, surcharge, service charge, GST, Calculation and interpretation of electricity bill, water supply and other supply bills.

Syllabus is covered from the following reference books:

1. John McCutcheon, William F. Scott: An introduction to the mathematics of finance, Elsevier Butterworth-Heinemann, Burlington, 2005.
2. S. Chandra, S. Dharmaraja, Aparna Mehra, R. Khemchandani: Financial Mathematics: An Introduction, Narosa Book Distributors Pvt. Ltd., Bengaluru, 2013.
3. Mark H. A. Davis: Mathematical Finance: A Very Short Introduction, OUP Oxford, 2019.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
SYLLABUS FOR M.Sc. MATHEMATICS (EVENING)
SEMESTER – IV
Effective from June 2024

M. Sc. Sem – IV (Mathematics)						
Theory Paper/Practical	Teaching schedule Hrs/week	Exam Schedule			Total Marks	Credit
		Duration	Internal Marks	External Marks		
Theory papers:						
1: Core Paper-I PGMTH-401- Advanced Functional Analysis -II	4	3	30	70	100	4
2: Core Paper-II PGMTH-402- Advance Linear Algebra	4	3	30	70	100	4
3: Core Paper-III PGMTH-403 Integral Equations	4	3	30	70	100	4
4:Inter/Multi-Disciplinary **Elective Paper** PGMTH -4042 Nonlinear Programming PGMTH -4043 Advanced Integral Transforms – II PGMTH -4044 Partition Theory and CrytographyPGMTH -4045 Advanced Special Functions – II	4	3	30	70	100	4
5. Practical based on 401 to 404 PGMTH -405 :Practical	12	10-15	50	100	150	6
6. Skilled based elective paper / swayam/other moac courses (Course can be taken from any faculty) Skilled based elective Papers: **Basics of Data Science**	2	0	20	30	50	2
		Total	190	410	600	24

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

PGMTH: 401 Advanced 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, Adjoint Operator

Unit-3

Reflexive Spaces, Category Theorem and Uniform Boundedness Theorem, Strong and Weak Convergence

Unit-4

Convergence of Sequences of Operators and Functionals, Open Mapping Theorem, Closed Linear Operators, Closed Graph Theorem, Banach Fixed Point Theorem

Syllabus is covered from the following reference books:

1. E. Kreyszig: Functional Analysis and its application, John Wiley and sons.
2. B.V. Limaye: Functional Analysis, New Age International Limited, Publishers
3. G.F. Simmons: Introduction to Topology and Modern Analysis, Tata McGraw - Hill.
4. A. R. Vashistha & J.N. Sharma: Functional Analysis, Krishna Prakashan Media (P) Ltd.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

PGMTH: 402- Advanced Linear Algebra

L : T : P
4 0 0

UNIT 1:

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

UNIT 2:

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 3:

Characteristic Roots and Characteristic Vectors, Algebra of Matrices, Similar linear transformations, Triangular form.

UNIT 4:

Nilpotent transformations, Invariants, Jordan Canonical form, Rational Canonical form.

Syllabus is covered from the following reference books:

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

PGMTH–403 : Integral Equations

L : T : P
4 0 0

UNIT -1

Preliminary Concepts:

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

Conversion of ODE into Integral Equations:

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

Fredholm Integral Equations of second kind with Separable kernel:

Eigenvalues and Eigenfunctions, 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

Method of Succesive approximations:

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

Syllabus is covered from the following reference books:

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 Rimple Pundir: Integral Equations and Boundary Value Problems, Pragati Prakasan, 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.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

PGMTH–4041: Computational Fluid Dynamics)

L : T : P
4 0 0

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-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,

UNIT -4

Laplace and poison Equation

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

Syllabus is covered from the following reference books:

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 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.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

PGMTH–4042 : Non – Linear Programming

L : T : P
4 0 0

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.

Syllabus is covered from the following reference books:

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.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

PGMTH: 4043 - Advanced Integral Transforms-II

L : T : P
4 0 0

UNIT 1

Basic concepts and Definitions, The Fourier Integral formulae, Definition of Fourier transforms and examples, Basic properties of Fourier transforms

UNIT 2

Definitions of Fourier Cosine and Sine transforms with examples, Properties of Fourier Cosine and Sine transforms,Evaluation of definite integrals, Solutions of integral equations

UNIT 3

Definition of finite Cosine and Sine transforms with examples,Basic properties of finite Fourier Cosine and Sine transforms, Applications of finite Fourier Cosine and Sine transforms

UNIT 4

Applications of Fourier transforms to partial differential equations, Applications of Fourier Cosine and Sine transforms to partial differential equations

Syllabus is covered from the following reference books:

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.
M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

Paper: PGMTH – 4044 Partition Theory and Cryptography

L : T : P
4 0 0

Unit I:
Partition theory: An introduction, Partitions into exactly k parts, Geometric representation of partitions, Generating functions, Recurrence relations for $p(n,k)$, Value of $p(n,k)$ for some special cases, Euler's Pentagonal number theorem.

Unit II:
Partition theory: Euler's recursion formula for $p(n)$, Durfee's identity, Jacobi's identity, Upper bound of $p(n)$, Two-line partitions, Formula for $R(A,B)$.

Unit III:
Cryptography: The Objectives of Cryptography, Encryption Schemes, Classification of Attacks, Cesar Cipher, Vigenère cipher, Autokey cipher, Hill's cipher.

Unit IV:
Cryptosystems: RSA algorithm, Knapsack problem, Superincreasing knapsack problem, Knapsack cryptosystem, ElGamal Cryptosystem.

Syllabus is covered from the following reference books:

1. Hansraj Gupta: Selected Topics in Number Theory, Abacus Press, England, 1980 Ed.
2. David M. Burton: Elementary Number Theory, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 7th edition, 2012.
3. George Andrews, Kimmo Eriksson: Integer Partitions, Cambridge Univ. Press, UK, 2004 Ed.
4. Johannes A. Buchmann: Introduction to Cryptography, Springer-Verlag, NY, Second Edition, Sixth Indian Reprint, 2013.
5. Tom M. Apostol: Introduction to Analytic Number Theory, Narosa Pub. House, New Delhi, 1998 Ed.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

M.Sc. M.Sc. Mathematics (EVENING)

SEMESTER – IV Effective from June- 2024

PGMTH–4045 : Advanced Special Functions-II

L : T : P
4 0 0

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.

Syllabus is covered from the following reference books:

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.

M.Sc. (Mathematics) Semester: III, IV

Syllabus to be in force from June 2024

Skill based Elective Course:

PGMTH –406

Basics of Data Science

Unit 1. Descriptive Statistics and probability

Mean, Mode, Median, Standard Deviation, Variance, Range, Percentile, Quartile, Interquartile Range, Counting, Random variables, distributions, quantiles, mean variance, Conditional probability, Bayes' theorem, base rate fallacy, Joint distributions, covariance, correlation, independence, Central limit theorem

Unit 2: Correlation and Regression

measure the relationship between two variable, linear relationship between two variables. Correlation coefficient, positive correlation, negative correlation and no correlation, Linear regression, Logistic regression:

Unit 3: Probability Distribution

Simple and Composite Hypotheses Null and Alternative Hypotheses, Critical Region, Type-I and Type-II Errors, Level of Significance, One-Tailed and Two-Tailed Tests, Procedure of Testing a Hypothesis

Books:

1. Sheldon Ross, Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press/ Elsevier, 2014.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
3. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.
4. Goon A.M., Gupta M.K.: Das Gupta.B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.