ANNEXTURE-I

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS OF M. Sc. (MATHEMATICS)

SEMESTER-III

Effective from June-2018

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS FOR M. Sc. (MATHEMATICS)

Effective from June-2018

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	

*Enclosed here with syllabus of M. Sc –Sem-IV

VEER NARMAD SOUTH GUJARATUNIVERSITY,SURAT
SYLLABUS FOR M.Sc. (MATHEMATICS)
Semester: III
Effective from June -2018
PGMTH–301 (Functional Analysis – I)

L : T : P
4 0 0

Metric Space:

Metric Space, Further examples of Metric Spaces, Completeness, Examples with proofs, Completion of Metric Spaces, Completion theorem.

Normed Spaces and Banach Spaces:

Vector Space, Normed Space, Banach Space, Further properties of Normed Spaces, FiniteDimensional Normed Space and Subspaces, Compactness and finite dimension, Linear Operators,Bounded and Continuous Linear Operators, Linear Functionals, Linear Operators and Functionals on Finite dimensional Spaces, Normed Spaces of Operators, Dual space.

Inner Product Spaces, Hilbert Spaces:

Inner Product space, Hilbert space, Properties of Inner product Space, 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 GUJARATUNIVERSITY,SURAT
SYLLABUS FOR M.Sc. (MATHEMATICS)
Semester-III
Effective from June -2018
PGMTH–302 (Differential Equations)

L : T : P
4 0 0

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.

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, 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.

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

VEER NARMAD SOUTH GUJARATUNIVERSITY,SURAT
SYLLABUS FOR M.Sc (MATHEMATICS)
Semester-III
Effective from June -2018
PGMTH–303 (Calculus of Variations)

L : T : P
4 0 0

Variational Problems with Fixed Boundaries:

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

Variational Problems with Moving Boundaries:

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

Sufficient Conditions for an Extremum:

Field of Extremals, Jacobi Condition, Weirstrass Function, Legendre Condition, Second Variation, Canonical Equations and Variational Principles, Complementary 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 GUJARATUNIVERSITY,SURAT
SYLLABUS FOR M.Sc (MATHEMATICS)
Semester-III
Effective from June -2018
PGMTH–304 (Advanced Linear Algebra – I)

L : T : P
4 0 0

Prerequisite:

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

Dual Spaces:

Hom (V, W), dimension ofHom (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.

Linear Transformations:

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, Characteristic Roots and Characteristic Vectors, Algebra of Matrices.

Real Quadratic Forms:

Qudratic form, Rank and Signature of Quadratic forms.

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.

VEER NARMAD SOUTH GUJARAT UNIVERSITY , SURAT

SYLLABUS FOR M. Sc. (MATHEMATICS)

SEMESTER: III

Group of Optional Papers

Effective from June-2018

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 GUJARATUNIVERSITY,SURAT

SYLLABUS FOR M.Sc. (MATHEMATICS)

Semester: III

Effective from June -2018

PGMTH–3001 (Fluid Dynamics)

L : T : P
4 0 0

- Vectors and Tensors:
- Flow Kinematics
    - Flow descriptions (Lagrangian, Eulerian, Material derivative)
    - Motion of Fluid particles(rate of dilation, rate of shear, rate of rotation)
    - Conservation Laws
- Reynold's transport theorem
- Conservation of mass
- Conservation of momentum
- Conservation of energy
- Navier-stokes equation
- Non dimensionalization of the Navier-stokes equation
- Special form of conservation laws
- Euler equation for inviscid gas dynamics
- Potential equation
- Incompressible inviscid irrotational flows
- Velocity potential and stream function in 2d and 3d

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

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SYLLABUS FOR M.Sc. (MATHEMATICS)

Semester: III

Effective from June -2018

PGMTH–3002 (Mathematical Software)

L : T : P
4 0 4

Introduction

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

Plotting

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

Branching statement and program design

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

Loops

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

User defined function

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

Reference books:

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

VEER NARMAD SOUTH GUJARATUNIVERSITY,SURAT
SYLLABUS FOR M.Sc. (MATHEMATICS)
Semester: III
Effective from June -2018
PGMTH–3003 (Linear Programming)

L : T : P
4 0 4

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.

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SYLLABUS FOR M.Sc. (MATHEMATICS)

Semester: III

Effective from June -2018

PGMTH–3004(Operations Research)

L : T : P
4 0 4

Inventory Control:

Introduction to Various Types of Inventory Problems, Method with known Demand Function, Economic Order Quantity (EOQ), Deterministic Inventory Problems when Shortages are AllowedDeterministic 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.

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.

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 GUJARATUNIVERSITY,SURAT

SYLLABUS FOR M.Sc. (MATHEMATICS)

Semester: III

Effective from June -2018

PGMTH–3005 (Integral Transform-I)

L : T : P
4 0 0

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,
- The inverse Laplace transforms and examples,

Finite Laplace Transforms:

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

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
- Solution of differential equations.
- Application of finite Laplace transforms.

References:

1) Ian Sneddon : The use of Integral Transform. TMIH, 1979.
2) Loknath Debnath: Integral Transform and their applications, CRC Pub., 1995.
3) Poularikas, A.D. : The Transforms and Applications Handbook: Second Edition. Boca Raton: CRC Press LLC, 2000
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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SYLLABUS FOR M.Sc. (MATHEMATICS)

Semester: III

Effective from June -2018

PGMTH–3006 (Advanced Integral Transform-I)

L : T : P
4 0 0

Hankel Transforms:

- Introduction and definition of Hankel transforms with examples,
- Operational properties of the Hankel transforms

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Finite Hankel Transforms:

- Introduction and definition of the finite Hankel transforms with examples,
- Basic operational properties

Application of Hankel Transforms:

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

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) Ian Sneddon : The use of Integral Transform. TMIH, 1979.
2) Loknath Debnath: Integral Transform and their applications, CRC Pub., 1995.
3) Poularikas, A.D. : The Transforms and Applications Handbook: Second Edition. Boca Raton: CRC Press LLC, 2000
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 GUJARATUNIVERSITY,SURAT

SYLLABUS FOR M.Sc. (MATHEMATICS)

Semester: III

Effective from June -2018

PGMTH–3007 (Advanced Number Theory – I)

L	T	P
4	0	0

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

The Quadratic Reciprocity Law: Euler's criterion, The Legendre symbol and its properties, Gauss' Lemma, QuadraticReciprocity and Quadratic Reciprocity law, Quadratic congruence with compositemoduli.

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.

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Semester: III

Effective from June -2018

PGMTH–3008 (Analytic Number Theory)

L	T	P
4	0	0

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

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 $\sigma_\alpha(n)$, 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 $\Lambda(n)$.

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.

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SYLLABUS FOR M.Sc. (MATHEMATICS)
Semester: III
Effective from June -2018
PGMTH–3009 (Special Functions-I)

L : T : P
4 0 0

Infinite Products :

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

THE GAMA AND BETA FUNCTIONS:

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

THE HYPERGEOMETRIC FUNCTION:

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, Aquadratic transformation, other quadratic transformations, a theorem due to Kummer, Additionalproperties.

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: III
Effective from June -2018
PGMTH–3010 (Advanced Special Functions-I)

L	T	P
4	0	0

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 Berns' integrals and the function pFq , A useful integral.

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 aninteger, Modified Bessel functions, Neumann polynomials, Neumann series.

THE CONFLUENT HYPERGEOMETRIC FUNCTION:

Basic properties of the 1F1 ,Kummer's first formula, Kummer's second formula.

GENERATING FUNCTIONS:

The generating function concept, Generating functions of the form G(2xt – t 2), sets generated by $et\ \psi$ (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.