Programme Project Report (PPR) for Master of Arts in Mathematics

Programme's Mission & Objectives :

1. To provide educational opportunities for higher education through distance mode for a large segment of the population, including those in employment, women (including housewives) and adults who wish to upgrade their education or acquire knowledge in various fields of study.
2. To spread the light of education till the smallest & darkest corner.
3. To provide access to higher education to all segments of the society;
4. To offer high-quality, innovative and need-based programmes at different levels, to all those who require them;
5. To reach out to the disadvantaged by offering programmes in all parts of the country at affordable costs with our motto "देश हित में शिक्षा का प्रसार, देश के कौने कौने में"
6. To promote, coordinate and regulate the standards of education offered through open and distance learning in the country.
7. To spread more literacy in the society.

Relevance of the program with HEI's Mission and Goals :

The University understands the need of literacy in India & firmly believes that education has to be spread to the general masses. The University has acquired a commendable record of service in the field of education, health care, and social welfare. To reach with the above motive of service to the remotest corner of India, the Distance Education Programme of Swami Vivekanand Subharti University was conceived in 2009.

Nature of prospective target group of learners :

A large segment of the population living in villages, weaker sections of the society including those who are already in employment, girls belonging to the remote areas, women with social commitments (including home-makers) and anyone who wishes to upgrade their education or acquire knowledge in various fields of study.

Appropriateness of programme to be conducted in Open and Distance Learning mode to acquire specific skills and competence :

Through various programmes, distance education can be able to spread more literacy in the society and encourage the large segment of population to upgrade their education skill/s.

Course Structure :

1. **Instructional Design :**

The Instructional System of the University comprises six components, viz, Self Learning Material, Continuous Internal Assessment (IA) & Assignment work (AW), Theory Training

Classes, Practical Exposure Classes, Professional Project Work, Internship & Industry Integrated Learning.

1. **Self Learning Material (SLM) –**

The success and effectiveness of distance education systems largely depends on the study materials. Self-learning materials depend on exploiting the various means and ways of communication to suit it to the needs of learners. These have been so designed as to substitute effectively the absence of interaction with teachers in class room teaching mode. Their style is ideal for easy and better understanding in self-study mode.

2. **Continuous Internal Assessment (CIA)**

The progress of a learner is continuously monitored through Personal Contact Programmes, Viva & Group Discussions, Personality Development Programmes and Assignment Work. All these are compulsory and marks shall be awarded for attendance and performance of a learner in all these activities, as may be prescribed in the syllabus.

a. **Personality Contact Programme (PCP) –** PCP sessions guide the learners as the programme proceeds. The date and venue for the PCP will be communicated to the learners through our website. During PCP, the learner gets guidance for better understanding of the subject. The learners can get their doubts cleared with the help of subject experts so as to improve their self-learning capability. The total duration of PCP seesions for a subject of four credits shall be 12-16 hours. Learners are required to attend PCP sessions for all their respective subjects.

b. **Viva & Group Discussion (VGD) –** VGDs are designed to help the learners improve their professional communication and presentation abilities. Special emphasis is laid on learners speaking extempore, an ability necessary for building leadership skill as well as for enhancing the capability of understanding and exchanging views. The total duration of VGD sessions for a subject of four credits shall be 3-4 hrs.

c. **Personal Development Programme (PDP) –** The PDPs are designed to improve the overall personality of the learner, and aim, especially, at the improvement of body language and strengthening of the power of expression. The purpose is to inculcate leadership, communication and presentation skills and brush up the knowledge of the learner by organizing a mix of management games, debates, quizzes and role play. The duration of PDP sessions for a subject of four credits shall be 3-4 hrs.

d. **Assignment Work (AW) –** Distance Education learners have to depend much on self study. In order to ascertain the writing skill and level of comprehension of the learner, assignment work is compulsory for all learners. Each assignment shall consist of a number of questions, case studies and practical related tasks. The Assignment Question Papers will be uploaded to the website within a scheduled time and the learners shall be required to respond them within a specified period of time. The response of the learner is examined by a faculty member.

3. **Practical Exposure Class (PEC)** – Not Applicable.
4. **Professional Project/Dissertation Work (PPW)** – The PPW enables a learner to experience the regours of an environment with the real life situations. The learners shall also be required to prepare a project report, which shall be evaluated by the University. Learners shall be subjected to a comprehensive viva for proper evaluation of the Project Report. For project work, wherever mentioned in the syllabus, DDE shall provide complete guidance to the learners. Normally, one credit of PPW shall require 30 hrs or input by the learner.
5. **Internship & Industry Integrated Learning (IIIL) –** Not Applicable
6. **Examinations –**

(a) The examination shall be held semester wise in June & December for the Calendar Batch and in December & June for Academic batch respectively.

(b) Admit Cards/Roll No. Slips and date sheet for appearing in the examination shall be provisional subject to fulfilling the eligibility, etc. Admit Cards/Roll Nos. and date-sheet will be issued to the candidates concerned, by e-mail or by hand, 10-12 days before the commencement of examination concerned, if the students have fulfilled all the requirements and paid their all kinds of fees/dues and submitted the requisite documents. If any candidate does not receive his/her Admit Card/Roll No. slip in time, he/she should contact the Directorate of Distance Education.

(c) An Examination Centre for theory & practical will be decided by the DDE and will be located in a government college or a school, where all the requisite facilities can be made available.

2. Curriculum design

I SEMESTER

S. No.	Paper Name	Paper Code	Evaluation Scheme			Total
			Internal		ESE	
			CT	Total		
1	Algebra	M.A-M-103(A)	4	30	70	100
2	Real Analysis	M.A-M-103(B)	4	30	70	100
3	Differential Equations	M.A-M-103(C)	4	30	70	100
4	Mathematical Methods	M.A-M-103(D)	4	30	70	100
5	Viva Voice/Lab I	M.A-M-153	60		140	200
	TOTAL MARKS		16		420	600

II SEMESTER

S. No.	Paper Name	Paper Code	Evaluation Scheme			Total
			Internal		ESE	
			CT	Total		
1	Metric Spaces	M.A-M-203(A)	4	30	70	100
2	Complex Analysis	M.A-M-203(B)	4	30	70	100
3	Mathematical Statistics	M.A-M-203(C)	4	30	70	100
4	Operations Research	M.A-M-203(D)	4	30	70	100
5	Viva Voice/Lab II	M.A-M-253	60		140	200
	TOTAL MARKS		16			600

II YEAR

III SEMESTER

S. No.	Paper Name		Paper Code	Evaluation Scheme			Total
				Internal		ESE	
				CT	Total		
1	Topology		M.A-M-303(A)	**4**	**30**	**70**	**100**
2	Measure and Integration		M.A-M-303(B)	**4**	**30**	**70**	**100**
3	Numerical Analysis		M.A-M--303(C)	**4**	**30**	**70**	**100**
4	**Elective – I** (Any one out of the three papers)						
	1	Programming in C And Data Structure	M.A-M-303(D1)				
	2	Advanced Discrete Mathematics	M.A-M-303(D2)				
	3	Differential Geometry	M.A.M-303(D3)	**4**	**30**	**70**	**100**
5	Viva Voice/Project I		M.A.M-353	**60**		**140**	**200**
	TOTAL MARKS			**16**			**600**

IV SEMESTER

S. No.	Paper Name		Paper Code	Evaluation Scheme			Total
				Internal		ESE	
				CT	Total		
1	Functional Analysis		M.A-M-403(A)	**4**	**30**	**70**	**100**
2	Number theory		M.A-M-403(B)	**4**	**30**	**70**	**100**
3	Fuzzy Sets and its Application		M.A-M-403(C)	**4**	**30**	**70**	**100**
4	**Elective – II** (Any one out of the three papers)						
	1	Mathematical Cryptography	M.A-M-403(D1)				
	2	Mathematical Programming	M.A-M-403(D2)				
	3	Fluid Dynamics	M.A-M-403(D3)	**4**	**30**	**70**	**100**
5	Viva Voice/Project II		M.A-M-453	**60**		**140**	**200**
	TOTAL MARKS			**16**			**600**

I YEAR, I SEMESTER

Paper Name: ALGEBRA
Paper Code: M.A.M-103(A)

Unit-I

Normal subgroups, Quotient groups, Simple groups, Homomorphisms, Isomorphisms and Automorphisms, Cayley's theorem, Factor's theorem, Cauchy's theorem, Second Fundamental theorem.

Unit-II

Normal& Composition chains, Jordon Holder's Theorem, Solvable groups, Permutation groups, Alternating groups, Simplicity of An (n>=5), Galois theorem, Conjugacy, Class equations, Sylow's theorems, Direct products, Finite abelian groups, Fundamental theorem on finite abelian groups, Decomposable groups.

Unit-III

Rings, Ideals, Prime and maximal ideals, Homomorphism, Quotient- rings, Integral domains, Imbedding of rings, Field, Prime fields, Wilson's theorem, Zorn's lemma, Zrulls theorem, Field of quotients of an Integral domain, Euclidean domains, The ring of Gussian integers, Principal ideal domains, Unique factorization theorem, Fermat's theorem.

Unit-IV

Polynomial rings over rings and fields, Division algorithm, Gauss lemma, Eisenstein's irreduciblity criterion, Primitive polynomials, Cyclotomic polynomials, Unique factorization in R[x] where R is a Unique factorization Domain.

Unit-V

Field extensions, Algebraic and transcendental extensions, Normal extensions, Construction by Ruler and Compass, Finite fields, Structure of finite fields, Subfields of finite fields.

Paper Name: REAL ANALYSIS
Paper Code: M.A..M-103(B)

Unit I

Definition and existence of Reimann -Stieltjes integral. Properties of the integral, Integration and differentiation, the fundamental theorem of calculus, Integration of vector-valued functions.

Unit II

Sequences and series of functions. Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Uniform convergence and continuity, Uniform convergence and Riemann-Stieltjes integration, Uniform convergence and differentiation, Weierstrass approximation theorem.

Unit III

Power series, algebra of power series, Uniqueness theorem for power series. Abel's and Tauber's theorems.

Unit IV

Functions of several variables, Linear transformation, Derivatives in an open subset of Rn, Chain rule, Partial derivatives, Interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem.

Unit V

Inverse function theorem and Implicit function theorem (without proof), Jacobians, Extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals.

Paper Name: DIFFERENTIAL EQUATIONS
Paper Code: M.A..M-103(C)

Unit I

Ordinary Differential Equations: Qualitative properties of solution: Oscillation, Wronskian, Sturm separation and comparison theorems.

Unit II

Ordinary points, Regular singular points, Frobenius series solution.

Unit III

Gauss hyper geometric equation, the point at infinity, Gamma functions, Hermite polynomials

Unit IV

Partial Differential Equations: Origin of first order partial differential equations, Linear equations of the first order, Integral surfaces passing through a given curve, Surface orthogonal to a given system of surface, Non-linear partial differential equations of the first order, Charpits method, Special type of first order equations, Jacobi method. Origin of second order partial differential equation, Linear partial differential equations with constant coefficients, Equations with variable coefficients.

Unit V

Problems of Laplace, wave and diffusion equations by the method of separation of variables, Reduction of second order partial differential equation into its canonical form. Non-linear equation of second order.

Paper Name: MATHEMATICAL METHODS
Paper Code: M.A..M-103(D)

Unit I

Inner products of functions. Orthogonal set of functions. Fourier series and their properties. Bessels inequality and a property of fourier constants. Parseval's equation, Convergence of Fourier series, Fourier theorem, Uniform convergence of Fourier series.

Unit II

Differentiation of Fourier series, Integration of Fourier series, Solutions of ordinary boundary value problems in Fourier series. A slab with faces at prescribed temperature. A Dirichlet problem (in Cartesian coordinates only), a string with prescribed initial velocity, an elastic bar. Applications of Fourier series in Sturm Lioville problems

Unit III

Definitions of integral equations and their classification, Relation between integral and differential equations, Fredholm integral equations of second kind with separable kernels, Reduction to a system of algebraic equations.

Unit IV

Eigen values and eigen functions, iterated kernels, iterative scheme for solving Fredholm integral equation of second kind (Neumann series), Resolvent kernel, Application of iterative scheme to Volterra's integral equation of second kind.

Unit V

Hilbert Schmidt theory, symmetric kernels, Orthonormal systems of functions. Fundamental properties of eigenvalues and eigen functions for symmetric kernels. Solution of integral equations by using Hilbert Schmidt theory**.**

I YEAR, II SEMESTER

Paper Name: METRIC SPACES
Paper Code: M.A.M-203(A)
Unit I
Metric on a set, pseudo-metrics and metrics Distance between two sets. Equivalent metrics. Limit points and closure: closed sets, Derived set of a set. Adherent points and closure of a set, Densesubsets, Interior of a set and its properties, Subspaces, Product spaces, Structure of Open balls in a product space. Closures and interiors in a product space, Finite product of metric spaces.
Unit II
Convergent sequences. Cauchy sequences. Characterization of adherent points and limit points in terms of convergent sequences. Convergence in products. Convergence in Euclidean spaces. Cluster points of a sequence. Subsequences. Cluster points and convergent subsequences. Algebra of convergent real sequences. Spaces of sequences.
Unit III
Continuity at a point. Continuity over a space. Continuity of composite, graph and projection maps. Algebra of real valued continuous functions in a metric space. Homeomorphisms. Isometries. Relation between isometries and Homeomorphism. Uniform continuity.
Unit IV
Complete metric spaces. Completeness and Continuous mappings. Completeness and subspaces. Cantor's Intersection Theorem. Contraction Mapping Principle. Connectedness: Connected metric spaces. Connected sets. Characterization of connected subsets of the real line. Properties of Connectedness
Unit V
Compact spaces and Compact subsets. Compact subsets of the real line. Sequential compactness and its characterization. Countable compactness, Bolzano-Weierstrass property. Sequential characterization of BWP. Equivalence of BWP and sequential compactness. Covering characterization of the BWP. Bolzano-Weierstrass Property and Total boundedness. Bolzano-Weierstrass Property and compactness. Lebesgue covering lemma. Compactness and completeness, Compactness and uniform continuity. Boundedness of continuous real-valued functions on compact metric spaces.

Paper Name: COMPLEX ANALYSIS
Paper Code: M.A..M-203(B)
Unit I
Complex integration. Cauchy-Goursat Theorem. Cauchy's integral formula. Higher order derivatives. Morera's Theorem. Cauchy's inequality and Liouville's theorem The fundamental theorem of algebra. Taylor's theorem. Maximum modulus principle. Schwarz lemma.
Unit II
Bilinear transformations, their properties and classifications. Definitions and examples of conformal mappings Meromorphic functions. The argument principle. Rouche's theorem. Inverse function theorem.(Statement only).
Unit III
Laurent's series. Isolated singularities. Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functionswith special reference to arg z, log z and za .
Unit IV
Weierstrass' factorization theorem. Gamma function and its properties. Riemann zeta function. Riemann's functional equation. Runge's theorem. Mittag-Leffler's theorem. Analytic continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation.
Unit V
Canonical products. Jensen's formula. Poisson-Jensen formula. Hadamard's three circles theorem. Order of an entire function. Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem.

Paper Name: MATHEMATICAL STATISTICS
Paper Code: M.A.M-203(C)
Unit I
Probability: Set theoretic approach, Baye's theorem, Geometric probability, Random experiments, Sample spaces, Random variables, Distribution functions, Joint probability distribution function, Conditional distribution function, Transformation of one and two dimensional Random variables, Mathematical expectation : Covariance, Variance of variables, Chebysheff's inequality.
Unit II
Moment generating function, Cumulant generating function and cumulants, Applications and why they are used, Discrete distributions: Geometric, Binomial, Poisson and uniform distributions, Continuous distributions: Normal, Exponential, Gamma, Chi-square ,t , F, Beta , and uniform on an interval.
Unit III

Central limit theorem and applications (1) for a sequence of independent, identically distributed random variables (2) to establish normal approximations to other distributions, and to calculate probabilities, Statistical inference and sampling distribution.

Unit IV

Correlation and regression: Partial and multiple correlations, Correlation coefficients, rank correlation, Regression lines and its properties.

Unit V

Test of significance: (1) Null and alternative hypotheses, Simple and composite hypotheses, Errors, Test statistic. (2) Large sample tests for proportion and mean, Small sample test based on t, F and Chi-square statistics.

Paper Name: OPERATIONS RESEARCH

Paper Code: M.A.M-203(D)

Unit I

Operations research and its scope, Necessity of operations research in industry. Linear programming problems. Convex sets, Simplex method, Theory of simplex method. Duality theory and sensitivity analysis. Dual simplex method.

Unit II

Transportation and Assignment problems of linear programming. Sequencing theory and Travelling salesperson's problem.

Unit III

Replacement: Replacement of items that deteriorate. Problems of choosing between two machines, Replacement of items that fail completely, Problems in mortality and staffing. Inventory problems, Simple deterministic and stochastic models of inventory control.

Unit IV

Network analysis: Shortest-path problem, Minimum spanning tree problem, Maximum flow problem, Minimum cost flow problem, Network simplex method. Project planning and control with PERT/CPM.

Unit V

Queuing theory: Steady state solution of Markovian queuing models: M/M/1, M/M/1 with limited waiting space. Game theory: Two person zero-sum games, Games with mixed strategies, Graphical solutions, Solutions by linear programming.

II YEAR, III SEMESTER

Paper Name: TOPOLOGY
Paper Code: M.A..M-303(A)
Unit I
Definition and examples of topological space, Closed sets, Closure, Dense subset, Neighborhoods, interior, exterior, boundary and accumulation points, Derived sets, Bases and sub-bases. Subspaces, product spaces and relative topology.
Unit II
Continuous functions, homeomorphisms, the pasting lemma, Connected and disconnected sets, connectedness on the real line, components, locally connected spaces.
Unit III
Countability axioms – First and second countable spaces, Lindelof's theorems, Separable spaces, second countability and separability.
Unit IV
Separation axioms – T_0, T_1, T_2, T_3, T_4, their characterizations and basic properties. Urysohn's lemma and Teitze extension theorem, Statement of Urysohn's metrization theorem.
Unit V
Compactness – Continuous functions and compact sets, basic properties of compactness, compactness and finite intersection property, sequentially and countably compact sets, local compactness and one point compactification. Statements of Tychonoff's Product theorem and Stone-cech compactification theorem.

Paper Name: MEASURE AND INTEGRATION
Paper Code: M.A.M-303(B)
Unit I
Countable and uncountable sets, Infinite sets and the Axiom of Choice, Cardinal numbers and its arithmetic, Schroeder-Burstein theorem, Cantor's theorem and continuum hypothesis, Zorn's Lemma, Well-ordering theorem, Decimal, Binary and Ternary Expansion, Cantor's Ternary set.
Unit II
Algebra's of sets, Lebesgue outer measure, Measure of open and closed sets, Borel sets, Measurable sets, Regularity, A non-measurable sets.
Unit III
Measurable functions, Algebra of measurable functions, Step functions, Characteristic functions, Borel and Lebesgue measurability, Little wood's three principles, Convergence almost everywhere and convergence in measure, Egoroff's and Reisz- Fisher Theorems.
Unit IV
The Lebesgue Integral, Riemann and Lebesgue integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of non-negative functions, The general Lebesgue integral.
Unit V
Functions of Bounded Variation, Lebesgue Differentiation Theorem, Differentiation of Monotone Functions, Differentiation of an Integral, Absolute Continuity. The Lp-Space, Convex function, Jensen's Holder's and Minkowsky's inequality, Completeness of Lp-space.

Paper Name: NUMERICAL ANALYSIS
Paper Code: M.A.M-303(C)
Unit I
Errors in computation- Floating point representation of numbers, Significant digits, Rounding and chopping a number and error due to these absolute and relative errors, Computation of errors using differentials, Errors in evaluation of some standard functions, Truncation error. Linear equations-Gauss elimination method, LU Decomposition method, Gauss–Jordan method, Tridiagonal system, Inversion of matrix, Gauss-Jacobi method, Gauss- Seidal method.
Unit II
Nonlinear equations-Iterative method, Bisection method, Method of false position, its convergence, Secant method, Newton-Raphson method, Convergence of Newton-Raphson method for simple and multiple roots,
Unit III
Interpolation-Some operators and their properties, Finite difference table, Error in approximating a function by polynomial, Newton forward and backward Difference formulae, Gauss forward and backward formulae, Stirling's and Bessel formulae, Lagrange's method, Divided differences and Newton's divided difference formula.
Unit IV
Numerical differentiation and integration-Differentiation methods based on Newton's forward and backward formulae, Differentiation by central difference formula, Integration- Methodology of numerical integration, Rectangular rule, Trapezoidal rule,Simpson's1/3rd and 3/8th rules, Gauss-Legendre quadrature formula.

Unit V
Ordinary differential equations- Initial and boundary value problems, Solutions of Initial Value Problems, Picard's method, Taylor's method, Single and multistep methods, Euler's and Modified Euler's method, Runge-Kutta second order method and statement of fourth order, Milne's method, Adams-Bashforth method.

Elective – I (Any one out of the three papers)

Paper Name: PROGRAMMING IN C & DATA STRUCTURES
Paper Code: M.A.-303(D1)
Unit I
Computer system introduction, Characteristics and classification of computers, CPU, ALU, Control unit, data & instruction flow, primary, secondary and cache memories, RAM, ROM, PROM, EPROM, Programming language classifications.

Unit II
C-Programming : Representation of integers, real, characters, constants, variables, Operators: Precedence & associative, Arithmetic, Relation and Logical operators Bitwise operators, increment and decrement operators, comma operator, Arithmetic & Logical expression.

Unit III
Assignment statement, Looping, Nested loops, Break and continue statements, Switch statement, goto statement. Arrays, String processing, functions, Recursion, Structures & unions.

Unit IV
Simple Data Structures: Stacks, queues, single and double linked lists, circular lists, trees, binary search tree. C-implementation of stacks, queues and linked lists.

Unit V
Algorithms for searching, sorting and merging e.g, sequential search, binary search, insertion sort, bubble sort, selection sort, merge sort, quick sort, heap sort.

Paper Name: ADVANCED DISCRETE MATHEMATICS
Paper Code: M.A.M-303(D2)
Unit 1
Formal Logic- Statements, Symbolic Representation of statements, duality, Tautologies and contradictions. Quantifiers, Predicates and Validity of arguments. Propositional Logic. Languages and Grammars, Finite State Machines and their transition table diagrams.
Unit 2
Lattices: Lattices as partially ordered sets, their properties, duality, Lattices as algebraic systems, Sub lattices, Direct products, Bounded Lattices, Complete Lattices, Complemented Lattices and Distributive lattices. Cover of an elements, atoms, join and meet irreducible elements.
Unit 3
Boolean Algebras: Boolean Algebras as lattices. Various Boolean Identities. The Switching Algebra example. Sub algebras, Direct products and Homeomorphisms. Boolean forms and their Equivalence. Min-term Boolean forms, Sum of product Canonical forms. Minimization of Boolean functions, Applications of Boolean Algebra to Switching Theory (using
AND, OR & NOT gates). The Karnaugh Map method.
Unit 4
Definition of (undirected) graph, Walk, Path, Circuit, Cycles, Degree of a vertex, Connected graphs, Complete and Bipartite graphs, Planar graphs, Euler's formula for connected Planar graphs, Kuratowski's Theorem (Statement only) and its uses. Colouring of graphs, Five colour theorem and statement of Four colour theorem.
Unit 5
Trees , Cut-sets, Spanning Trees, Fundamentals Cut-sets and minimum Spanning Trees, Prim's and Kruskal's algorithms, Connectivity, Matrix Representation of graphs, Directed Graphs, Indegree and outdegree of a vertex.

Paper Name: DIFFERENTIAL GEOMETRY
Paper Code: M.A.M-303(D3)

Unit I

Theory of space curves, arc length, tangent and normals, Curvature and torsion of curve given as the intersection of two surfaces, Involute and Evolute.

Unit II

Metric: The first and second fundamental form, Weingarton equation, Orthogonal trajectories, Mensuier theorem, Gaussian curvature, Euler's theorem, Dupin's theorem, Rodrigue's theorem, Dupin's indicatrix.

Unit III

Envelopes, Edge of regression, Ruled surface. Developable surface, Monge's theorem, Conjugate directions.

Unit IV

Asymptotic lines, the fundamental equations of surface theory, Gauss's formulae, Gauss characteristics equations, Mainardi Codazzi equations, Weingarton equations, Bonnet's theorem on parallel surface.

Unit V

Geodesics, Clairaut's theorem, Gauss Bonnet theorem, conformal mapping and Geodesic mappings, Tissot's theorem, Dini's theorem.

II YEAR, IV SEMESTER

Paper Name: FUNCTIONAL ANALYSIS
Paper Code: M.A.M-403(A)
Unit I
Normed linear spaces, Banach spaces, Examples and counter examples, Quotient space of normed linear spaces and its completeness. Equivalent norms,
Unit II
Reisz Lemma, Basic properties of finite dimensional normed linear spaces, Bounded linear transformations and normed linear spaces of bounded linear transformations, Uniform boundedness theorem and some of its applications.
Unit III
Dual spaces, weak convergence, open mapping and closed graph theorems, Hahn Banch theorem for real and complex linear spaces.
Unit IV
Inner product spaces, Hilbert spaces – Orthonormal sects, Bessel's inequality, complete orthonormal sets and Perseval's identity.
Unit V
Structure of Hilbert spaces, Projection theorem, Riesz representation theorem, Adjoint of an operator on Hilbert space, Self adjoint operators, Normal and Unitary operators. Projections

Paper Name: NUMBER THEORY
Paper Code: M.A.M-403(B)
Unit I
The Division Algorithm, the gcd, The Euclidean Algorithm, Diophantine equation ax + by = c. The fundamental theorem of arithmetic. The Sieve of Eratosthenes. The Goldbach conjecture.
Unit II
Theory of Congruences – Basic properties of Consequence, Linear Congruences, Chinese remainder theorem, Fermat's Theorem, Wilson's Theorem. Statement of Prime number theorem. Some primality testing.
Unit III
Number-Theoretic Functions – The functions T and Sigma. The mobius inversion formula, The Greatest integer function, Euler's Phi function – Euler Theorem, Properties of the Phi-function, Applications to Cryptography.
Unit IV
The order of an integer modulo n, Primitive roots for primes, The theory of indices, Euler's criterion, Legendre's symbol and its properties, Quadratic reciprocity, Quadratic congruences with composite moduli.
Unit V
Perfect Numbers, Representation of integers as sum of two squares and sum of more than two squares.

Paper Name: FUZZY SETS AND ITS APPLICATIONS
Paper Code: M.A.M-403(C)
Unit I
Basic definitions, á -level sets, comparison with classical (crisp) sets, Types of fuzzy sets, extension principle.
Unit II
Fuzzy complement, t-norms, t-conorms, combination of operations, aggregation operations. Fuzzy numbers, linguistic variables, arithmetic operations on intervals, arithmetic operations on fuzzy numbers, lattice of fuzzy numbers, fuzzy equations.
Unit III
Crisp versus fuzzy relation, projections and cylindric extensions, binary fuzzy relations, binary relations on a single set, fuzzy equivalence relations, fuzzy compatibility and fuzzy ordering relations.
Fuzzy measures, evidence theory, possibility theory, fuzzy sets and possibility theory.
Unit IV
An overview of classical logic, multivalued logic, fuzzy propositions, fuzzy quantifiers, linguistic hedges, Inference from conditional fuzzy propositions, Inference from conditional and qualified propositions.
Information and uncertainty, non-specificity of crisp and fuzzy sets, fuzziness of fuzzy sets.
Unit V
Individual, multiperson, multicriteria decision making, fuzzy ranking method, fuzzy linear programming. Methods of defuzzyfication.

Elective – II (Any one out of the three papers)

Paper Name: MATHEMATICAL CRYPTOGRAPHY
Paper Code: M.A.M-403(D1)
Unit-I
Classical cryptography: Encryption schemes, Symmetric key encryption, Feistel ciphers, NDS, DES, Multiple encryptions, Modes of operation, Applications to authentication and identification.

Unit-II
Some Mathematical Tools: Algorithm, complexity, Modular arithmetic, Quadratic residues, Primality testing, Factoring and square roots, Discrete logarithm.

Unit-III
Public key Cryptography: Public key cryptosystems and their applications, RSA algorithm and its security, Key management, Diffie-Hellman key exchange.

Unit-IV
Elliptic curve cryptography, ID based public key cryptosystems.

Unit-V
Introductory concepts of Signcryption and Certificate less public key cryptosystems.

Paper Name: MATHEMATICAL PROGRAMMING
Paper Code: M.A.M-403(D2)
Unit I
Convex sets, convex functions, pseudo-convex functions, quasi-convex, explicit quasi-convex, quasi-monotonic functions and their properties from the point of view of mathematical programming. Kuhn-Tucker conditions of optimality.
Unit II
Theory of revised simplex algorithm. Duality theory of linear programming. Sensitivity analysis.
Unit III
Parametric linear programming. Integer programming and linear goal programming.
Unit IV
Quadratic programming: (i) Wolfe's algorithm (ii) Beale's algorithm (iii) Theil and Vande-Panne algorithm.
Unit V
Duality theory of quadratic and convex programming, separable programming, sequential unconstrained minimization.

Paper Name: FLUID DYNAMICS
Paper Code: M.A.M-403(D3)
Unit I
Concept of fluid and its physical properties, Continuum hypothesis, Kinematics of fluids-Methods of describing fluid motion, Translation, Rotation and deformation of fluid elements, Stream Lines, Path lines and Streak lines, concepts of Vorticity.

Unit II
General theory of stress and rate of strain in a real fluid –Symmetry of stress tensor, Principal axes and Principle values of stress tensor, Constitutive equation for Newtonian fluid. Conservation laws- Conservation of mass, Conservation of momentum, Conservation of energy.

Unit III
One and two dimensional inviscid incompressible flow-Equation of continuity and motion using stream tube, , Circulation, Velocity potential, Irrotational flow, Some theorems about rotational and irrotational flows – Stoke's theorem, Kelvin's minimum energy theorem, Gauss theorem, Kelvin's circulation theorem.

Unit IV
Vortex motion and its elementary properties, Integration of equations of motion - Bernoulli's equation, Stream function in two dimensional motion, Complex variable technique, flow past a circular cylinder, Blasius theorem, Milne's circle theorem, Sources, Sinks and Doublets. Dynamical similarity, Buckingham's pie theorem, Non-dimensional numbers and their physical significance

Unit V

Incompressible viscous fluid flows- Steady flow between two parallel plates (non-porous and porous) - Plane couette flow, Plane poiseuille flow, Generalized plane couette flow, Steady flow of two immiscible fluids between two rigid parallel plates, Steady flow through tube of uniform circular cross section, Steady flow through annulus under constant pressure gradient.

4. Course Duration :

Minimum Duration: 2 Years **Maximum Duration: 5 Years**

5. Faculty and support staff requirement : 02 full time Faculty of Professor/Assoc./Asst. Professor level

Procedure for admission, curriculum transaction and evaluation :

A. Admission Procedure:

1. **Procedure for Obtaining Admission Form and Prospectus**
   a. The prospectus containing Admission Form can be obtained in person from :
   The Directorate of Distance education, Swami Vivekanand Subharti University, Subhartipuram, NH-58, Delhi-Haridwar Bypass Road, Meerut or its city office located at Lokpriya Hospital Complex, Samrat Palace, Garh Road, Meerut on payment of Rs. 125/- in cash or by demand draft.

   b. The Prospectus can also be obtained by post by sending a demand draft of Rs. 175/- drawn in favour of "SVSU, Distance Education", payable at Meerut along with a filled requisite proforma (available at DDE website i.e. www.subhartidde.com) for "Obtaining the Prospectus and Admission Form" to the Directorate of Distance Education.

2. **Submission of Admission Form:**
   a. An applicant should submit the admission form duly filled with all enclosures completed, personally or by post, to the Directorate of Distance education, Swami Vivekanand Subharti University, Subhartipuram, NH-58, Delhi-Haridwar Bypass Road, Meerut-250005.
   b. The application for admission should be submitted along with the following :
      i. A demand draft for the course fee (as per fee structure table) drawn in favour of "SVSU, Distance Education" payable at Meerut.
      ii. Duly attested photocopy of Aadhar Card, statement of marks and other relevant documents/certificated pertaining to the qualifying examination, by a gazetted officer or Principal of the college from where these were obtained, should be submitted at the time of admission.
      iii. Self attestation of document/s is permissible, if the originals are produced before the Registrar of Swami Vivekanand Subharti University or Asst. Director/Deputy Director/Director of Directorate of Distance Education.
      iv. 4 recent passport size color photographs should be provided in which 2 photographs should be pasted on the admission form & Enrollment form accordingly and another two photographs should be attached/stapled with the form.
   c. The learners are advised to check up the eligibility criteria of a course they wish to apply for, from our website www.subhartidde.com or DDE Prospectus.

3. **Admission Procedure -**
   a. Applications can be sent to the Directorate of Distance Education directly or through its city office. The applicant's eligibility will be checked and accordingly he/she shall be granted admission and an acknowledgement of the receipt of the fee and the application form shall be issued.

b. An Identity Card, mentioning the enrollment number of the learner, shall be issued by University as soon as the admission is confirmed. Learners are advised to keep their Identity Card safely, as it will be required for attending counseling sessions/PCPs and also for the receipt of study material, mark sheets, Degree etc in person. In case of loss of Identity Card, a duplicate can be issued on receiving a written request along with a fee of Rs. 100/-. The Identity Card shall be valid for the entire duration of the Programme.

c. The University conduct entrance examination twice in a year for admission in MBA and MCA or any other programme, as may be decided by the University. Learners can obtain information relating to the entrance examination from the Directorate of Distance Education or its website www.subhartidde.com. The University may, as an alternative, consider granting admission on the basis of the score obtained by an applicant in any central or state level entrance examination for a similar course.

4.

1 . Minimum Eligibility and Fee Structure for ODL –

Sr. No.	Title of Programme		Course Duration		Annual Fees Per
		Eligibility	Minimum	Maximum *	Year (In Rs.)
1	Master of Arts in Mathematics	Graduation or eq.	2 Years	5 Years	20000-/-

2 . Minimum Minimum Eligibility and Fee Structure for OL –

Sr. No.	Title of Programme		Course Duration		Annual Fees Per
		Eligibility	Minimum	Maximum *	Year (In Rs.)
1	Master of Arts in Mathematics	Graduation or eq.	2 Years	5 Years	30000-/-

B. Curriculum transaction and evaluation :

The University follows the following evaluation system:

a. Continuous evaluation through personal contact programmes, assignment work, viva, group discussion and personality development programmes.
b. Semester wise Examination
c. Evaluation of practicals, wherever prescribed
d. Evaluation of professional project report, wherever prescribed
e. A learner shall be declared 'pass' at the end of the academic/calendar year, if he/she secures minimum 40% marks in each subject (including project report, internship, industry integrated learning and practicals, wherever prescribed) separately in the Semester wise Examination and the internal assessment. If a learner fails to secure 40% marks in any subject or in internal assessment, he/she will still be promoted to the next academic/calendar year, but he/she will have to appear in back paper for the subject in which he/she has not been able to obtain the requisite passing marks. The examination for learners giving back paper in any subject shall be held along with the subsequent examination for the relevant subject. In case, the learner fails to secure minimum 40% marks in internal assessment, he/she will have to resubmit the assignments for evaluation.

Requirement of the laboratory support and Library Resources :

Resources are available of Library for the learners during PCPs. The University has a rich Central Library with more than 3.80 lac books, 181 journals (Foreign & Indian), Internet Section, Computer Centres, Museum, Instrumentation (USIC) workshop, Student's Guest House, etc.

The resources for laboratory also available as per the need of the programme.

Cost estimate of the programme and the provisions :

a. Cost estimate: Approx. Rs. 14,10,786.05/-

(The cost estimate may vary depending upon the no. of students enrolled)

b. Provisions: Swami Vivekanand Subharti University

Quality assurance mechanism and expected programme outcomes :

In accordance to the UGC Guidelines, the University has established an Internal Quality Assurance Cell, as per ordinance no. VI (1), dated 11.02.2009, to instill a momentum of quality consciousness amongst its all Institutions including Directorate of Distance Education, aiming for continuous improvement.

1. The cell holds various events regularly and maintain the documentation of the various programmes/activities leading to quality improvement.

2. The cell is responsible for incorporating various new changes/developments regarding up-gradation of learning material and spreading awareness of Quality Culture in the various institutions of the University.
3. The cell also prepares 'Annual Quality Assurance Report (AQAR)' as per the laid guidelines and parameters.