SCHEME OF EXAMINATION

&

DETAILED SYLLABUS

For MSc. Mathematics

(Semester System)

(W.e.f. 2019 – 2020)

KALINGA UNIVERSITY

RAIPUR

FACULTY OF SCIENCE

Kalinga University, Atal Nagar Raipur

Chhattisgarh

Kalinga University						
Proposed Msc. Mathematics Semester System Syllabus 2019-2020 Onwards						
Programme Structure & Syllabus For M.Sc Mathematics						
Semester - I						
S.NO.	**Subject Code**	**Subject Name**	**Credits**	**MM**	**External Marks**	**Total Marks**
1	MSMH101	Real Analysis I	5	70	30	100
2	MSMH102	Complex Analysis I	5	70	30	100
3	MSMH103	Abstract Algebra-I	5	70	30	100
4	MSMH104	Ordinary and Partial Differential Equation	5	70	30	100
Total			**20**	**280**	**120**	**400**

Semester - II						
S.NO.	**Subject Code**	**Subject Name**	**Credits**	**MM**	**External Marks**	**Total Marks**
1	MSMH201	General Topology	5	70	30	100
2	MSMH202	Advanced Abstract Algebra-II	5	70	30	100
3	MSMH203	Real Analysis II	5	70	30	100
4	MSMH204	Complex Analysis II	5	70	30	100
Total			**20**	**280**	**120**	**400**

Second Year						
Semester - III						
S.NO.	**Subject Code**	**Subject Name**	**Credits**	**MM**	**External Marks**	**Total Marks**
1	MSMH301	Operation Research I	6	70	30	100
2	MSMH302	Functional Analysis I	6	70	30	100
3		Elective I	6	70	30	100
4		Elective II	6	70	30	100
Total			**24**	**280**	**120**	**40**
Semester –III Elective Subjects For Pure/Applied						

1. MSMH303A Advance Discrete Mathematics
2. MSMH303B Set Theory, Logic and Elementary Probability Theory
3. MSMH303C Differential Geometry
4. MSMH304A Probability and Statistics
5. MSMH304B Fluid Dynamics
6. MSMH304C Number Theory & Cryptography

Second Year						
Semester - IV						
S.NO.	**Subject Code**	**Subject Name**	**Credits**	**MM**	**External Marks**	**Total Marks**
1	MSMH401	Integral Equation and COV	6	70	30	100
2	MSMH402	Advance Numerical Method	6	70	30	100
3		Elective I	6	70	30	100
4		Elective II	6	70	30	100
Total			**24**	**280**	**120**	**400**
Semester –IV Elective Subjects For Pure/Applied						

1. MSMH403A Fuzzy Set and Their Applications
2. MSMH403B Measure Theory
3. MSMH403C Advance Coding Theory
4. MSMH404A Fluid Mechanics
5. MSMH404B Advance Optimization Technique & Control Theory
6. MSMH404C Computer C++ and Matlab

MSc. Mathematics
Semester –I

MSMH	Total Marks: 100
Semester- I	Internal Marks: 30
Paper Code. MSMH101	External Marks: 70
Real Analysis – I	No. of Hours: 40
	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Finite, Countable and uncountable sets, Limit point, interior point, adherent point, exterior point, Continuity, Uniform continuity and differentiability, mean value theorem, Riemann sums and Riemann integral and its properties.	**8**
2	Sequences and series of functions. Point wise and uniform convergence, Cauchy criterion for uniform convergence,,M_n test, Weierstrass M-Test Abel's and Dirichlet's tests for uniform convergence, Uniform convergence and continuity,	**8**
3	Functions of several variables: linear transformations, Derivatives in an open subset of R^n, chain rule. Partial derivatives, Interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Jacobians, differentiation of integrals.	**8**
4	Labesgue outer measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue measurability, on-measurable sets, Integration of non-negative functions, The general integral, Integration of series,	**8**
5	,Functions of bounded variation, Differentiation of an integration, Integral of the derivative ,The Lp spaces, Jensen's inequality. Holder and Minkowaski inequalities, Completeness of Lp space and its duality, Uniform convergence and almost uniform convergence.	**8**

Text book-

1. Walter Rudin, Principles of Mathematical Analysis, McGraw H i l l.

Reference books.

1. T.M. Apostal, Mathematical analysis, Naross.
2. G. de Barra Measure and Integration, Wiley Eastern (Indian Edition)
3. H.L. Royden Real Analysis , Mecmillan , Indian Edition New Delhi.

MSMH	Total Marks: 100
Semester - I	Internal Marks: 30
Paper Code. MSMH102	External Marks: 70
Complex Analysis – I	No. of Hours: 40
	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Differentiation of complex valued functions , Analytical function , C-R equation ,Harmonic function , Derivative of elementary function , Higher order derivatives ,Orthogonal families ,Multivalued functions ,Construction of analytical functions (Milne-Thomson method)	8
2	Complex line integral , Simply and multiply connected region ,Jordan curve ,Cauchy –Goursat theorem , Cauchy integral formula for simply and multiply connected region , Different application of Cauchy integral formula.	8
3	Cauchy's Inequality, Morera's theorem, Lioville's theorem, The fundamental theorem of algebra, Taylor series, Laurent series and its applications.	8
4	Zeros of analytical functions, Singularities and its classifications, Residues, Cauchy Residue theorem, Meromorphic function, The argument principal, Maximum Modulus and Principal theorem.	8
5	Transformation and mapping , Jacobian of a transformation , Conformal mapping , Inverse point with respect to circle , Some elementary transformation, Linear transformation ,Bilinear or Linear fractional transformation ,Critical points ,Product of the two bilinear transformations , Cross ratio ,Preservance of cross atio under bilinear transformation	8

Text Books.

1. L.V. Ahlfors , Complex Analysis , MeGraw - H i l l , Kogakusha Ltd, (Second Edition)
2. J.B. Canvey, Function of one complex Variable (Springer - Verlag) Narosa publishing House New Delhi.
3. Complex Anlysis by A.R. Vashistha ,Krishna Education Publication Meerut

Reference Books.

1. S. Ponnuswamy, Foundations of complex Analysis , Narosa publishing House.
2. H.A. Priestley, Introducation to Complex Analysis, Oxford University press.

MSMH103		Total Marks: 100
Semester- I		Internal Marks: 30
Paper Code. MSMH103		External Marks: 70
Advanced Abstract Algebra – I		No. of Hours: 40
		Total Credits: 02
Unit No.	**Details**	**Nos. of Hours**
1	Ring, Ideal, Prime and maximal ideal, Quotient ring, Polynomial Ring and irreducible criteria.	**08**
2	Unique factorization domain, Principal ideal domain, Euclidean domain, Field, Finite field, Field extension, Algebraic extension	**08**
3	Splitting field, Normal extension, Multiple root, Separable extension, Algebraic closed fields and algebraic closure.	**07**
4	Automorphism groups and fixed fields, Fundamental theorem of Galois Theory and example. Roots of unity and cyclotomic polynomials, cyclic extension, Solution of polynomial by radicals, Insolvability of equation of degree five by radicals.	**09**
5	Algebra of linear transformation ,Invertible Linear transformation ,Matrix of linear transformation ,Characterstic polynomial of linear operator ,minimal polynomial , Diagonalizable operator ,primary decomposition theorem.	**08**

Text Book-

1. P.B. Bhattacharya, S.K. Jain and S. R. Nagpaul, Basic Abstract Algebras Cambridge University press.
2. I.N. Herstin Tipic in Algebra wiley Eastern, New Delhi.
3. A Course in Abstract Algebra, Vijay Khanna and S K Bhambri Vikas Publishing House PVT LTD

Reference Books

1. .N. Jacobs, Basic Algebra Vol I, II, & III Hindustan Publishing company
2. S. Lang, Algebra Addision - Wisley.
3 .S. Luther & IBS Passi, Algebm Bol, I, II ,& III Narosha pub. House , New Delh.
4. M. Artin Algebra prentice Hall of India 1991-

MSMH104		Total Marks: 100
Semester- I		Internal Marks: 30
Paper Code. MSMH104		External Marks: 70
Ordinary and partial differential equations		No. of Hours: 40
		Total Credits: 02
Unit No.	**Details**	**Nos. of Hours**
1	Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, Qualitative properties of ordinary differential equations of order two: Sturm separation theorem, normal form and standard form	**09**
2	General theory of homogeneous and nonhomogeneous linear ODEs, variation of parameters, Sturm –Liouville boundary value problem, Green's functions	**08**
3	Power series solutions: Series solutions of first order equations and second order linear equations, ordinary points, regular singular points, identical equations, Gausse's Hypergeometric equation.	**08**
4	Introduction of PDE ,Charpit's method ,Jacobi's method ,Quasi linear equations ,non linear first order PDE.	**07**
5	Classification of second order PDEs, One dimensional heat and wave equation, Laplace equation, Boundary value problem, the Cauchy problem , Classification of PDE in the case of n variables.	**08**

Text Books :

T. Amarnath : An Elementary Course in Partial Differential Equations (2nd edition) (Narosa Publishing House)

G.F. Simmons : Differential equations with applications and Historical Notes second edition (Mc-Graw Hill).

MSc. Mathematics
Semester –II

MSMH		Total Marks: 100
SEMESTER- 2		Internal Marks: 30
Paper Code. MSMH201		External Marks: 70
General Topology		No. of Hours: 40
		Total Credits: 02
Unit No.	**Details**	**Nos. of Hours**
1	Infinite sets and the axiom of choice, Cardinal numbers and its arithmetic Schroeder- Bernstein theorem, Zorn's lemma, well ordering theorem. Definition and examples of topological spaces, Closed sets clasher, Dense subsets,Neighborhoods interior, Exterior and boundary, Accumulation points and derived sets.	**08**
2	Bases and sub - bases, subspaces and relative topology. Alternate methods of defining a topology in terms of kuratowski closure operator and neighbor heed system, Continuous functions and homomorphism,First and second countable spaces, Lindelof 's theorems.	**08**
3	Separable spaces, second count ability and separability.Separation axioms T0, T1 ,T2 , T3, T1/2 & T4 their characteristics and properties. Uryson lemma Tietze extension theorem, compactification. Para compactness. Compactness, continuous functions and compact sets. Basic properties of compactness, Compactness, and finite intersection property. Sequentially and countably compact compact sets. Local compactness and one point	**08**
4	Countable compactness and sequential compactness in metric spaces. Connected spaces. Connectedness on the line. Components Locally connected spaces. Embedding and metrization. Embedding lemma and Tychonoff embedding theorem The Urysohn metrization theorem. Tychonoff product topology in terms of standard sub base and its characterizations.	**08**
5	Projection maps. Separation axioms and product spaces.Connectedness and product spaces.Compactness and product spaces (Tychonoffs theorem) Countability and product spaces. Net and filters.Topology and convergence of nets Had sdorffness and nets Compactness and nets.Filters and their convergence.Canonical way of converting nets to filters and vice- versa Ultra filters and compactness.	**08**

Text Book-

1. James R. Munkres, Topology, A first course , prentice Hall of India Pvt. Ltd. New Delhi.
2. J.N. Sharma and J.P. Chauhan Krishna Educational Publication Meerut.

Reference Books

1. G.F. Simmons , Introduction to Topology and Madern Analysis , McGraw Hill Book Company.
2. K. D Joshi Introduction to general Topology Wiley Eastern.
3. J.L. Kelley General Topology Van Nostrand.

MSMH1202		Total Marks: 100
Semester- II		Internal Marks: 30
Paper Code. MSMH202		External Marks: 70
Advanced Abstract Algebra – II		No. of Hours: 40
		Total Credits: 02
Unit No.	**Details**	**Nos. of Hours**
1	Modules, General properties of modules, Submodule , Quotient modules ,Homomorphism of modules , Simple and semi simple modules ,Completely reducible modules , Free modules	**09**
2	Noetherian and Artirian modules and ring s, Homomorphism of R- modules ,Wedderburn Artin theorem ,,Uniform modules ,Primary modules and Noetherian –Lasker theorem.	**08**
3	Smith normal form over a PID and rank: Introduction, Row- modules, Columns modules and rank, Smith normal form.	**07**
4	Finitely generated modules over a PID: Decompositio theorem, Uniquness of decomposition, Rational canonical form, Generated Jordan form over any field.	**08**
5	Invariant space, Canonical form , Nilpotent transformatation , Jordan form, Jordan canonical form.	**08**

Text Book-

1. P.B. Bhattacharya, S.K. Jain and S. R. Nagpaul, Basic Abstract Algebras Cambridge University press.
2. I.N. Herstin Tipic in Algebra wiley Eastern, New Delhi.
3. A Course in Abstract Algebra, Vijay Khanna and S K Bhambri Vikas Publishing House PVT LTD

Reference Books

1. N. Jacobs , Basic Algebra Vol I, II, & III Hindustan Publishing company
2. S. Lang , Algebra Addision - Wisley.
3. I.S. Luther & IBS Passi, Algebm Bol, I, II ,& III Narosha pub. House , New Delhi
4. M. Artin Algebra prentice Hall of India 1991

MSMH		Total Marks: 100
Semester - 2		Internal Marks: 30
Paper Code. MSMH203		External Marks: 70
Real Analysis (II)		No. of Hours: 40
		Total Credits: 02
Unit No.	**Details**	**Nos. of Hours**
1	Definition and existence of Riemann - Stieltjes integral and its properties Integration and differentiation. The fundamental theorem of calculus . Integration of vector valued functions. Rectifiable curves. Rearrangements of terms of a series Riemann's theorem. .	**08**
2	uniform convergence and integration,uniform convergence and differentiation. power series and its properties, uniform convergence of power series, Abel's theorem of power series.	**08**
3	The contraction mapping principle, Inverse function theorem. .the implicit function theorem , Extreme problem with constraints. Lagrange's multiplier method.	**08**
4	The lebesgue integral: Riemann integral, simple function, step function, Riemann and lebesgue integral, lebesgue bounded convergence theorem, Properties of the lebesgue integral for bounded measurable function, Lebesgue monotone convergence theorem.	**08**
5	L^p–Space ,Jensen's inequality, Holder inequality, Minkowaski's inequality ,Completeness of L^p–Space,Convergence in Measure ,Almost uniform Convergence .	**08**

Text book-

1.Walter Rudin, Principles of Mathematical Analysis, McGraw H i l l.
2. H.L. Royden Real Analysis , Mecmillan , Indian Edition New Delhi

Reference books.

1.T.M. Apostal, Mathematical analysis, Naross.
2.G. de Barra Measure and Integration, Wiley Eastern (Indian Edition)

MSMH	Total Marks: 100
Semester - II	Internal Marks: 30
Paper Code. MSMH204	External Marks: 70
Complex Analysis – II	No. of Hours: 40
	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Preservance of the family of circles and straight line under bilinear transformation, Fixed point or invariatnt point of a bilinear transformation, Normal form of a bilinear transformation, Elliptic, Hyperbolic and Parabolic transformation, Some special bilinear transformation	**8**
2	Evaluation of real definite integral by contour integration, Integration round the unit circle, Evaluation of the integral, Jordan's inequality, Jordan Lemma, Evaluation of the integrals of the different forms.	**8**
3	Pole lies on the real axis, Integral of many value of function, Rectangular and othr contours, Inverse function theorem ,Power serieses and elementary functions.	**8**
4	Schwarz 's lemma ,Roche's theorem and its applications ,Little Picard theorem ,The Great Picard theorem ,Green's function .	**8**
5	Weistrass factorization theorem , Gamma function and its properties, Riemann Zeta function, Runge's theorem .Mittag-Leffer's theorem , Analytic continuation,Uniqueness of direct Analytica continuation , Uniqueness of Analytic continuation along a curve.	**8**

Text Books.

1. L.V. Ahlfors , Complex Analysis , MeGraw - H i l l , Kogakusha Ltd, (Second Edition)
2. J.B. Canvey, Function of one complex Variable (Springer - Verlag) Narosa publishing House New Delhi.
3. Complex Anlysis by A.R. Vashistha ,Krishna Education Publication Meerut

Reference Books.

1. S. Ponnuswamy, Foundations of complex Analysis , Narosa publishing House.
2. H.A. Priestley, Introducation to Complex Analysis, Oxford University press.

MSc. Mathematics
Semester –III

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH301	External Marks: 70
Operations Research	No. of Hours: 40
	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Linear Programming- Introduction of general LPP, Simplex method, duality, Dual simplex method, Two-Phase simplex method, Big-M method. Degeneracy in Linear programming	**08**
2	Transportation problem-initial basic feasible solution, Solution by Matrix minima method and vogel's approximation method, Optimal solution, degeneracy in transportation problems. Assignment Problems: Hungarian Method for solution. Traveling-Salesman problems.	**07**
3	Games Theory: two people zero sum game, game with mixed strategies.Principle of dominance, rectangular game. Graphical Solution By linear programming. Queueing Theory: Poison queueing system, Non- Poison queueing system, Different queuing models :Model(M/M/1):(∞/FIFO) ,(M/M/1)):(N/FIFO),(M/M/C):(∞/FIFO)	**09**
4	Integer Programming : Pure and Mixed Integer programming,Gomory's All – I.P.P. Method ,Fractional Cut method- All Integer LPP , Branch and Bound method (its application) , Goal programming , Dynamic programming	**09**
5	Non Linear Programming : Kuhn-Tucker Condition with non –negative constraints ,Wolfe's Modified Simplex method , Geometric Programming	**07**

Text Book:

1. H.A Taha, Operations Research-An Introduction, Macmillan Publishing INC., New York.
2. KantiSwarup, P.K. Gupta & Man Mohan, Operations Research, Sultan Chand & sons, New Delhi.

Reference Books:

1. F.S. Hillier & G.J. Lieberman, Introduction to Operations Research, (Sixth-edition) McGraw Hill International Edition.
   S.D. Sharma Operations Research, KedarNath Ram Sons & Co. Publisher Meerut (thirteenth-edition)

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH302	External Marks: 70
	No. of Hours: 40
Functional Analysis	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Normed linear spaces, Banach spaces and examples, Quotient space of normed linear space and its completeness, equivalent norms, Riesz Lemma, basic properties of finite dimensional normed linear spaces and compactness.	08
2	Weak convergence and bounded linear transformations, normed linear spaces of bounded linear transformations, dual spaces with examples and reflexive spaces.	08
3	uniformboundedness theorem and some of its consequences. Open mapping and closed graph theorems, Hahn-Banach theorem for real linear spaces and complex linear spaces. Inner product spaces: Hilbert spaces, Orthonormal Sets,	08
4	Bessel's inequality. Complete Orthonormal sets and parseval's identity, Structure of Hilbert spaces, Reflexivity of Hilbert spaces, Projection theorem, Riesz representation theorem, Adjoint of an operator on a Hilbert space, Self-Adjoint operators, Positive, compact operators, normal and unitary operators.	08
5	General measures Examples Semifinite& Sigma-finite measure . Measurable functions.Signed measure Hahn Decomposition theoram, mutually singular measures.Jordon Decomposition theorem.Radon-Nikodym theorem	08

Text Books:

1. B. Choudhary and Sudarsan Nanda, Functional Analysis with applications, Wiley Eastern Ltd.
2. G.F. Simmons, Introduction to Topology & Modern Analysis, McGraw Hill, New York, 1963.
3. E.Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons, New York, 1978.

Reference Books:

1. Walter Rudin, Functional analysis, TMH Edition, 1974.
2. A.E. Taylor-Introduction to Functional Analysis, John Wiley & Sons, New Your, 1978.
3. A.H. Siddiqui, Functional Analysis with applications, TMH Publication company Ltd. New Delhi.
4. B.K. Lahiri, Elements of functional Analysis, The World Press, Calcutta,
5. P.R. Halmos, Measure theory, Bon-Nostrance.
6. L.K. Rana,Introduction to measure & integration, Narosa Publishing House, New Delhi

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH303A	External Marks: 70
Advanced Discrete Mathematics	No. of Hours: 40
	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Congruence relation and quotient semigrops. Subsemigroup and sub monoids. Direct products Basic homomorphism theorem. Lattices: lattices as partially ordered sets. Their properties. Lattices as Algebraic systems. Sub lattices such as complete, Complemented and Distributive Lattices.	08
2	Non - deterministic finite automata and equivalence of its power to that of deterministic finite automata. Moore and mealy machines. Turing machine and partial recursive functions. Grammars and Languages Phrase Structure grammars. Rewriting rules Derivations. Sentential forms.Language generated by a grammar.	08
3	Boolean algebra as lattices Various Boolean identities. The switching algebra examples sub algebras. Direct products and homomorphism's, join irreducible elements atoms and minterms. Boolean forms and their equivalence, minterms. Boolean forms, Sum of products canonical forms minimization of Boolean functions. Applications of Boolean algebra to switching theory (using AND, OR, NOT gates) The karnaugh map method	07
4	Graph theory definition of graphs, paths ,circuits, cycles & sub graphs into sub graphs ,degree of a vertex connectivity. Planer graphs and their property, Trees, Euler's formula for connected planer graphs.Complete bipartite graph, kuratowski's theorem (Statement only) Minimal spanning trees and kruskal's algorithm. Matrix representation of graphs.	09
5	Directed graphs, in degree and out degree of a vertex (theorems) Weighted undirected graphs. Dijkstra's algorithm , Eulerian and Hamiltonian graphs,Dijkrtra's algorithm, strong connectivity and War shall a algorithm directed trees search trees, tree traversals, Introductory computability theory finite state machines machine, Homomorphism Finite automata, Acceptors.	08

Text Book-

1. J.P. Tremblay & R. Manohar, discrete Mathematical Structures , McGraw Hill New Delhi.
2. Narsingh Deo Graph Theory with applications prentice Hall New Delhi.
3. A text book of Discrete Mathematics by Swapan Kumar Sarkar S.Chand Publication New Delhi

Reference Books.

1. C.L. Liu Elements of Discrete Mathematics McGraw Hill New Delhi.
2. J.L. Gresting Mathematical Structures for computer science computer science press New York.
3. Discrete Mathematics by Semyour Lipschurtz & Marck Lipson The McGraw Hill New Delhi.

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH303B	External Marks: 70
	No. of Hours: 40
Set theory, Logic and probability Theory	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Statements, Propositions and Theorems, Truth value, Logical connectives and Truth tables, Conditional statements, Logical inferences, Methods of proof, examples.	**08**
2	Basic Set theory: Union , intersection and complement, indexed sets, the algebra of sets, power set, Cartesian product, relations, equivalence relations, partitions, discussion of the example congruence modulo-m relation on the set of integers, Functions, composition of functions, surjections, injections, bijections, inverse functions, Cardinality Finite and infinite sets, Comparing sets, Cardinality , $\|A\| < \|P(A)\|$, Schroeder-Bernstein theorem , Countable sets, Uncountable sets, Cardinalities of N , $N \times N$, Q, R, $R \times R$.	**08**
3	Order relations, order types, partial order, Total order, Well ordered sets, Principle of Mathematical Induction, Russel's paradox, introduction to axiomatic set theory, Statements of the Axiom of Choice, the Well Ordering Theorem, Zorn's lemma, applications of Zorn's lemma to maximal ideals and to bases of vector spaces.	**08**
4	Permutations, decomposition into cycles, product of permutations, permutations and geometric symmetry, computing the order of a permutation, even and odd permutations.	**08**
5	Pigeon-hole principle, generalized pigeon-hole principle and its applications, ErdosSzekers theorem on monotone subsequences	**08**

Recommended Books

1. Larry J. Gerstein: Introduction to mathematical structures and proofs, Springer.
2. Joel L. Mott, Abraham Kandel, Theodore P. Baker: Discrete mathematics for computer scientists and mathematicians, Prentice-Hall India.
3. Robert R. Stoll: Set theory and logic, Freeman & Co.
4. Robert Wolf: Proof , logic and conjecture, the mathematician's toolbox, W.H.Freemon.
5. James Munkres: Topology, Prentice-Hall Indi

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH303C	External Marks: 70
	No. of Hours: 40
Differential Geometry	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Curves in space , 3 R parameterized curves, regular curves, helices, arc length, reparametrization (by arc length), tangent, principal normal, binormal, osculating plane, normal plane, rectifying plane, curvature and torsion of smooth curves, FrenetSerret formulae, Frenet approximation of a space curve.	**08**
2	Osculating circle, osculating sphere, spherical indicatrices, involutes and evolutes, intrinsic equations of space curves, isometries of , 3 R fundamental theorem of space curves, surfaces in , 3 R regular surfaces, co-ordinate neighborhoods, parameterized surfaces, change of parameters, level sets of smooth functions on , 3 R surfaces of revolution, tangent vectors, tangent plane, differential of a map.	**08**
3	Normal fields and orientability of surfaces, angle between two intersecting curves on a surface, Gauss map and its properties, Weingarten map, second and third fundamental forms, classification of points on a surface.	**08**
4	Curvature of curves on surfaces, normal curvature, Meusnier theorem, principal curvatures, geometric interpretation of principal curvatures, Euler theorem, mean curvature, lines of curvature, umbilical points, minimal surfaces, definition and examples, Gaussian curvature, intrinsic formulae for the Gaussian curvature, isometries of surfaces, Gauss Theorem Egregium (statement only).	**08**
5	Christoffel symbols, Gauss formulae, Weingarten formulae, Gauss equations, Codazzi-Mainardi equations, curvature tensor, geodesics, geodesics on a surface of revolution, geodesic curvature of a curve, Gauss-Bonnet Theorem (statement only).	**08**

Books Recommended:

1. M. P. Do Carmo, Differential Geometry of Curves and Surfaces, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1976.
2. B. O' Neill, Elementary Differential Geometry, Academic Press, 1997.
3. A. Gray, Differential Geometry of Curves and Surfaces, CRC Press, 1998.
4. A. Pressley, Elementary Differential Geometry, Springer (Undergraduate Mathematics Series), 2001.
5. A. Thorpe, Elementary Topics in Differential Geometry, Springer (Undergraduate Texts in Mathematics), 1979.
6. D. Somasundaram, Differential Geometry, A First Course, Narosa Publishing House, New Delhi, 2005.
7. L. P. Eisenhart, A Treatise on the Differential Geometry of Curves and Surfaces, Ginn and Company, Boston, 1909.

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH304A	External Marks: 70
Probability and statistics	No. of Hours: 40
	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Descriptive statistics, exploratory data analysis, sample space, discrete probability, independent events, Bayes theorem.	**08**
2	Random variables and distribution function (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distribution, .characteristics function. Probability inequalities (Tchebyshef, Markov, Jensen) , Central limt theorems.	**07**
3	Standard discrete and continuous univariate distributions, sampling distributions, standard errors and asymptotics distributions, distribution of order statistics and range, methods of estimation, properties of estimators, confidence interval.	**09**
4	Tests of hypothesis: most powerful and uniformly most powerful tests, likelihood ratio tests, Analysis of discrete data and chi-square test of goodness of fit. Large sample tests. Sample nonparametric tests for one and two sample problem.	**09**
5	Gauss- Markov models, best linear unbiased estimators, analysis of variance and covariance, simple and multiple linear regression, Multivariate normal distribution, partial and multiple correlation coefficients and related tests.	**07**

Text Book:

1 Applied Statistics ;- V.K Kapoor and S.C Gupta , S Chand & sons.

2 Applied Statistics :- Parimal Mukhopadhaya, Books and Allied (p) ltd.

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH304B	External Marks: 70
	No. of Hours: 40
Fluid Dynamics	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Kinematics — Lagrangian and Eulerian methods. Equation of continuity. Boundary surface. Stream lines. Path lines and streak lines. Velocity potential. Irrotational and rotational motions. Vortex lines. Equations of Motion— Lagrange's and Euler's equations of motion. Bernoulli's theorem. Equation of motion byflux method. Equations referred to moving axes Impulsive actions. Stream function	**08**
2	Irrotational motion in two-dimensions. Complex velocity potential. Sources, sinks, doublets and their images. Conformal mapping, Milne-Thomson circle theorem. Two-dimensional irrotational motion produced by motion of circular, co-axial and elliptic cylinders in an infinite mass of liquid. Kinetic energy of liquid. Theorem of Blasius. Motion of a sphere through a liquid at rest at infinity. Liquid streaming past a fixed sphere. Equation of motion of a sphere. Stoke's stream function.	**08**
3	Vortex motion and its elementary properties. Kelvin's proof of permance. Motions due to circular and rectilinear vertices. Wave motion in a gas. Speed of Sound. Equation of motion of a gas. Subsonic, sonic and supersonic flows of a gass. Isentropic gas flows. Flow through a nozzle. Normal and oblique shocks.	**08**
4	Stress components in a real fluid. Relations between rectangular components of stress. Connection between stresses and gradients of velocity. Navier-stoke's equations of motion. Plane Poiseuille and Couette flows between two parallel plates. Theory of Lubrication. Flow through tubes of uniform cross section in form of circle, annulus, ellipse and equilateral triangle under constant pressure gradient. Unsteady flow over a flat plate.	**08**
5	Dynamical similarity. Buckingham p-theorem. Reynolds number. Prandt's boundary layer. Boundary layer equations in twodimensions. Blasius solution. Boundary-layer thickness. Displacement thickness. Karman integral conditions. Separations of boundary layer flow.	**08**

Text :

1. P.K. Kundu and I.M. Cohen ,Fluid Mechanics , Academic Press ,2005
2. F . Chorlton : Text Book of Fluid Dynamics ,CBS ,2004

MSMH	Total Marks: 100
Semester-III	Internal Marks: 30
Paper Code. MSMH304C	External Marks: 70
	No. of Hours: 40
Number Theory & Cryptography	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Divisibility, Greatest common divisor, Euclidean Algorithm, The Fundamental Theorem of arithmetic, congruences, Special divisibility tests, Chinese remainder theorem, residue classes and reduced residue classes, Fermat's little theorem, Wilson's theorem, Euler's theorem.	**08**
2	Arithmetic functions ϕ(n), d(n), σ(n), μ(n), Mobius inversion Formula, the greatest integer function, perfect numbers, Mersenne primes and Fermat numbers,	**08**
3	Primitive roots and indices, Quadratic residues, Legendre symbol, Gauss's Lemma, Quadratic reciprocity law, Jacobi symbol, Diophantine equations: $ax + by = c$, $x^2 + y^2 = z^2$, $x^4 + y^4 = z^2$, sums of two and four squares, [Ref. 2]	**08**
4	Cryptography: some simple cryptosystems, need of the cryptosystems, Discrete log, the idea of public key cryptography, RSA cryptosystem. [Ref. 4].	**08**
5	Differential Criptanalysis , Modes of DES, Attack on DES ,Advanced encrypt standard,	**08**

:

RECOMMENDED BOOKS:

1. Burton, D.M., Elementary Number Theory, 7th Edition. McGraw-Hill Education, 2010.
2. Hardy, G.H. and Wright, E.M., An introduction to the Theory of Numbers, 4th edition. Oxford University Press, 1975.
3. Niven, I., Zuckerman, H.S. and Montgomery, H.L., Introduction to Theory of Numbers, 5th Edition. John Wiley & Sons, 1991.
4. Koblitz N., A Course in Number Theory and Cryptography, Graduate Texts in Mathematics, No.114. New-York: Springer-Verlag, 1987.
5. Stallings, W., Cryptography and Network Security, 5 th Edition. Pearson, 2010.

MSc. Mathematics
Semester –IV

MSMH	Total Marks: 100
Semester-IV	Internal Marks: 30
Paper Code. MSMH401	External Marks: 70
	No. of Hours: 40
Integral equation and COV	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Introduction and basic examples, Classification of Integral equation, Conversion of volterra integral equation into ODE, Conversion of IVP and BVP to integral equation.	**08**
2	Decomposition, Direct computation, successive approximation, successive substituting method for fredholm integral equation, successive substituting method for Volterra integral equation	**08**
3	Volterra integral equation of first kind, Integral equation with separable kernel, Integral equation with symmetric kernel, Integral equation with resolvent kernel, Eigan value and eigan function of integral equation.	**08**
4	Functions and functional comparison between the notion of extrema of a function and a functional variational problem with the fixed boundaries, Eulers equation, fundamental lemma of calculus of variation and examples, function involving more than one dependent variables and their first derivatives.	**08**
5	Functional depending on the higher derivatives of the dependents variables, Eulers poission equation, ostrogradesky equation, jecobi condition, The weierstrass function, weak and strong extrema, the legandre condition, transforming the Eulars equation into canonical forms.	**08**

References:

1. Calculus of variations pergamon press limited
2. Calculus of variation with application, Weinstock , Robert, Dover
3. Integral equation ajnd application, Cordumeanu, Cambridge university press

MSMH	Total Marks: 100
Semester-IV	Internal Marks: 30
Paper Code. MSMH402	External Marks: 70
Advance Numerical Methods	No. of Hours: 40
	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Derivatives from Difference tables, Higher Order Derivatives, Extrapolation Techniques, Newton-Cotes Integration formulas,Gaussian Quadrature, Adaptive Integration, Multiple Integration with Variable Limits ,An application of Numerical Integration- Fourier Transforms.	08
2	The Spring-Mass Problem- A variation, Multistep Method, Milnes Method, The Adams-Moulton Method, System of equation and higher Order Equation. .	07
3	The Shooting Method, Solution Through Aset of equations, Derivative Boundary conditions , Characteristics Value problems, The alternating direction Implicit Method.	09
4	Types of partial differential equations, the heat equation and wave equation, Solution technique for the heat equation in one dimension, Parabolic equation in two & three dimensions.	09
5	The Rayleigh-Ritz Method, The Collection and Galerkin method, Finte Elements for ordinary differential equations, Finite elements for elliptic partial differential equations, Finite elements for parabolic and hyperbolic equations.	07

Text Book:

1 Applied Numerical analysis- Curtis F. Gerad, Parick O Wheathly ,Addision Wisley..
2 Numerical Methods – S.C.Chapra& R.P.Canale,TMH Publisher
3 Numerical Method in engineering & Science- B.S.Grewal, Khanna Pub.

Reference Books:

4. Numerical Methods – E. Balaguruswamy, TMH Publication.

MSMH	Total Marks: 100
Semester-IV	Internal Marks: 30
Paper Code. MSMH403A	External Marks: 70
	No. of Hours: 40
Fuzzy Set and their application	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Fuzzy sets-Basic definitions, α-level sets, convex fuzzy set, Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian products, Algebraic products. Bounded sum and difference, t-norms and tconorms.	**08**
2	The Extension Principle- The Zadeh's extension principle. Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic.	**08**
3	Fuzzy Relations on Fuzzy sets, Composition of Fuzzy relations. MinMax composition and its properties.	**08**
4	Fuzzy equivalence relations. Fuzzy compatibility relations. Fuzzy relation equations. Fuzzy graphs, Similarity relation.	**08**
5	Possibility Theory-Fuzzy measures. Evidence theory. Necessity measure. Possibility measure. Possibility distribution. Possibility theory and fuzzy sets. Possibility theory versus probability theory.	**08**

REFERENCES :

1. H.J. Zmmemann, Fuzzy set theory and its Applications, Allied Publishers Ltd. New Delhi, 1991.
2. G.J. Klir and B. Yuan- Fuzzy sets and fuzzy logic, Prentice-Hall ol India, New Delhi, 1995.

MSMH	Total Marks: 100
Semester-IV	Internal Marks: 30
Paper Code. MSMH403B	External Marks: 70
	No. of Hours: 40
MEASURE THEORY	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Lebesgue Outer and Inner measure and their properties, properties of a measurable set, Measurable functions and Their properties, limit sup. , limit inf. and limit of sequence of Measurable functions, Little wood's three Principles, Egorff's Theorem, Lusin Theorem and some other Theorems.	**08**
2	Characteristic function, Simple function, Canonical representation of Simple function, Integral of Simple function, Some Important Theorem :- Fatou's Lemma, monotone Convergence Theorem, Bounded and dominated Convergence Theorem, Monotone Convergence Theorem. The general Lebesgue Integral,	**08**
3	Function of Bounded Variation, Curvature and Torsion, serret – Frenet formula, Locus of centre of Curvature, Spherical Curvature, Locus of Centre of Spherical Curvature, Helics, curve determined by its intrinsic equations. Spherical indicatrix, Bertrand curves, envelope,	**08**
4	Developable Surfaces, Osculating developable, Polar developable, Rectifying developab , Curvilinear Co-ordinates, First and Second order Magnitude, Curvature of Section, Meunier's Theorem	**08**
5	Principle Directions and Curvature, Mean Curvature, Euler's Theorem, Dupins Theorem. Joachimsthal's Theorem, Dupinindicatrix, Conjugate direction, Conjugate systems, Asymptotic Lines – Curvature and torsions, Theorem of Beltrami and Enneper	**08**

Text Books:

1. Measure Theory : K. P. Gupta Measure Theory
2. P. R. Halmos Measure Theory and Integration

REFERENCES:

1. S. K. Berberian Differentional Geometry of Three diamension :
2. C. E. Weatherburn Differentional Geometry : Mital and Aggarwal

MSMH	Total Marks: 100
Semester-IV	Internal Marks: 30
Paper Code. MSMH403C	External Marks: 70
	No. of Hours: 40
Advance Coding Theory	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Error detection: correction and decoding: Communication channels,Maximum likelihood decoding,Hamming distance,Nearest neighbour / minimum distance decoding, Distance of a code.	**08**
2	Linear codes: Vector spaces over finite fields,Linear codes, Hamming weight, Bases of linear codes, Generator matrix and parity check matrix, Equivalence of linear codes, Encoding with a linear code,Decoding of linear codes, Cosets, Nearest neighbour decoding for linear codes, Syndrom decoding.	**08**
3	Cyclic codes: Definitions, Generator polynomials, Generator and parity check matrices, Decoding of cyclic codes, Burst-error-correcting codes.	**08**
4	Some special cyclic codes: BCH codes, Defintions, Parameters of BCH codes, Decoding of BCH codes.	**08**
5	The Griesmer bound , Maximum distance separable (MDS) code ,weight distribution of MDS code , Neccesary and sufficient condtion for a linear code to be an MDS code, MDS from RS codes ,Abramson codes ,	**08**

Reference:

1. San Ling and Chaoing xing, Coding Theory- A First Course
2. Applied Abstract Algebra - Lid and Pilz 2nd Edition
3. E.R. Berlekamp ,Algebra Coding Theory, McGraw Hill Inc. , 1984.

MSMH	Total Marks: 100
Semester-IV	Internal Marks: 30
Paper Code. MSMH404A	External Marks: 70
	No. of Hours: 40
Fluid Mechanics	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Equation of state of substance , first law of Thermodynamics , Internal energy and specific heat of gas , Entropy ,Second law of Thermodynamics.	**08**
2	Types of physical similarity,Non dymensionlizing the basic equation of incompressible viscous fluid flow,Non dymansional parameters,Dymensional analysis.	**08**
3	Compessibility effects, Elements of wave motion in a gas,Speed of sound , Basic equation of one dimensional compressible flow,Subsonic,sonic and supersonic flows,Flow through a nozzle.	**08**
4	Maxwell electromagnetic field equations, Equation of motion of a conducting fluid,Rate of flow of change ,Magnetic Reynolds number and magnetic field equation.	**08**
5	Concept ,Boundary layer thickness ,Prandtl's boundary layer, Boundary layer on flat plate,Blassius solution ,Karman's integral equation**.**	**08**

Text books:

1. Text books of Fluid Dynamics, F .Chorlton,G.K.Publishers
2. Fluid Mechanics ,P.K.Kundu ,J.M.Cohen ,Academic Press 2010.

Refferecnce books:

1. Fluid Mechanics ,P.K.Kundu ,J.M.Cohen ,Academic Press 2010.
2. Introduction to Fluid Mechanics ,G.K. Batchelor ,Foundattion book,New Delhi

MSMH	Total Marks: 100
Semester-4	Internal Marks: 30
Paper Code. MSMH404B	External Marks: 70
	No. of Hours: 40
Advance Optimization technique and Control Theory	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	Taguchi technique- introduction to DOE, ANOVA, F-TEST,Response surface methodology, Markov chain.	08
2	Introduction to mdern optimization technique- ANN,Genetic Algorithms, Memetic algorithms, Antz colony algorithm, Tabu Search.	07
3	Dynamic programming, Bellman's principle of optimality, allocation problem, Cargo load problem, Stage coach problem,	09
4	Function taking values in extended reals, proper convex functions, subgradients, Dierctional derivative, conjugate functions. Conjugate duality.	09
5	Optimal control problem, classical approach to solve variational problem, Pontryagin,s maximum principle, Dynamic programming and maximum principle	07

Text Book:

1. Optimization methods in operation research and system analysis- K.V.Mithal& C
2. Quantitaive technique – N. D.Vora, TMH PUB.
3. D. Liberzon, calculus of variations and Optimal control theory: AConcise introduction, Princeton university press.

Rference Books:

1. Neural Network in computer intelligence- Li Min Fu-TMH.
2. O.Guler, Foundation of optimization, Springer,2010

MSMH	Total Marks: 100
Semester-IV	Internal Marks: 30
Paper Code. MSMH404C	External Marks: 70
	No. of Hours: 40
Computer C++ and Matlab	Total Credits: 02

Unit No.	Details	Nos. of Hours
1	OOP Paradigm : Comparison of Programming paradigms, Characteristics of Object – Oriented Programming Languages, Object – based programming languages C++, Brief History of C++, Structure of a C++ program, Difference between C and C++, - cin, cout, new, delete operators,	**08**
2	ANSI/ISO Standard C++, Comments, Working with Variables and const Qualifiers. Enumeration, Arrays and Pointer.	**08**
3	Implementing oops concepts in C++ Objects, Classes, Encapsulation, Data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Message Passing, Default Parameter Value, Using Reference variables with Functions.	**08**
4	Introduction to MAT LAB, Elementary MATH Built – in Functions, Creating Arrays, one dimensional and Two Dimensional arrays, Variables, Strings, Mathematical operations with arrays, Sript files, Two dimensional plots, Functions and Function files.	**08**
5	Programming in C – Constants and variables. Arithmetic expressions, Input-output, Conditional statements, Implementing loops in programs. Defining and manipulating arrays, Processing character strings, functions Files in C. Simple computer programming	**08**

REFERENCES :

1. MAT LAB An Introduction with Applications : Amos Gilat (Wiley India)
2. Programmingin C++ : J. B. Dixit
3. Let us C++ : Yashavant P. Kanetkar