Scheme of Examination

M.A./ M.Sc. MATHEMATICS -I Semester w.e.f. July-2011

		Regular		PracticalMarks
Paper Code	**Title of the paper**	**Theory Marks**	**Internal Assessment Marks**	
MAT 101	Complex Analysis	70	30	-
MAT 102	Differential Equations	70	30	-
MAT 103	Advanced Discrete Mathematics	70	30	-
MAT 104	Programming in C++	50	30	20
Total Marks 400				

Note 1: The marks of internal assessment of each paper shall be split as under:

(A) Class tests 15 Marks
(B) Assignments / tutorials 10 Marks
(C) Attendance 05 Marks

Note 2: As per UGC recommendations, the teaching program shall be supplemented by tutorials and problem solving sessions for each theory paper. For this purpose, tutorials classes shall be held for each theory paper.

MAT: 101 Complex Analysis

Max Marks: 70

UNIT-I

Continuity and differentiability of complex functions, Analytic and regular functions, Cauchy-Reimann equations, Necessary and sufficient conditions for a function to be analytic, some properties of conjugate functions, Construction of an analytic function, Milne Thomson's method.

UNIT-II

Complex integration, Cauchy Goursat theorem, Cauchy's theorem, Morera's theorem, Cauchy's integral formulae, Cauchy inequalities, Liouville's theorem.

UNIT-III

Gauss mean value theorem, Maximum & minimum modulus theorems, The Argument Theorem, Rouche's Theorem, Poisson's integral formulae.

UNIT-IV

Power series, The circle of convergence of the power series, Taylor's series, Laurent's series, The zeros of an analytic function, Types of singularities, Introductory conformal mapping (Bilinear transformation).

UNIT-V

Residue at a single pole, Residue at a pole a of order greater than unity, Residue at infinity, Cauchy's residue theorem, Evaluation of real definite integral, Integral round the unit circle.

Books Prescribed:

1. B.Churchil	Fundamental of Complex Analysis
2. T.Pati	Fundamental of Complex Variable
3. J.H. Methews & R.W.Howell	Complex Analysis for Mathematics & Engineering, Narosa Pub.

Books Recommended:

1. Murry R. Spiegel	Complex Analysis, Schaum's outline
2. LV.Ahlfors	Complex Analysis, McGraw-Hill, 1977
3. Z. Nehari	Conformal Mapping , Dover Pub.

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 102 Differential Equations

Max Marks: 70

UNIT-I

The Existence and Uniqueness of solutions : The method of successive approximation, Picard's Existence and Uniqueness theorem, Solution of linear differential equations of second order with variable coefficients, Applications to the vibrational mechanical systems.

UNIT –II

Boundary value problems: Wave equation, Laplace equation and Heat conduction equation, Their solutions by method of separation of variables and applications, Eigenvalues, Eigenfunctions.

UNIT-III

Ordinary and regular singular points, Power series solution, Series solution (Frobenius method) of first and second order linear equations, Legendre and Bessel Functions and their recursion formulae, Integral representation and properties.

UNIT –IV

Partial Differential Equations of the First Order: Origin of First order Partial Differential Equations, Cauchy's problems for the first order equations, Linear & Non-linear partial differential equations of the first order,Charpit's method, Jacobi's method.

UNIT –V

Partial Differential Equations of Second Order: Linear Partial Differential Equations with constant and variable coefficients, Solution of linear hyperbolic equations.

Books Prescribed :

1. G.F. Simmons — Differential equation with Applications and Historical Notes, Tata Mgraw Hill

Books Recommended:

1. W.I. Martin and E. Reissner — Elementary Differential Equations, Addison-Wesley Publishing Company
2. I. G. Petrovaski — Ordinary Differential Equations, Moscow State University publishing
3. I.N.Sneddon — A text book of Partial Differential Equations, McGraw-Hill
4. M.D.Raisinghania — Advanced Differential Equations, S.Chand Pub.

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 103 Advanced Discrete Mathematics

Max Marks: 70

UNIT-I

Propositional Calculus: Proposition and logical operations, Proposition and truth tables, Tautologies & contradiction, Logical equivalence, Conditional & Bi-conditional statements, Logical implication , Propositional functions & quantifiers.

Semi groups & Monoids: Definitions and examples of semi groups and monoids, Isomorphism & homomorphism of semi groups and monoids.

UNIT-II

Partially ordered set, Hasse diagram, External element of poset, Lattices as algebraic system. Sub lattices, Isomorphic lattices, Bounded lattices, Complete, Compliment, Complemented lattices, Modular lattices, Penthogonal lattices, Pentagonal.

UNIT-III

Boolean algebra: Definition, Principle of duality, Basic Theorems, Sub algebra, Isomorphic, Boolean algebra as lattices, Boolean functions and min-terms, Disjunctive normal form, Complete disjunctive normal form, Conjugate normal form.

UNIT-IV

Language & Grammar and their types: Regular expressions and Regular sets, Regular language, Finite state Automata.

UNIT-V

Finite state Machine, Semi-Machines and languages, Application of Logic Circuit: Sum-of products form for Boolean algebra, Minimal Boolean expressions, Prime implicants, Logic and Circuits, Boolean functions, Karnaugh map.

Books Prescribed:

1**.** B.Colman, R.C. Busby & S.Ross	Discrete Mathematical Structures (PHI),[II &III]
2**.** Schaum's series	Discrete Mathematics, Tata Mc-Graw- Hill Edition [I, III, IV &V]

Books Recommended:

1**.** Susanna S. Epp.	Discrete Mathematics with Applications (Thomson Learning TM)

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 104 Programming in C++

Max Marks: 50

UNIT-I

C++ Programming Basics : Basic Program Construction, Character Set, Tokens, Keywords and Identifiers, Constants and Variables, Data Types, Declaration and Initialization of Variables, Qualifiers, Coercion, I/O Operators, Cascading of I/O Operators, Manipulators, Comments, Arithmetic Operators, Expressions, Precedence of Operators, Evaluation of Expressions, Library Functions, Preprocessor Directives.

UNIT-II

Loops and Decisions: Relational operators, Loops, Logical Operators, Decisions, Precedence and Associativity of Operators, Control Statements. Structures and Functions : Structures, Nested Structures, Enumerated Data Types, Simple Functions, Passing Arguments to and Returning Values from Functions, Reference Arguments, Overloaded Functions, Inline Functions, Default Arguments, Variables and Storage Classes, Returning by Reference.

UNIT-III

Introduction to OOP and C++: Procedure Oriented Programming (POP)and Object Oriented Programming(OOP), Need of Object Oriented Programming, Characteristics of Object Oriented languages, C++ an OOP Language . Objects and Classes : Specification of class, Access Specifiers, Using Class and Objects, Constructors, Objects as Function Arguments, Returning Objects from Functions, Structures and Classes, Static Class Data. Arrays: Arrays Fundamentals, Arrays as Class member data, Arrays of objects, Strings.

UNIT-IV

Operator Overloading: Overloading of Unary and Binary Operators, Data Conversion. Inheritance: Derived class and Base class, Derived Class Constructors, Overriding Member Functions, Class Hierarchies, Public and Private Inheritance, Levels of Inheritance

UNIT- V

Pointers: Pointers with Arrays, Functions, Strings and Objects, Memory Management, This Pointer. Subtleties and Files I/O : Virtual Functions, Friend Functions, Static Functions, String I/O, Character I/O, Object I/O, I/Owith Multiple Objects, File Pointers, Disk I/O with Member Function.

Books Prescribed:

1. Robert Lafore Object Oriented Programming in TURBO C++, Galgotia Pub.
2. E. Balagurusamy Programming in ANSI C, Tata Mc-Graw Hill

Books Recommended

1. Yashwant Kanitkar Let us C, B.P.B. Pub.
2. E. Balagurusamy Object Oriented Programming with C++, Tata Mc-Graw Hill

Note :

1. Practical will be based on the course.
2. The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 104 LIST OF PROGRAMS IN C++

Max Marks: 20

1. Write a program to generate the reverse of a five digit number. Check the number to be palindrome.

2. Write a program to find the product of the two matrices A and B of order m x n.

3. Write a program in C++ that uses function overloading to do following tasks:
(I)find the maximum of two integer numbers.
(II)Find the maximum of three integer numbers.

4. Declare a class to represent Bank account of 10 customers having the following data members:
Name of depositors,
Account Number,
Type of Account (S for Saving and for Current Account),
Balance Amount.
The class also contains following member functions:
To initialize the data members
To deposit money
To withdraw money (minimum balance is Rs. 1000)
To display the data members

5. Write a program, which reads records of N numbers of students in an array of objects and prints the list of students in the following format

Lists of students		
Name	Roll No.	Grade

The structure of student's record is given below
Name, Roll No., Marks
The grade obtained by the student is determined according to the rules given below

Marks Grade

Below 200D

200-240C

240-320B

Above320A

6. Declare a class set with the following specification.

Set
list [ ],i,n
read _list ( ) find( )

Where list [ ]: is an array to store the list ; i , n are integers

read –list ( ) is a function to read the list;

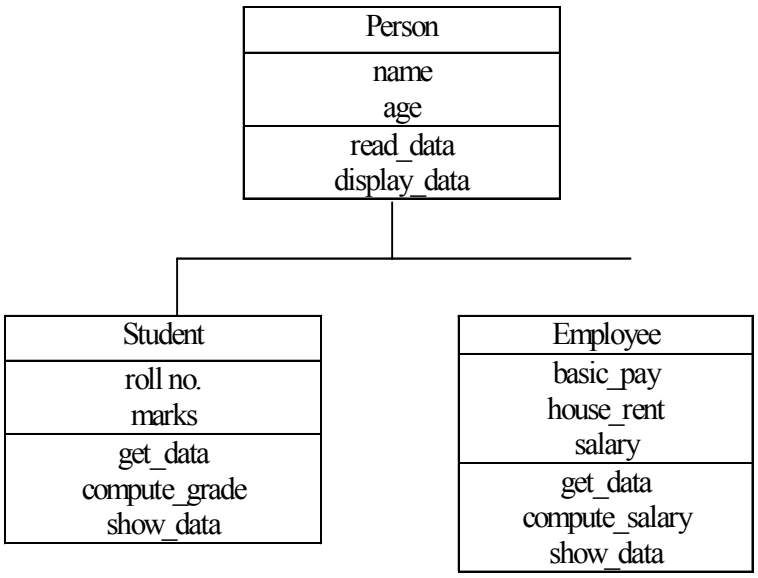
find ( ) is a function to find the largest and return it.

Take two sets and find the largest numbers of these sets.

7. Write a C++ program to overload '= =' and '+ =' operators for strings to compare and concatenate two string.

8. Use operator overloading to overload addition operator '+' to advance time by h hours, m minutes and s seconds. Also overload the '+' operator to add two time objects.

9. Write a C^{++} program to implement following hierarchical inheritance.



10. Write a program in C++ to implement multiple inheritances.

11. Use friend function to find the mean of the two data members of the two different objects of different classes.

12. Write a program in C++ in which the statement like

dist1 =7.5*dist2;

can be written, where dist1 and dist2 are objects of English Distance class.

13. Use static function to determine the count of number of objects created of a class.

14. Write a program in C++ to write the name and address of a person on a file. Also read the contents of that file after writing on it.

Scheme of Examination

M.A./ M.Sc. MATHEMATICS -II Semester w.e.f. January-2012

		Regular		Practical Marks
Paper Code	**Title of the paper**	**Theory Marks**	**Internal Assessment Marks**	
MAT 201	Topology	70	30	-
MAT 202	Abstract Algebra	70	30	-
MAT 203	Numerical Analysis	50	30	20
MAT 204	Mathematical Methods	70	30	-
Total Marks 400				

Note 1: The marks of internal assessment of each paper shall be split as under:

(A) Class tests 15 Marks
(B) Assignments / tutorials 10 Marks
(C) Attendance 05 Marks

Note 2: As per UGC recommendations, the teaching program shall be supplemented by tutorials and problem solving sessions for each theory paper. For this purpose, tutorials classes shall be held for each theory paper.

MAT: 201 Topology

Max Marks: 70

UNIT-I

Metric space, Open sets, Closed sets, Convergence, Completeness, Continuity in metric space, Cantor intersection theorem.

UNIT-II

Topological space, Elementary concept, Basis for a topology, Open and closed sets, Interior and closure of sets, Neighborhood of a point, Limits points, Boundary of a set, Subspace topology , Weak topology, Product topology, Quotient topology.

UNIT-III

Continuous maps, Continuity theorems for Open and closed sets, Homeomorphism, Connected spaces, Continuity and connectedness, Components, Totally disconnected space, Locally connected space, Compact space, Limit point compact, Sequentially compact space, Local compactness, Continuity and compactness, Tychonoff theorem.

UNIT-IV

First and second countable space, T_1 spaces, Hausdorff spaces, Regular spaces, Normal spaces, Completely normal space, Completely regular space, Tietz-Extention theorem, Metrizability, Uryshon Lemma, Uryshon metrization theorem.

UNIT-V

Fundamental group function, Homotopy of maps between topological spaces, Homotopy equivalence, Contractible and simple connected spaces, Fundamental groups of S^1, and $S^1 x\ S^1$ etc., Calculation of fundamental groups of S^n , $n>1$ using Van Kampen's theorem , Fundamental groups of a topological group.

Books Prescribed:

1.C.A.R. Franzosa	Introduction to Topology, Narosa Pub.
2. G.F.Simmons	Introduction to Topology, Mc-Graw Hill
3. J.Munkers	Topology, Prentice Hall of India
4.Marwin J.Greenberg and J.R. Harper	Algebraic Topology, Westview Pr. (for Unit-V)

Books Recommended:

1. Schaum's outline series	General Topology, McGraw-Hill Pub.

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT :202 Abstract Algebra

Max Marks: 70

Unit-I

Symmetric groups, Alternating groups, Normal subgroups, Conjugacy, Normalization, Centre of a group, Class-equation of a group and its consequences, Theorems for finite groups, Cauchy's theorem, Sylow's theorem.

Unit-II

Homomorphisms, Endomorphisms, Automorphisms, Inner automorphisms, Group of automorphisms and Inner automorphisms, Simple groups, Maximal subgroups, Composition series, Jordan-Holder theorem, Normal series, Solvable groups, Direct-Products.

Unit-III

Rings, Sub-rings, Integral domain, Euclidean Rings, Ideal, Principal Ideal, Maximal and Prime ideals, Module, Sub-module, Module homomorphism, Linear sum and direct sum of sub-module.

Unit –IV

Extension fields, Transitivity of finite extensions, Algebraic element, Algebraic field extensions, Minimal polynomials, Roots of polynomials, Multiple roots, Splitting field, Uniqueness of SF of a polynomial.

Unit- V

Automorphism of a field, Fixed field, Group of Automorphism of a field K relative by a subfield F of K, Galois group of a Polynomial over a field, Construction with straight edge and Compass, Solvability by radicals.

Books recommended:

1.I.N. Herstein	Topics in Algebra, Wiley Eastern Ltd.
2.J. Fraleigh	A First Course in Abstract Algebra, Pearson Education.
3.Mac-Donald	Theory of Groups and Fields, Clarendon Press

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 203 Numerical Analysis

Max Marks: 50

Unit – I

Errors in numerical calculations: Absolute, Relative and percentage errors, A general error formula, Error in a series approximation; Solutions of algebraic & transcendental equations: The Bisection method, The iteration method: Acceleration of convergence, Aitken's process, Regula-Falsi method, Secant method, Newton- Raphson method, Solution of system of non-linear equations: The method of iteration, Newton-Raphson method.

Unit – II

Interpolation: Errors in Polynomial interpolation, Finite differences: Forward, Backward and Central differences, Symbolic relations, Difference of polynomial, Newton's formulae of interpolation, Central difference interpolation formulae: Gauss's , Bessel's & Stirling's formulae; Interpolation with unevenly spaced points: Lagrange's interpolation formula, Interpolation with cubic splines, Divided differences and their properties, Newton's general interpolation formula, Inverse interpolation, Method of successive approximations.

Unit-III

Numerical differentiation and integration: Forward, Backward and Central difference formulae for first and second order derivatives, Errors in numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Boole's and Weddle's rules, Newton's-Cotes integration formulae.

Unit – IV

Numerical solution of ordinary differential equations: Taylor's series, Picard's successive approximations, Euler's, Modified Euler's, Runge-Kutta & Milne's Predictor-Corrector methods, Simultaneous and higher order equations: Taylor's series method and Runge-Kutta method, Boundary value problems: Finite differences method.

Unit –V

Numerical solution of partial differential equations: Finite difference approximations to derivatives, Laplace's equation: Jacobi's method, Gauss Seidel method, The ADI method; Parabolic equations: Explicit scheme, C-N scheme, Hyperbolic equations: Explicit scheme, Implicit scheme.

Books Prescribed :

1. S.S. Sastry	Introductory Methods of Numerical Analysis, Prentice Hall of India.
2. M.K. Jain, S.R.K Iyengar & R.K.Jain	Numerical methods of Scientific and Engineering Computation, New Age Pub.

Notes :

1. Practical will be based on the course.
2. The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 204 Mathematical Methods

Max Marks: 70

UNIT-I

Origin and classification of Integral equations, Conversion of differential equations into integral equations, Linear integral equations of the first and second kind of Fredholm and Voltra types, Solution by successive substitutions and successive approximations.

UNIT-II

Solution of equations with separable kernels. The Fredholm alternative, Holbert-Schmidt theory for symmetric kernels.

UNIT-III

Functional: Some simple variational problems, The variation of a functional, Euler's equation, Special cases of Euler's equation, Case of several variables, Simple variable end point problem, Variational derivative, Invariance of Euler's equation, Fixed end point problem for n unknown functions, Variational problems in parametric form, Functional depending on higher order derivatives, Variational problems with subsidiary conditions.

UNIT-IV

Laplace transform, Transform of elementary functions, Transform of Derivatives, Inverse transforms, Convolution theorem. Application of Laplace transform in solving ordinary and partial differential equations.

UNIT-V

Z-Transform: Definition, Linearity property of Z-transform, Z-transform of elementary functions, shifting theorems, Convolution theorem, Inversion of Z-transforms, Solution of difference equation by Z- transform.

Books Prescribed:

1. F.B. Hildebrand — Methods of Applied Mathematics, Prentice Hall.
2. L.B. Chambers — Integral Equations, International Text Book Co.
3. I.M Gelfand, & S.V. Fomin — Calculus of Variations, Prentice Hall (Unit-III)
4. N. Seddon — Integral Transforms, Schaum's Outline Series

Books Recommended:

1. M.D.Raisinghania — Integral Equations, S. Chand
2. B.S.Grewal — Engineering Mathematics, Khanna Publishers

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

Scheme of Examination

M.A./ M.Sc. MATHEMATICS –III Semester w.e.f. July-2012

		Regular		PracticalMarks
Paper Code	**Title of the paper**	**Theory Marks**	**Internal Assessment Marks**	
MAT 301	Functional Analysis	70	30	-
MAT 302	Measure Theory	70	30	-
MAT 303	Probability Theory and Statistics	70	30	-
Any one of the following Group A	-	70	30	-
Total Marks 400				

Group A:

MAT 304 : Graph Theory
MAT 305 : Spherical Astronomy
MAT 306 : Number Theory

Note 1: The marks of internal assessment of each paper shall be split as under:

(A) Class test	15 Marks
(B) Assignments / tutorials	10 Marks
(C) Attendance	05 Marks

Note 2: As per UGC recommendations, the teaching program shall be supplemented by tutorials and problem solving sessions for each theory paper. For this purpose, tutorials classes shall be held for each theory paper.

Note 3: Optional papers can be offered subject to availability of requisite resources/ faculty and more option can be added depending upon the availability of the staff.

MAT:301 Functional Analysis

Max Marks: 70

UNIT-I

Normed spaces, Banach space, Subspace of Banach space, Finite dimensional Normed space and subspaces,Compactness and Finite dimension, Linear operators, Bounded and Continuous linear operators. Linear functionals, Linear operators and Functional on finite dimensional spaces, Normed spaces of operators, Dual spaces.

UNIT-II

Principle of uniform boundedness, Boundedness and Continuity of linear transformations, Hahn-Banach theorem, Open mapping theorem, Closed graph theorem.

UNIT-III

Inner product space, Schwarz and Minkowski inequalities, Orthogonal compliments and Direct sums, Hilbert spaces, Projections, Orthonormal basis, Riesz-representation theorem, Conjugate Hilbert spaces, Hilbert-Adjoint operator.

UNIT-IV

Bessels inequality, Parsaval's identity, Self adjoint operators, Normal operators, Unitary operators, Spectral theory in finite dimensional Normed spaces, Spectral properties of bounded linear operators.

UNIT-V

Banach fixed point theorems and their iteration methods, Application to collinear and integral equations, Application to ordinary differential theorems.

Books Prescribed:

1. E Kreyszig — Introductory Functional analysis with applications, J Wiley & Sons
2. W. Rudin — Functional analysis, Mc Graw Hill Pub.
3. B.V. Limaye — Functional analysis, Wiley Eastern Ltd. New Delhi

Books Recommended:

1. T.Nair — Functional analysis, Prentice Hall

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 302 Measure Theory

Max Marks: 70

UNIT-I

Cardinality of sets, Cardinal numbers, Order relation, Addition, Multiplication, Exponentials, Canter like sets, Measurable sets, Borel sets, Outer measure, Lebesgueb measure in R.

UNIT-II

Measurable functions, Lebesgue integral of simple functions, Lebesgue nonnegative measurable function.

UNIT-III

General Lebesgue Integral, Comparison of Riemann and Lebesgue Integrals, Convergence in measure, Monotone convergence theorem, Fatou's lemma, dominated Convergence theorem.

UNIT-IV

Differentiation of monotone functions and bounded variation, Jordan-Hahn Decomposition theorem, Absolute continuity, Differentiation of an integral.

UNIT-V

L_p spaces : Definition of L_p space, Definite conjugate number, Holder's inequalities, Schwartz inequality, Minkowski inequality.

Books recommended:

1. P.K. Jain and V.P. Gupta	Lebesgue Measure and Integration, New Age International (Relevent parts of Chapter II and Chapter II to VI only)
2. P.P. Gupta	Lebesgue Measure and Integration (chapter VIII only), Wiley Eastern, New Delhi,
3. H.L.Roydon	Real Analysis, Prentice Hall

Books Prescribed:

1. Inder K. Rana	An Introduction to Measure and integration, American Mathemaical Socity, Second Edition

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 303 Probability Theory and Statistics

Max Marks: 70

UNIT-I

Probability: Sample space and Events, Axioms of Probability, Conditional Probability, Baye's theorem.,Expectations, Moments, Chebyshev's inequality, Weak law of large numbers, Strong law of large numbers.

UNIT-II

Probability Distributions: Random Variables, Distribution functions, Probability density function, Discrete Random Variable, Bernoulli's Distribution, Binomial Distribution, Poisson distribution, Hyper geometric distribution (their density functions, means, variance, moments up to fourth order)

UNIT-III

Continuous Distributions: Continuous random variable, Normal Distribution, Uniform & Exponential distribution, Null hypothesis, Test of hypothesis, Testing the significance of sample mean and difference between means of two samples.

UNIT-IV

Pt. Estimation, Interval Estimation, Methods of Estimation ,Max Likelihood method, Method of moments, Least square method, Unbiasedness, Efficiency, Consistency, Sufficient Statistics.

UNIT-V

Curve Fitting, Simple linear regression, Assumptions, Least square estimators of parameter, Standard error of parameters, Correlation, Multiple correlation.

Books Prescribed:

1. Miller & Johan Freund — Probability and Statistics, Prentice Hall
2. Gupta & Kapoor — Probability and Statistics, Sultan. Chand & Sons

Books Recommended:

1. M.R.Spiegel — Theory & problems of Probability, Schaum's Otline Series

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 304 Graph Theory

Max Marks:70

UNIT – I

Introduction, Finite and infinite graphs, Weighted graph, Sub-graph, Walks, Paths, Circuits, Connected and Disconnected graphs, Components, Euler graph, Unicursal graph, Operations on graphs, Hamiltonian paths and circuits, Directed graphs, Types of digraphs, Digraphs and binary relations, Directed paths and Connectedness, Euler Digraphs, Trees with directed edges.

.

UNIT-II

Trees, Properties of Trees, Distance and Centres in a tree, Counting trees: Counting labeled and unlabeled trees, Fundamental circuits, Spanning trees of a graph and weighted graph.

UNIT-III

Cuts-sets and Cut-vertices, Fundamental circuits and cut-sets, Connectivity and Seperability, Isomorphism, 1- Isomorphism, 2- Isomorphism, Combinatorial vs. Geometric graphs, Planer graphs, Kuratowski's two graphs, Detection of planarity, Homeomorphic graphs, Geometric Dual, Combinatorial Dual.

UNIT-IV

Modular arithmetic and Galois Fields, Vector space associated with a graph, Incidence matrix, Submatrix of A(G), Circuit matrix, Fundamental circuit matrix and rank of B, Cut-sets matrix, Path matrix and Adjacency matrix.

UNIT-V

Chromatic number, Chromatic partitioning, Chromatic polynomial, Matchings, Coverings, Four-color problem, Five-color theorem.

Books Prescribed:

1. Nar Singh Deo — Graph Theory, PHI

Books Recommended:

1. Frank Harary — Graph Theory, Addison Wesley Longman Publishing Co.

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT 305 Spherical Astronomy

Max. Marks : 70

UNIT -I & II

Spherical Trigonometry, Sine, Cosine and Tangent formulae.

UNIT-III & IV

Celestial sphere including rising and setting of stars, Twilight, Refraction.

UNIT-V

Aberration, Precession and Notation.

Books Recommended:

1. S.K. Sharma, R.K. Gupta and D. Kumar Spherical Astronomy, Krishna Prakashan Mandir, Meerut

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 306 Number Theory

Max Marks:70

UNIT – I

Prime numbers, Unique factorisation theorem, Farey series, Irrational numbers, Congruence, Quadratic residues.

UNIT - II

Quadratic Reciprocity law, Primitive roots, Fermat's theorem, Wilson's theorem, Continued fractions, Approximation of irrationals by rationals.

UNIT -III

Hurwitz theorem, The fundamentals of arithmetic in K(i), K(I) P, Diphnatine equations $x^2+y^2=z^2$, $x^4=y^4$, $ax^2+by^2+cz^2=0$, Quardratic fields.

UNIT - IV

The arithmetic functions (Mu,Tau, Phi and Sigma)including elementary results on their order and average order. Representation of a number by two or four squares.

UNIT -V

Warings Prob Elementary results on g (k) and G(K), The prime number theory.

Prescibed Books :

1. D.M.Burton Elementary Number Theory, Mcgraw-Hill

Books Recommended:

1. Tailing and Nodkarni Theory of Numbers
2. M. Coblets Theory of Numbers

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

Scheme of Examination

M.A./ M.Sc. MATHEMATICS –IV Semester w.e.f. Januray-2013

		Regular		PracticalMarks
Paper Code	**Title of the paper**	**Theory Marks**	**Internal Assessment Marks**	
MAT 401	Mathematical Modeling	70	30	-
MAT 402	Operation Research	70	30	-
MAT 403	Fuzzy Sets and their Applications	70	30	-
Any one of the following Group B	-	70	30	-
Total Marks 400				

Group B:

MAT 404 : Fourier Analysis and Wavelet Theory
MAT 405 : Fluid Dynamics
MAT 406 : Neural Networks

Note 1: The marks of internal assessment of each paper shall be split as under:

(A) Class test 15 Marks
(B) Assignments / tutorials 10 Marks
(C) Attendance 05 Marks

Note 2: As per UGC recommendations, the teaching program shall be supplemented by tutorials and problem solving sessions for each theory paper. For this purpose, tutorials classes shall be held for each theory paper.

Note 3: Optional papers can be offered subject to availability of requisite resources/ faculty and more option can be added depending upon the availability of the staff.

MAT:401 Mathematical Modeling

Max Marks:70

UNIT-I

The Modeling process: Introduction, Mathematical models, Construction of models, Scientific method, The iterative nature of model construction, Types of modeling, Some characteristics of mathematical models, Linear growth and decay models, Non-linear growth and decay model, Simple compartment models.

UNIT-II

Mathematical modeling through difference equations: Basic theory of difference equations with constant coefficients, Mathematical modeling through difference equations in Economics and Finance: The Harrod Model, The Cobweb model, Mathematical modeling through difference equations in Genetics: Hardy-Weinberg law, Improvement of plants through elimination of recessives.

UNIT-III

Two species population models: Introduction, Types of interaction between two species, Prey –Predator model .Models for competing species.
Epidemics: Basic concept, Simple Epidemic model (formulation, solution, interpretation),General epidemic model (formulation, solution, interpretation),SIS model, SIS model with specific rate of infection as a function of t., general deterministic model with removal and immigration (SIS model), model for control of an epidemic.

UNIT-IV

Equation of continuity in fluid flow (Euler's and Langrange's), Equation of continuity in Cartesian ,Cylindrical and spherical polar coordinates, Equivalence between Eularian and Langrangian forms of equations of continuity, Euler's Equation of motion..

UNIT-V

Structure and flow properties of blood, Blood flow in circulatory system, Effects of mild stenosis , Pulsatile flow.

Books Prescribed:

1. F.R. Giordano, M.D. Weir and W.P. Fox	A First Course in Mathematical Modeling, Brooks Cole Publishing
2. J.N.Kapur	Mathematical Modelling, New Age Int.
3. J.N.Kapur	Mathematical models in Biology and Medicine, East-West Press
4. F.Chorlton	A Text Book of Fluid Dynamics, Chorlton Pub.
5 .M.D.Raisinghania	Fluid Dynamics, S. Chand.

Books Recommended:

1. N.T.J.Bailey	The Mathematical Theory of Epidemics, Hafner Publishing

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 402 Operation Research

Max Marks: 70

UNIT-I

Introduction: Definition and scope of O.R., Different O.R. models, General methods for solving O.R. models , Main characterization and phases of O.R., Linear programming and Simplex method with simple problems, Two-phase and Big-M methods.

UNIT-II

Inventory Management: Inventory control, Types of inventories, Cost associated with inventories, Factors affecting inventory control, Single item deterministic problems with and without shortages, Inventory control with price breaks, Inventory control for one period without setup cost with uncertain demands (News paper boy type problem).

UNIT-III

Sequencing Theory: Introduction, Processing with n-jobs and two machines, n-jobs and three machines, n-jobs and m- machines, Concept of jobs blocks.

Non-linear Programming: Convex sets and convex functions, Quadratic programming, Wolfe's complementary pivot method and Beale's methods.

UNIT-IV

Queuing Theory: Introduction, Characteristics of queuing systems, Poisson process and Exponential distribution, Classification of queues, Transient and steady states, Poisson queues (M/M/1, M/M/C).

UNIT-V

Non-Poisson Queuing systems: (M/E_k/1) queuing systems.

Replacement Problems: Replacement of items that deteriorate gradually and value of money does not change with time, Replacement of items that fail suddenly, Individual and group replacement policies.

Books Prescribed:

1. H.A. Taha	Operation Research: An introduction, Macmillan Publishing Company
2. P.K.Gupta, Kanti Swarup& Man Mohan	Operation Research, Sultan Chand & Co
3. R.L.Ackoff and N.W. Sasieni	Fundamental of Operations Research, John Willy, New York

Books Recommended:

1. S.D.Sharma	Operation Research, Kedar Nath Ram Nath

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT: 403 Fuzzy Sets and Their Applications

Max Marks: 70

UNIT-I

Crisp sets, Fuzzy sets (basic types), Fuzzy sets (basic concepts), Representation of fuzzy sets, Decompositions theorems, Extension principle for fuzzy sets.

UNIT-II

Operations on fuzzy sets (Fuzzy compliment, intersection, and union), Combinations of operations.

UNIT-III

Fuzzy numbers, Linguistic variables, Arithmetic operations on fuzzy numbers, Lattice of fuzzy numbers, Fuzzy equations.

UNIT-IV

Crisp and fuzzy relations, Projections, Binary fuzzy relations, Binary relations on a single set, Fuzzy equivalence relations, Fuzzy compatibility relations, Fuzzy ordering relations, Fuzzy morphism, Sup-i compositions of binary fuzzy relations, Inf-w_i compositions of fuzzy relations.

UNIT-V

Fuzzy relation equations, Fuzzy logic, Fuzzy decision making**,** Fuzzy linear programming, Linear Regression with fuzzy parameters, Fuzzy regression with fuzzy data.

Books Prescribed:

1. H.J. Zimmerman. Fuzzy Set Theory and Its Applications, Kluwer Academic Publishers
2. George J. Klier and Bo Yuan Fuzzy Sets and Fuzzy Logic, Prentice Hall of India

Books Recommended:

1. Kaufmann, A. and Gupta, M.M. Fuzzy Mathematical Models in Engineering and Management Science

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT-404 Fourier Analysis and Wavelet Theory

Max Mark: 70

UNIT-I

Trigonometric Fourier series: Periodic functions, Harmonic functions, Trigonometric polynomial and series, Orthogonality of sine and cosine, Fourier series of 2π-periodic functions.Orthogonal Systems: Definition and examples, Fourier series for orthogonal system, Definition of L_p-space and examples, Complete system and its important properties, Bessel's inequality.

UNIT-II

The limit as $n \to \infty$ of the trigonometric integrals, Formula for sum of cosine-auxiliary integral, Integral formula for partial summation Fourier series, Sufficient condition for convergence of a Fourier series at a point of Continuity and discontinuity, Integration of Fourier series, Differentiation of Fourier series. Double Fourier series: Orthogonal systems in two variables and examples, The Fourier integral as a limiting case of the Fourier series, The Fourier transform and examples.

UNIT-III

Definitions of wavelets and examples, Continuous wavelet transforms and examples, Basic properties of wavelet transforms, Parseval's formula for wavelet transform, Inversion theorem for wavelet transform. The Discrete wavelet transforms and examples, Orthonormal wavelets and its examples.

UNIT-IV

Refinement equation and examples, Dyadic number, Definition of Multiresolution Analysis (MRA) and examples, Properties of scaling functions and orthonormal wavelets bases, Orthonormalization process, Construction of orthonornal wavelets (Some basic Examples).

UNIT-V

Daubechies wavelets (D4) and some examples. Algorithms for D4. Definition of Harmonic wavelets, Orthogonality of Harmonic wavelets and normalization. Approximation of functions in Harmonic wavelets bases.

Books Prescribed:

1. Georgi P. Tolstor — Fourier Series, Dover Pule., INC New York
2. Lokenath Debnath — Wavelet transforms and Their Applications, Birkhauser, Boston
3. K. P. Soman — Insight Into Wavelets From Theory To Practice, PHIL

Books Recommended:

1. A Boggess & F J. Narcowich — A First Course in Wavelets with Fourier Analysis, Prentice Hall
2. C. K. Chui — An Introduction to Wavelets, Academic Press, New York
3. E. Herna'ndez and G. Weiss — A First Course in Wavelets, CRC Press, New York
4. Ingrid Daubechies — Ten Lectures on Wavelets, SIAM Pub.

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT-405 Fluid Dynamics

Max Mark: 70

UNIT-I

Kinematics: Lagrangian and Eulerian descriptions, Continuity of mass flow, Circulation, Irrotational and rotational flows, Boundary surface.

UNIT -II

Euler's Equations: General equations of motion, Bernoulli's theorem (Compressible incompressible flows) Kelvin's Theorem (Constancy of circulation).

UNIT-III

Two Dimensional Irrotational Motion : Stream function, Complex potential, Sources, Sinks and doublets circle theorem, Method of images, Theorem of Blasius, Schwartz Christoffel transformation, Jacowski aero-foil and potential flow.

UNIT - IV

Three Dimensional Irrational Motion : Potential flow due to sources, Sinks and Doublets, Stokes stream function, Spherical harmonics and motion of a sphere.

UNIT-V

Real Fluids : Navier- Stoks equations, Dissipation of energy, Diffusion of vorticity, Steady parallel flow between two infinite parallel plates, Through a circular pipe (Hagen-Poiseulle flow), Past a sphere (Stoke's flow).

Books Recommended:

1. S. W. Yuan — Foundations of Fluid Mechanics, Academic Press
2. L.M. Milne-Thomson — Hydrodynamics, Dover Publications

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.

MAT-406 Neural Networks

Max Mark: 70

UNIT -I & II

Uncoupled linear systems, Diagonalization, Linear systems in R, Stability theory, Non-homogeneous linear systems, Nonlinear systems, Local theory, Fundamental existence, Uniqueness theorem, Flow defined by a differential equation, Linearization, Stability and Lipunov functions, Saddles, Nodes, Foci and Centres, Non-Hyperbolic critical points in R^2, Gradient and Hamiltonian systems.

UNIT-III

Artificial Neural Systems, Preliminaries

UNIT - IV

Fundamental concepts and Models of Artificial Neural Systems
2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7

UNIT -V

Single-layer perception classifiers
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8

Prescribe Books:

1. Lawrence Perlov	Differential Equations and Dynamic Systems, Spring Verlag 13 (for unit-I) (Articles : 1.1, 1.2, 1.5, 1.9, 1.10 ; 2.2, 2.5, 2.6, 2.9, 2.10, 2.11,2.14)
2. Jack M. Zurada	Introduction to Artificial Neural Systems, Jaico Publishing House, India (Chapter 1,2,3 for Units 2,3 4).

Note –The course is divided into five units .The question paper will consist of five questions. One question per unit will be asked. Each question will consist of four parts, out of which the examinee will be asked to attempt only two parts. The examinee will be required to attempt all questions.