SCHEME OF EXAMINATION

AND

COURSE OF STUDY

IN

M.Sc.MATHEMATICS

[UnderChoice Based Credit System]

(w.e.f. Session 2021-2022)

DEPARTMENT OF MATHEMATICS& STATISTICS
GURUKULA KANGRI (Deemed to be University), HARIDWAR – 249404
September 2021

Syllabus w. e. f. Session 2021-22
Gurukula Kangri (Deemed to be University), Haridwar

M.Sc. MATHEMATICS

S.N	Subject Code	Subject Title	Period			Evaluation Scheme				Subject Total
						Sessional			ESE	
			L	T	P	Credit	CT	TA		
M. Sc I Year										
Semester – I										
1	MMA-C111	Ordinary Differential Equations	5	2	-	6	20	10	70	100
2	MMA-C112	Mathematical Statistics	5	2	-	6	20	10	70	100
3	MMA-C113	Advanced Real Analysis	5	2	-	6	20	10	70	100
4	MMA-C114	Abstract Algebra	5	2	-	6	20	10	70	100
									Total credit	**24**
Semester – II										
1	MMA-C211	Complex Analysis	5	2	-	6	20	10	70	100
2	MMA-C212	Topology	5	2	-	6	20	10	70	100
3	MMA-C213	Partial Differential Equations	5	2	-	6	20	10	70	100
4	MMA-C214	Optimization Techniques	5	2	-	6	20	10	70	100
									Total credit	**24**
M. Sc II Year										
Semester – III										
1	MMA-C311	Functional Analysis	5	2	-	6	20	10	70	100
2	MMA- C312	Programming in C	3	2		4	20	10	70	100
3	MMA- C352	Lab Course with C			3	2	20	10	70	100
Elective Papers (Select any two)										
3	MMA-E311	Vedic and Ancient Mathematics	5	2	-	6	20	10	70	100
4	MMA-E312	Discrete Mathematics	5	2	-	6	20	10	70	100
5	MMA-E313	Mathematical Methods	5	2	-	6	20	10	70	100
6	MMA-E314	Number Theory	5	2	-	6	20	10	70	100
7	MMA-E315	Mechanics	5	2	-	6	20	10	70	100
8	MMA-E316	Neural Network	5	2	-	6	20	10	70	100
									Total credit	**24**
Semester – IV										
1	MMA-C411	Numerical Analysis	5	2	-	6	20	10	70	100
2	MMA-C412	Mathematical Modeling	5	2	-	6	20	10	70	100
Elective Papers(Select any two)										
3	MMA-E411	Fuzzy Sets and Their Applications	5	2	-	6	20	10	70	100
4	MMA-E412	Fourier Transform& Wavelet Analysis	5	2	-	6	20	10	70	100
5	MMA-E413	Fluid Dynamics	5	2	-	6	20	10	70	100
5	MMA-E414	Differential Geometry	5	2	-	6	20	10	70	100
	MMA-E415	Cryptographic Mathematics	5	2	-	6	20	10	70	100
7	MMA-E416	Dissertation*	-	-	-	6				100
									Total credit	**24**
									Cryptographic Mathematics**G Total (credit)**	**96**

*** Dissertation can be offered to those students securing more than 70% of marks upto IInd semester and the availability of the requisite resources/ facility.**

L = Lecture T = Tutorial P = Practical
CT = Cumulative Test TA = Teacher Assessment
ESE = End Semester Examination

Note: 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.

***DISTRIBUTION OF MARKS FOR DISSERTATION**

Distribution of marks for Dissertation shall be as follows:

Dissertation	**Report**	**Viva-voce/Presentation**	**Seminar (Internal)***	**TOTAL**
	50	30	20	100

Note:

1. Marks in the Dissertation shall be awarded jointly by the external and internal examiners, after viva-voce examination.
2. *****There shall be a seminar on dissertation work of the candidate to be evaluated by a departmentalCommitteechaired by H.O.D.

MMA-C111
ORDINARY DIFFERENTIAL EQUATIONS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

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.

Power Series: Power series solution, Ordinary and regular singular points, Series solution (Frobenius method) of first and second order linear equations,

Legendre Polynomial: Legendre's equation and its solution, Generating function for Legendre polynomials, Orthogonal properties of Legendre's polynomials, Recurrence relations, Rodigue's formula

Bessel Functions: Bessel's equations and its solution and their recursion formulae, Integral representation and their properties.

Hermite Polynomial: Hermite equation and its solution, Generating Function for Hermite polynomials, Orthogonal property of Hermite Polynomial, Rodrigue formula for Hermite Polynomial, Recurrence Relation.

Laguerre Polynomial: Laguerre equation and its solution, Generating Function for Laguerre polynomials, Orthogonal property of Laguerre Polynomial, Rodrigue formula for Laguerre Polynomial, Recurrence Relation.

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

Text /Reference Books

1. G.F. Simmons, Differential equation with Applications and Historical Notes, Tata Mgraw Hill
2. W.I. Martin and E. Reissner, Elementary Differential Equations, Addison-Wesley Publishing Company
3. I. G. Petrovaski, Ordinary Differential Equations, Moscow State University publishing
4. I.N.Sneddon, A text book of Partial Differential Equations, McGraw-Hill
5. M.D.Raisinghania, Advanced Differential Equations, S.Chand Pub.

MMA-C112

MATHEMATICAL STATISTICS

MM : 100 | Sessional : 30
Time : 3 hrs | ESE : 70
L T P | Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Probability: Sample space and Events, Axioms of Probability, Conditional Probability, Baye's theorem, Expectations, Moments, moment generating functions, characteristic functions.

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

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

Pt. Estimation, Interval Estimation, Methods of Estimation, Max Likelihood method, Method of moments, Unbiasedness, Efficiency, Consistency, Sufficiency.

Curve Fitting,methods of Least square, Simple linear regression, Assumptions,Correlation, Multiple correlation

Text /Reference Books

1.Miller & Johan, Freund Probability and Statistics, Prentice Hall
2. Gupta & Kapoor, Probability and Statistics, Sultan. Chand & Sons
3.M.R.Spiegel, Theory & problems of Probability, Schaum's Otline Series
4. Ray & Sharma, Mathematical Statistics.

MMA-C113

ADVANCED REAL ANALYSIS

MM : 100 | Sessional : 30
Time : 3 hrs | ESE : 70
L T P | Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Sequences and series of real valued functions, Pointwise and uniform convergence of sequences of functions, Pointwise and uniform convergence of series of functions, Continuity, Integrability and differentiability by means of uniform convergence.

Equivalent sets, Countable and uncountable sets, Length of sets, Lebesgue outer measure of sets, Lebsgue measurable sets and their properties, Boolean algebra of sets, $\sigma-$Boolean algebra, Borel sets and their measurability, Further properties of measurable sets, Characterization of measurable sets.

Measurable functions and their properties, Algebra of Measurable functions, Step function, Max and min functions, Positive and negative parts of a function, Characteristics function,Simple function, Continuity of a function over measurable sets, Sets of measure zero, Almost everywhere property, Egoroff's theorem, Lusin theorem, Frechet theorem, Convergence in measure , Riesz theorem, Fundamental in measure.

Lebesgue Integral of a bounded function, Relation between Riemann and Lebesgue Integrals, Properties of Lebesgue integrals on bounded measurable functions, Bounded convergence theorem, Integral of nonnegative measurable function, Fatou's lemma, Monotone convergence theorem, Integrable functions, General Lebesgue integral, Lebesgue dominated convergence theorem.

Text /Reference Books

1. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International.
2. H. L. Roydon, Real Analysis, Prentice Hall.
3. Walter Rudin, Principles of Mathematical Analysis, McGraw Hill.
4. Robert Bartle, The elements of integration and Lebesgue measure, Wiley Classics Library.
5. Gerald Folland, Real Analysis, Modern Techniques and Their Application, Wiley.
6. S. C. Malik and S. Arora, Mathematical Analysis, New Age International.

MMA-C114
ABSTRACT ALGEBRA

MM : 100 | Sessional : 30
Time : 3 hrs | ESE : 70
L T P | Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

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

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

Rings, Sub-rings, Integral domain, Euclidean Rings, Ideal, Principal Ideal, Maximal and Prime ideals, Vector spaces, Subspaces, Linear span, Basis and dimension.

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

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.

Text /Reference Books

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
4. Khanna and Bhambari , A Course in Abstract Algebra(Vikash Pub.,III Edition.)

MMA-C211
COMPLEX ANALYSIS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

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.

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

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

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).

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.

Text /Reference Books

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.
4. Murry R. Spiegel, Complex Analysis, Schaum's outline
5. LV.Ahlfors, Complex Analysis, McGraw-Hill
6. Z. Nehari, Conformal Mapping , Dover Pub.

MMA-C212
TOPOLOGY

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Metric space and examples, Neighbourhood point, Open sets, Limit point, Derive set, Closed sets, Boundary of Set, Diameter of set, Convergence, Cauchy sequence, Completeness, Continuity of function in metric space, Some basic properties of continuity, Cantor intersection theorem.

Topological space and examples, Some elementary concept, Neighbourhood point, Basis and Sub-basis for a topology, Elementary concept of basis, Subspace topology and some basic concept , Definitions of Weaktopology, Strong topology and Product topology.

Interior and exterior points of topological space, Limit and isolated points, Interior and closure of sets, Elementary concept of Interior and closure of sets, Boundary of set, Dense and it's elementary, Perfect set and examples.

Continuity of function in topological space, Continuity theorems for open and closed sets, Homeomorphism and its examples, Connected space and examples, Elementary of connectedness, Connected spaces of the real lines, Definition of path, Components and locally connected space, Totally disconnected space.

Compact space and examples, Elementary of compactness, Compact spaces of the real lines Limit point compactness, Sequentially compact space, Local compactness, Continuity and compactness, Tychonoff theorem.
First and second countable space, T_1-Space, Hausdorff spaces, Regular spaces, Normal spaces, Completely normal space, Completely regular space,, Uryshon Lemma.

Text /Reference Books

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)
5.Schaum's outline series , General Topology, McGraw-Hill Pub.
6. Colin Adams, Introduction to Topology Pure & Applied [Pearson]

MMA-C213
PARTIAL DIFFERENTIAL EQUATIONS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

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

Partial Differential Equations: Homogeneous linear partial differential equations with constant coefficients. Non-homogeneous linear partial differential equations with constant coefficients, Linear partial differential equations of order two with variable coefficients, Partial differential equation of second order Monge's Method.

Boundary value problems: Method of separation of variable, One dimentional wave equation, Two dimentional wave equation, One dimentional heat equation, Two dimentional heat equation,Laplace equation and solution of Laplace equation.

Fourier Transform: Fourier Integral and their representation, Different forms of Fourier integral theorem (or formula), Infinite Fourier Transform, Finite Fourier Transform, Solution of Partial differential equations using Laplace and Fourier Transform.

Text /Reference Books

1. G.F. Simmons, Differential equation with Applications and Historical Notes, Tata Mgraw Hill
2. W.I. Martin and E. Reissner, Elementary Differential Equations, Addison-Wesley Publishing Company
3. I. G. Petrovaski, Ordinary Differential Equations, Moscow State University publishing
4. I.N.Sneddon, A text book of Partial Differential Equations, McGraw-Hill
5. M.D.Raisinghania, Advanced Differential Equations, S.Chand Pub.

MMA-C214
OPTIMIZATION TECHNIQUES

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Introduction: Definition of O.R.,General methods for solving O.R. models, Phases of O.R. study, Simplex method, Two-phase and Big-M methods, Transportation and assignment problem.

Non-linear Programming: Convex setsand convex functions, Quadratic programming,K-T conditions, Beale's methods.

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

Game Theory: Saddle point, Graphical method for 2 x n and m x 2 games, Solution of m x n games by linear programming.

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.

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).

Text /Reference Books

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

MMA-C311

FUNCTIONAL ANALYSIS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

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.

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

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

Definition of sublinear functional and examples, Hahn-Banach theorem for normed space, Boundedness of linear functional, Definition of Category, Baire's category theorem for metric space, Uniform boundedness theorem, Definitions of open mapping and closed graph, Closed linear operator, Open mapping theorem, Closed graph theorem.

Definition of fixed point and contraction mapping, Banach fixed point theorems and their iteration methods, Application to linear and integral equations, Application to ordinary differential theorems.

Text /Reference Books

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
4.T.Nair, Functional analysis, Prentice Hall

MMA-C312
PROGRAMMING IN C

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
3 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Functional block diagram of digital computer and functions of each component, Binary, Octal and Hexadecimal number systems, Problem solving algorithm, Flowcharts, Program development steps, Basic concepts of low level language and high level language, Compiler, Interpreter.

Structure of a C program, Pre-processor directives, Character set, Tokens in C, Keywords and identifiers, Constants, Variables, Data types, Arithmetic operators, Relational operators, Logical operators, Assignment operator, Conditional operator, Operator precedence and associativity, expressions, Declaration and initialization of variables, Reading and writing characters, Reading and writing strings, Data I/O, Qualifiers, Coercion, Manipulators, Comments, Library functions.

Branching and looping decisions, Decision making with IF, IF-ELSE, Nesting of IF-ELSE, ELSE-IF ladder, switch statement, 'for' loop, 'while' loop, 'do' loop, break, continue and goto statements.

Simple functions, Passing arguments to functions and returning values from functions, Recursion, Reference arguments, Storage classes, Scope and visibility of local and global variables.

Arrays Fundamentals, One-dimensional arrays, Two-dimensional arrays, Multi-dimensional arrays, Nesting of arrays, Passing arrays to functions, Strings, String handling functions, Array of strings.

Structures, Arrays and structures within structures, Array of structures, Passing structures to functions, Unions, Enumerations, typedef, Pointers, Pointers and arrays, Pointers and strings, Array of pointers, Reading from a file and writing in a file.

Recommended Books :

1. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall.
2. Byron S. Gottfried, Schaum's Outline of Theory and Problems of Programming with C, McGraw-Hill.
3. E. Balagurusamy, Programming in ANSI C, Tata McGraw-Hill.
4. Yashwant Kanitkar, Let us C, B.P.B. Pub.

MMA-C351
LAB COURSE WITH C

L T P ESE : 100

0 0 4

Note : Each student shall have to perform any two programs asked by the examiner.

List of Programs in C

1. Write a program to find the volume of a room.
2. Write a program to find greatest among three numbers.
3. Write a program to check for an Armstrong number.
4. Write a program to find the roots of quadratic equation.
5. Write a program to print a pattern

   a b c

   a b

   a
6. Write a program to print a pattern

   1

   1 2 1

   1 2 3 2 1
7. Write a program to generate the reverse of a five digit number. Check the number to be palindrome.
8. Write a program to find the sum

   1!+2!+3!+…n!
9. Write a program to find the sum of first *n* terms of the series

$$x - \frac{x^3}{3!} + \frac{x^5}{5!} + \cdots$$

10. Write a program to find the trace and transpose of a matrix.
11. Write a program to add and multiply two square matrices.
12. Write a program to find the factorial of a number by recursion.
13. Write a program togenerate Fibonacci series using recursion.
14. Write a program to sort a list of numbers in descending order.
15. Write a program to implement nested structures.
16. Write a program to concatenate one string at the end of other string by means of user defined function as well as library function. Also compare the two outputs.
17. Write a program to sort a list of names alphabetically.
18. Write a program to find the average of a list of *n* numbers using pointers.
19. Write a program to create a linked list and then add one node before second node and delete fifth node from this linked list.
20. Write a program to read from a file and write on a file.

NOTE:

1. Marks distribution of practical exam is as follows:
    - **a.** Main Practical Exam **40 marks (20 Marks for each program)**
    - **b.** Viva-voce examination **20 marks**
    - **c.** Practical recordfile **10 marks**
    - **d.** Sessional Exam **30 marks**
2. The teacher shall be assigned maximum 20 students for daily practical work.

Addition/deletion in the above list may be made in accordance with the facilities available with the approval of H.O.D./Dean.

MMA-E311
VEDIC AND ANCIENT MATHEMATICS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

Learning of Hindu Numerals,Vowels and Consonants.

Definitions and Tables, Place Values of Digits, Methods of Multiplication, Division, Methods of Finding Squares, Square Root, Methods to Find the Cube, Cube Roots, Eight Operations on Fractions, Addition and Subtraction of Fractions, Multiplication of Fractions, Division of Fractions, Squares, Cubes, Square Roots and Cube Roots of Fractions, Eight Rules Concerning Zero, Reverse Process , To Find an Unknown Quantity, Method of Transition, Square Transition, Quadratic Equation, Wood Cutting, Volume of a Heap of Grain, Shadows, Pulverization, Concatenation (Permutations, Partitions etc.)

Introduction to Śulbsūtrās : Study of Baūdhāyana Śulbsūtra, Pythagorus Theorem, Addition of many squares geometrically,converting squares into rectangle and vice-versa, squaring the circle and vice-versa.

Introduction to Jain Mathematics: Contribution of Mahaviracarya (Gaṇit Saar Sangreh), Piṇgala Śastra [Permutations and Combinations]

Simple Arithmetic Operations using:Ekādhiken Pūrveṇa, Nikhil am Navatascaramam Daśtah, Urdhva-triyagabhyam &Veśtanam,Application of mental multiplication techniques and decimal division .

Brief Study About :

1. Some Aćarya / Saints of Vedic era who knew mathematics.
2. Golden Era of Indian Mathematicians [400-1200 CE] who contributed to commercial applications, Indeterminate Analysis, Astronomical problems etc.: Āryābhatta, Brahmagupta, Bhāskara II, Vārahmihira.[Life Sketch (Lineage, Time Period and Contribution)],Indeterminate equations, Place value system and zero, Approximation of π, Trigonometry, Algebra
3. Kerala Mathematicians [1300-1600CE]
4. Srinivasan Ramanujan, a Man who reshaped 20th century Mathematics [Dec.!887-Jan.1920]

Reference books:

1. 'Līlāvatīof Bhaskaracarya' (Motilal Banarsidas publishers Pvt. Ltd.)
2. Krishnaji Shankara Patvardhan, Somashkhara Amrita Naimpally, Shyam lal Singh Jagadgwru swami sri
3. Bharti K r s n a Tirthaji Maharaja, Vedic Mathematics (Motilal Banarsidas publishers Pvt. Ltd.
4. 'The Sulbasutras of BALIDHAYANA, APASTAMBA, KATYAYANA AND MANAVA' with text, English translation and commentary by S.N. Sen & A.K. Bag. Publ. Indian National Science Academy, New Delhi.
5. The prosody of PINGALA, Dr. Kapil dev Dwivedi, Prof. Shyamlal Singh. Publication Vishwavidyalya prakasan, Varanasi.
6. 'The Great Mathematical Heritage of india' Dr. Sudyumna Acharya, Parimal Publications, Delhi.

[Chapter-8: Indeterminate Quadratic Equations with two variables and rule for making squarenumbers. And Chapter-9: Indeterminate Equations with two variables]

MMA-E312
DISCRETE MATHEMATICS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 1 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Logic and Propositional Calculus: Introduction to proposition (or statement) and compound propositions; basic logical operations (conjunction, disjunction and negation) and their truth tables; derived logical operations (NAND, NOR, XOR) and their truth tables; nature of compound propositions (as tautology, contradiction and contingency);algebra of propositions; conditional and bi-conditional statements; precedence of logical operations; principle of duality; logical equivalence and logical implications of compound propositions; converse, inverse and contra-positive of propositions; arguments and their nature (as valid and fallacy); elementary valid argument forms; proof of validity without using truth tables; predicates (or propositional functions) and their truth sets; free and binding variables; quantifiers; negation of quantified statements.

Partially Ordered Sets and Lattices: Partial order, dual order and quasi-order relation on a set; subsets of a partially ordered set (POSet); comparability of elements in a POSet; linear order, product order and lexicographical order on a set; Kleene closure of a set of alphabets; Hasse diagram of a POSet; various elements (first element, last element, lower bound, upper bound, minimal, maximal, supremum and infimum) in a POSet; well ordered set; lattices, sub-lattices, isomorphic lattices, bounded lattices, distributive lattices; elements (join irreducible, meet irreducible, atoms, anti-atoms, complements) in a lattice; complemented, modular and product lattices.

Boolean Algebra: Unary and binary operations on a set; Boolean algebra and sub-algebra; elements of Boolean algebra; isomorphic Boolean algebras; basic laws for Boolean algebra; principle of duality; alternative definition of Boolean algebra; Boolean function; literal and fundamental products; sum-of-products(SOP) and product-of-sums(POS) forms; canonical and non-canonical forms of SOP and POS; complete SOP and POS forms; disjunctive normal form (DNF) and conjunctive normal form (CNF); minimal SOP and minimal POS; prime implicants; consensus of fundamental products; Boolean expansion theorem; determination of Boolean function from its truth table; logic gates (AND, OR, NOT, NAND, NOR, XOR) and circuits; Karnaugh maps (up to three variables); coding of binary information and error detection; encoding function and parity check codes; Hamming distance and group codes; parity check matrix; decoding function and error correction; algorithms and their complexity; rate of growth for complexity of an algorithm; asymptotic notations (big-O, big-omega and big-theta); worst-case, best-case and average-case.

Graphs: 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, 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.

Text /Reference Books

1. B. Colman, R. C. Busby and S. Ross, Discrete Mathematical Structures, PHI.
2. K. H. Rosen,Discrete mathematics and its applications, McGraw-Hill.
3. S. Lipschutz and M. L. Lipson,Discrete Mathematics, Tata Mc-Graw- Hill.
4. J. Gallier and J. Quaintance, Mathematical Foundations and Aspects of Discrete Mathematics, Springer.
5. U. S. Gupta, Discrete Mathematical Structure, Pearson Education.

MMA-E313
MATHEMATICAL METHODS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Definition and classification of linear integral equations,Conversion of ordinary 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.

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

Classical Fredholm Theory: Fredholm method of solution and Fredholm Theorems.

Solution of Integral Equations by Transform Methods: Laplace Transform, Some special types of integral equations, Applications of Laplace Transform to determine the solution of integral equation with convolution-type kernels, Fourier Transform, Applications of Fourier Transform to determine the solution of integral equation.

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.

Text /Reference Books

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
5. M.D.Raisinghania, Integral Equations, S. Chand

6.B.S.Grewal, Engineering Mathematics, Khanna Publishers

MMA-E314
NUMBER THEORY

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

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

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

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.

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.

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

Text /Reference Books

1. D.M.Burton, Elementary Number Theory, Mcgraw-Hill.
2. I. Niven, H. S. Zuckerman and H. L. Montgomery, An Introduction to Theory of Numbers, John Wiley & Sons.
3. A. Baker, A comprehensive Course in Number Theory, Cambridge University Press.

MMA-E315
MECHANICS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

Equilibrium of forces in 3D: Condition of equilibrium for a system of forces in 3D, finite and infinitesimal displacements of a rigid body, work, potential energy virtual work, D'Alembert' s principle.

Motion of rigid body: General motion of a rigid body, momental ellipsoid and principal axes, kinetic energy and angular momentum of a rigid body, principles of energy and momentum, moving frames of reference, Coriolis force.

Lagrange's and Hamilton theory: Generalized forces, Lagrange's equation of motion, Lagrangian function, generalized momentum, deduction of principle of energy from Lagrange's equations (conservative field), Lagrange's equations with impulsive forces, Hamilton formulation, Hamilton to Lagrangian, Ignoration of coordinate and Routh's product procedure, Hamilton principle, Lagrange's equations by variational methods, derivative of Lagrange's equation from Hamilton principle.

Small oscillations: The general theory of small oscillation, stable equilibrium and small oscillation, the approximate forms of T and V, normal modes, orthogonality of normal modes.

Text /Reference Books

1. Synge, J.L. and Griffith, B.A., "Principles of Mechanics", McGraw-Hill , 1970
2. Gregory, R.D., "Classical Mechanics", First South Asian Edition, Cambridge Univ. Press, 2008
3. Rana, N.C and Joag, P.S,"Classical Mechanics", Tata McGrawHill, 1991
4. Ramsey, A.S., "Dynamics Part II", Cambridge Univ. Press, 1961
5. Louis, N. Hand and Janet, D. Finch, Analytical Mechanics, Cambridge University Press. 1998

MMA-E316

NEURAL NETWORKS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Introduction: Some examples and applications of neural computation, History of artificial neural systems development. Fundamental concepts: Biological neurons and their artificial models, Models of artificial neural networks, Neural processing, Learning and adaption, Neural network learning rules- Hebbian learning rule, Perceptron learning rule, Delta learning rule, Widrow-Hoff learning rule, Winner-take-all learning rule, Outstar learning rule.

Single-Layer feed forward networks: Classification model, Features and Decision regions. Discriminant functions. Linear machine and minimum distance classification. Non-parametric training concept. Training and classification using the discrete perceptron. Single-layer continuous perceptron networks. Multicategory single-layer perceptron networks.

Multilayer Feedforward Networks: Linearly nonseperable pattern classification, Delta learning rule for multiperceptron layer. Generalized delta learning rule. Feedforward recall and error back-propagation training. Learning factors-initial weights, cumulative weight adjustments versus incremental updating, steepness of the activation function, learning constant, momentum method, network architecture versus data representation, necessary number of hidden neurons, Classifying and expert layered networks. Functional link networks.

Single-layer Feedback Networks: Basic concepts of dynamical systems. Discrete-time Hopfield networks, Gradient-type Hopfield networks. Associative Memories: Basic concepts. Linear associator. Recurrent associative memory-concepts and performance analysis. Bidirectional associative memories.

Matching and self-Organizing Networks: Hamming Net and MAXNET. Unsupervised learning of clusters. Conuterpropagation network. Feature mapping. Self-organizing maps, Cluster discovery network (ART1). Brief study of other applications.

Text /Reference Books

1. J.M. Zurada, Introductin to Artificial Neural Systems, Jiaco Publishing House
2. K. Gurney, An Introductin to Neural Networks, UCL Press
3. L. Perlov, Differential equations and Dynamic Systems, Springer Publication.

MMA-C411

NUMERICAL ANALYSIS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

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

Interpolation: Finite differences: Forward, Backward and central differences, Symbolic relations, Difference of polynomial, Newton's formulae of interpolation. Central difference interpolation formulae: Gauss's formula (forward and backward), Stirling's and Bessel's formulae. Interpolation with unevenly spaced points: Lagrange's interpolation formula and its error, Divided differences and their properties, Newton's general interpolation formula, Inverse interpolation, Method of successive approximations.

Solution of linear simultaneous equations: Crout's method, LU decomposition method, Gaussian elimination method, Gauss-Jordon method, Jacobi's method, Gauss-Seidel method.

Numerical differentiation and integration: Newton's forward and backward difference formula for first and second order derivatives, Errors in numerical differentiation forNewton's forward and backward difference formula, Numerical integration, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Boole's rule, Weddle's rule, Newton-Cotes integration formulae.

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

Text /Reference Books

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

MMA-C412
MATHEMATICAL MODELING

MM : 100 Sessional 30
Time : 3 hrs ESE 70
L T P Pass Marks 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

The Modeling process:Introduction, Mathematical models, Construction of models, Scientific methods, The iterative nature of model construction, Types of modeling, Some characteristics of mathematical models, Linear growth and decay models: Population growth model, Effect of immigration and Emigration on population size, Decrease of temprature, diffusion, Change of price of a commudity, Non-linear growth and decay model: Simple logistic model, Logistic model for non isolated population, Simple compartment models.

Mathematical modeling of Epidemics: Basic concept, Simple Epidemic model through system of ordinary differential equaiton of first order- A simple epidemic model, SIS model with constant number of carrir, Simple epidemic model with carriers, Model with removal, Model with removal and immigration, Compartment models through system of ordianry linear equations.

Economics based models: Domar Macro model, Domar first debt model, Momar's second debt model, samuelson's investment model, Stability of market equilibrium. Mathematical models in Medicine, arms race and battles: A model for Diabetes Mellitus, Richardson's Model for arms race, Lancester's combat Model, Microbial growth in a chemostat. Product formation due to microbial action,
Mathematical modeling through difference equations: Basic theory of difference equations with constant coefficients, complimentary function, particular solution, Obtaing complimentary function by use of Matrices, Solution of linear difference equation by using Laplace and z-transform. Mathematical modeling through difference equations in Economics and Finance: The Harrod Model, the Cobweb model,

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..

Air pollution: Introduction, Mathematical model for plume rise, Gaussian model of dispersion, application of Gaussian model.
Models for Blood flow: Navier-stokes equation for the flow of a viscous incompressible fluid, Hagen Poiseuille Flow, Basic concepts about Blood, Cardiovascular system and Blood flow: Constitution of Blood, Viscosity of Blood.

Text /Reference Books

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

MMA-E411

FUZZY SETS AND THEIR APPLICATIONS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

Crisp sets, Fuzzy sets (basic types), Fuzzy sets (basic concepts), Representation of fuzzy sets, Basic operations on fuzzy sets, Fuzzy convex set, α-cuts, Additional properties of α-cuts, Decomposition Theorems, Extensions principal for fuzzy sets and related theorems,

Fuzzy Complements, Equilibrium of a fuzzy complement, Theorems on fuzzy complement, Increasing generator, Decreasing generators, Characteristic theorems for fuzzy complement (without proof), Fuzzy intersection (t-norms), Drastic intersection , Characteristic theorem for t-norms (without proof), Theorems on t-norms, Fuzzy Unions (t-conorms), Drastic union, Theorems on t-conorms, Characteristic theorem for t-conorms (without proof), Combinations of operations and related theorems.

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

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

Fuzzy relation equations, Fuzzy logic, Fuzzy ranking method; Based on Hemming distance, Based on α −cut, Defuzzification; Center of area method, Center of Maxima method, mean of maxima method, Fuzzy linear programming.

Text /Reference Books

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

MMA-E412
FOURIER TRANFORM AND WAVELET ANALYSIS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

The Fourier transforms (FT) and examples, Basic properties FT, Derivatives of FT, Riemann-Lebesgue lemma, Inverse Fourier transform Convolution of functions and its examples, Convolution theorem, Parseval's relation, statement of Plancherel's theorem, Eigenvalues and eigenfunctions of FT.

Periodic functions, Trigonometric polynomial and series, Orthogonal Systems, Orthogonality of trigonometric systems, Fourier series of 2π-periodic functions, Fourier series for orthogonal system, Definition of Lp-space and examples, Complete system.

The limit as $n\rightarrow\infty$ of the trigonometric integrals, Formula for sum of cosine-auxiliary integral, Integral formula for partial summation Fourier series, Convergence of a Fourier series at the points of Continuity and discontinuity (Piecewise smooth function of period 2π).

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.

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).

Text /Reference Books

1. Georgi P. Tolstor, Fourier Series, Dover Pule., INC New York
2. Lokenath Debnath, Wavelet transforms and Their Applications, Birkhauser, Boston
3. A Boggess & F J. Narcowich, A First Course in Wavelets with Fourier Analysis, Prentice Hall
4. C. K. Chui, An Introduction to Wavelets, Academic Press, New York
5. E. Herna'ndez and G. Weiss, A First Course in Wavelets, CRC Press, New York
6. Ingrid Daubechies, Ten Lectures on Wavelets, SIAM Pub.

MMA-E413
FLUID DYNAMICS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

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

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

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.

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

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).

Text /Reference Books

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

MMA-E414
DIFFERENTIAL GEOMETRY

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

Curves With Torsion: Tangent, Principal normal-Curvature, Binormal -Torsion ,Serret-Frenet formulae, Locus of centre of curvature and examples. Spherical curvature, Locus of centre of spherical curvature, Theorem: Curve determined by its intrinsic equation, Helices, Spherical indicatrix of tangent, Involutes, Evolutes. Bertrand curves.

Envelopes, DevelopableSurfaces: Surfaces, Tangent plane –Normal, One –Parameter Family of Surfaces: Envelope, Characteristics, Edge of regression, Developable surfaces, Developables associated with a curve : Osculating development , Polar development, Rectifying development. Two –parameter Family of Surface: Envelope, Characteristics points, and its examples.

Curvilinear Coordinates on a Surface Fundamental Magnitudes: Curvilinear Coordinates, First order magnitude , Directions on a surface , The normal , Second order Magnitude ,Derivatives of n ,Curvature of normal section ,Meunier's theorem and examples.

Curves on a Surface: Lines of Curvature: Principal direction and curvatures, First and second curvature, Euler's theorem, Dupin's indicatrix, The Surface z = f(x,y), Surface of revolution and examples. Conjugate directions, Conjugate systems.
Asymptotic lines, Curvature and torsion, Isometric Parameters,Null Lines or Minimal curves and examples.

The Equations of Gauss and of Codazzi: Gauss's formula for r_{11}, r_{12}, r_{22} ,Gauss's characteristic equations ,Mainardi–Codazzi relations, Alternative expressions ,Bonnets theorem, Derivation of an angle ω and examples.
Geodesic: Geodesic property, Equations of geodesics, Surface of revolution, Torsion of a geodesic ,Curves in relation to Geodesics : Bonnet's theorem ,Joachimsthal's theorems ,Vector curvature , Geodesic curvature and its other formulae ,Examples.

BOOKS SUGGESTED:

1.C.E.Weatherburn Differential Geometry
2.Bansi Lal Differential Geometry, Atma Ram & Sons, Delhi
3.Andrew Presely Elementry Differential Geometry, Springer

MMA-E415
CRYPTOGRAPHIC MATHEMATICS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 2 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Division algorithm, relatively prime numbers, greatest common divisor(gcd), Euclidean algorithm, modular arithmetic operation, extended Euclidean algorithm, Fermat's theorem, Euler's totient function, Euler's theorem, Miller-Rabin's primality testing algorithm, Chinese remainder theorem(CRT), Pollard rho method, primitive roots for prime numbers, discrete logarithm and modular arithmetic logarithm, discrete logarithm problem(DLP).

Introduction to cryptography, cryptanalysis and cryptology; ingredient of cryptography, types of cryptography, requirements for public key cryptography(PKC), easy and hard problems, applications of PKC, substitution techniques, Caesar cipher, Play fair cipher, Hill cipher, Polyalphabetic ciphers, one-time pad(OTP), rail fence transportation technique, stream cipher and block cipher (definition only), RSA, time complexity of an algorithm, big-O notation, security of RSA, Diffie-Hellman(DH) key exchange algorithm, man-in-the-middle attack, Elgamal cryptographic system, elliptic curves over finite fields, arithmetic operation in the set of elliptic curve points, elliptic curve cryptography(ECC),elliptic curve Diffie-Hellman algorithm(ECDHA), ECDLP, security of ECC, digital signatures, requirements for digital signatures, digital signature algorithm(DSA), Elgamal DSA (EDSA), Schnorr DSA (SDSA), elliptic curve DSA (ECDSA).

Row and column vectors; inner, outer and tensor (Kronecker) products of vectors; inner product of two vectors having components as complex numbers, norm of a vector, Hilbert space, Dirac (bra and ket) notations for vectors, representation of column vectors of an identity matrix as smallest ket vectors $|0\rangle$, $|1\rangle$, $|2\rangle$, ... etc, standard basis for a Hilbert space, change of basis, projection of a vector along another vector, representation of a vector using its projections on basis vectors, orthogonal projections, Gram-Schmidt orthogonalization method; Hermitian, unitary and rotational matrices; qubit, qutrit, ququart, qudit, multiple qubits, quantum states and quantum superposition principle, Bloch sphere representation of qubit states, separable (non-entangled) and non-separable quantum states, Einstein-Podolsky-Rosen(EPR) paradox, Bell states, pure and mixed quantum states, Pauli operators, quantum operations, joint quantum operations, quantum gates and circuits, quantum measurement.

Text /Reference Books

1. William Stallings, Cryptography and Network Security, Pearson Education, 2011. (ISBN 0-13-03221-0).
2. Steven D. Galbraith, Mathematics of Public Key Cryptography, Cambridge University Press, Version 2.0, 2018.
3. Martin Laforest, The Mathematics of Quantum Mechanics, University of Waterloo, 2015. (Unit-IV and V).
4. Michael A. Nielsen & Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, N. Y., 2010. [ISBN 978-1-107-00217-3](Unit-IV and V).
5. James S. Kraft and Lawrence C. Washington, An Introduction to Number Theory with Cryptography, Second Edition, CRC Press, Taylor & Francis Group , N. W., 2018. (ISBN-13: 978-1-1380-6347-1).
6. Lawrence C. Washington, Elliptic Curves Number Theoryand Cryptography, Second Edition, Chapman & Hall/CRC Press, Taylor & Francis Group, N.W., 2008. (ISBN-13: 978-1-4200-7146-7)[with Computer Packages : Pari, Magma and SAGE]

MMA-E416

DISSERTATION

Dissertation	Report	Viva-voce/Presentation	Seminar (Internal)*	TOTAL
	50	30	20	100

Note:

1. Marks in the Dissertation shall be awarded jointly by the external and internal examiners, after viva-voce examination.
2. *****There shall be a seminar on dissertation work of the candidate to be evaluated by a departmentalCommitteechaired by H.O.D.