DEPARTMENT OF HIGHER EDUCATION GOVT. OF J&K

JAMMU & KASHMIR INSTITUTE OF MATHEMATICAL SCIENCES

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PROGRAMME STRUCTURE AND SYLLABI FOR INTEGRATED B.SC–M.SC.

IN MATHEMATICS W.E.F. 2017–18

SEMESTER I

S.NO.	COURSE CODE	COURSE TITLE	CREDITS	CONT.HRS (per week)	MARKS
1	IMTH-101	ANALYSIS- I	4	4	100
2	IMTH-102	PLANE AND SOLID GEOMETRY	4	4	100
3	IMTH-103	PHYSICS-I	4+2 =6	6	125
4	IMTH-104	COMPUTER APPL.-I	4+2 =6	6	125
5	IMTH-105	COMMUNICATION SKILLS	4	4	100

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	CREDITS	CONT.HRS. (per week)	MARKS
1	IMTH-201	INTEGRATION AND DIFFERENTIAL EQUATIONS	4	4	100
2	IMTH-202	MATRIX ANALYSIS AND THEORY OF EQUATIONS	4	4	100
3	IMTH-203	PHYSICS-II	4+2 =6	6	125
4	IMTH-204	COMPUTER APPL.-II	4+2=6	6	125
5	IMTH-205	ENVIRONMENTAL SCIENCE	4	4	100

Semester III

S.NO.	COURSE CODE	COURSE TITLE	CREDITS	CONT.HRS. (per week)	MARKS
1	IMTH-301	ANALYSIS-II	4	4	100
2	IMTH-302	ALGEBRA-I	4	4	100
3	IMTH-303	PROBABILITY THEORY	4	4	100
4	IMTH-304	PHYSICS-III	4+2 =6	6	125
5	IMTH-305	COMPUTER APPL. III	4+2=6	6	125

Semester IV

S.NO.	COURSE CODE	COURSE TITLE	CREDITS	CONTACT HOURS (per week)	MARKS
1	IMTH-401	LINEAR ALGEBRA	4	4	100
2	IMTH-402	DISCRETE MATHEMATICS	4	4	100
3	IMTH-403	BASIC COMPLEX ANALYSIS	4	4	100
4	IMTH-404	PHYSICS-IV	4+2 = 6	6	125
5	IMTH-405	COMPUTER APPL.-IV	4+2 = 6	6	125

Semester V

S.NO.	COURSE CODE	COURSE TITLE	CREDITS	CONTACT HRS. (per week)	MARKS
1	IMTH-501	NUMERICAL ANALYSIS	4+2 =6	6	125
2	IMTH-502	PARTIAL DIFFERENTIAL EQUATIONS	4	4	100
3	IMTH-503	VECTOR CALCULUS	4+2 =6	6	125
4	IMTH-504	SOFT SKILLS	4	4	100
5	Elective C.	ELECTIVE COURSE I	4	4	100

Semester VI

S.NO.	COURSE CODE	COURSE TITLE	CREDITS	CONTACT HOURS (per week)	MARKS
1	IMTH- 601	METRIC SPACES	4	4	100
2	IMTH- 602	TOPOLOGY	4	4	100
3	IMTH- 603	NUMBER THEORY	4	4	100
4	Minor Project/ Electives C.	Minor project/ ELECTIVE II, ELECTIVE III	8	8	200
5	Elective C.	ELECTIVE IV	4	4	100

LIST OF ELECTIVES FOR ELECTIVE-I:

E-501: OPERATION RESEARCH

E-502: OPTIMIZATION TECHNIQUES

LIST OF ELECTIVES FOR ELECTIVE-II, III, IV:

E-601: COMPUTATIONAL MATHEMATICS

E-602: MATH FINANCE

E-603: GRAPH THEORY (METHODS OF APPLIED MATHEMATICS)

E-604: FLUID MECHANICS

E-605: HISTORY OF MATHEMATICS

ELECTIVES WILL BE OFFERED SUBJECT TO THE AVAILABILITY OF FACULTY.

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Semester I
IMTH-101: Differential Calculus

Unit I:

Limit of a function, basic properties of limits, continuous functions ($\in -\delta$ definition) and their attainments of bounds on closed interval. Differentiability of a function, Rolle's theorem, Mean value theorems and applications.

Unit II:

Taylor's theorem and Maclaurin's theorem with applications, L-Hospital's rule, Maxima and Minima, successive differentiation, Leibnitz theorem with applications.

Unit III:

Tangents and Normals (polar form), pedal equations, length of arcs, Curvature, Envelops, involutes and evolutes.

Unit IV:

Partial Differentiation of several variables, total differentiation, Euler's theorem on homogenous functions, asymptotes, singular points.

Books Recommended
1. Differential Calculus, Auzeem, Chopra and Kochar, Kapoor sons.
2. Calculus -I, T M Apostol, Wiley.
3. Calculus-II, T M Apostol, Wiley.
4. Calculus, Thomas, Pearson India.
5. Differential Calculus, Shanti Narayan, S. Chand and Sons

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IMTH-102 : PLANE AND SOLID GEOMETRY(MATHEMATICS)

Unit- I:

Parabola: Equation of tangent and normal, pole and polar, equation of chord in terms of middle point, parametric equation of parabola.

Ellipse: Tangents and normal, pole and polar, parametric equation of ellipse, diameter and conjugate diameter.

Unit- II:

Hyperbola: Tangent and normal, Equation of hyperbola referred to asymptotes as axes, rectangular and conjugate diameter, tracing of conics, General second degree equation in x, y.

Unit- III:

Plane: Equation of plane, bisectors of angle between two planes, joint equation of planes, volume of tetrahedron.

Sphere: Equation of sphere, condition for two spheres to be orthogonal.

Cone: Definition of cone, equation of cone, condition for general second degree equation to represent a cone, necessary and sufficient conditions for a cone to have three mutually perpendicular generators.

Unit- IV:

Cylinder: Equation of cylinder, enveloping cylinder of a sphere, central conicoids, tangent lines and tangent planes, normal to conicoid at a point on it, normal from a point to conicoid, shapes and features of the three central conicoids, diametric planes.

BOOKS RECOMMENDED:

1.   R. J. T. Bell , ELEMENTARY TREATISE ON COORDINATE GEOMETRY OF 3 DIMENSIONS,Mac Millan
2.   P. K. Jain and Khalil Ahmad ,A TEXT BOOK OF ANALYTICAL GEOMETRY OF 3 DIMENSIONS , New age international publisher
   3.   D. Chattergi, ANALYTICAL GEOMETRY OF 2 AND 3 DIMENSIONS
4.   Shanti Narayan, ANALYTICAL SOLID GEOMETRY, S.Chand & sons.

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IMTH-103: Physics-I

Classical Mechanics I   *No. of Lectures: 65*

Review of Newton's Laws, Coordinate systems-Cartesian, spherical polar, cylindrical.

Uniformly rotating frame: centrifugal and Corioli's Force and its applications.

Conservation of linear momentum, Collision problems, Rocket Motion, Central forces,

Inverse square laws, Rutherford scattering-potential theory. Harmonic oscillations, Damped, Forced and Kicked oscillators.

Principle of least action, Constraints and generalized co-ordinates, Lagrange's equations, Noether's Theorem and symmetries and applications. Hamilton's Equations, Small oscillation, stability, Normal modes.

Review of Hamilton's theory, Liouville's theorem, Poincare recurrence theorem, Poisson's Brackets, Canonical transformations, Action-Angle variable, Adiabatic invariants, Hamilton-Jacobi Theory.

Galilean Transformation, Michelson-Morley experiment, Postulates of special relativity, Lorentz transformation, length contraction, time dilation, space-time diagrams, addition of velocities.

BOOKS RECOMMENDED: Classical Mechanics-I

1. Classical Mechanics Natrajan and Ramesh.

2. Mechanics by D.S. Mathur.

3. Classical Mechanics by H. Goldstien.

4. Classical Mechanics by David Morin.

5. Classical Mechanics by J.C. Uphadiyan.

6. Classical Mechanics by Rana & Joag.

7. Mechanics vol.1 L .D. Landau & E.M. Liftshitz.

8. An introduction to Mechanics by Kleppner and Kolenkov

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IMTH-103

Lab Activities:

1. To determine the value of g by bar pendulum.

2. To determine the value of g using Kater's Pendulum.

3. To determine the frequency of AC mains using sonometer.

4. To Determine the Mechanical Equivalent of Heat by Callander

& Barnae's method.

5. To find the frequency of AC mains using electrical vibrator.

6. To Determine the frequency of electrically maintained tuning Fork using Melde's apparatus.
7. Co-efficient of viscosity by Stoke's methods.
8. To Determine the Moment of Inertia of a Flywheel.
9. To determine the surface Tension by Searle's apparatus.

IMTH-104: COMPUTER APPLICATIONS-I
Course Title: Computer Programming Using C

UNIT- I

Basic Computer Fundamentals: Introduction to computer systems; number system, integer, signed integer, fixed and floating point representations; IEEE standards, integer and floating point arithmetic; CPU organization, ALU, registers, memory, the idea of program execution at micro level. **(4L)**

C programming language: Problem Solving, Algorithms, Flowchart, Pseudocodes, Basic Structure of C programs, Character Set, Identifiers, Reserved Words, Data Types, Constants, Variables, Symbolic Constants, Casting, and Preprocessor Directives. **(4L)**

Operators (Assignment, Arithmetic, Relational, Logical, Compound Arithmetic Operators, Increment, Decrement, Bitwise Operators &Ternary Operators) **(2L)**

UNIT- II

Control Statements – Conditional, switching, looping control statements. **(3L)**

Functions: Declaring, Defining and Invoking a function, Function arguments and return types, Recursion. **(4L)**

Pointers: Concepts, Call by value and call by reference, pointer Arithmetic. Dynamic Memory Allocation. **(3L)**

UNIT- III

Arrays: Types of arrays, initialization, passing arrays to functions, dynamic arrays. Strings &String-handling functions. Pointer and Arrays **(5L)**

Structures and Unions: struct, structure members, member access operator, structures& pointers, array of structures, structures & functions. **(5L)**

UNIT- IV

File Handling in C: File Input/Output, File Operations, Opening a File, Reading from a File in C Language, Closing the File, File Opening Modes, String (line) I/O in Files **(7L)**

Command Line Parameters: in C Programming Language **(3L)**

TEXT BOOKS:

1.   E.Balagurusamy - 'Object Oriented Programming in C++", Tata McGraw Hill.
2.   E.Balagurusamy - ''Programming in ANSI C, Tata McGraw Hill.
3.   Yashwant P. kanetkar, "Let Us C", BPB Publication

IMTH-104

Lab activities:

1)   Program to calculate sum, average, area of different geometric shapes.

2)   Series generation using loops.

3)   Program to find whether a given no. is prime. Generate prime series

4)   Armstrong Number, Sum of digits & Reverse of a Number.

5)   Programs on 1-dimensional arrays (searching sorting, insertion, deletion.

6)   Matrix operations through C Programs.

7)   String manipulation functions in c (copy, compare, length, reverse etc.)

8)   Programs on pointer declaration & Arithmetic.

9)   Implementing structures and unions.

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Semester I
IMTH 105: Communication Skills

Communication Skills Syllabus and Course Structure for the Students of Integrated Programme in Mathematics at JKIMS.

Unit I: Introduction to Communication   Marks 25

- Communication and Process of Communication
- Verbal and Non-Verbal Communication
- Barriers to Communication: Physical, Cultural and Psychological
- Levels of Communication

Unit II: English in Everyday Communication   Marks 25

- Presentation
- Group Discussion
- Simulation and Role Play
- Nuances of Interview

Unit III: Effective Speaking and Writing   Marks 25

- Basic English Sounds: Vowels and Consonants
- Everyday Conversations and Dialogues: Telephonic, Ticket Counters, Greetings and etc.
- Letter Writing, Resume and Email: Style, Structure, Content and Etiquette
- Art of Condensation

Unit IV: Vocabulary Building   Marks 25

- Idioms , Phrases and Proverbs
- Antonyms and Synonyms
- Homophones and Homonyms
- One Word Substitution

Semester II
IMTH-201: Integral Calculus and Ordinary Differential Equations.

Unit I:

Review of methods of integration, Integration of irrational functions, Reduction formulae: ($\int sin^n x \, dx$, $\int cos^n x \, dx \, etc.$, $\int sin^m x \, cos^n x \, dx$, $\int x^m \, (a + bx^n)^p dx$, $\int x^m \, cosnx \, dx \, etc$, $\int x^m \, (logx)^n \, dx$, $\int cos^m x \, cosnx \, dx$, $\int \frac{sinnx}{sinx} \, dx$).

Unit II:

Definite integral as a limit of a sum, Fundamental theorem of calculus, integral form of mean value theorem, properties of definite integral, rectification and quardrature.

Unit III:

Solution of differential equations (Variable separable, Homogenous, reducible to Homogenous, Linear), Bernoulli's differential equations, Exact differential equations. Necessary and sufficient condition for a differential equation $Mdx + Ndy = 0$ to be exact.

Unit IV:

Symbolic operators, Homogenous and non homogenous linear differential equations with constant and variable coefficients, Differential equations (Miscellaneous forms), Clairaut's form and equations reducible to Clairaut's form.

Books Recommended:
1. Integral Calculus, S. D. Chopra and M. L. Kochhar, Universal publishing Co.
2. Integral Calculus, Shanti Narayan, S. Chand and Co.
3. Differential Equations, H T H Piaggio, CBS PUBLISHERS & DISTRIBUTORS-NEW DELHI.
4. Calculus, Early Transcendental by James Stewart.
5. Ordinary Differential Equations with Applications, G. F. Simmons, Tata MCGraw.
6. Ordinary Differential Equations. P. Hartmen, S. L. Ross, D. E. , John Wiley

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Semester II
IMTH-202: Matrix Algebra

Unit I:

Matrix (Definition and types), Transpose of a matrix, reversal law for transpose of product of two matrices, Every square matrix can be uniquely expressed as a sum of symmetric (Hermetian) and skew-symmetric (skew-Hermetian) matrices, Every square matrix can be uniquely expressed as $P + iQ$, where P and Q are both Hermetian matrices, Inverse of a square matrix, Reversal law for the inverse of product of two matrices, A square matrix A possess an inverse if and only if it is non singular, The operation of transposing and inverting are commutative, Trace of a matrix, Trace of AB= Trace of BA.

Unit II:

Matrix polynomials, Characteristic and minimal equations of a matrix, partitioning of matrices, Cayley Hamilton theorem, Rank of a matrix, Elementary row(Column) Transformations of a matrix do not alter its rank, Finding the rank of a matrix by elementary transformations, reduction of a matrix to the normal form, Elementary matrices. Every non-singular matrix is a product of elementary matrices, employment of only row (column) transformations. Rank of product of two matrices.

Unit III:

Linear dependence and linear independence of Row (Column) vectors, Linear combination, The columns of a matrix A are linearly dependent iff there exists a vector $X \neq 0$ such that AX=0. The columns of a matrix A of order $m \times n$ are linearly dependent iff rank of A< n .The matrix A has rank r iff it has r linearly independent columns (analogous results for rows).

Unit IV:

Linear homogeneous and non- homogeneous equations, The equation AX=0 has a non-zero solution iff rank of A < n, the number of its columns, The number of linearly independent solutions of the equation AX=0 is n-r, where r is the rank of matrix A of order $m \times n$, The equation AX=B is consistent iff two matrices A and [A: B] are of the same rank. Inner product of two vectors, length of a vector, normal vectors, Orthogonal and Unitary matrices, A matrix P is orthogonal (Unitary) iff its columns are normal and orthogonal in pairs, Determination of orthogonal matrices.

Books Recommended:

1. A Text book of matrices, Aziz et.al, KBD.
2. A text book of Matrices, Shanti Narayan, S. Chand.

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IMTH-203 : Physics-II

No. of Lectures: 70

Classical Mechanics II

General Mathematical formulation of kinematics and Dynamics of Continuum systems, Eulerian and Lagrangian descriptions, Rigid body Dynamics - Angular Velocity, Inertia tensor, Angular Momentum, The equation of motion, Eulerian Angles, Euler's equations.

Elasticity: The strain tensor, the stress tensor, Hooke's Law, Homogeneous and temperature dependent deformations, Elastic waves, Thermal Conduction and Viscosity. Fluid Dynamics - Conservation Law, ideal Fluids, viscous fluids, Basics of turbulence, Thermal conduction and Diffusion in fluids.

Electrodynamics

Gradient, Divergence, Curl — Theorems of Gauss, Green, and Stoke. Electrostatics: Charges, Fields, Potentials, Capacitance.

Magnetostatics: Currents, Fields, Potentials, Inductance — Electromagnetic Induction: Faraday's Law — Displacement Current, Maxwell's Equations.

Currents and Conductors: Uniqueness Theorems — Method of Images — Ohms' Law — Microscopic Theory of Conduction — Hall Effect.

Electric and Magnetic Fields in Matter: Polarization — Displacement — Magnetization — Boundary Conditions at a Surface of Discontinuity.

Conservation Laws: Conservation of Energy — Poynting's Theorem — Conservation of Linear Momentum and Angular Momentum in Electromagnetic Field.

I.   BOOKS RECOMMENDED:
1.   Mechanics by D.S. Mathur.

2.   Mechanics by Hans Puri.
3.   Elaslicity Vol.7 L.D.Landau- E.M.:Liftshitz.

4.   Classical Mechanics by H. Goldistien.

5.   Classical Mechanics by J.C. Uphadiyan.

6.   Fluid Mechanics Vol.6 L.D.Landau- E.M.:Liftshitz.
7.   Fluid Mechanics by R.H. Bansal.

II.   BOOKS RECOMMENDED:

1.   Electricity and Magnetism: Berkeley Physics Course, Vol. 2, by E. M. Purcell; Tata-McGraw Hill.

2.   Introduction to Electrodynamics: by D. J. Griffiths; Benjamin Cummings, Prentice-Hall of India.

3.   Principles of Electrodynamics by Melvin Schwartz; Dover Publications

IMTH-203

Lab Activities:

1.   Young's Modulus of Rectangular bar by bending beam apparatus.

2.   To Determine the Poisson's ratio of rubber tubing.

3.   To Determine the Young's Modulus of Rigidity & Poisson's ratio.

4.   To Determine the Modulus of Rigidity by Maxwell's needle.

5.   To find the surface Tension of water by Jaeger's Method.

6.   To Determine the surface Tension by Searle's apparatus.

7.   Maxwell's Bridge with Headphone.

8.   Resonance by De-Sauty with Headphone.

9.   To Determine the specific Resistance by Carey Foster bridge.

10.   To Determine the Ballistic constant of a Ballistic Galvanometer.

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IMTH-204: COMPUTER APPLICATIONS-II
Course Title: Data Structures

Unit-I

Data Structure Basics: Basic Terminology, Built-in Data Structures in C: An overview, Data Structure and Problem Solving, Data Structure and Data Operations **(3L)**

Linear Data structures - Arrays: Traversing, Inserting and Deleting values in Linear Arrays. **(2L)**

Stacks: Stacks and their representation in memory and their implementations **(2L)**

Queues: Implementations De-Queues, Priority Queues. **(3L)**

Unit II

Linked Lists: Singly and Doubly Linked List and their implementations. Concepts of Circular Linked Lists. Dynamic Memory Allocations (**4L**)

Trees: Introduction, Trees terminology Binary Tree and their representation in memory, Traversing Binary Trees. **(4L)**

Polish Notations: Evaluation of Postfix, Infix, Prefix Expressions **(2L)**

Unit-III

Graphs: array and linked representation, operations: add, delete and find vertex, add, delete edge, traverse graph (depth-first, breadth-first). Networks: minimum spanning tree, shortest path algorithm (Dijkstra's algorithm and Kruskal's algorithm). **(7L)**

Traversing a Graph: BFS, DFS Algorithms **(3L)**

Unit-IV

Searching Techniques – Linear Search, Binary Search **(2L)**

Sorting Techniques: Insertion sort, Bubble sort, Selection sort, Merge Sort, Radix Sort, Shell sort, Heap sort. **(8L)**

TEXT BOOKS:

1)   "Elis Horowiz&SartajSahani, "Fundamentals of Data Structures", Galgotia Publications.
2)   "Elis Horowiz&SartajSahani, "Fundamentals Computer Algorithms", Galgotia Publications

REFERENCES:

LIPSCHUTA, "Data Structures", Tata Mcgraw Hill

IMTH-204

Lab activities:

1. Array Operations: Searching & Sorting Algorithms

2. Implementation of Singly, Doubly & Circular Linked List.

3. Stack and Queue Implementation Using Arrays and Lists

4. Implementation of Binary Tree, Binary Search Trees, Tree Traversal (Inorder, Preorder, Postorder)

5. Implementation of Graphs, Graph Traversal (DFS, BFS).

IMTH 205: ENVIRONMENTAL SCIENCE

Unit-I

Definition of Environment and Environmental Science, its scope and importance, Need for public Awareness, Concept of components of environment, Ecological Balance in Nature, Man and Environment, Biosphere: a brief account.

Unit-II

Ecosystem: Definition and types of ecosystems. Structure and Function, Food chains, Food webs and Ecological pyramids, Energy flow in an Ecosystem, Abiotic and biotic components of an aquatic and terrestrial ecosystem. Primary and secondary productivity: a brief account, Biotic interaction in ecosystem., Ecological Succession.

Unit -III

Biodiversity basic concept, India as mega biodiversity nation, Values of biodiversity, Threats to biodiversity, Hot spots of biodiversity, Conservation of biodiversity- in-situ and ex-situ, Concept of extinction threshold and extinction debt.

Unit-IV

Environmental Pollution. Definition, Causes, consequences and control of. Air pollution. Water pollution. Soil pollution. Noise pollution. Solid waste management. Wasteland reclamation. Sustainable development and causes of unsustainability. Environmental ethics. Global Warming, Climate Change, Acid rain and Ozone layer Depletion.

BOOKS RECOMMENDED:

1. Text Book of Environmental Studies, Bharucha, Erach, Universities Press (India), Hyderabad,

2. Environmental Sciences, Y. K. Singh, New Age International (P) Limited, Publishers, 2006.

3. Environmental Studies. Joseph, Benny, McGraw Hill Companies, 2005.
4. Environmental Engineering, De, Anil Kumar and De, Arnab Kumar, 2nd edition. New Age International Publishers.

5. Textbook on Environmental Studies, Kanagasabai, S, PHI Learning , 2010.

6. Environmental Studies Chauhan, B.S. 2008..University Science Press.

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Semester III
IMTH-301: Theory of equations, Inequalities and Advanced Calculus

Unit I:

General properties of equations, synthetic division, Relationship between roots and coefficients of an equation, Transformation of equations, Diminishing the roots of an equation by given number, removal of terms of an equation, Formation of equations whose roots are function of given equation, Equations of squared differences.

Unit II:

Symmetric functions, Newton's method of finding the sum of powers of the roots of an equation, solution of cubic and biquardratic equations by Cardan's and Descarte's method respectively, Descarte's rule of signs. Location of roots of an equation (simple cases).

Unit III:

Inequalities: Arithmetic and Geometric mean inequalities, Cauchy's Schwarz inequality, Holders inequality and Minkowski's inequality, Jensons inequality with illustrative problems.

Unit IV:

Limit, Continuity and Differentiability of function of two or more variables, Directional derivatives, sufficient conditions for equality of mixed partials (Young's and Schwarz Theorems), Change of variables Extrema of functions of two and three variables. Restricted maxima and minima.

Books Recommended:
1. Theory of equations, Auzeem et-al, KBD.
2. Real Analysis, S. C. Malik, New age publications.
3. Methods of Real analysis, R. Goldberg, Oxford and IBH publications.
4. W. Rudin, Principles of Mathematical analysis, Tata Mc Graw Hill.

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IMTH-302 : ALGEBRA (MATHEMATICS)

Unit- I:

Recollection of equivalence relations and equivalence classes, congruence class of integers modulo n, Definition of Binary operation and examples. Definition of group, examples with matrices, permutation groups, groups of symmetry, roots of unity, properties of group, laws of exponents, finite and infinite groups.

Unit- II:

Subgroups and Cosets, order of an element, Lagrange's theorem, Normal Subgroups, Quotient groups, homomorphisms, kernel and image, isomorphism, homomorphism theorems. Cyclic groups, subgroups and quotients of cyclic groups. Finite and infinite cyclic groups.

Unit- III:

Definition of ring, examples with congruence classes mod n, integral domains, division rings and fields with examples. Subrings and ideals, algebra of ideals, prime and maximal ideals of a ring, principal ideals, nilpotent ideals, nil ideals. Field of quotients and embedding theorem.

Unit- IV:

Ring of polynomials F[x] is an integral domain. The division algorithm in F[x], factorization of integral domains. Divisibility ,units, associates, prime and irreducible elements in a commutative ring. Principal ideal domains with related results.

BOOKS RECOMMENDED:

1.   I. N. Herstein, TOPICS IN ALGEBRA, John Wiley.

2.   P.B. Bhattachariya, S.K. Jain, S. R. Nagpaul, BASIC ABSTRACT ALGEBRA, Cambridge.

3.   M. Artin ,ALGEBRA, Prentice hall of India.

4.   D. S. Dumit and R. M. Foote ,ABSTRACT ALGEBRA, John Wiley

5.   Joseph Gallian , ABSTRACT ALGEBRA , Narosa

6.   Surjeet singh and Qazi Zameeruddin ,MODERN ALGEBRA ,New age International.

7.   I. N. Jacobson , BASIC ALGEBRA , Hindustan publishing corporation.

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Semester III
IMTH-303: Probability Theory

Unit I:

The probability set functions, its properties, probability density function, the distribution function and its properties, Mathematical expectations, some special mathematical expectations, inequalities of Markov, Chebyshev and Jensen.

Unit II:

Conditional probability, independent events, Baye's theorem, distribution of two and more random variables, marginal and conditional distributions, conditional means and variances, correlation coefficient, stochastic independence and its various criteria.

Unit III:

Some Special Distributions, Bernoulli, Binomial, trinomial, multinomial, negative binomial, Poisson, gamma, chi-square, beta, Cauchy, exponential, geometric, normal and bivariate normal distributions.

Unit IV:

Distribution of functions of random variables, distribution function method, change of variables method, moment generating function method, t and f distributions, Dirichelets distribution, distribution of order statistics, distribution of X and $\frac{nS^2}{S^2}$ limiting distributions, different modes of convergence, central limit theorem.

Recommended Books:
1. Hogg and Craig, An introduction to the Mathematical Statistics.
2. Mood and Grayball, An introduction to the Mathematical Statistics.
3. V. K. Rohatgi, An introduction to Probability and Statistics.

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IMTH-304 : Physics-III   *No. of Lectures: 70*

Thermal Physics

The laws of Thermodynamics — Thermodynamic Potentials — Clausius-Clayperon equation, Equation of State — Description of Phase Transitions — Surface Effects in Condensation —Van der Waals Equation of State — Joule- Thomson Cooling.

Probability — General Definitions, One Random Variable, Some Important Probability Distributions — Many Random Variables.

Microstates and Macrostates, Maxwell-Boltzmann Distribution — Most Probable Distribution, Partition function.

Statistical Mechanics

General Definitions — The Microcanonical Ensemble — The Ideal Gas — Mixing Entropy and the Gibbs Paradox — The Canonical Ensemble — Examples — The Grand Canonical Ensemble — The Equivalence of the Canonical and the Grand Canonical Ensemble.

The Postulates of Quantum Statistical Mechanics — Density Matrix — Ensembles in Quantum Statistical Mechanics — Ideal Gases: The Ideal Fermi Gas — The Ideal Bose Gas — Applications

Quantum Mechanics I

Experimental Background — The Old Quantum Theory — Uncertainty and Complementarity — Discussion of Measurement — The Schrodinger and Heisenberg Pictures and Equivalence — Development of the Wave Equation — Interpretation of the Wave Function — Wave Packets in Space and Time — Eigen functions and Eigen values — Energy and Momentum Eigen functions

— Expectation Values — Two-level System — One-dimensional Square Well and Barrier Potential — Linear Harmonic Oscillator — The Hydrogen Atom — Collisions in Three Dimensions — Scattering by a Coulomb Field.

BOOKS RECOMMENDED:

1. Statistical Physics: Berkeley Physics Course, Vol. 5, by F. Reif; Tata- McGraw Hill.
2. Statistical Mechanics by Kerson Huang, Wiley Eastern.
3. Statistical Physics of Particles by Mehran Kardar, Cambridge University Press.
4. Statistical Physics: Course of Theoretical Physics, Vol. 5, Part 1, by L.D. Landau and E.M. Lifshitz;
5. Quantum Physics: Berkeley Physics Course, Vol. 4, by E. H. Wichman; Tata-McGraw Hill.
6. Quantum Mechanics by L. I. Schiff, McGraw Hill.
7. Quantum Mechanics by E. Merzbacher, John Wiley.
8. Quantum Physics: Berkeley Physics Course, Vol. 4, by E. H. Wichman; Tata-McGraw Hill.

IMTH-304

Lab Activities:

1.   Heating efficiency of electric kettle with varying voltage.

2.   Thermal Conductivity of poor conductors of different materials by Lee's apparatus.

3.   To verify the laws of probability distribution

4.   To study deviation of probability from theoretical value by tossing coins / dices.

5.   To study of temperature dependence of total radiation.

6.   Specific heat of graphite and its variation with temperature.

7.   GM counter for study of nuclear disintegration.

8.   To Study of adiabatic expansion of gas.

9.   To Study Brownian motion.

10.   To study the ratio of specific heats using Clements and Desormers Experiment.

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IMTH-305: COMPUTER APPLICATIONS-III
Course Title: Numerical and Statistical Computing

UNIT I

Computer Arithmetic: Introduction, Floating Point Representation and Arithmetic, Normalized Floating Point Representation of Numbers. **(2L)**

Approximations & Errors: Types of Programming Errors, Data Errors, Computer & Arithmetic Errors, Round off and Truncation Errors. Accuracy and Precision, Measures of Accuracy, Error Propagation. **(2L)**

Iterative Methods: Non-Linear Equations, Types of Methods to find solutions to nonlinear equations, Algorithms to Compute Roots of Equation – Methods of Tabulation or Brute Force Method, Method of Bisection, Secant Method, Newton-Raphson Method, Method for False Position. **(6L)**

Derivation of mathematical formulas and implementation of these methods.

UNIT II

Solution of Simultaneous Algebraic Equations: Linear Equations, Types of Methods to find solutions to linear equations. Algorithms to Solve Linear Algebraic Equations: Gauss Elimination, Gauss Jordan, Gauss Seidel, L.U. Decomposition (6L)

Interpolation: Lagrange Interpolated Polynomial, Newton's Methods of INTERPOLATION – Forward difference, backward difference. (4L)

Derivation of mathematical formulas and implementation of these methods.

UNIT III

Least Square Approximation of Functions: Linear and Polynomial Regression. (2L)

Differentiation and Integration: Simpsons Rule, Trapezoidal Rule (2L)

Unit IV

Numerical solution of Differential Equations: Taylor Series Method, Euler's Method, Modified Euler's Method, Runge-Kutta Methods, Predictor Corrector Formula. (6L)

Derivation of mathematical formulas and implementation of these methods.

REFERENCE BOOKS:

1. S.C.Chapra & R.P.Canale: "Numerical methods for Engineering". Tata McGraw Hill.
2. Krishenmurty and Sen : "Numerical Algorithms"
3. V. Rajaraman "Computer oriented numerical methods." Prentice Hall of India.

4. McCalla, Thomas Richard: "Introduction to Numerical Methods and FORTRAN Programming", John Wiley & Sons, Inc.

5. Grewal, B. S.: "Higher Engineering Mathematics", Hindustan Offset Problems Series.
6. "SCHAUM'S Solved Problems Series".

7. Jain, M. K., Iyengav, S. R. K., Jain, R. K.: "Numerical Methods for Scientific and Engineering Computation"+, Wiley Eastern Ltd, New Delhi.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

SEMESTER –I
IMTH-401: Real ANALYSIS

Unit- I:

Real numbers: Countable and uncountable sets, proof of countability of rationals and of uncountability of reals, Bounded and unbounded sets, L.u.b. and g.l.b. of a set, completeness and the least upper bound property of the set of real numbers (statements only), incompleteness of the set of rational numbers. Uniform continuity: Uniform continuity of continuous functions on closed and bounded intervals..

Unit II:

Sequences of real numbers: Theorems on limit of sequences, bounded and monotonic sequences, Cauchy's criteria for convergence of sequences, nested interval theorem, Bolzano-Weierstrass theorem, limit inferior and limit superior of a sequence

Unit III:

Infinite series: Convergence and divergence of series, Cauchy criteria for convergence of series, series of positive terms, Comparison test, Integral test, Cauchy's root test, D-Alembert's ratio test, Rabee's test and Gauss test, absolute and conditional convergence.

Unit IV:

Riemann-Integration: Upper and lower sums, refinement of a partition, behaviour of lower sums and upper sums under refinement, definition and existence of the Riemann integral, necessary and sufficient condition for R- integrability of a bounded function, R-integrability of sum, difference, product and quotient of two functions, R-integrability of $|f|$ for which f is bounded and R-integrable on an interval, R- integrability of a function having a finite number of discontinuities and of continuous and monotone functions, indefinite integral of a R-integrable function and its basic properties, Fundamental theorem of integral calculus, Mean value theorem for integrals.

Books Recommended:

1. Shanti Narayan, A course in Real Analysis.

2. S.C. Malik, Real Analysis.

Suggested Readings:

1. T.M.Apostol, Mathematical Analysis.

2. S.C. Malik, Mathematical Analysis.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

IMTH-402:
Discrete Mathematics

Unit-I.

Counting principle, counting set of pairs two way counting, stirling numbers of 2nd kind, simple recursion formula satisfied by S(n,k) and direct formula for S(n, k) for k=1,2,…,n. Pigeonhole principle and its strong form, its applications to geometry. Principle of inclusion and exclusion, its applications, de arrangements, explicit formula for dn, various identities involving dn, deriving formula for Euler phi function.

Unit-II.

Recurrence relation**s,** definition of homogeneous, non-homogeneous, linear, non linearrecurrence relations, obtaining recurrence relations in counting problems, solve (homogeneous as well as non-homogeneous) recurrence relations of 2nd degree using algebraic method. Partially ordered sets: (i) Concept of partial order, total order and examples. (ii) chains, Zorn's Lemma. (i) Peano's axiom. (ii) Well ordering principle (iii) Weak and strong principles of mathematical induction (v) Equivalence of axiom of choice, Zorn's lemma and well ordering principle.

Unit-III.

Introduction to graphs, paths and cycles, operations on graphs, bipartite graphs and Konig's theorem, Euler graphs and Euler's theorem, Hamiltonian graphs and Dirac's theorem. Degree sequences.

Unit-IV.

Trees and their properties, binary and spanning trees, degrees in trees, Cayley's theorem, fundamental cycles, cut vertex and cut edge in a graphs, planar graphs and Euler's formula, incidence matric, adjacency matrix of a graph.

Text Books:

1. Norman Biggs, Discrete Mathematics, John Wiley and sons.
2. V. Krishnamurthy, Combinations Theory And Applications, Affiliated East-West Press.
3. S. Pirzada, An Introduction to Graph Theory, Universities Press, Orient BlackSwan, Hyderabad, India, 2012.

References:

1. Richard Brauldi , Introductory Combinations, John Wiley and Sons.
2. Discrete Mathematics, Schaum's Outlines Series.
3. Allen Tukker Applied Combinations, John Wiley and Sons.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

IMTH-403: VECTOR CALCULUS

Unit- I

Vectors in Euclidean Space, Scalar and vector product of three vectors, product of four vectors, Reciprocal vectors, Ordinary derivatives of vectors, Vector differentiation, Scalar valued and vector valued point function, Derivative along a curve, Directional derivatives.

Unit- II

Vector and scalar functions, Continuity and differentiability, Partial derivatives of vectors and related problems, Vector differential operator del, Gradient Divergence Curl Operators, Formulae involving these operators, Laplacian operator.

Unit- III

Vector integration, Line integral, Surface integral, Volume integral, Theorems of Gauss and Stokes Greens theorem in plane, Aplications of these theorems.

Unit- IV

Curvilinear Coordinates: Curvillinear coordinates, Arc length, Orthogonal curvilinear coordinates, conditions for orthogonality, Vector derivative in orthogonal coordinates, Cylindrical and spherical polar coordinates, Arc lengths. Volume elements. Gradient, Divergence and Curl in curvilinear coordinate systems. Some special orthogonal curvilinear coordinate systems

BOOKS RECOMMENDED:

1. Shanti Narayan, J. N. Kapur, "A TEXT BOOK OF VECTOR CALCULUS" S. Chand and company, N. Delhi

2. Murray. R.Spiegel , "VECTOR ANALYSIS" , Schaum Series Pub.Mc Graw Hill

3. Absos Ali Shaikh, Sanjib Kumar Jana, "VECTOR ANALYSIS WITH APPLICATIONS," Narosa.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

IMTH-404 : Physics-IV   No. of Lectures:70

Optics

Waves: Plane waves — Spherical Waves — Harmonic Waves — Phase Velocity — Wave packets — Group Velocity — Plane Electromagnetic Waves: Linear, Circular, and Elliptic Polarizations — Stokes Parameters, Polarisers.

Eikonal Approximation — Ray and Matrix Optics — Fermat's Principle — Optical Imaging — Aberrations: Chromatic, Spherical, Coma, Astigmatism, Distortion — Optical Instruments.

Wave Optics: Reflection and Refraction — Interference and Interferometers — Multiplebeam Interference — Coherent and Incoherent Light — Elementary Theory of Diffraction: Kirchoff theory — Fraunhofer and Fresnel Diffraction — Elementary Dispersion Theory — Elementary Scattering Theory.

Quantum Mechanics II

Matrix Formulation of Quantum Mechanics: Bra and Ket Formulation — Transformation Theory — Equations of Motion — Symmetry in Quantum Mechanics — Space and Time Displacements — Rotation — Angular Momentum and Unitary Groups — Combination of Angular Momentum States and Tensor Operators — Space Inversion and Time Reversal — Dynamical Symmetry.

Approximation Methods for Bound States: Stationary Perturbation Theory — Variational Method — Dalgarno-Lewis Method – WKB Approximation — Time-dependent Perturbation Theory.

Approximation Methods in Collision Theory: The Scattering Matrix — Stationary Collision Theory — Born Approximation — Distorted Wave Born Approximation — Partial Wave Analysis.

Identical Particles and Spin: Stern-Gerlach Experiment — Pauli Matrices — Boson and Fermion Wave functions — Density Operator and Density Matrix.

5. Quantum Mechanics: Course of Theoretical Physics, Vol. 3 by L.D. Lan- dau and E.M. Lifshitz; Butterworth Heineman

IMTH-404

Lab Activities:

1. Refractive index of the material of a prism using spectrometer.
2. Dispersive power of the material of a prism.
3. Wavelength of laser light by diffraction method.
4. Polarization of light by reflection/ Malus law.
5. Determination of thickness of hair strand / size of slit by diffraction of laser beam.
6. Interference of laser light by Michelson's interferometer.
7. Planck's constant using photocell.
8. e/m of electron by Thomson apparatus.
9. Rydberg's constant for hydrogen.
10. Study of Hall effect in semiconductors.
11. To study wave forms on an oscilloscope.
12. To study wave forms of bridge rectifier along with filters using oscilloscope.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

SEMESTER –V
IMTH-501: Partial Differential Equations

Unit-I

Formation and classification of first-order PDEs, Linear and Quasilinear first-order PDEs, Cauchy's problem for first order PDEs, The Cauchy Kowalevski Theorem. Nonlinear first-order PDEs, The method of characteristics, Compatible systems, Charpit's method, Jacobi's method for nonlinear PDEs.

Unit- II

Lagrange's linear equation, linear p.d.e. of second order with constant co-efficients Cauchy- Neumann and Dirichlet conditions. Solutions of Laplace, diffusion and wave equation by method of separation of variables, Use of Fourier series and integral transforms. D'Alembert's solution of wave equation.

Unit-III

The Wave Equation - Derivation of the wave equation, The infinite string problem, The semi-infinite string problem, The finite vibrating string problem, The Fourier Transform Methods for PDEs –Fourier transform, Fourier sine and cosine transform, Heat flow problem in an infinite and semi-infinite rod, Infinite string problem, Laplace equation in a half-plane.

Unit- IV

Heat equation, Maximum principle, Uniqueness of solution via Energy method, The Method of Green's Functions – Integral formulation, The method of Green's functions for the Laplace, Heat and Wave equations.

BOOKS RECOMMENDED:

1. I. N. Sneddon, "ELEMENTS OF PARTIAL DIFFERENTIAL EQUATIONS" Dover Publications, New York 2006.
2. F. John, "PARTIAL DIFFERENTIAL EQUATIONS" Springer-Verlag, New York, 1982.
3. D.A. Murray, "INTRODUCTORY COURSE ON DIFFERENTIAL EQUATIONS" Orient Longman (India),1967.
4. W. T. H. Piaggio, ELEMENTARY TREATISE ON DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS, CBS Publishers, New Delhi.
5. George A. Artico, Partial Differential Equations and Boundary Value Problems with Maple, 2nd Edition, academic Press.
6. L. C. Evans, Orient Black Swan Partial Differential Equations, 2nd edition.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

SEMESTER –V
IMTH-503: NUMERICAL ANALYSIS

Unit-I

Finite difference and Interpolation: Error estimation, Forward, Backward and Central difference Operator, and relation between them. Newton's Difference formulas, Newton's divided difference formulas, Gauss forward and backward formulae, Sterling, Bessel's and Everett's formulae, Lagrange's interpolation formula.

Unit-II

Numerical solution of Algebraic and Transcendental equations: Basic concepts on polynomial equations, Roots of equations by Bisection method, iterative method, Regula-falsi method, Newton – Raphson method, Secant method.

Unit – III

Numerical differentiation and integration: Numerical differentiation, errors in numerical differentiation, Numerical integration, Trapezoidal, Simpson's 1/3 and 3/8 rules, Romberg integration-recursive formulae, Evaluation of double integrals by Tralpezoidal and Simpson's rules.

Unit-IV

Numerical solutions of ordinary differential equations: Initial value problems, Picard's and Taylor series methods, Modified Euler method, Runge Kutta methods of second and fourth order, Multistep method, The Adoms-Moulton method.
IMTH-501 L: Numerical Analysis Lab

Experiments in the Lab are based on the contents of IMTH-501 T: Num. Anal.

BOOKS RECOMMENDED:

1. S. S. Sastary, "INTRODUCTORY NUMERICAL ANALYSIS", Narosa publishing house.

2. M.K. Jain, S.R.K. Iyenger and R.K.Jain, "NUMERICAL METHODS FOR SCIENTIFIC AND ENGINEERING COMPUTATION, Wiley Eastern Limited.

3. C.F. Gerald and P. O. Wheatley, "APPLIED NUMERICAL METHODS" Pearson Education Asia.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

IMTH-502: LINEAR ALGEBRA

Unit- I:
 Vector Spaces, Definition and examples (spanning sets and subspaces, linear span, direct sum of subspaces, quotient spaces.

Unit- II:
Linear combinations, linear dependence and linear independence, basis and dimensions of a vector space, linear functionals on .

Unit- III:
Linear mappings (Transformations), kernel and image of linear mapping, rank and nullity of linear mapping, singular and non singular linear mappings, isomorphisms, operations with linear mappings, Algebra of linear mappings and relate results.

Unit- IV:
Matrix representation of linear operator, change of basis matrices and related results, similarity matrices and general linear mappings, characteristic and minimal polynomial, Cayley Hamilton Theorem, eigen values and eigen vectors.

BOOKS RECOMMENDED:

1. K. Hoffman and R. Kunze, LINEAR ALGEBRA, Pearson Education.

2. Linear Algebra, Schaum"s outline series, Tata McGraw-Hill.

3 Gilbert Strang, INTRODUCTION TO LINEAR ALGEBRA, Wellesley- Cambridge Press.

4. Howard Anton, ELEMENTARY LINEAR ALGEBRA, Wiley.

5. Serge Lang, Linear Algebra, springer.

6. S.Kumaresan, LINEAR ALGEBRA- A GEOMETRIC APPROACH.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

IMTH-504: SOFT SKILLS

Unit-I:

MATLAB: Basic introduction: Simple arithmetic calculations, Creating and working with arrays, numbers and matrices, creating and printing simple plots, Function files, Application to ordinary differential equations, A first order ODE, A second order ode, ode23, ode45, Basic 2 D Plots and 3-D Plots.

Unit-II:

MATHEMATICA: Basic introduction: Arithmetic operations, functions, Graphics: 2D Plots & 3-D Plots, Plotting the graphs of different functions, Matrix operations, Finding roots of an equation, Finding roots of a system of equations, Solving differential equations.

Unit-III:

LATEX: Basic introduction: mathematical symbols and commands, Arrays, Formulas and equations, Borders and colors, Using date and time option in latex, To create application and letters, PPT. in Latex, writing an article, pictures and graphics.

BOOKS RECOMMENDED:

1. R. Pratap, GETTING STARTED WITH MATLAB, Oxford university press, 2010.

2. S. Lynch, DYNAMICAL SYSTEMSWITH APPLICATIONS USING MATLAB, Birkhauser,2010

3. M.L.Abell, J.P. Braselton, DIFFERENTIAL EQUATIONS WITH MATHEMATICA, Elsevier academic press.

4. I.P.Stavroulakis, S.A. Tersian, AN INTRODUCTION WITH MATHEMATICA AND MAPPLE,Word scientific,2004.

5. MATHEMATICA - Stephen Wolfram, Cambridge.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

ELECTIVE 505
OPERATION RESEARCH

Unit-I:

Definition of Operation Research, Basics of Operational Research: Origin & Development of Operational Research, Definition and Meaning of Operational Research, Different Phases of an Operational Research Study, Scope and Limitations of Operational Research, Mathematical Modeling of Real Life Problems.

Unit-II:

Linear Programming problem(LPP), General LPP models, Formulation of LPP models, Graphical solutions of LPP, Convexity, Simplex and Revised Simplex algorithm, Extreme point theorems, development of simplex methods, Artificial variable technique, Big M method and Two phase method.

Unit-III

Transportation, Formulation of Transportation problem, Finding of Basic Feasible solution using North-west Corner rule, Matrix Minima and Vogel's Approximation method. Testing for optimality of the basic feasible solution-MODI and Stepping Stone Methods. Assignment Problem and its formulation, Finding an optimal assignment using Hungarian Method.

Unit-IV

Project scheduling, Network representation of a Project, Rules for construction of a network, Network analysis by Critical Path method (CPM)/ Programme evaluation and review technique(PERT), Basic concepts, constraints in network, construction of network, Time calculations, concepts of slack and float in network, ,finding optimum project duration and minimum project cost.

BOOKS RECOMMENDED:

1. G. Hadley: LINEAR PROGRAMMING. Narosa, Reprint, 2002.

2. Hamdy A. Taha: OPERATIONS RESEARCH-AN INTRODUCTION, Prentice Hall, 9th Edition, 2010.

3. A. Ravindran, D. T. Phillips and James J. Solberg: OPERATIONS RESEARCH-PRINCIPLES AND PRACTICE, John Wiley & Sons, 2005.

4. F.S. Hillier. G.J. Lieberman: INTRODUCTION TO OPERATIONS RESEARCH-CONCEPTS AND CASES, 9TH EDITION, Tata Mc-Graw Hill, 2010.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

OR (ELECTIVE 505)
OPTIMIZATION TECHNIQUES

Unit-I:
Convex functions and their properties. Unconstrained and constrained optimization problems. Fritz-John and Karush-Kuhn-Tucker optimality conditions. Quadratic Programming: Wolfe's and Beale's method. Applications of Quadratic programming. Dorn's Duality for Quadratic programming problem.

Unit-II:
 Linear and Quadratic Programming Complementary Pivoting Algorithms. Steepest Ascent and Descent Method. Feasible Direction Method. Separable Programming. Linear Fractional Programming.

Unit-III:
Non-Linear Programming: Convex function and its properties, basics of NLP, Method of Lagrange multiplier, Karush-Kuhn-Tucker optimality conditions, Quadratic Programming: Basic Concepts, Wolfe's method, Beale's method.

Unit-IV:
Dynamic Programming: Multistage decision processes, Recursive nature of computations, Forward and Backward recursion, Bellman's principle of optimality, Selective dynamic programming applications involving additive and multiplicative separable returns for objective as well as constraint functions, Problem of dimensionality.

BOOKS RECOMMENDED:

1. M. S. Bazara, H. D. Sherali, C. M. Shetty: Nonlinear Programming-Theory and Algorithms. Wiley, 3rd Edition, 2006.

2. A. Antoniou, Wu-Sheng Lu: Practical Optimization- Algorithms and Engineering Applications, Springer, 2007.

3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.

4. Wayne L. Winston and M. Venkataramanan: Introduction to Mathematical Programming: Applications and Algo

INSTITUTE OF MATHEMATICAL SCIENCES

Semester VI
IMTH-601: Complex analysis

Unit I

Review of complex numbers and their properties, point set, neighbourhood, limit point, open sets, closed sets, bounded sets, domain (region), Jordan arc, function of complex variable, single valued and many valued functions, branch point of a function, complex differentiability, analytic function, singular point, Cauchy Riemann equations, conjugate functions, harmonic functions, Necessary condition for a function to be analytic, sufficient condition for a function to be analytic, construction of analytic function.

Unit II

Mobius transformation: Determinant of the transformation, critical points, fixed points of a transformation, cross-ratio, invariance of a cross ratio, some special Mobius transformations which map I(z) in to $|w| \geq 1$, which map $|z| \leq 1$ into $|w| \leq 1$. Mobius transformation of the type $w = \frac{\rho(z-a)}{(\rho^2 - \bar{a}z)}$, where $|a| < \rho$ and $|a| > \rho$. Transformation $w = z^2$, $z = \sqrt{w}$ and $w = \sqrt{z}$.

Unit III

Complex Integrals: Contoour, simply and multiply connected domain, complex line integral, an upper bound for contour integral, Cauchy's integral theorem, Cauchy' s Integral formula, Cauchy's Integral formula for first and higher derivatives, applications of Cauchy's Integral formula for evaluation of complex integrals, Morera's Theorem, Cauchy's Inequality.

Unit IV

Taylors theorem, Liouville's theorem, zeros and singularities of ban analytic function, Lauraents series and Laurent's theorem, different type of singularities, isolated, removable, pole and essential singularity, zeros and poles of are isolated, limiting points of zeros and poles, Rieman's theorem on singularity, Weierstrass theorem on essential singularity.

Books recommended

1. Richard A. Silverman, Introductory complex Analysis, Dover publicationinc., New York.
2. E. G. Philips, Functions of a complex variable with applications, Oliver and Boyd, NY: Interscience publication, inc.
3. L. V. Ahlfors, Complex analysis, 3rd ed., McGraw-Hill Book Company.
4. J. E. Brown and R. V. Churchill, Complex Variables and Applications, 8th ed. McGraw-Hill International edition-2009.
5. S. Ponnusamy, foundation of complex Analysis, Narosa publishing House.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

IMTH-602: METRIC SPACES

Unit-I

Metric, metric space, metric induced by norm, open ball, closed ball, interval, interior, exterior, boundary, open set, closure point, limit point, isolated point, closed set, Cantor set. Definition and examples of metric spaces, Open spheres and closed spheres, Neighborhoods, Equivalent metrics, Interior points, Limits, Distance between sets and diameter of a set, Subspace of metric space, Product metric spaces (definition only),

Unit- II:

Convergent sequences, Cauchy sequences, dense sets and separable spaces. Sequences in metric spaces, complete metric space, Cantor's Intersection Theorem.

Unit- III:

Continuous functions: Definition and characterizations, Extension theorem, Uniform continuity (definition only), Homeomorphism.

Unit-IV

Construction of real numbers as the completion of the incomplete metric space of rationals. Dense subsets. Separable metric spaces. Continuous functions. Equivalent metrics.

BOOKS RECOMMENDED:

1. T. Copson, Metric Spaces, Cambridge University Press, 1968

2. P. K. Jain and K. Ahmad, METRIC SPACES, Narosa Publishing House, New Delhi, 1996.

3. Satish Shirali and H. L. Vasudeva ,METRIC SPACES ,Springer International Edition,2006.

4. S.Kumaresan, TOPOLOGY OF METRIC SPACES, NAROSA.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

IMTH-603: NUMBER THEORY

Unit- I
Divisibility in integers, division algorithm, GCD, LCM, Fundamental theorem of arithmetic, inInfinitude of primes, Mersenne primes and Fermat numbers.

Unit- II
Property of congruences, residue classes, complete and reduced residue system, their properties, Linear Diophantine equations, Fermat theorem, Euler theorem, Wilson theorem, Linear congruence of degree 1, Chinese remainder theorem.

Unit- III
Greatest integer functions, arithmetic function, Euler ϕ function, the number of divisors $d(n)$, sum of divisors and similar functions, Arithmetic functions, multiplicative functions, Mobius functions, Mobius inversion formula.

Unit- IV
Farry series, Quadratic residues and nonresidues, Legendre symbols, its properties, law of quadratic reciprocity.
BOOKS RECOMMENDED:

1. Niven and Zuckerman & H.L.Montgomery, AN INTRODUCTION TO THEORY OF NUMBERS, John Wiley

2. David M. Burton, Elementary Number Theory, Universal book stalls

J & K INSTITUTE OF MATHEMATICAL SCIENCES
IMTH 605: Elective
Descriptive Statistics

Unit I. Statistics a conceptual frame work, Statistical enquiry, collection of data, classification and tabulation of data. Diagrammatic and graphic presentation of data Measures of central tendency: Mean median, mode, geometric mean and harmonic mean. Characteristics of a good average.

Unit II. Measures of dispersion: range, mean deviation, quartile deviation, standard deviation, coefficient of variation. Measure of skewness- Karl-Pearson's and Bowley's methods. Measures of Kurtosis. Sheppard's corrections.

Unit III. Correlation Analysis-conceptual frame work. Methods of studying correlation-Scatter diagram, Karl Pearson's correlation coefficient, Spearman's rank correlation coefficient and concurrent deviation methods. Probable error (ungrouped data), coefficient of determination. Principle of least squares and fitting of polynomials and exponential curves. Regression Analysis - definition and uses, simple linear regression, regression equations and regression coefficient, Properties of regression coefficient.

UNIT IV. Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

Text Books:

1. Statistics: A Beginner's Text, Bhat B.R, Srivenkatramana T and Rao Madhava K.S, New Age International (P) Ltd.

2. Applied General Statistics, Croxton F. E, Cowden D.J and Kelin S, Prentice Hall of India.

References:

1. Theory & Problems of Statistics, Spiegel, M.R, Schaum's Publishing Series

2. Fundamentals of applied Statistics, Gupta, S.C. and Kapoor, V.K, Sultan Chand and sons.
3. Anderson T.W and Sclove S.L: An introduction to the Statistical Analysis of Data, Houghton Miffin/Co.
4. Basic Statistical Computing, Cooke, Cramer and Clarke, Chapman and Hall.

5. Introduction to the Theory of Statistics, Mood A.M. Graybill F.A and Boes D.C, Tata Macgra.

J & K INSTITUTE OF MATHEMATICAL SCIENCES

OR
MATHEMATICAL FINANCE (IMTH 605)

Unit-I

BASIC PRINCIPLES: Comparison, arbitrage and risk aversion, interest(simple and compound), time value money, inflation, net present value, internal rate of return(calculation by bisection and Newton-Raphson methods), Comparison of NPV and IRR bonds, bond prices and yields, Macaulay and modified duration, term structure of interest rates.

Unit-II

Marketing decisions, Mathematical models in marketing: joint optimization of price and promotional efforts, media allocation of advertisement, brand switching analysis. Introduction to basic financial management concepts: financial analysis and planning, short term and long term financial planning. Mathematical models: working capital, capital budgeting, inventory management and cash management problems.

Unit-III

Asset , return, short selling, portfolio return(brief introduction to expectation, variance, co variance, correlation), random returns, portfolio mean return, diversification, portfolio diagram.

Unit-IV

Markowitz model, two fund theorem, risk free assets, one fund theorem, capital market line, sharp index, capital asset pricing model(CAPM) and Portfolio Selection Models.

BOOKS RECOMMENDED:

1. Gary L. Lilien, Philip Kotler, K. Sridhar Moorthy: MARKETING MODELS, Prentice Hall of India, 2003.

 2. J. C. Van Horne, J. M. Wachowicz: FUNDAMENTALS OF FINANCIAL MANAGEMENT, 13th Edition, Prentice Hall of India, 2009.

3. Sheldon Ross, AN ELEMENTARY INTRODUCTION TO MATHEMATICAL FINANCE, 2nd Edi. Cambridge university press,USA 2003.

4. David G. Luenberger, INVESTIMENT SCIENCE, Oxfort university Press ,Delhi,1998.

Semester IV				
IMTH-401	Real Analysis	4		
IMTH-402	Discrete Mathematics	4		
IMTH-403	Vector Calculus	4		
IMTH-404	Physics- IV	4 + 2=6		
IMTH-405	Computer Appl. IV	4 + 2=6		

Semester V				
IMTH-501	PDE	4 + 2=6		
IMTH-502	Linear Algebra	4		
IMTH-503	Numerical analysis	4+ 2=6		
IMTH-504	Soft Skills	4		
IMTH-505	Elective I	4	Operation Research or Optimization Techniques	

Semester VI				
IMTH-601	Complex Analysis	4		
IMTH-602	Metric Spaces	4		
IMTH-603	Number Theory	4		
IMTH-604	Minor Project	8		
IMTH-605	Elective II	4	Descriptive Statistics or Mathematical Finaznce	