MATHCC-101: ABSTRACT ALGEBRA

Objective: - The main aims of this course abstract algebra are to provide a first approach to the subject of algebra, which is one of the basic pillars of modern and applied mathematics. The focus of the subject will be the study of certain structures called groups, rings, fields, field extensions, ideals and some related structures for skill development.

UNIT – 1 **(10 Sessions)**
Algebraic structure, Semi-Group, Groups, Abelian group, Order of a finite group, Permutations, Cyclic permutations, Order of element of a group, Isomorphism of groups, Subgroup, Cosets, Lagrange's theorem, Cayley's theorem, Cyclic groups to understand entrepreneurial skill.

UNIT – 2 **(10 Sessions)**
Normal subgroups, Conjugate elements, Normalizer of an element of a group, Centre of a group, Quotient group, Homomorphism of groups, Kernel of a homomorphism, automorphism of a group, Inner automorphism, Solvable groups, p - Sylow subgroup, Sylow's theorem for skill development.

UNIT – 3 **(10 Sessions)**
Ring, Commutative ring, Integral domains, Field, Division ring, Isomorphism of rings, Subrings, Subfields, Characteristics of a ring, The field of quotients, Ideals, Principal ideal ring, Prime fields for skill development.

UNIT – 4 **(08 Sessions)**
Quotient rings, Homomorphism of rings, Kernel of a ring homomorphism, Maximal ideal, Prime ideals, Unique factorization theorem to understand entrepreneurial skill.

UNIT – 5 **(10 Sessions)**
Field extensions, Finite field extension, Roots of a polynomial, Remainder theorem, Factor theorem, Elements of Galois Theory, Fundamental theorem of Galois Theory for skill development.

Course Outcomes:
CO1: Demonstrate insight into abstract algebra with focus on axiomatic theories for better skilling of entrepreneurship.
CO2: Apply algebraic ways of thinking for skill development.
CO3: Demonstrate knowledge and understanding of fundamental concepts including groups, subgroups, normal subgroups, homeomorphisms and isomorphism for skill development.
CO4: Demonstrate knowledge and understanding of rings, fields and their properties to develop skill.
CO5: Understand and prove fundamental results and solve algebraic problems using appropriate techniques for skill development.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	2	3	3	1
CO2	3	3	3	3	2	3	3	3
CO3	3	3	3	3	1	1	3	3
CO4	3	3	3	3	1	2	3	3
CO5	3	3	3	3	1	2	3	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. A. R. Vasishtha: Modern Algebra, Krishna Prakashan Media (P) Ltd Meerut, India.
2. Joseph A. Gallian: Contemporary Abstract Algebra, (Fourth Edition), Narosa, 1999.
3. Goyal & Gupta: Advanced course in Modern Algebra, PragatiPrakashan, Meerut.
4. P. B. Bhattacharya, S. K. Jain & S. R. Nagpaul : Basic Abstract Algebra (Second Edition), Cambridge University Press(Indian Edition 1995).
5. John B. Fraleigh: A First Course in Abstract Algebra, Pearson Education India..
6. I. N. Herstein: Topics in Algebra,2nd Edition , John Wiley & Sons. Copyright.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-102: REAL ANALYSIS

Objective: - The main aims of this course real analysis are to provide students with the special knowledge which necessary for basic concepts in real analysis. It strives more precisely for skill development to enable students to learn basic concepts about functions of bounded variation grasp basic concepts about the uniform convergence of sequences and series of functions, total variation and learn about Riemann integrals.

UNIT-1 **(10 Sessions)**

Elements of set theory, Finite, Countable and uncountable sets, Least upper bound property, The field of real numbers, Archimedean property, Density of rational numbers, Existence of nth root of positive real numbers, Exponential and logarithm, The extended real number system for entrepreneurship & skill development.

UNIT-2 **(10 Sessions)**

Numerical sequences and their convergence, Bounded sequences, Cauchy sequences, Construction of real numbers using Cauchy sequences, Limit supremum and limit infimum for skill development.

UNIT-3 **(08 Sessions)**

Power series, Summation by parts, Absolute convergence, Addition and multiplication of series, Rearrangements (statement only), Uniform convergence of series and sequences of functions, Bolzano Weierstrass Approximation Theorem for skill development.

UNIT-4 **(10 Sessions)**

Limits of functions, Continuous functions, Uniform continuity, Absolute continuity, Connected sets, Connected subsets of real numbers, Continuity and connectedness, Intermediate value theorem, Discontinuities and their classifications, Monotonic functions, Infinite limits and limits at infinity for skill development.

UNIT-5 **(10 Sessions)**

Differentiation of real-valued functions and its elementary properties, Mean value theorem, Taylor's theorem, Differentiation of vector-valued functions, Elementary properties of Riemann integral, Integration of vector-valued functions, Fundamental Theorem of integral calculus for entrepreneurship & skill development
.

Course Outcomes:

CO1: Describe the basic differences between the rational and the real numbers for entrepreneurship & skill development.
CO2: Understand and perform simple proofs for skill development.
CO3: Answer question concerning uniform convergence of concrete numerical sequences and series for entrepreneurship &skill development.
CO4: Give the definition of concepts related to metric spaces, such as continuity, compactness, completeness and connectedness for skill development.
CO5: Give the essence of the proof of Stone-Weierstrass theorem, the contraction theorem as well as the existence of convergent subsequences using equicontinuity for skill development.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes (POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	1	3	3	3
CO2	3	3	3	3	3	1	2	3
CO3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	2	3	1	3
CO5	3	3	3	3	1	3	1	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. T. Apostol: Mathematical Analysis (5th edition), Addison-Wesley Pub.
2. R. G. Bartle and D. R. Sherbert : Introduction to Real Analysis (3rd edition), John Wiley &Sons, Inc.
3.G.C.Chadda&K.P.Gupta: Real Analysis, Students Friends & Company, Agra.
4. Pawan K. Jain & Shiv K. Kaushik: Real Analysis, S.Chand& Company Ltd, New Delhi.

Website Sources:
- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-103: NUMBER THEORY

Objective: - The main aims of this course are to provide an introduction of basic course in number theory for the interest of students in mathematics and teaching of mathematics. The course begins with the basic notions of integers and sequences, divisibility, and Mathematical Induction. It also covers standard topics such as prime numbers, the fundamental theorem of arithmetic and Euclidean algorithm, the Diophantine equations, Congruence equations, Euler's phi-function, Cryptography, Data encryption, Digital signatures and their applications for entrepreneurship & skill development.
.

UNIT 1   **(10 Sessions)**
Divisibility in Z, Fundamental theorem of arithmetic, Primes, Congruence, Fermat's   theorem, Euler's theorem and Wilson's theorem, Fermat's quotients and their elementary consequences, Solutions of congruence's, Chinese Remainder theorem to develop skill.

UNIT 2   **(10 Sessions)**
Euler's phi-function, Power residues, Primitive roots and their existence, Quadratic residues, Legendre symbol, Gauss lemma about Legendre symbol, Quadratic reciprocity law, Proofs of various formulations Jacobi symbol for skill development.

UNIT 3   **(10Sessions)**
Greatest integer function, Arithmetic functions, Multiplicative arithmetic functions, Möbius inversion formula, Convolution of arithmetic functions, Group properties of arithmetic functions, Recurrence functions, Fibonacci numbers and their elementary properties, Properties of Pythagorean triples to develop skill.

UNIT 4   **(08Sessions)**
Solution of sum of two, Four and five squares of integers, Difference of two squares, Perfect numbers, Polygonal numbers, Partition generating function, Uniqueness, representation of rational and irrational numbers as simple continued fractions for skill development.

UNIT 5   **(10 Sessions)**
Introduction to Cryptography: Stream ciphers, Pseudo-random number generators, Block ciphers and modes of operations, Data encryption standard, Private key encryption, Public key encryption, RSA cryptosystem, Rabin's public key cryptosystem, Digital signatures, RSA digital signature scheme, Key distribution, Two-party and Multi-party protocols for entrepreneurship & skill development.

Course Outcomes:

CO1: Analyses hypotheses and conclusions of mathematical statements for skill development
.**CO2:** Apply different methods of proof to verify mathematical assertions, including proof by induction, by contrapositive and by
        Contradiction to skill development.
CO3: Solve systems of Diophantine equations using the Chinese Remainder Theorem & the Euclidean algorithm for
         entrepreneurship.
CO4: Understand the basics of modular arithmetic for skill development.
CO5: State and prove Fermat's little Theorem & its generalization using Euler's function & use them to implement the RSA cipher
         & Discrete log cipher for entrepreneurship & skill development.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	2	2	3	3
CO2	3	3	2	3	3	3	1	1
CO3	1	1	3	1	3	3	3	2
CO4	3	3	1	3	3	2	3	3
CO5	3	3	3	3	1	3	3	1

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	1	1
CO3	3	2	2
CO4	3	2	1
CO5	3	3	1

Suggested Readings:

1. I. Niven, H. Zuckerman and H. L. Montgomery: An Introduction to the Theory of Numbers (6th edition) , John Wiley and sons, Inc., New York, 2003.
2. D. M. Burton: Elementary Number Theory (4th edition) –Universal Book Stall,New Delhi,2002.
3. S. B. Malik: Basic Number Theory (Second Revised Edition), Visas Publishing House (Pvt.) Ltd. New Delhi
4. Dr. G. S. Sandhu :Number Theory –I, First world Publication,

Website Sources:
- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-104: ORDINARY DIFFERENTIAL EQUATIONS

Objective: - The main aims of these course ordinary differential equations are to provide an introduction of ordinary differential equations. Solving first-order differential equations, existence and uniqueness theorems, second-order linear equations, power series solutions and higher-order linear equations, systems of equations, non-linear equations, Sturm Liouville theory, and applications. An introduction to numerical solutions and applications of differential equations in physics, engineering, biology, and economics are presented. This course covers more material at greater depth than the standard undergraduate-level ODE course to knowledge for better skill development.

UNIT-1 (10 Sessions)
Existence and Uniqueness theorem, Linearly dependent and independent solutions, The Wronskian, Theorems for Wronskian, Necessary and sufficient conditions for the Wronskian, The Wronskian for n functions, Solution of Exact differential equation of order n, Solution of differential equations of special forms for skill development.

UNIT-2 (10 Sessions)
Existence and Uniqueness of solution of initial value problem for first order ODEs, Singular solution of first order ODEs, System of first order ODEs, General theory of homogeneous and non – homogeneous linear ODEs to develop skill.

UNIT-3 (08 Sessions)
Solutions of ODEs of Second order with variable coefficient when C.F. is known, Normal form, Change of independent variable, Variation of parameter by Initial and boundary conditions for skill development.

UNIT-4 (10 Sessions)
Bessel's Differential equation and its solution, Recurrence relations for Bessel's function, Generating function for Bessel's function, Orthogonality of Bessel's function, Problems on Bessel's function, Legendre differential equation and its solution, Generating function for Legendre Polynomial , Trigonometric series for $P_n(x)$, Laplace first and second Integral for $P_n(x)$, Orthogonal property for $P_n(x)$, Recurrence relations, Rodrigue formula to develop skill
.

UNIT-5 (10 Sessions)
Picard's Method, Existence and uniqueness of Picard's solutions, Sturm – Liouville boundary value problem, Green's function for skill development.

Course Outcomes:

CO1: Explain the concept of differential equation, Classifies the differential equations with respect to their order and linearity to develop better skill.
CO2: Solves exact differential equations. Converts separable and homogeneous equations to exact differential equations by integrating factors for skill development.
CO3: Gain clear concept of Second order linear differential equations with variable coefficients for skill development.
CO4: Get an idea of power series method to solve differential equations Familiar with Legendre equation and Legendre polynomial. Discuss various properties of the Bessel's function to develop better skill.
CO5: Expresses the existence-uniqueness theorem of differential equations. Solve first-order ordinary differential equations by using Picard's Method to knowledge for better skill development.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	2	3	3	3
CO2	3	3	3	2	3	1	2	3
CO3	3	2	1	3	3	2	3	3
CO4	3	1	3	3	1	3	1	3
CO5	1	3	3	3	1	3	3	1

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	2
CO2	3	1	1
CO3	3	1	1
CO4	3	2	2
CO5	3	3	1

Suggested Readings:

1. J.N. Sharma & Dr. R.K. Gupta: Differential Equations, Krishna Publication.
2. M.D. Rai Singhania: Advanced Differential Equations, S. Chand & Company Ltd, New Delhi.
3. Shepley. L. Ross   : Differential Equations, Wiley India (Pvt.) Ltd.
4. RamKrishna Ghosh & Maity: An Introduction to Differential Equations, Sarthak Publication

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC- 105: COMPUTER FUNDAMENTAL AND PROGRAMMING IN C

Objective: - The main aims of this course Computer Fundamental and Programming in C to provide an introduction of Computer fundamental, an understanding of basic concepts of computer science and engineering, fundamentals of hardware, software and programming, mathematical software. This course also provides an understanding of cyber laws and computer security knowledge for better employability in industry.

UNIT-1   **(10 Sessions)**
Computer Fundamental: Introduction of computer, Classification of computers, Applications of computers, Generations of computer, Basic organization of a computer, Software and its types, Hardware, Input devices, Output devices for entrepreneurship & skill development.

UNIT-2   **(08 Sessions)**
Computer memory, Memory hierarchy, Registers, Cache memory, Primary memory, Secondary memory, Logic gates.
Operating System: Definition of operating system, Function of operating system, Types of operating system to provide employability & skills.

UNIT-3   **(10 Sessions)**
Programming Using C: Variables, Constant, Operators, Basic data types, Type casting, Type conversion, Functions, Decision control statements, Looping statements, Arrays and String for entrepreneurship & skill development.

UNIT-4   **(10 Sessions)**
Internet: Introduction of internet and Internet services (E-mail, File transfer protocol, Online shopping etc.), Searching information through a search engines, World wide web to provide employability & skills.

UNIT-5   **(10 Sessions)**
Networks: Computer networks, Types of networks, Network topology, Data transmission mode for entrepreneurship & skill development.

Course Outcomes:

CO1: Bridge the fundamental concepts of computers with the present level of knowledge of the students and also know about organization of computer, Input and output devices for entrepreneurship & skill development.
CO2: Develop the ability to understand about the computer memory and operating system to provide employability & skills.
CO3: Develop ability to design and develop C Language programs, analyzes, and interprets the concept of array, declarations, initialization, operations on array and string for entrepreneurship & skill development.
CO4: Understand the internet, world wide web, internet services and searching engines for entrepreneurship & skill development.
CO5: Develop interests computer networking for professional work for entrepreneurship & skill development.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	1	2	3	3	1	3
CO2	2	3	1	2	3	3	2	3
CO3	3	3	1	2	3	3	2	3
CO4	1	3	1	2	3	3	2	3
CO5	1	3	1	2	3	3	1	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	3	2
CO3	3	3	1
CO4	3	3	1
CO5	3	3	1

Suggested Readings:

1. 1.Pradeep K. Sinha and PritiSinha: Computer Fundamentals, BPB Publications, (4th Edition).
2. V. Raja Raman: Fundamentals of Computers, PHI Learning, (5th Edition).
3. Yashavant P. Kanetkar: Let us C, Infinity Science Press, (8th Edition).
4. E. Balagurusamy: Fundamentals of Computers, McGraw-Hill Inc.,US.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-201: TOPOLOGY

Objective: - The main aims of this course are to introduce Topological spaces, Open Sets, closed sets, and Subspaces, Basis, Product Topology and Subbasis, Metrics, Metric spaces, Hausdorff Space, Sequences in Topological Spaces, Metrizability Problem and Examples of Metrizable Spaces, Continuity, Homeomorphisms, Compactness, Limit Point Compactness and Sequentially Compact Spaces and Some of their properties for skill development.

UNIT-1   **(10 Sessions)**
Metric Space: Metric, Metric space, Open sets, Interior, Exterior, and Frontier points, Closed sets, Continuity and Homomorphism in metric space to develop skill.

UNIT-2   **(10 Sessions)**
Topological Spaces: Topological space, Open and closed sets and Limit points, Metric topology, Subspace, Continuous functions, Homomorphism of topological space, Basis for a topology, Product space and Quotient space for skill development.

UNIT-3   **(10 Sessions)**
Connectedness: Connected spaces, connected subspaces of real line, Components and Local connectedness, totally disconnected spaces understanding for entrepreneurial skill.

UNIT-4   **(08 Sessions)**
Compactness: Compact spaces, Compact subspaces of real line, Limit point compactness, Local compactness to develop skill.

UNIT-5   **(10 Sessions)**
Countability and Separation Axioms: Countability axioms, the separation axioms, Normal spaces, Regular spaces, Completely regular spaces, Urysohn's lemma, Urysohn metrization theorem (without proof), Tietze extension theorem for skill development.

Course Outcomes:

CO1: Know what it means for a metric space to be complete, and you can characterize compact metric spaces to develop skill.
CO2: Know how the topology on a space is determined by the collection of open sets, by the collection of closed sets, or by a basis of neighborhoods at each point, and you know what it means for a function to be continuous for skill development.
CO3: Know the definition and basic properties of connected spaces, path connected spaces, compact spaces, and locally compact Spaces understanding for entrepreneurial skill.
CO4: Know the definition and basic properties of compact spaces for skill development
CO5: Construction of the fundamental group of a topological space and applications to covering spaces . Know about the Urysohn lemma and the Tietze extension theorem, and you can characterize metrizable spaces understanding for entrepreneurial skill.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	1	3	3	3
CO2	3	3	3	3	1	3	3	3
CO3	3	3	3	3	1	3	3	3
CO4	3	3	3	3	2	3	3	3
CO5	3	3	2	3	3	3	3	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	2
CO2	3	1	1
CO3	3	2	2
CO4	3	2	1
CO5	3	1	1

Suggested Readings:

1. J.L. Kelley: General Topology, Springer Verlag, New York 1991.
2. B. D. Gupta: Topology, Kadarnath Ramnath Publication.
3. J. R Munkres: Topology, a first course, Prentice-Hall of India Ltd., New Delhi, 2000.
4. K. D. Joshi, An introduction to general topology, 2nd edition, Wiley Eastern Ltd., New Delhi,2002.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC– 202: CLASSICAL MECHANICS

Objective: - The main aims of this course are to demonstrate the knowledge of functional and extreme path and the application in solving some fundamental problems, demonstrate the knowledge and understanding of the fundamental concepts in the dynamics of system of particles and Lagrangian and Hamiltonian formulation of mechanics and for better skilling of entrepreneurship to represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulation.

UNIT – 1   **(10 Sessions)**
Definitions, Moment of Inertia, Product of inertia, Moment of Inertia of rectangle, Hollow sphere, Solid sphere, Circular wire, Archual wire, Cone, Moment of Inertia of heterogeneous bodies for skill development.
.
UNIT – 2   **(10 Sessions)**
Principle axes, Moment of Inertia about principle axes at any point, Motion about fixed axes for better skill development.

UNIT – 3   **(08 Sessions)**
Generalized coordinate, Holonomic& non-holonomic system, D'Alembert's principle, Lagrange's equations for skill development.

UNIT – 4   **(10 Sessions)**
Hamilton's principle, Lagrange's equations from Hamilton's principle, Extension of Hamilton's principle to non-conservative and non-holonomic systems, Conservation theorems and symmetry properties for better skill development.

UNIT – 5   **(10 Sessions)**
Eulerian angles, Euler's theorem on the motion of a rigid body, Infinitesimal rotations, Rate of a vector, Coriolis force, Euler's equation of motion, force free motion of a rigid body, Heavy symmetrical top with one point fixed for skill development.

Course Outcomes:

CO1: Define and understand basic mechanical concepts related to discrete and continuous mechanical systems for better skilling of entrepreneurship.
CO2: Describe and understand the various for skill development to Moment of Inertia.
CO3: Describe and understand the vibrations of discrete and continuous mechanical systems for skill development.
CO4: Describe and understand planar and spatial motion of a rigid body knowledge for better skill development.
CO5: Describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism knowledge for better skill development.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	1	3	3	2	3
CO2	3	3	3	1	3	1	3	2
CO3	3	3	2	3	3	1	3	1
CO4	3	3	3	3	3	2	3	1
CO5	1	3	3	3	1	3	2	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	2	1
CO2	3	2	1
CO3	3	1	1
CO4	3	1	2
CO5	3	2	2

Suggested Readings:

1. C.R. Mondal : Classical Mechanics, Prentice-Hall of India,2001 .
2. T. W. B. Kibble:Classical Mechanics, Longman, Londan,1985 .
3. L.D. Landau and E. M. Lipshitz: Mechanics, pergamon press, oxford, 1976 .
4. Morin David: Introduction to Classical Mechanics with Problems and Solutions, Cambridge.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Master of Science (Mathematics) Programme
M.Sc. (Mathematics) – I Year (II Semester)

MATHCC-203: DISCRETE MATHEMATICS

Objective: -The main aims of this course are to prepare students to develop mathematical foundations to understand and create mathematical arguments require in learning many mathematics and computer sciences courses. To motivate students how to solve practical problems using discrete mathematics. Also, in this course basic concepts of Graph theory such as Trees, Eulerian Graphs, Matching, Vertex colourings knowledge for better skill development
.

UNIT – 1 (10 Sessions)
Propositional Calculus: Propositions, Compound propositions, Basic logical operations, Tautologies and Contradictions, Logical equivalence, Algebra of propositions, Conditional and Bi conditional statements, Normal forms, Arguments and Quantifiers to develop skill.

UNIT – 2 (10 Sessions)
Graph Theory: Graph, Finite and Infinite graphs, Multi graph, Trivial graph, Simple graph, Psuedo graph, Degree of a vertex, Null graph, Sub graph, Connected and Disconnected graphs, Directed graph, Paths, cycles, Isomorphic graph, Homomorphic graph, Complete graph, Regular graph, Bipartite graph, Complete bipartite graph, Operations of graphs, Shortest path problems for better skill development.

UNIT – 3 (08 Sessions)
Planar graph, Region of a graph, Euler's formula, Graph coloring, Chromatic number, Matching, Matrix representation of undirected graph and directed graph, Adjacency matrix, Incidence matrix, Path matrix and Circuit matrix for understanding for entrepreneurial skill.

UNIT – 4 (10 Sessions)
Trees: Tree, Forest, Rooted tree, Properties of trees, Binary tree, Level, Height, Balanced tree, Spanning Trees, Path length of tree, Minimal Spanning Tree, Kruskal's algorithm, Prim's algorithm, Cut Sets, Fundamentals Cut- set, Edge connectivity and vertex connectivity for better skill development.

UNIT – 5 (10 Sessions)
Combinatorics: Basic counting principles, Permutation, Combination, Pigeonhole principle, Inclusion-Exclusion principle, and discrete numeric function, Generating function, Recurrence relations for understanding entrepreneurial skill.

Course Outcomes:

CO1: Write an argument using logical notation and determine if the argument is or is not valid to develop skill.
CO2: Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described for better skill development.
CO3: Understand the basic principles of sets and operations in sets to develop skill.
CO4: Demonstrate an understanding of relations and functions and be able to determine their properties for better skill development.
CO5: Demonstrate different traversal methods for trees and graphs understanding for entrepreneurial skill.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	1	3	1	3
CO2	3	3	3	2	1	3	1	2
CO3	3	3	2	1	2	3	2	1
CO4	3	3	3	1	1	2	2	3
CO5	2	3	1	3	1	3	1	2

CO- Curriculum Enrichment Mapping

Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	2
CO2	3	**3**	1
CO3	3	1	1
CO4	3	1	2
CO5	3	**3**	1

Suggested Readings:

1. J.P. Tremblay and R.P. Manohar: Discrete Mathematics with Applications to Computer   Science, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1989.
2. Seymour Lipschutz and Marc Lars Lipson: Discrete Mathematics, Tata McGraw-Hill publishing company Limited, New Delhi.
3. N. Deo : Graph Theory with application to Engineering and Computer Science, PHI.
4. Swapan Kumar Sarkar: A text book of discrete mathematics, S. Chand & Company Pvt. Ltd.   New Delhi.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC– 204: LINEAR ALGEBRA

Objective: - The main aims of this course are to enables the students to understand the basic ideas of vector algebra, linear dependent and independent set, basis, the fundamental properties of eigenvalue, eigenvectors of a linear transformation Various types of real quadratic forms and their applications to familiar with the notion of inner product space and orthogonal vectorsto provide skill development.

UNIT-I   (10 Sessions)
Vector spaces, Linear independence, linear transformations, Matrix representation of a linear transformation, Isomorphism between the algebra of linear transformations and that of matrices knowledge for better skill development.

UNIT-II   (10 Sessions)
Similarity of matrices and linear transformations, Trace of matrices and linear transformations, Characteristic roots and characteristic vectors, Characteristic polynomials, Relation between Characteristic polynomial and Minimal polynomial, Cayley-Hamilton theorem, Diagonalizability for skill development**.**
.
UNIT-3   (10 Sessions)
Linear transformations and their algebra, Range and null space, Rank and nullity, Rank-nulity theorem, Matrix representation of linear transformations, Change of basis for better skill development.

UNIT-4   (08 Sessions)
Linear functions, Dual space, Bi-dual space, Natural isomorphism, Annihilators, Bilinear and quadratic forms to provide skill development.

UNIT-5   (10 Sessions)
Inner product spaces, Cauchy-Schwarz's inequality, Bessel's inequality and orthogonality, Hermitian, Unitary and normal transformations and their diagonalizations to provide skill development ..

Course Outcomes:

CO1: Define basic terms and concepts of matrices, vectors and complex numbers to provide skill development.
CO2: Use of various forms of complex numbers to solve numerical problems to develop skill
CO3: Apply the matrix calculus in solving a system of linear algebraic equations to develop skill
CO4: Calculate the area of planar shapes (triangle, parallelogram) and the volume of parallelepiped using vector algebra knowledge for better skill development
CO5: Find the eigenvalues and eigenvectors of a square matrix using the characteristic polynomial and will know how to diagonalize a matrix for develop skill.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	2	3	1	3
CO2	3	3	3	3	2	3	2	3
CO3	3	3	3	3	3	3	1	3
CO4	3	3	3	3	1	3	1	3
CO5	3	3	3	3	1	3	2	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. I. N. Herstein : Topics in Algebra (4th edition) –Wiley Eastern Limited, New Delhi, 2003.
2. G. E. Shilov : Linear Algebra -Prentice Hall, 1998.
3. P. R. Halmos, Van Nostrand Inc: Finite Dimensional Vector Spaces –1965.
4. D. T. Finkbeiner, D.B. Taraporevala: Introduction to Matrices and Linear Transformations (3rd edition), Bombay, 1990.
5. S. Kumaresan: Linear Algebra,A Geometric Approach –, Prentice-Hall of India Pvt.

Website Sources:
*   www.pdfdrive.com
*   www.dmi.gov.in
*   www.yourarticlelibrary.com
*   onlinecourses.nptel.ac.in
*   en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-205: COMPLEX ANALYSIS

Objective: - The main aims of this course are to enables the students to understand the strength of being analytic for a complex variable function and different properties associated with analytic functions, the integration of complex variable functions and different techniques to evaluate complex integrals the series of complex variable functions, criteria for their convergence and divergence, the singularities of complex variable functions and methods to compute residues, mapping of complex variable functions and its different types of skill development.

UNIT-1 (10 Sessions)
Powers and roots Regions in complex plane, Functions, Mapping, Limits, Continuity, Differentiability, Analytic Functions, C-R equations, Theorems on analytic functions, Harmonic functions, Milne's Thomson method to provide skill development

UNIT-2 (10 Sessions)
Elementary Complex Functions like Exponential, Logarithmic, Complex exponent, Trigonometric, Inverse trigonometric and hyperbolic functions, Cauchy's fundamental theorem for n^{th} derivative, simply and multiply connected Domains, Cauchy's integral theorem, Cauchy's integral formula, Liouville's Theorem for better knowledge of skill development.

UNIT-3 (10 Sessions)
Convergence of sequence and series, Taylor's series, Laurent's series, Uniform convergence of power series, Continuity of sums of power series, Integration and differentiation of power series, Multiplication and division of power series for knowledge of skill development.

UNIT-4 (10 Sessions)
Residues, Cauchy's residue Theorem, Residues at poles, Zeros of analytic functions, Zeros and poles, Behaviour of near Isolated Singular Points, Applications of Residues in Evaluation of improper integrals, Jordan's lemma, Indented paths, Integration along a branch cut to develop skill.

UNIT-5 (08 Sessions)
Conformal mapping, Mapping by Elementary Functions, Bilinear transformations, Mappings by the transformations 1/z, Mappings of upper half plane for develop skill.

Course Outcomes:

CO1: Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra for skill development
CO2: Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula to provide skill development.
CO3: Analyze sequences and series of analytic functions and types of convergence also represent functions as Taylor and Laurent series, classify singularities and poles for skill development
CO4: Find residues and evaluate complex integrals using the residue theorem to provide skill development.
CO5: Concepts of bilinear transformation, Principle of symmetry, conformal mapping., also constructing Mobius transformation between regions plane for develop skill.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	2	3	1	3
CO2	3	3	3	3	2	3	2	3
CO3	3	3	3	3	2	3	2	3
CO4	3	3	3	3	1	3	1	3
CO5	3	3	3	3	1	3	2	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	2	1
CO3	3	2	1
CO4	3	1	1
CO5	3	2	2

Suggested Readings:

1. V. Ruel: Churchill / James Ward Brow: Complex Variables and Applications, TMH Publication.
2. T. Pati: Function of Complex Variable, Pothisala Pvt. Ltd, Allahabad.
3. S. Ponnusamy: Foundation of complex Analysis, Narosa Publishing House, India 2005.
4. L.V. Ahlfors: Complex Analysis, 2nd Edition. McGraw-Hill International Student Edition, 1990.
5. R.R. Kumar: Complex Analysis, Pearson Education, 2015.
6. R. Churchill and J.W. Brown, Complex Variables and Applications, 6th Edition. New- York, McGraw-Hill, 1996.

Website Sources:

- www.pdfdrive.com
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- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-301: FLUID DYNAMICS

Objective: -The main aims of this course are to introduce fundamental aspects of fluid dynamics for its fluid flow behaviour. Students will learn to develop steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machineryto develop skill.

UNIT-1 **(10 Sessions)**
Kinematics of fluids: Lagrange's and Euler's Method, Stream lines, Equation of continuity, Boundary surface equation of motions of non-viscous fluids , Euler's equation of motion (Vector form), Bernoulli's pressure equation, Equation for impulsive motion (vector form)to provide skill development.

UNIT-2 **(10 Sessions)**
Motion in two dimensions: Stream function, Complex potential of the motion, Sources and sinks in two dimensions, Doublets, Images to develop skill

UNIT-3 **(08 Sessions)**
General theory of irrotational motion: Flow and circulations, Permanence of irrotational motion, Kelvien's circulation theorem , Minimum Energy theorem , Kutta –Joukowski theorem, Kinetic Energy of infinite liquid, Motion of cylinders, Motion of a circular cylinder, Liquid Streaming passed a fixed circular cylinder for understanding entrepreneurial skill.

UNIT-4 **(10 Sessions)**
Irrotational Motion in three Dimensions: Motion of a sphere, Sphere through a liquid at rest at Infinity, Liquid streaming passed a fixed sphere, Equation of a sphere, Stokes stream function to provide skill development.

UNIT-5 **(10 Sessions)**
Stress components in a real fluid, Relation between rectangular components of stress connection between stresses and gradients of velocity, Navier – Stoke's equations of motions, plane Poiseuille and Couette flows between two parallel plates for entrepreneurship & skill development.

Course Outcomes:

CO1: Apply knowledge of mathematics, science and engineering to arrive solutions for skill development.
CO2: Identify, formulate and analyze engineering problems through technical literature to develop skill.
CO3: Design a component, a process and a system to meet desired needs considering economic, environmental, social, ethical, health and safety, manufacturability and sustainability understanding for entrepreneurial skill.
CO4: Conduct experiment, analyze and interpret data to arrive valid conclusions**.**
CO5: Use the techniques, skills, and modern engineering tools for modeling and prediction of problems by understanding the Limitations for entrepreneurship & skill development.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	3	3	2	2	1	3
CO2	1	3	3	3	2	2	2	3
CO3	3	2	3	3	3	3	2	1
CO4	1	2	3	1	1	1	1	3
CO5	3	3	2	1	3	3	2	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	2	1
CO3	3	2	1
CO4	3	1	2
CO5	3	2	2

Suggested Readings:

1. G.K. Bachlor: An introduction to Fluid Mechanics, foundation book.
2. H. Schnichting: Boundary layer theory Mc. Graw Hill, book company.
3. R.K. Rathy: An Introduction to Fluid Dynamics, Oxford &IBH publishing company.
4. W.H. Besaint and A.S. Ramsey: A Treatise on Hydromechanics, part II, CBS publication.
5. A.J. Chorin and A. Marsden: A Mathematical introduction to Fluid Dynamics, Springer-Veriag New York
6. M. D. RaiSinghania: Fluid Dynamics, S. Chand Publication, New Delhi.
7. M. Ray: Fluid Dynamics, Ram Prasad and Sons, Agra.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-302: NUMERICAL ANALYSIS

Objective: -The main aims of this course are to introduce a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering. The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods, along with a rudimentary understanding of finite precision arithmetic and the conditioning with stability of the various problems and methods. This will help to choose, develop and apply the appropriate numerical techniques for your problem, interpret the results, and assess accuracy for skill development.

UNIT - 1 **(10 Sessions)**
Interpolation with Equal Intervals: Introduction, Newton's-Gregory forward and Newton's-Gregory backward interpolation formulae, Central differences, Gauss's forward and Gauss's backward interpolation formulae, Stirling's formula, Bessel's formula and Laplace-Everett formula to provide skill development.

UNIT - 2 **(08 Sessions)**
Interpolation with Unequal Intervals: Introduction, Divided differences, Divided difference table, Newton's divided difference formula, Lagrange's interpolation formula, Lagrange's inverse formula, Hermite interpolation formula.
Numerical Differentiation: Introduction, Derivatives of Newton's forward and Newton's backward interpolation formulae, Derivative of Stirling's formula, Maxima and minima for skill development.

UNIT - 3 **(10 Sessions)**
Numerical Integration: Introduction, General quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Boole's, Weddle's rule and applications to provide skill development.
Numerical Solution of Ordinary Differential Equations: Introduction, Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge–Kutta's methods and Predictor-Corrector methods to provide skill development.

UNIT - 4 **(10 Sessions)**
Solution of Simultaneous Algebraic Equations: Introduction, Gauss's elimination method and with pivoting, Gauss-Jordan Method, Jacobi's iteration method and Gauss - Seidal iteration method and III-Conditioned system of linear equations for skill development.

UNIT - 5 **(10 Sessions)**
Solution of Algebraic and Transcendental Equations: Introduction, Bisection method, Regula - falsi method, Iteration method, Newton - Raphson method, Graeffe's root squaring method and rate of convergence of Newton – Raphson method for entrepreneurship & skill development.

Course Outcomes:

CO1: Derive numerical methods for various mathematical operations and tasks such as interpolation, Differentiation, linear and nonlinear equations for entrepreneurship & skill development.
CO2: Derive numerical methods to find out solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations to provide skill development.
CO3: Apply various interpolation methods with finite difference concepts for skill development.
CO4: Work out numerical differentiation and integration whenever and wherever routine methods are not applicable for skill development.
CO5: Derive numerical methods for solving ordinary differential equations with certain initial and boundary conditions for entrepreneurship & skill development.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	2	3	2	3	1	1
CO2	2	3	3	2	1	3	1	3
CO3	3	3	3	3	3	3	1	3
CO4	1	3	2	3	3	3	2	1
CO5	3	3	1	3	3	3	2	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	3	1
CO3	3	1	1
CO4	3	2	1
CO5	3	3	2

Suggested Readings:

1. V. Rajaraman: Computer Oriented Numerical Methods, PHI.
2. Gupta & Malik: Numerical Analysis, Krishna Publication, Meerut.
3. B. S. Grewal: Numerical methods in Engineering and Science, Khanna Publishers, Delhi.
4. Pradip Niyogi: Numerical Analysis and Algorithms, TMH.
5. R. K. Jain, Iyenger: Numerical Analysis, New age publication, Delhi.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-303: PARTIAL DIFFERENTIAL EQUATIONS

Objective: -The main aims of this course are to familiarize the students with the fundamental concepts of Partial Differential Equations (PDE) which will be used as background knowledge for the understanding of specialized courses in the field of science by solving homogeneous heat, wave, Laplace's equations, characteristics of Integral Transforms, special functions and orthogonal polynomials, Sturm-Liouville and generalized fourier series, PDE's in higher dimensions and numerical methods for PDE problems to provide skill development**.**.

UNIT I   **(10 Sessions)**
Lagrange's equations, Charpit's method, Jacobi's method for solving a non- linear first order P.D.E in two variables, Cauchy Problem for First order P.D.Es. to develop skill

UNIT II   **(10 Sessions)**
PDEs of order two with variables coefficient, Monge's method, Method of Separation of variables for Laplace, Heat and Wave Equations, Solution of Boundary value Problems by Laplace Transformation for better skill and entrepreneurship.

UNIT III   **(10 Sessions)**
Solution of Laplace Heat and wave equations in Cartesian, Polar, Cylindrical, Application of sine and cosine transforms and their finite fourier to solve boundary value Problems to provide skill development.

UNIT IV   **(08 Sessions)**
Calculus of variations: Variations of a functional, Euler- Lagrange's equations, Necessary and sufficient conditions for extrema, Variational method for boundary value problem in ordinary and partial differential equations for better skilling of entrepreneurship.

UNIT V   **(10 Sessions)**
Numerical Solution of Partial Differential Equations: Solution of Laplace equation: Solution of Laplace equation by Liebmann's method, Jacobi method, Solution of Poisson's equations, Solution of heat equations by Bender- Schmidt and Crank-Nicholson methods, Solution of Wave equation to develop skill.

Course Outcomes:

CO1: Classify partial differential equations and transform into canonical form to develop skill.
CO2: Solve linear partial differential equations of both first and second order for entrepreneurship.
CO3: Apply partial derivative equation techniques to predict the behavior of certain phenomena to provide skill development..
CO4: Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of Specialization for better skills.
CO5: Extract information from partial derivative models in order to interpret reality to develop skills.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	3	3	2	1	2	3
CO2	3	3	3	3	3	3	1	3
CO3	3	3	1	3	3	2	2	1
CO4	3	3	3	2	3	3	3	3
CO5	3	1	3	3	3	3	2	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	2	1
CO3	3	1	2
CO4	3	1	2
CO5	3	3	1

Suggested Readings:

1. N. Sharma & Dr. R.K. Gupta : Differential Equations : Krishna Prakashan Media (P) Ltd. Meerut.
2. M.D. Raisinghania : Advanced Differential Equations: Including Boundary Value Problems, Laplace Transform & Its Applications : S.Chand and company Ltd, Delhi.
3. I.N. Sneddon: Elements of Partial Differential Equation, 3rd Edition. McGraw Hill BookCompany, 1998.
4. E.T.Copson: Partial Differential Equations, 2nd Edition. Cambridge University Press, 1995.
5. N. Kumar and R. Kumar : Partial Differential Equations with Numerical Solutions, Real world Education, New Delhi.

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- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHDE-304(A): MATHEMATICAL METHODS

Objective: The main aims of this course are to prepare the student with mathematical tools and techniques that are required in advanced courses offered in the applied mathematics and engineering programs. It also enables students to apply to develop skills for transforms and variation problem technique for solving differential equations and extremum problems.

UNIT-1 **(12 Sessions)**
Fourier series and transforms, Determination of Fourier coefficients, Fourier series, Even and Odd functions, Fourier series in an arbitrary interval, Half-range Fourier sine and cosine series for entrepreneurship & skill development.

UNIT-2 **(10 Sessions)**
Fourier integral theorem (without proof)– Fourier sine and cosine integrals, Fourier transforms, Fourier sine and cosine transforms and their properties, Inverse transforms, Finite Fourier transforms, Discrete Fourier transforms for better knowledge skill **development**.

UNIT-3 **(10 Sessions)**
Z-transforms: Introduction, Definition, Some standard Z-transforms, Initial and final value theorems, Z-transforms properties, Inverse Z-transforms, Convolution theorem, Solution of difference equations using Z-transforms for skill development.

UNIT-4 **(10 Sessions)**
Series Solution of ODE, Special function**,** Power series method, Legender's equation, Legender's polynomial, Generating function of Legender polynomial, Orthogonal property, Recurrence relations, Laplace transformation of first kind and second kind for $P_n(x)$ and its problems for better skilling of entrepreneurship.

UNIT-5 **(08 Sessions)**
Bessel's equation and its solution, Generating function for Bessel's function, Recurrence relations, Bessel's function of first and second kind, Sine and cosine series for Bessel's function for skill development.

Course Outcomes:

CO1: To represent periodic functions using Fourier series for entrepreneurship.
CO2: Learn Fourier transformation and their applications to relevant problems for skill development.
CO3: Solve finite difference equations using Z-transforms to develop skills.
CO4: Get an idea of power series method to solve differential equations Familiar with Legendre equation and Legendre polynomial for better skilling of entrepreneurship.
CO5: Discuss various properties of the Bessel's function for skill development.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	2	3	1	3
CO2	3	3	3	1	2	3	1	3
CO3	3	3	3	3	1	3	2	3
CO4	3	3	3	2	1	3	1	3
CO5	3	3	3	3	1	3	2	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	2
CO2	3	2	1
CO3	3	1	1
CO4	3	2	1
CO5	3	1	2

Suggested Readings:

1. Erwin Kreyszig:Advanced Engineering Mathematics (Second edition), Michael Greenberg, John Wiley & Sons, (10th Edition).
2. I.N. Sneddon : The use of Integral Transforms, Tata McGraw Hill, Publishing Company Ltd, New Delhi,1974.
3. R.P. Kanwal: Linear integral equations theory and techniques, Academic Press, New York, 1971.
4. C.M. Bender and S.A. Orszag : Advanced mathematical methods for scientists and engineers, McGraw Hill, New York, 1978.
5. H.T. Davis: Introduction to nonlinear differential and integral equations, Dover Publications, 1962.

Website Sources:

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- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC-401: OPERATIONS RESEARCH

Objective: -The main aims of this course are to help the students for solving problems in different environments that needs decisions. This module aims to introduce students to use quantitative methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems as well as to our daily life in science and engineering for skill development.

UNIT – 1 (10 Sessions)
Basics of Operations Research: Definitions of operations research, Scope of operations research, Phases of operations research, Models in operations research, Uses and limitations of operations research.
Linear Programming Problems: Definition, Formulation of LPP, Advantages of LPP, Limitations of LPP, Application areas of LPP, Graphical method for solving LPP, Simplex method, Big-M simplex method, Two-Phase simplex method knowledge for better skill development.

UNIT – 2 (10 Sessions)
Duality in Linear Programming Problems: Definition, Formulation of dual problem, Advantages of duality, Characteristics of dual problem and Dual simplex method.
Integer Linear Programming Problems: Definition, Applications of integer programming, Types of Integer programming problems, Gomory's all integer cutting plane method and Branch and bound method for skill development.

UNIT – 3 (10 Sessions)
Replacement Models: Definition, Types of failure, Replacement of items whose efficiency deteriorates with time, Replacement of equipment that deteriorates with time and Replacement items that fail completely.
Inventory Control: Definition, Types of inventories, Inventory control terminology, Economic order quantity, Inventory control models without shortages, Inventory control models with shortages, EOQ models with quantity discounts with one-price break and Two-Price break knowledge for better skill development.

UNIT – 4 (10 Sessions)
Queuing Theory: Definition, Essential features of a queuing system, Performance measures of a queering system, Probability distributions in queuing system, Classification of queuing models and their solution, Single server queuing models I, II, III and Multi-Sever queuing models for skill development.

UNIT – 5 (08 Sessions)
Game Theory: Definition, Pay-off, Types of games, The maximine-minimax principle, Principles of dominance, Games without saddle points (Mixed strategies), Solution of games by Graphical method and Linear programming method.
Non-Linear Programming Problem: Definition, Lagrange multiplier method, Quadratic programming and Kuhn-Tucker conditions for skill development.

Course Outcomes:

CO1: Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method, demonstrate the solution process by hand and solver for skill development.
CO2: Explain the relationship between a linear program and its dual, including strong duality and complementary slackness for skill development.
CO3: understand the methods used by organizations to obtain the right quantities of stock or inventory also familiarize themselves with inventory management practices knowledge for better skill development.
CO4: To analyze a network of queues with Poisson external arrivals, exponential service requirements and independent routing to develop skill.
CO5: Demonstrate solution methods including graphs and linear programming to analyze and solve the Two-person, zero-sum Games for skill development.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	2	3	3	3
CO2	3	3	3	3	3	3	2	1
CO3	3	3	3	3	1	3	3	3
CO4	3	3	3	2	3	1	2	3
CO5	3	3	3	1	2	3	1	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	3	1
CO2	3	3	1
CO3	3	3	2
CO4	3	1	2
CO5	3	3	1

Suggested Readings:
1. H. A. Taha: Operations Research an introduction, Macmillan.
2. J. K. Sharma: Operations Research Theory and Applications, Macmillan India Ltd.
3. V. K. Kapoor: Operations Research, Sultan Chand and Sons, New Delhi.
4. S. D. Sharma: Operations Research, Kedarnath & Ramnath and Company.

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- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHCC- 402: MATHEMATICAL STATISTICS

Objective: -The main aims of this course are to enable the students with understanding of various types of probability distributions and testing of hypothesis problems. Its aim to equip the students with standard concepts of statistical techniques and their utilization in the field of science to develop skills.

UNIT-1 **(10 Sessions)**
Probability set theoretic approach, Baye's theorem, Geometric probability, Random variables: Distribution function, Joint probability distribution, Conditional distribution function to develop skills.
.

UNIT-2 **(10 Sessions)**
Mathematical Expectation, Expectation of continuous random variable, Moment generating functions, Cumulant and characteristic functions, Weak law and Bernoulli's Laws of large numbers for develop skill.
.

UNIT-3 **(10 Sessions)**
Distributions: Bernoulli, Binomial, Poisson and Normal distributions, Central limit theorem to provide skill development.

UNIT-4 **(08 Sessions)**
Correlation and Regressions, Method of least square, Fitting of a straight line, Parabola and exponential curves.
Derivation of Chi-square distribution, Goodness of fit, Test of significance, t-test and F-test for skill development.

UNIT-5 **(10 Sessions)**
Analysis of variance, Analysis of variance in one way and two ways classification, Theory of estimation, Principle of maximum likelihood, Properties of maximum likelihood estimators to provide skill development..

Course Outcomes:

CO1: Recognize the importance and value of mathematical and statistical thinking, training, and approach to problem solving, on a diverse variety of disciplines for skill development.
CO2: Be familiar with a variety of examples where mathematics or statistics helps accurately explain abstract or physical Phenomena for skill development.
CO3: Recognize and appreciate the connections between theory and applications to provide skill development..
CO4: Be able to independently read mathematical and statistical literature of various types, including survey articles, scholarly books, and online sources for entrepreneurship
CO5: Be life-long learners who are able to independently expand their mathematical or statistical expertise when needed, or for interest's sake to provide skill development.

Mapping Course Outcomes(COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	3	3	2	3
CO2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	1	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	3	2
CO3	3	3	2
CO4	3	1	1
CO5	3	3	1

Suggested Readings:

1. J. Medhi : Statistical Methods , New age International (P) Ltd.
2. J.K.Ghosh : Mathematical Statistics , John Wiley & Sons , New York .
3. Hogg : Introduction of Mathematical Statistics, Pearson Education.
4. S. C. Gupta & V. K. Kapoor : Advanced Statistics, S. Chand.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHDE – 403 (B): DIFFERENCE EQUATIONS

Objective: -The main aims of this course are to understand application of sequences and series of numbers and functions, partial difference equations, Discrete boundary value problem, Application with different engineering problem, Discrete mathematical models for entrepreneurship & skill development.

UNIT-1 (10 Sessions)
Introduction, Difference Calculus – The Difference Operator Summation, Generating functions a approximate summation.
Linear Difference Equations – First order equations, General results for linear equation. Equations with constant coefficients Applications, Equations with variable coefficients, nonlinear equations that can be linearized and the z-transform for skill development.

UNIT-2 (10 Sessions)
Stabilty Theory- Initial value problems for linear systems, Stability of linear systems, Stability of nonlinear systems, Chaotic behavior.
Asymptotic methods – Introduction, Asymptotic analysis of sums, Linear equations, Nonlinear equations to develop skill.

UNIT-3 (10 Sessions)
The self-adjoint second order linear equation – Introduction Sturmian Theory, Greens functions, Disconjugacy, The Riccati Equations and Oscillation.
The Sturm-Liouville problem- Introduction, Finite Fourier analysis, A non-homogeneous problem to develop skill.

UNIT-4 (08 Sessions)
Discrete Calculus of variations- Introduction, Necessary conditions, Sufficient conditions and Disconjugacy for skill development.

UNIT-5 (10 Sessions)
Boundary Value Problems for Nonlinear equations- Introduction, The Lipschitz case, Existence of solutions, Boundary value Problems for differential Equations, Partial differential Equations, Discretization of Partial Differential Equations, Solution of partial differential equations for skill development.

Course Outcomes:

CO1: Apply the theory to study the qualitative theory of solutions of difference equations and partial difference equations of higher Order knowledge for better skill development.
CO2: Apply the theory to study the quantitative and qualitative study of solutions of different discrete models in Engineering to develop skill.
CO3: Difference between the qualitative and quantitative behavior of solutions of the difference equations and the corresponding differential equations entrepreneurship.
CO4: Apply the theory to study the solution in discrete boundary value problems to provide skill development.
CO5: Apply difference equations to find solution of Boundary Value Problems for Nonlinear equations for skill development.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	2	1	3
CO2	3	3	3	3	2	1	2	3
CO3	3	3	3	3	2	1	2	3
CO4	3	3	3	3	1	2	1	3
CO5	3	3	3	3	1	1	1	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	**3**	1
CO2	3	1	1
CO3	3	**3**	1
CO4	3	1	1
CO5	3	**3**	1

Suggested Readings:

1. M. D. Rai Singhaniya: Differential equations, S. chand Publications.
2. Difference equations : Schaum's Outlines, TMH.
3. Fulford Glenn R. : Modelling with Differential and Difference Equations, Cambridge University Press.
4. Youssef N. Raffoul : Qualitative Theory of Volterra Difference Equations, Springer International Publishing AG.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHOE – 402: OBJECT ORIENTED PROGRAMMING WITH C++

Objectives: The main aims of this course are to provide flexible and powerful abstraction, allow programmers to think in terms of the structure of the problem rather than in terms of the structure of the computer, decompose the problem into a set of objects, Objects interact with each other to solve the problem, create new type of objects to model elements from the problem space skill development and employability.

Unit-1 (10 Sessions)
Principles of Objective Oriented Programming Object Oriented Programming Paradigm, Basic Concepts of Object Oriented Programming, Benefits of Object Oriented Programming, Object Oriented Languages, Applications of Object Oriented Programming knowledge for better computer skill.

Unit-2 (10 Sessions)
Token Expressions & Control Structures Tokens, Keywords, Identifiers and Constants, Data Types, Type Compatibility, Variables, Operators in C++, Implicit Conversions, Operator Overloading, Operator Precedence, Control Structures knowledge for better computer skill.

Unit-3 (10 Sessions)
Functions in C++, Classes &Objects. The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Function Overloading, Friend and Virtual Functions. Specifying a class, Member Functions, Arrays within a class, Static Member Functions, Arrays of Objects, Friendly Functions for better skilling of entrepreneurship.
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Unit-4 (10 Sessions)
Constructors & Destructors, Operator Overloading, Inheritance Constructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, Defining Operator Overloading, Overloading Operators, Rules for Overloading Operators, Type Conversions to provide research oriented skill development.

Course Outcomes:

CO1: Understand basic concepts and applications of OOP's for better skilling of entrepreneurship.
CO2: Develop the ability to understand the control structures, Date Types and operators entrepreneurship.
CO3: Familiar with the functions, classes and objectsfor interdisciplinary skills.
CO4: Develop the ability to understand the special functions like constructors and destructors for research oriented skill development.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes (POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	3	3	2	3
CO2	2	3	2	3	3	3	1	3
CO3	3	3	1	2	3	3	1	3
CO4	3	3	1	2	3	3	1	3

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	2	1
CO2	3	2	1
CO3	3	3	2
CO4	3	3	2

Suggested Readings:

1. Rumbaugh, Object Oriented Design, Pearson publication.
2. Robert Lafore, Object-oriented programming in Turbo C++ , Galgotia Publication.
3. E. Balagurusamy, Object-oriented programming with C++ , TMH.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

MATHP-405: PROJECT & VIVA- VOCE

Objective: -The main aims of this course are to understand applications various subjects to study in previous semesters for the interest of students to provide research oriented skill development.

Course Outcomes:

CO1: Demonstrate knowledge and understanding of fundamental concepts of Research ability and writing skills and develop interdisciplinary skill.

CO2: Give the essence of the proof of the different theorems studied in the previous courses knowledge for better computer skill development.

CO3: Work out to enhance the previous knowledge differentiation and integration whenever and wherever routine methods are not Applicable to develop good writing skills.

CO4: Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method, demonstrate the solution process by hand and solver to provide research oriented skill development.

CO5: Demonstrate solution methods including graphs and programming to analyze and solve the mathematical problems understanding for better problems solving skill.

Mapping Course Outcomes (COs) leading to the achievement of Programme Outcomes(POs):
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	3	2	2
CO2	3	3	3	3	3	3	1	2
CO3	3	1	3	3	3	3	1	1
CO4	3	3	3	3	1	3	2	1
CO5	3	3	3	3	3	3	2	1

CO- Curriculum Enrichment Mapping
Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped

	Skill Development	Employability	Entrepreneurship
CO1	3	1	1
CO2	3	1	1
CO3	3	3	1
CO4	3	3	1
CO5	3	1	1

Suggested Readings:

1. John B. Fraleigh: A First Course in Abstract Algebra, Pearson Education India..
2. I. N. Herstein: Topics in Algebra,2nd Edition , John Wiley & Sons. Copyright.
3. T. Apostol: Mathematical Analysis (5th edition), Addison-Wesley Pub.
4. R. G. Bartle and D. R. Sherbert : Introduction to Real Analysis (3rd edition), John Wiley &Sons, Inc.
5. D. M. Burton: Elementary Number Theory (4th edition) –Universal Book Stall, New Delhi,2002.
6. Shepley. L. Ross : Differential Equations, Wiley India (Pvt.) Ltd.
7. James R. Munkres: Topology, 2nd Edition (Jan 7, 2000), Prentice Hall, ISBN-10:0131816292, ISBN-13: 978-0131816299.
8. Seymour Lipschutz and Marc Lars Lipson: Discrete Mathematics, Tata McGraw-Hill publishing company Limited, New Delhi.
9. S. Kumaresan: Linear Algebra, A Geometric Approach –, Prentice-Hall of India Pvt.
10. Erwin Kreyszig: Introduction to functional Analysis with Application, John wiley & Son Inc. New York.
11. M. D. Rai Singhania: Fluid Dynamics, S. Chand Publication, New Delhi.
12. R. K. Jain, Iyenger: Numerical Analysis, New age publication, Delhi.

13. I.N. Sneddon: Elements of Partial Differential Equation, 3rd Edition. McGraw Hill BookCompany, 1998.
14. H. A. Taha: Operations Research an introduction, Macmillan.
15. V. K. Kapoor: Operations Research, Sultan Chand and Sons, New Delhi.

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- en.wikipedia.org

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