M. Sc. Tech Mathematics (Part I) (Semester I)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT 101**
Title of Paper: **Algebra**

Unit I: **15 Lectures**

Groups, subgroups, Cosets, Lagrange's theorem, normal subgroups, quotient groups, homomorphism, isomorphism theorems, Conjugacy Class, Class equation, simple groups.

Unit II: **15 Lectures**

Sylow theorems, Normal and subnormal series, composition series, Jordan holder theorem. Solvable groups, simplicity of A_n ($n > 5$).

Unit III: **15 Lectures**

Rings, homomorphisms, ideals, Quotient rings, prime ideals, maximal ideals, field of quotients of an integral domain, Euclidean rings, Unique factorization domains, principal ideal domain. Polynomial rings.

Unit IV: **15 Lectures**

Eisenstenin's criterion of irreducibility. Chain conditions on rings. Noetherian and Artinian rings. Modules, Sub modules. Quotient modules. Homomorphism and Isomorphism theorems.

Recommended Books :

1. Topics in algebra in I. N. Herstein. Vikas publishing House.
2. " A first course in Abstract Algebra" by John Fraleigh (3rd Edition), Narossa Publishing House, New Delhi.

Reference Books:

1 " Basic Abstract Algebra" by Bhattacharya, Jain and Nagpal, 2nd Edition.
2. " Algebra" by S.Mcclane and G.Birkhoff, 2nd Edition,
3. " Basic Algebra" by N.Jacbson, Hind.Pub.Corp.1984.

M. Sc. Tech Mathematics (Part I) (Semester I)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: MT 102
Title of Paper: Advanced Calculus

Unit 1 **15 Lectures**

Metric spaces, Limits in a metric space, continuous functions on metric spaces, open sets, closed sets, connected sets, bounded sets, totally bounded sets, complete metric space, compact metric space, Continuous functions on compact metric spaces, Continuity of the inverse function, Uniform continuity.

Unit 2 **15 Lectures**

Sequences of real numbers, convergent sequence, Cauchy sequence, absolute and conditional convergence, Sequences of functions: Pointwise convergence of sequences of functions, Examples of sequences of real valued functions, Definition of uniform convergence, Uniform convergence and continuity, Cauchy condition for uniform convergence, Uniform convergence and Riemann integration, Uniform convergence and differentiation

Unit 3 **15 Lectures**

Series of functions: Rearrangement of series, subseries, double series, Rearrangement theorem for double series, Multiplication of series, Power series, multiplication of power series, substitution theorem, The Taylor series generated by function, Bernstein's theorem, Binomial series, Abel's limit theorem, Taubers theorem.

Unit 4 **15 Lectures**

Multivariable differential Calculus: The Directional derivatives, directional derivatives and continuity, total derivative, total derivatives expressed in terms of partial derivatives, The matrix of linear function, Jacobin matrix, Chain rule, mean value theorem for differentiable functions, A sufficient condition for differentiability, sufficient condition for equality of mixed partial derivatives, Taylor's formula for functions from Rn to R1. The inverse function theorem (Statement only) , The implicit function theorem (Statement only) and their applications. Extrema of real valued functions of one variable, Extrema of real valued functions of several variables.

Recommended Books :

1) Methods of Real Analysis, R. R. Goldberg, Wiley.
2) Mathematical Analysis, T. M. Apostal, Second Edition, Narosa Publishing House.

Reference Books:

1) Principles of mathematical Analysis, Walter Rudin, third Edition, McGraw Hill book company
2) Analysis on Manifolds by J.R. Munkers (Addision Wesely)

M. Sc. Tech Mathematics (Part I) (Semester I)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper : **MT 103**
Title of Paper: **Discrete Mathematical Structures - I**

Unit I: **15 Lectures**

Formal Logic-Statements. Symbolic Representation and Tautologies. Quantifiers, Predicates and Validity. Propositional Logic. Lattices: Partially ordered sets and Lattices, lattices as algebraic systems `sub-lattices, direct product and Homomorphisms. complete lattices.

Unit II: **15 Lectures**

Modular lattices, distributed lattices, the complemented lattices, convex sub lattices, Congruence relations in lattices. Conversion of Boolean Algebra in to Boolean rings and vice versa.

Unit III: **15 Lectures**

Boolean Algebras-Boolean Algebras as Lattices. Various Boolean identities. The Switching algebra. Sub algebras, Direct Products and Homomorphism. Join irreducible elements, Atoms and Minterms. Boolean Forms, Applications of Boolean algebra to Switching Theory.Graphs, complete graphs, regular graphs, bipartite graphs.

Unit IV: **15 Lectures**

Vertex degree, subgraphs, paths and cycles, the matrix representation of graphs, fusion, trees and connectivity, bridges, spanning trees, connector problems, shortest path problems, cut vertices and connectivity.

Recommended Books:

1) Kolman, Busby and Ross, Discrete mathematical structures, 4th edition. PHI, 2002.
2) G. Gartzer, General Lattice theory. AMS.
3) John Clark and Derek Allan Holton, A First Look At Graph Theory Allied Publishers Limited.

Reference Books:

1) C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co.
2) M. K. Sen, and B. C. Chakraborty, Introduction to Discrete Mathematics. Allied Publishers.
3) Goodaire and Parmenter, Discrete Mathematics with Graph Theory, Pearson edition. 2nd edi.
4) N. Deo, Graph Theory with Applications to Engineering and Computer Sciences, Prentice Hall of India
5) Herikrishna, Sandeep Kumar, Discrete Mathematics, Pragati Prakshan.
6) J. L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.
7) Seymour Lepschutz, Finite Mathematics (International edition 1983), McGraw-Hill Book Company, New York.
8) S. Witala, Discrete Mathematics – A Unified Approach, McGraw-Hill Book Co.

M. Sc. Tech Mathematics (Part I) (Semester I)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT 104**
Title of Paper: **Computer Architecture**

Unit I: **15 Lectures**

Digital Logic Circuits : K-map Multiplexers, Logic Gates, Combinational Logic – Adder, Subtractors, multiplexers, Demultiplexers. **Sequential logic –** SR Flip flop, D Flip flop, JK Flip flop, **Registers** – 4-bit register, 4-bit register with parallel load, **Shift Registers** - 4-bit register shift register, **Counters -** Ripple Counters, Synchronous counters, Asynchronous counters.

Unit II: **15 Lectures**

Memory Organization: Memory Hierarchy, Main memory – RAM and ROM chips, memory address map, memory connection to CPU. hardware organization of Auxiliary memory, hardware organization of Associative Memory, Cache memory. Virtual memory – Address and memory space, address mapping using pages, Direct Memory Access (DMA)

Unit III: **15 Lectures**

Pipeline and Vector Processing: **P**arallel processing, pipelining general considerations, Arithmetic pipeline, instruction pipeline, data dependency, handling of branch instructions, RISC pipeline, delayed load, delayed branch, Vector processing, vector operation, matrix multiplication, Memory interleaving.

Unit IV: **15 Lectures**

Multiprocessors : Characteristics of multiprocessors Interconnection structures – time sharing common bus, multiport memory, crossbar switch, multistage switch network, hypercube interconnection. Interprocessor communication and synchronization.

Recommended Books :

1. Computer System Architecture – M. Moris Mano
2. H.S. Stone, Introduction to Computer Architecture, Galgotia.
3. J.P. Hayes, Computer Architecture and Organization, McGraw-Hill.

Reference Books:

1. K. Hwang & F.A. Briggs, Computer Architecture & Parallel Processing, McGraw-Hill.
2. P.M. Kogge, The Architecture of Pipelined Computers, McGraw-Hill.
3. J.L. Hennessy & D.A. Patterson, Computer Architecture : A Quantitative Approach, Morgan Kauffmann.
4. J.G. Mayers, Advances in Computer Architecture, John Wiley.
5. Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, Data Structures using C, Prentice-Hall of India Pvt. Ltd. New Delhi, 1994.

M. Sc. Tech Mathematics (Part I) (Semester I)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT105**
Title of Paper: **Programming in C**

Unit I: **15 Lectures**

An overview of programming & Programming languages, Structure of C Program, Variables, Keywords and Constants, Data Types, **C instructions and Operators:** Unary plus and minus operators, Binary Arithmetic operators, Increment and Decrement Operators, Relational Operators, Logical Operators, Assignment Operator, storage classes in C.

Unit II: **15 Lectures**

Decision control structures: If Statements, if else, nested if-else, forms of if, Conditional operators. **Loop control structures:** while loop, for loop, odd loop, nested loop, do-while loop, The BREAK and CONTINUE statements. **Case control structures:** Switch Case, GOTO statement.

Unit III: **15 Lectures**

Functions and Pointers: Declarations and calls, Passing arguments, Recursion, pointer declaration, operations on pointers. **Arrays:** Concepts and Declarations of an Array, Initializing Arrays, Passing entire Arrays to Functions, 2-D Arrays, Passing Arrays as Function Arguments, Dynamic Memory Allocation, Bit-Manipulation Operators.

Unit IV: **15 Lectures**

Structures and unions: Use of Structures and Unions. **File Input / Output:** File Operations, File opening Modes. **Graphics in C:** Concepts, initgraph, close graph, Simple programs. **C Preprocessor:** Macro expansion, file inclusion, conditional compilation.

Recommended Books:

Let us C, Yeshwant Kanetkar, BPB publications.

Reference Book:

Programming in C, Schaum Series, Tata McGraw Hill.

M. Sc. Tech Mathematics (Part I) (Semester I)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper – **MT 106**
Title of Paper: **Lab Work I**

Specific Objectives: **Objectives are to apply theory studied in computer based papers in the semester.**

The programs related to Programming in C.

M. Sc. Tech Mathematics (Part I) (Semester II)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT 201**
Title of Paper: **Real Analysis**

UNIT I: **15**
Lectures
Open Sets, closed sets and Borel sets of real numbers, Lebesgue outer measure, The sigma algebra of Lebesgue measurable sets, Outer and inner approximation of Lebesgue measurable sets, Countable additivity, Continuity and Borel-Cantelli lemma, Non measurable Sets.

UNIT II: **15**
Lectures
Sums, product and composition of measurable functions, sequential pointwise limits and simple approximation, Littlewood's three principles, Egoroff's theorem, and Lusin's theorem, Lebesgue integration of a bounded measurable function.

UNIT III: **15**
Lectures
Lebesgue integration of a non-negative measurable function, The general Lebesgue integral, Characterization of Riemann and Lebesgue integrability, Differentiability of Monotone Functions, Lebesgue's theorem, functions of bounded variations, Jordan's theorem.

UNIT IV: **15**
Lectures
Absolutely continuous functions, integrating derivatives: differentiating indefinite integrals, normed linear spaces, The inequalities of Young, H lder and Minkowski, The Riesz-Fischer Theorem.

Recommended Book:
1. H. L. Royden, P.M. Fitzpatrick, Real Analysis, Fourth Edition, PHI Learning Pvt. Ltd., New Delhi, 2010

Reference Books:
1. G. de Barra, Measure Theory and Integration, New Age International (P) Ltd., 1981.
2. I. K. Rana, An Introduction to Measure and Integration, Narosa Book Company, 1997.
3. S. K. Berberian, Measure and Integration, McMillan, New York, 1965.
4. P. K. Jain, V. P. Gupta, Lebesgue measure and Integration, Wiley Easter Limited, 1986.
5. W. Rudin, Principles of Mathematical Analysis, McGraw-Hill Book Co, 1964.
6. P. K. Halmos, Measure Theory, Van Nostrand, 1950.

M. Sc. Tech Mathematics (Part I) (Semester II)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT – 202**
Title of Paper: **Operations Research**

Unit – I **15 lectures**

Convex sets and their properties: Lines and hyper planes, convex sets , Important Theorems, polyhedral convex set, Convex combination of vectors, convex hull, Convex polyhedron, convex cone, simplex and convex function, General formulation of linear programming problem, Matrix form of LP problem, definitions of standard LPP, Fundamental Theorem of linear programming,

Unit- II **15 lectures**

Simplex method, Computational procedure of simplex method, problem of degeneracy and method to resolve degeneracy. Revised simplex method in standard form I, Duality in linear programming, duality theorems, Integer linear programming, Gomory's cutting plane method, Branch and Bound method.

Unit – III **15 lectures**

Integer linear programming, Gomory's cutting plane method, Branch and Bound method, Dynamic programming, Bellman's principle of Optimality, solution of problems with a finite number of stages . Applications of dynamic programming in linear programming.

Unit – IV **15 lectures**

Non linear programming, unconstrained problems of maximum and minimum, Lagrangian method, Kuhn Tucker necessary and sufficient conditions, Wolfe's method, Beale's method.

Recommended Books:

1) S.D.Sharma : Operations Research, Kedar Nath Ram Noth and co.

Reference Books

1.Kambo, Mathematical Programming
2. Kanti Swarup , P.K.Gupta and Manmohan : Operations research, S.Chand & Co.
3. Hamady Taha : Operations Research :Mac Millan Co.
4. R.K.Gupta : Operations Research Krishna Prakashan Mandir, Meeru
5. G.Hadley : Linear programming, Oxford and IBH Publishing Co.
6. S.I.Gass : Linear Programming, Mc Graw Hill Book Co

M. Sc. Tech Mathematics (Part I) (Semester II)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT 203**
Title of Paper: **Discrete Mathematical Structures – II**

Unit – I **15 Lectures**

Euler Tours and Hamiltonian Cycles: Euler Tours, The Chinese Postman Problem (CPP), Hamiltonian Graphs, The Travelling Salesman Problem, Matchings, Marriage problem, personal assignment problem optimal assignment problem, CPP postscript.

Unit – II **15 Lectures**

Planar Graphs: Plane and Planar Graphs, Euler's Formula, Kuratowski's Theorem, Directed Graphs: Definitions, Indegree and Outdegree, Strong Connectivity, Warshall' Algorithm, Directed Trees, Tree Traversals. Networks, flows and cuts, The Ford and Fulkerson algorithm.

Unit – III **15 Lectures**

Finite Automata and Regular Expressions: Finite State System, Basic Definitions, Non-deterministic Finite Automata, Finite Automata with ε - Moves, Regular Expressions, Applications of Finite Automata. Properties of Regular Sets: The Pumping lemma for regular sets, Closure property of regular sets, Decision Algorithm for regular sets, The Myhill-Nerode theorem and minimization of Finite Automata.

Unit – IV **15 Lectures**

Context-free Grammars: Motivation and Introduction, Context-free Grammars, Derivation Trees, Simplification of Context-free Grammars, Chomsky normal form, Greibach normal form. Pushdown Automata: Informal description, Definitions, Pushdown Automata and Context-free Languages.

Recommended Books :

1) A First look at Graph Theory by John Clark and D. A. Holton, Allied Publishers Ltd.
2) Introduction to Automata Theory, Languages and Computation by J. E. Hopcroft, J. D. Ullman, Narosa Publishing House 1987 (Ninth Reprint)
3) C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co.
4) Discrete Mathematics Structure with Applications to computer Science by J. P. Tremblay & R. Manohar, McGraw-Hill Book Co.

Reference Books:

1) N. Deo, Graph Theory with Applications to Engineering and Computer Sciences by Prentice Hall of India.
2) Mathematical Structure for Computer Science (3^{rd} Edition) by J. L. Gersting, Computer Science Press New York

M. Sc. Tech Mathematics (Part I) (Semester II)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT 204**
Title of Paper: **Operating Systems**

Unit – I: **15 Lectures**

Operating System, Types of operating systems: Mainframe, server, multiprocessor, personal computer. Processes and Threads: Processes, Threads, inter process communication, Classical IPC problems such as Dining philosophers, Readers and writers, and Sleeping barber.

Unit – II: **15 Lectures**

Deadlocks: Resources, Deadlocks, ostrich algorithm, Deadlock detection and recovery, Deadlock prevention.

Unit – III: **15 Lectures**

Memory management: Basic memory management, Swapping, Virtual Memory, Segmentation, Page replacement algorithms.

Unit – IV: **15 Lectures**

Input/output: Principles of I/O hardware and software, I/O software layers. File systems: Files, Directories.

Recommended Books:

1. Tanenbaum A. S.: Modern Operating Systems, Pearson Education Aisa, First Indian reprint 2001

Reference Books:

1. Avi Silberschatz, Peter Galvin: operating system concepts, john wiley & sons. Inc.

2. Milan milenkovic: operating systems: concepts and Design, Tata McGraw-Hill Education.

M. Sc. Tech Mathematics (Part I) (Semester II)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper: **MT 205**

Title of Paper: ***Data Structures Using C***

UNIT-I: **15 Lectures**

Data, Data Types, abstract Data type, Data Structure, Arrays as abstract data types (1D, 2D, Multidimensional) **Linked lists:** Concepts, Operations: Insert, Delete, Traversal, Static implementation using arrays, Dynamic implementation, doubly linked lists, Circular lists, Linked lists applications, Polynomial representation.

UNIT- II: **15 Lectures**

Stack: Concepts push and pop operations, Stack implementation using C, Stacks as linked lists, Stack Applications, Infix to postfix conversion of expression, Expression evaluation, Recursion.
Queues: Concept, insert, And delete operations, Queue implementation using C, queues as linked lists, Queue Applications: priority queues.

UNIT- III: **15 Lectures**

Trees: Terminology and concepts, Binary trees representation, Static implementation using arrays Linked representation, binary search tree, Operation inserts and Delete, Tree traversals, Creation of a tree using preorder, inorder, and postorder traversals, Representing trees as binary Trees, Height balanced trees (AVL tree), B Trees.

UNIT- IV: **15 Lectures**

Graphs: Terminology and concepts, Graph representation: adjacency – matrix, lists, multilists Traversal: Depth 1^{st} and breadth 1^{st} search, Minimum Spanning Tree, Single Source Shortest path.
Sorting: Concepts and needs, Performance criteria, Techniques, Bubbles, Quick, Selection, Insertion, Tree (Heap), Merge, Radix sort.

Recommended Books:

1. Classic data Structures, Samantha PHI, 2002

Reference Books:

1 . Data Structures: A Pseudocode Approach with C, Richard Gilberg, Behrouz Forouzan, Cengage Learning, 2004.
2. Data Structures using C, Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, , Prentice-Hall of India Pvt. Ltd. New Delhi, 1994.

M. Sc. Tech Mathematics (Part I) (Semester II)
(Introduced from June 2014 onwards)
Choice Based Credit System

Paper – **MT 206**
Title of Paper: **Lab Work II**

Specific Objectives: **Objectives are to apply theory studied in computer based papers in the semester.**

The programs related to Data Structure in C.