SHIVAJI UNIVERSITY, KOLHAPUR.

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CHOICE BASED CREDIT SYSTEM

Syllabus For

M.Sc. Tech. Mathematics Part -I

SEMESTER I AND II

(Syllabus to be implemented from June, 2018 onwards.)

1) Title of the course: **M.Sc. Tech. (Mathematics)**

M.Sc. Tech. (Mathematics) program has semester pattern and Choice Based Credit System.

2)Duration: 3 years.

2) Structure of the course

The following table gives the scheme of Examination at **M.Sc. Tech. (Mathematics) (Part I)** according to the New Syllabus and pattern of Examination.

M. Sc. Tech. (Mathematics) (Part I) (Semester I) (26 credits)

Course Code	Title of course	Instruction hrs/week	Duration of Term end Exam	Marks Term end exam	Marks-(Internal) Continuous Assessment	Credits
MTT 101	Advanced Calculus	4	3	80	20	4
MTT 102	Linear Algebra	4	3	80	20	4
MTT 103	Discrete Mathematical Structures -I	4	3	80	20	4
MTT 104	Computer Architecture	4	3	80	20	4
MTT 105	Programming in C	4	3	80	20	4
MTT 106	Lab Work I	12	3	100	--	6

M. Sc. Tech. (Mathematics) (Part I) (Semester II) (26 credits)

Course Code	Title of course	Instruction hrs/week	Duration of Term end Exam	Marks Term end exam	Marks-(Internal) Continuous Assessment	Credits
MTT 201	Functional Analysis	4	3	80	20	4
MTT 202	Algebra	4	3	80	20	4
MTT 203	Discrete Mathematical Structures -II	4	3	80	20	4
MTT 204	Data Structures Using C	4	3	80	20	4
MTT 205	Operating Systems	4	3	80	20	4
MTT 206	Lab Work II	12	3	100	--	6

Open Electives for PG Students:

Semester	Title of course	Instruction hrs/week	Intake Capacity	Eligibility	Marks and Exam	Credits
ODD	Discrete Mathematical Structures -I	4	15	Science and Technology	As per MTT 103	4
ODD	Programming in C	4	15	Science and Technology	As per MTT 105	4
EVEN	Discrete Mathematical Structures -II	4	15	Science and Technology	As per MTT 203	4

M. Sc. Tech. (Mathematics) (Part I) (Semester I)

M. Sc. Tech (Mathematics) (Part I) (Semester I)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 101
Title of Course: Advanced Calculus
Course Outcomes : Upon successful completion of this course, the student will be able to:

(i) Analyze convergence of sequences and series of functions
(ii) check differentiability of functions of several variables
(iii)Apply inverse and implicit function theorems for functions of several variables
(iv) Use Green's Theorem, Stoke's Theorem, Gauss divergence Theorem.

Unit 1 : **15 Lectures**

Sequences and series 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, Equicontinuous family of functions.[1,2]

Unit 2: **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, 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 R^n to R^1. The inverse function theorem , The implicit function theorem (statements only) and their applications [2]

Unit 3: **15 Lectures**

Integral Calculus: Path and line integrals, Multiple integrals, Double integral (Theorems without proof) ,Application to area and volume, Greens theorem in the plane. Application of Green's Theorem. Change of variables, special cases of transformation formula. Surface integral, change of parametric representation. Other notations for surface integrals, Stoke's Theorem, Curl and divergence of a Vector field, Gauss divergence Theorem.[3]

Unit 4: **15 Lectures**

Tutorials, Seminars, group discussion, Presentations, Examples and problems on above three units.

Recommended Books :

1) Walter Rudin ,Principles of mathematical Analysis, third Edition, McGraw Hill ,1984
2) Apostol, Mathematical Analysis, Second Edition, Narosa Publishing House, 1985.
3) Tom M. Apostol ,Calculus Vol. II , Second Edition, Wiley Student Edition, 2017.

Reference Books:

1) W.Fleming, Functions of several Variables,2nd Edition ,Springer Verlag, 1977.
2)J.R.Munkres, Analysis on Manifolds.

M. Sc. Tech (Mathematics) (Part I) (Semester I)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 102
Title of Course: Linear Algebra
Course Outcomes: To introduce basic notions in Linear Algebra and use the results in developing advanced mathematics. To study the properties of Vector Spaces, Linear Transformations, Algebra of Linear Transformations and Inner product space in some details. To introduce and discuss Canonical forms and Bilinear forms.
After studying this course, students will have a demonstrable knowledge of Vector space, Linear Transformations, Canonical Forms and Bilinear Transformations.

Unit I: Basic concepts of vector space, Dual Spaces, Annihilator of a subspace, Quotient Spaces. Inner product spaces, Algebra of Linear transformations. **15 Lectures**

Unit II: Eigen values and eigenvectors of a linear transformation. Diagonalization. Invariant subspaces, Similarity of linear transformations. **15 Lectures**

Unit III: Triangular form, Nilpotent transformations, Primary decomposition theorem, Jordan blocks and Jordan forms, Rational Canonical Form, Trace and transpose, Determinants, Real Quadratic forms. **15 Lectures**

Unit IV: Hermitian, Self adjoint, Unitary and normal linear transformation, Symmetric bilinear forms, skew symmetric bilinear forms, Group preserving bilinear forms. **15 Lectures**

Recommended Books:

1. Herstein I. N. : Topics in Algebra, 2nd Edition, Willey Eastern Limited.
2. Hoffman, Kenneth and Kunze R: Linear Algebra, Prentice Hill of India Private Limited., 1984.

Reference Books:

1. A. R. Rao and P. Bhimashankaran, Linear Algebra, Hidustan Book Agency.
2. Surjit Singh, Linear Algebra, Vikas publishing House (1997).
3. Gilbert Strang: Introduction to Linear Algebra, Wellesley-Cambridge Press

M.Sc.Tech (Mathematics) (Part I) (Semester I)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 103
Title of Course: Discrete Mathematical Structures -I
Course Outcome: The aim of this course is to introduce basic concepts and applications of discrete mathematics. Upon completion of this course student will able to learn formal logic as a theoretical foundation and its application to topics in discrete mathematics and computer science and able to understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

Unit-I **15 Lectures**
Logic: Introduction, Proposition, Simple proposition, Compound proposition, Truth value, Prepositional Calculus, operators, Conjunction, Disjunction, Conditional statement, Bi conditional statement, converse, contra positive and In-verse,
Predicates and Quantifiers: Introduction, Universal quantifier, existential quantifier, counter example, negating quantifiers, nested quantifier, order of quantifiers, truth value of quantifier.
Methods of proof: Introduction, theorem, proof, rules of inference, argument, valid argument, invalid argument, direct method of proof, indirect method of proof, rules of inference for quantified statements.

Unit-II. **15 Lectures**
Counting: The Basic of Counting, the Pigeonhole Principle, Permutations and Combinations, Binomial Coefficient. Inclusion -Exclusion and Applications of Inclusion-Exclusion.
Graph: Definition, Graphs as Models, More definitions, vertex degrees, Subgraphs, Operations on graphs, paths and cycles, Matrix Representation, Fusion

Unit-III **15 Lectures**
Trees and Connectivity: Definitions and simple properties, Bridges, Spanning trees, Shortest Path problem, cut vertices and connectivity, 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,

Unit – IV **15 Lectures**
Planar Graphs: Plane and Planar Graphs, Euler's Formula, Kuratowski's Theorem, Directed Graphs: Definitions, Indegree and Outdegree, Strong Connectivity, Directed Trees, Tree Traversals. Networks, flows and cuts, The Ford and Fulkerson algorithm.

Recommended Books:
1. K. H. Rosen : Discrete Mathematics and its Applications (TATA McGraw-HILL)
2. John Clark and Allan Holton: A First Look at Graph Theory (Allied Publishers LTD)
Reference Books:
1. Kolman, Busby, Ross: Discrete Mathematical Structures (PHI) 6th Edition.
2. N. Deo : Graph Theory with Applications to Comp. Sc. and Engineering. PHI Publication.

M. Sc. Tech. Mathematics (Part I) (Semester I)
(Introduced from June 2018 onwards)
Choice Based Credit System

Course Code MTT 104
Title of Paper: Computer Architecture
Course Outcomes: After Completion of this course the student would be able to

- Use various metrics to calculate the performance of a computer system.
- Identify the addressing mode of instructions
- Determine which hardware blocks and control lines are used for specific instructions
- Demonstrate how to add and multiply integers and floating-point numbers using two's complement and IEEE floating point representation
- Analyze clock periods, performance, and instruction throughput of single-cycle, multi-cycle, and pipelined implementations of a simple instruction set
- Detect pipeline hazards and identify possible solutions to those hazards
- Show how cache design parameters affect cache hit rate
- Map a virtual address into a physical address

Unit I: 15 Lectures

Data Representation: Introduction to Digital Computer, Number Systems- Binary, Octal and Hexadecimal, Inter-conversion between number systems, **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 LecturesMemory

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 LecturesPipeline

and Vector Processing: Parallel 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. Digital Logic and Computer Design Morris Mano Prentice Hall
6. Computer Architecture & Organization J. P. Hayes MGH 3rd Edition
7. Computer Organization & Design Pal Chaudhary PHI 3dr Edition
8. Digital Computer Electronics Malvino TMH 3rd Edition
9. Computer Architecture & Organization Murdocca Wiley India

M. Sc. Tech (Mathematics) (Part I) (Semester I)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code MTT 105

Title of Paper: Programming in C

Course Outcomes: After Completion of this course the student would be able to

- Read, understand and trace the execution of programs written in C language.
- Write the C code for a given algorithm.
- Use functions to solve the given problem.
- Understand pointers, structures and unions.

Unit I: **15 Lectures**

An overview of programming & Programming languages, Structure of C Program, Variables, Keywords and Constants, Data Types,

Operators: Arithmetic, Relational, Logical, Assignment operator, Increment and Decrement operator, Conditional, Bitwise operator, Comma operator, sizeof operator, Precedence of Operator, Type Conversion, Input output operations.

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.

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:

1. Let us C, Yeshwant Kanetkar, BPB publications.
2. Programming in ANSI C, E Balagurusamy, Tata McGraw-Hill Publishing

Reference Books

1. Programming in C, Schaum Series, Tata McGraw Hill.
2. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie
3. Programming in ANSI C, Stephen G. Kochan
4. C: The Complete Reference, Herbert Schildt.
5. Head First C, David Griffiths
6. C Programming in an Open Source Paradigm: A Hands on approach, K.S.Oza, S.R.Patil, R.K.Kamat, River Publisher Series in Information Science and Technology, Netherland

M. Sc. Tech (Mathematics) (Part I) (Semester I)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 106
Title of Course: Lab Work I
Course Outcomes: Objectives are to apply theory studied in computer based papers in the semester.

The programs related to Programming in C.

Practical should consists of min. 10 to 12 practical assignments based on the syllabus.

M. Sc. Tech. (Mathematics) (Part I) (Semester II)

M. Sc. Tech. (Mathematics) (Part I) (Semester II)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 201
Title of Course: Functional Analysis

Course Outcomes: The course is designed to familiarize the students with the fundamental topics, principles and methods of functional analysis. After studying this course, students will have a demonstrable knowledge of normed spaces, Banach spaces, Hilbert space, continuous linear transformations between such spaces, bounded linear functionals and finite dimensional spectral theorem.

Unit I: Normed linear spaces, Banach spaces, Quotient spaces, Continuous linear transformations, Equivalent norms, Finite dimensional normed spaces and properties, Conjugate space and separability, The Hahn-Banach theorem and its consequences. **15 Lectures**

Unit II: Second conjugate space, the natural embedding of the normed linear space in its second conjugate space, Reflexivity of normed spaces, The open mapping theorem, Projection on Banach space, the closed graph theorem, the conjugate of an operator, the uniform boundedness principle. **15 Lectures**

Unit III: Hilbert spaces: examples and elementary properties, Orthogonal complements, The projection theorem, Orthogonal sets, The Bessel's inequality, Fourier expansion and Perseval's equation, separable Hilbert spaces, The conjugate of Hilbert space, Riesz's theorem, The adjoint of an operator. **15 Lectures**

Unit IV: Self adjoint operators, Normal and Unitary operators, Projections, Eigen values and eigenvectors of an operator on a Hilbert space, The determinants and spectrum of an operator, The spectral theorem on a finite dimensional Hilbert space. **15 Lectures**

Recommended Book:

1. G. F. Simmons, Introduction to Topology and Modern Analysis, Tata McGraw Hill, 1963.

Reference Books:

4. Erwin Kreyszig, Introductory Functional Analysis with Applications, John Wiley and Sons, 1978
5. A. E. Taylor, Introduction to Functional analysis, John Wiley and sons,1958.
6. J. B. Convey, A course in Functional Analysis, Springer-Verlag, 1985.
7. G. Bachman and L. Narici, Functional Analysis, Academic Press, 1972.
8. B. V. Limaye, Functioned Analysis, New age international, 1996.

M. Sc. Tech. (Mathematics) (Part I) (Semester II)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 202
Title of Course: Algebra
Course Outcomes: To study group theory and ring theory in some details. To introduce and discuss module structure over a ring. After studying this course, students will have a demonstrable knowledge of groups, polynomial rings and modules.

Unit I: Groups of permutations, Simple groups, simplicity of A_n ($n > 5$), Commutator subgroups, normal and subnormal series, Jordan-Holder theorem, Solvable groups, isomorphism theorems, Zassenhaus Lemma, Schreier refinement theorem. **15 Lectures**

Unit II: Group action on a set, fixed sets and isotropy subgroups, Burnside theorem, Sylow theorems, p-groups, Applications of the Sylow theory and Class equation. **15 Lectures**

Unit III: Rings of polynomials, factorization of polynomials over fields, the division algorithm in F[x], irreducible polynomials, Eisenstein criteria, ideals in F[x], uniqueness of factorization in F[x], unique factorization domains, principal ideal domain, Gauss lemma, Euclidean Domains. **15 Lectures**

Unit IV: Modules, sub-modules, quotient modules, homomorphism and isomorphism theorems, fundamental theorem for modules, Simple modules, Schur's lemma, Artinian and Noetherian modules. **15 Lectures**

Recommended Book:

3. John B. Fraleigh , A first course in Abstract Algebra (Third Edition), Narosa publishing house, New Delhi.
4. C. Musili, Introduction to Rings and Modules (Second Revised Edition), Narosa Publishing house, New Delhi.

Reference Books:

1. Joseph A. Gallian, Contemporary Abstract Algebra (Fourth Edition), Narosa Publishing house, New Delhi.
2. Bhattacharya, Jain and Nagpal, Basic Abstract Algebra, 2nd edition, Narosa Publishing House, New Delhi.
3. I. N. Herstein, Topics in Algebra, Vikas Publishing House.
4. N. Jacobson, Basic Algebra, Hind Publishing Corporation, 1984.

M. Sc. Tech. (Mathematics) (Part I) (Semester II)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 203

Title of Course: Discrete Mathematical Structures -II

Course Outcome: The aim of this course is to introduce basic concepts and applications of discrete mathematics. After completion of this course student will able to understand applications of discrete mathematics including lattices, Boolean algebra and its applications and will able to understand the terminology, operations, and symbols of finite state automata and minimum language accepted.

Unit-I **15 Lectures**

Lattices: Partially ordered sets and Lattices, lattices as algebraic systems, sub-lattices, direct product, Ideals, Types of ideals, Quotient lattice, Homomorphisms, complete lattices. Modular lattices, distributive lattices, the complemented lattices, convex sub lattices, Congruence relations in lattices.

Unit-II. **15 Lectures**

Conversion of Boolean Algebra in to Boolean rings and vice versa. 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.

Unit – III **15 Lectures**

Finite Automata and Regular Expressions: Finite State System, Basic Definitions, Nondeterministic 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) G. Gartzer: General Lattice theory, AMS.
2) J. E. Hopcroft, J. D. Ullman: Introduction to Automata Theory, Languages and Computation, Narosa Publishing House,1987 (Ninth Reprint).

Reference Books:

1. J. P. Tremblay & R. Manohar: Discrete Mathematics Structure with Applications to computer Science, McGraw-Hill Book Co.
2. Garrett Birkhoff, Lattice Theory AMS.
3. Kolman, Busby, Ross: Discrete Mathematical Structures (PHI) 6th Edition.

M. Sc. Tech. (Mathematics) (Part I) (Semester II)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 204
Title of Course: Data Structures Using C
Course Outcomes: After Completion of this course the student would be able to

- Design linear data structures stacks, queues and linked lists.
- Design non linear data structures trees and Graphs, and implement their operations.
- Implement different searching and sorting techniques.

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, conversion of infix expression to postfix and prefix expressions, 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: : Graph representations, Breadth first and Depth first search, Topological sort, Single source Shortest path, Minimum Spanning tree.
Sorting: Concepts and needs, Bubbles, Quick, Selection, Insertion, Tree (Heap), Merge, Radix sort.

Recommended Books:

1. Data structure Through C In Depth, S. K. Srivastava, BPB Publication.
2. 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.
3. Data structures and algorithms, Aho, Hop craft and Ulman. (Addision - Wesley)
4. Data Structures using Cand C++ - Tanenbaum.
5. Classic data structures- D. Samantha- PHI.,
6. The C Programming Language (PHI-88), Karnighan B. and Ritchi D.
7. Data Structures and Program design (PHI-96), R.L.Kruse.

M. Sc. Tech. (Mathematics) (Part I) (Semester II)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 205

Title of Course: Operating Systems

Course Outcomes: After Completion of this course the student would be able to

- Describe process management and concepts of threading, multitasking, IPC.
- Differentiation of various scheduling algorithms and identify the reasons of deadlock and their remedial measures in an operating system.
- Describe various memory management techniques.
- Know the components and management aspects of concurrency management
- Understand representation of file system interface.

Unit – I: **15 Lectures**

Operating System: Introduction, Objectives and Functions, Types of operating systems: Batch Operating Systems, Multiprogramming Operating Systems, Time -sharing Systems, Real-Time Operating Systems, Distributed Operating Systems, Personal Computer Operating Systems, Mobile Operating Systems, **Processes and Threads**: Processes, Threads, inter process communication, Classical IPC problems such as Dining philosophers, Readers and writers, and Sleeping barber, **CPU Scheduling**: Basic Concepts, Scheduling Criteria

Unit – II: **15 Lectures**

Deadlocks: Resources, Deadlocks, Deadloch Characterization, Deadlock prevention, Deadlock Avoidance: Resource Allocation Graph Algorithm, Banker's Algorithm, Ostrich algorithm, Deadlock detection and recovery.

Unit – III: **15 Lectures**

Memory management: Basic memory management, Contiguous Memory allocation, Fragmentation, Paging, Swapping, Virtual Memory, Demand Paging, Segmentation, Page replacement algorithms.

Unit – IV: **15 Lectures**

Input/output: Principles of I/O hardware and software, I/O software layers. **File systems**: Files, Basic Concepts, File Attributes, File Operations, File Types, File Structure, File Access, Directories: Single level, Two level, Hierarchical level Directory System.

Recommended Books :

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

2. Operating System: Rohit Khurana, ITLESL, Delhi

Reference Books:

1. Operating Systems: Concepts: By Abraham Siberschatz, Peter Galvin- Willey- Sixth edition

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

3. System Programming and Operating Systems by D.M. Dhamdhere-TMH –Second Edition.

4. Operating Systems: Internals and Design Principles, Seventh Edition by William Stallings, Pearson Publications

M. Sc. Tech. (Mathematics) (Part I) (Semester II)
(Choice Based Credit System)
(Introduced from June 2018 onwards)

Course Code: MTT 206
Title of Course: Lab Work II

Course Outcomes: Objectives are to apply theory studied in computer based papers in the semester.

- The programs related to Data Structure in C.
- Practical should consists of min. 10 to 12 practical assignments based on the syllabus.

1. Nature of the Theory Question Papers:

1. There shall be 7 questions each carrying 16 marks
2. Question No.1 is compulsory. It consists of objective type questions.
3. Students have to attempt any four questions from Question No.2 Question No.7.
4. Question No.2 shall consists short-answer type sub-questions
5. Question No.2 Question No.7 shall consists descriptive-answer type sub-questions.

2. Nature of the Lab work Question Papers:

Practical Examinations will be conducted at the end of semester. Exam will be of 3 hrs. There shall be 6 questions each of 20 marks, of which a student has to attempt any 4 questions. There shall be 20 marks for practical assignments and Practical VIVA.