II Year

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC 201: Data Structure	L	T	P	Basic Mathematics and Discrete structures
	3	0	2	

Course Objective: To introduce the concept of complexity of algorithms and to introduce different kinds of data structures with their respective operations.

Course Outcome (CO):

CO1	Define and illustrate different data structures.
CO2	Design algorithms to create, manipulate, and analyze data structures.
CO3	Analyze, estimate, and compare the performance of various operations performed on the data structures.
CO4	Explain and evaluate various sorting techniques to sort the data.
CO5	Illustrate and develop the usage of hashing functions and collision resolution techniques.

S.No.	Contents	Contact hours
UNIT 1	**Introduction:** Abstract data types, design, implementation and applications. Introduction to Algorithm, Time complexity and Space complexity Trade-off. Introduction to Arrays and Strings: Representation of Arrays in Memory: one-dimensional, Two-dimensional and Multidimensional, operations on array. Strings and String Operations. **Stacks:** Introduction, Operations on Stacks, Array representation of Stacks, Applications of Stacks, recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression. **Queues:** Introduction, Operations of Queues, Representations of Queues Applications of Queues, Priority queues.	10
UNIT 2	**Linked Lists:** Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List, Concepts of Circular linked list and Doubly linked list and their Applications, Implementation of Stacks and Queues using linked list.	7
UNIT 3	**Trees and Graphs:** Binary trees, Binary search trees, and various operations on Binary search trees like traversing, searching, insertion, and deletion. Applications of Binary search Trees, Complete Binary trees, and Extended Binary Trees. AVL trees, Threaded trees, General trees, B trees, B+ trees. Introduction to types of graphs, graph representation and traversal, shortest path, and transitive closure, Spanning trees.	10
UNIT 4	**Sorting:** Insertion Sort, Quicksort, Merge sort, Heap sort, sorting on different keys, External sorting.	8
UNIT 5	**File Structure:** File Organization, Indexing & Hashing, Hashing Functions, Collision Resolution Techniques.	7
	TOTAL	42

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1	Horowitz, E., Sahni, S., & Anderson-Freed, S. *Fundamentals of Data Structures in C.* Silicon Press, 2nd Edition, ISBN: 978-0929306407.	2007
2	Tenenbaum, A. M., Langsam, Y., & Augenstein, M. J. *Data Structures Using C.* Prentice Hall, ISBN: 978-0131997462.	1989
3	Tremblay, J. P., & Sorenson, P. G. *An Introduction to Data Structures with Applications*. McGraw-Hill, 2nd Edition, ISBN: 978-0070651579.	1984
4	Kruse, R. L., Leary, B. P., & Tondo, C. L. *Data Structures and Program Design in C.* Prentice Hall, ISBN: 978-0137256495.	1991

PRACTICALS LIST	
1	Write a program to implement traversal, insertion, and deletion of elements in a linear array.
2	Write a program to: a. Fetch a substring from a string, find its position and length of the substring. b. Replacement of 1 string with another. c. Concatenation of 2 strings.
3	Write a program to: a. Implement stack using arrays (push & pop). b. Evaluate arithmetic expression by converting it from infix and postfix. c. Check for balanced parentheses in an expression.
4	Write a program to implement a linear queue using arrays.
5	Write a program to implement linear queues, circular queues, and priority queues.
6	Write a program to implement a singly linked list, doubly linked list, and circular linked list (Searching, Insertion, Deletion).
7	Write a program to perform linear search and binary search in an array.
8	Write a program to perform insertion, deletion, and traversal in a binary search tree and threaded binary tree.
9	Write a program to perform Insertion sort, Quicksort, and Merge sort.
10	Write a program to perform Depth First Traversal and Breadth First Traversal.

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC 202: Operating System	L	T	P	NIL
	3	0	2	

Course Objective: To familiarise with the fundamental principles of the operating system, its services and functionalities, the concepts of processes, synchronization and scheduling, memory management and the need for protection in computer systems.

Course Outcome (CO):

CO1	Describe the fundamental design principles and core components of operating systems, including processes, threads, memory, files, and I/O devices.
CO2	Analyze process scheduling, synchronization, and deadlock management, and evaluate performance trade-offs in different design approaches.
CO3	Explain memory management techniques and compare space allocation strategies for main memory, virtual memory, and file systems.
CO4	Implement operating system concepts using system calls for process management, memory handling, and file operations.
CO5	Differentiate various types of operating systems and analyze their functionalities based on application requirements.

S.No.	Contents	Contact hours
UNIT 1	**Operating System:** Introduction and Evolution of Operating System (OS) - Batch, Interactive, Time-Sharing, Real-Time System, System Protection. Computer-System Organization and Architecture, OS Structure - System Components, System Structure, OS Services, User - OS Interface, System Calls.	8
UNIT 2	**Process Management I:** Process concept, Inter Process Communication, Process operations. Process Threads - Introduction and Multithreading Models. CPU Scheduling - Scheduling Concept, Performance Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.	8
UNIT 3	**Process Management II:** Process Concurrency - Producer-Consumer Problem, Critical Section Problem and Solution, Mutex Locks, Semaphores, Classical problems in Concurrency. Deadlock Management - System Model, Deadlock Characterization, Prevention, Avoidance, Banker's Algorithm, Deadlock Detection, Recovery from Deadlock.	9
UNIT 4	**Memory Management:** Basics, Memory protection, Multiprogramming with fixed partition and variable partition, Multiple base register, Paging, Segmentation, Page Table Structure. Virtual Memory - Basic concepts, Demand paging, Copy-on-write, Performance, Page replacement algorithms, Thrashing.	9

17/2/22

UNIT 5	**Disk Management:** Disk Structure and its attachments, Disk Scheduling Algorithms. File Management - File Concept and Access Methods, File System structure and its Implementation, Directory Structure and its implementation. I/O Management - I/O devices and organisation, I/O functions, I/O Buffering. Case studies – Windows, Linux, and Unix	8
	TOTAL	42

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	Silberschatz, A., Galvin, P. B., & Gagne, G., *Operating system concepts*. Wiley, 9th Edition, ISBN: 978-1118063330.	2012
2.	Tanenbaum, A. S., & Woodhull, A. S., *Operating systems: Design and implementation*. Pearson Education, 3rd Edition, ISBN: 978-0-13-142938-3.	2006
3.	Stallings, W., *Operating systems: Internals and design principles*. Pearson, 9th Edition, ISBN: 978-0-13-467095-9.	2018

	PRACTICALS LIST
1	Write a C program to copy the contents of one file to another file using system calls like read(), write(), open() and close().
2	Write a C program to create a child process using fork(). Print the process id of child and the parent process. Also, explain the behaviour of fork in parent-child process.
3	Write a C program that creates a new child process using fork(). The child process should be assigned to find the length of your name using the execlp() system call.
4	Write a C program that creates another process. The child process should print the contents of any text on the screen using the cat command. The parent process should exit only after the child process has completed its execution.
5	Write a program to implement the FCFS and Elevator Algorithm for Disk Scheduling. Print the Seek time for each algorithm. You may consider your own input queue for the requests (cylinder no.).
6	Write a program to implement the SSTF and LOOK Disk Scheduling Algorithms. Print the Seek time for each algorithm. You may consider your own input queue for the requests (cylinder no.).
7	Write a menu-driven program to implement First Come First Serve and Shortest Time First Algorithm (Non Preemptive) scheduling algorithm. Input - Sequence of Processes with their arrival time and burst time. Output - Sequence of processes executing, Average Waiting time and Average Turnaround time
8	Write a menu-driven program to implement Round Robin Algorithm. Input - Sequence of Processes with their arrival time and burst time, and Maximum Time Quantum. Output - Sequence of processes executing, Average Waiting time and Average Turnaround time.
9	Write a menu-driven program to implement the Shortest remaining time First and Preemptive Priority-based Scheduling Algorithms. Input - Sequence of Processes with their arrival time and burst time. Output - Sequence of processes executing, Average Waiting time and Average Turnaround time
10	Write a program to implement Banker's Algorithm. The program should either print the safe sequence of execution of given processes (if any exists) or print "There is a deadlock in the system.
11	Write a program to implement FIFO and Least Recently Used algorithm for page replacement. Input - Reference String and Number of frames. Output - Number of page faults for each LRU and FIFO.

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC203: Real Analysis	L	T	P	NIL
	3	1	0	

Course Objective: To impart knowledge of real numbers system, sequences, metric spaces, and Riemann integral.

Course Outcome (CO):

CO1	Describe the basic concepts of Real numbers system, sets and bounds.
CO2	Explain the convergence of real sequences.
CO3	Demonstrate the understanding of Metric spaces and its topology.
CO4	Explain continuity and uniform continuity in Metric spaces.
CO5	Identify the Riemann integrability of a given function.

S. No.	Contents	Contact hours
UNIT 1	Peano's Axiom, Real number system $\mathbb{R}$, countable and uncountable sets, concepts of bound, least upper bound & greatest lower bound, order and completeness properties of $\mathbb{R}$, Archimedean property of real numbers, Nested interval property.	8
UNIT 2	Definition of real sequence, sub-sequence, bounded sequence, convergence of a sequence (Limit of a sequence), monotone sequences and their convergence, operations on convergent sequences, Bolzano-Weierstrass theorem for sequences, Cauchy sequence, Cauchy's general principle for convergence.	9
UNIT 3	Definition and examples of Metric Spaces, Euclidean spaces, Pseudo metric space, open sphere, neighbourhood of a point, open set, limits points of a set, closure of a set, closed set, limit and continuity of functions in metric space.	9
UNIT 4	Cluster points, Convergent sequences in metric space, sub sequence, Cauchy sequence in a metric space.	8
UNIT 5	Riemann sums, Riemann integral, criterion for integrability, properties of Riemann integral, fundamental theorem of calculus.	8
	Total	42

17/2/23

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	Richard R. Goldberg; Methods of Real Analysis, Oxford & IBH publishing Co. Pvt. Ltd.	2020
2.	Bartle, R.G., and Sherbert, D.R.; Introduction to Real Analysis, John Wiley & Sons, Inc., New York, 4th Edition.	2011
3.	Mathematical Analysis, Apostol, Narosa pub. House, 2nd Edition.	2002
4.	S.C. Malik and Savita Arora; Mathematical Analysis, New Age International publishers, 5th Edition.	2017
5.	Walter Rudin; Principles of Mathematical Analysis, Mc Draw Hill, 3rd Edition.	2017

Details of Course

Course Title	Course Structure			Pre-Requisite
MC204:	L	T	P	NIL
Scientific Computing	3	0	2	

Course Objective: The course will develop numerical methods aided by technology to solve algebraic, transcendental, and differential equations, and to calculate derivatives and integrals. The course will also develop an understanding of the elements of error analysis for numerical methods and certain proofs. The course will further develop problem solving skills.

Course Outcome (CO):

CO1	Apply numerical methods to obtain the errors and the approximate solutions to the transcendental and polynomial equations.
CO2	Describe the Eigen value problems for the system of linear algebraic equations and analyze the applications.
CO3	Identify numerical methods for various mathematical operations and tasks, such as interpolation formulae like forward, backward, and divided difference formulae.
CO4	Apply the appropriate techniques for numerical differentiation and integration problems.
CO5	Design the numerical solution of initial value problems of the ordinary differential equations with implicit and explicit methods as appropriate.

S. No.	Contents	Contact hours
UNIT 1	Solution of Transcendental and polynomial equations: . Types of error in numerical methods, Iterative methods: Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method, Fixed point method, their convergence, Solution of system of nonlinear equations using Newton -Raphson method.	8
UNIT 2	Linear systems of equations: Direct Methods (Gauss Elimination, LU decomposition); iterative methods (Gauss - Jacobi, Gauss-Seidel), convergence of iterative methods; ill-conditioned system of equations, Eigen value problems using power method.	8
UNIT 3	Finite differences and Interpolation: Finite difference operators and their properties, Interpolation of equally spaced intervals: Newton and Gauss forward and backward formulae, Bessel's formula; Interpolation of unequally spaced intervals: Newton's divided difference, Lagrange's method, Hermite interpolation formula; Inverse interpolation, quadratics and cubic spline Interpolation.	9
UNIT 4	Numerical differentiation and integration: Differentiation for equal and unequal spaced using interpolating formulae; Integration: Newton's Cotes formula, Gauss Quadrature formula, Trapezoidal formula, Simpson's one-third and three-eight rules and error estimates.	9

17/7/25

UNIT 5	Numerical solution of Initial Value Problems: Picard's method, Taylor series method, Euler's and Modified Euler's method, and their Convergence, Runge-Kutta method, Predictor-corrector method.	**8**
	Total	**42**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1	M. K. Jain and S.R.K. Iyengar , Numerical Methods for Scientific and Engineering Computation, New Age International Publishers.	2007
2	Curtis F. Gerald & Patrick O. Wheatley , Applied Numerical Analysis, Pearson Publication, 7th Ed.	2007
3	S.D. Conte, & C. Deboor , Elementary Numerical Analysis, Tata Mc- Graw Hill.	2005
4	Uri Ascher, A First Course in Numerical Methods, SIAM Publication.	2011
5	R. S. Gupta: Elements of Numerical Analysis, Cambridge, 2nd Ed.	2015
6	S.S. Sastry, Introductory methods of numerical analysis, Prentice Hall India Learning Private Limited, 5th Ed.	2012

Practical List	
S. No.	**List of Experiments**
1	Write a program to implement following methods: 1. Bisection method 2. Secant method 3. Regula Falsi method 4. Newton Raphson method.
2	Write a program to implement Gauss Elimination method with and without partial pivoting.
3	Write a program to implement Gauss Seidel and Jacobi Iterative methods.
4	Write a program to implement Power method for finding maximum eigen value and corresponding eigen vector.
5	Write a program to create Forward and Backward difference table from the given data.
6	Write a program to implement Lagrange's method of Interpolation.
7	Write a program for Spline method for Interpolation.
8	Write a program to implement Trapezoidal and Simpson's 1/3 rule for integration.
9	Write a program to implement Runge-Kutta method for solving ODE.
10	Write a program to implement Picard's method for solving ODE.

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC205:	L	T	P	NIL
Probability & Statistics	3	0	2	

Course Objective: To acquire knowledge on descriptive statistics, random variables, specific probability distributions and their real life applications specifically, in science and engineering. Acquaintance with the tools for the large and small sample testing.

Course Outcome (CO):

CO1	Prepare the data set and Summarize its main features. (exploratory data analysis). Also student shall be able to calculate and infer for real problems on the basis of probabilistic theory.
CO2	Describe and identify the various probability distribution function and infer their statistical properties. The student shall be able to derive the relation between bivariate random variables.
CO3	Analyze and apply the laws of Sampling. Also, be able to perform random sampling, construct the confidence intervals for parameter estimates.
CO4	Compute and interpret the results of Bivariate Regression and Correlation Analysis, for forecasting and investigating the relationships between them. Define and perform hypothesis testing and perform ANOVA.
CO5	Demonstrate the qualitative and quantitative properties of data using appropriate diagrams, tabulations, hypotheses testing and summaries using SPSS.

S.No.	Contents	Contact Hours
UNIT 1	Descriptive statistics, Axioms on probability, Conditional probability, Addition and multiplication rules, Bayes' Theorem. Random variables: Discrete and Continuous, Probability mass and density functions, Joint marginal and conditional distributions.	8
UNIT 2	Mathematical Expectation, Variance, Covariance, Moment generating function, Markov's inequality, Chebyshev's inequality. Correlation and Regression, Rank Correlation.	8
UNIT 3	Binomial, Negative binomial, Poisson, Geometric, Hypergeometric, Uniform, Normal, Exponential, Gamma, Weibull, Erlang and Beta distributions	8
UNIT 4	Types of sampling, Parameter and statistic, Law of large numbers, Central limit theorem, Sampling distributions, Confidence intervals, Hypothesis testing, Sampling of attributes and variables, Tests of significance for large sample testing.	9
UNIT 5	Exact sampling distributions: Chi-square, Student's t, Snedecor's F and their applications. ANOVA: one and two-way classification.	9
	Total	42

17/2/25

Suggested Books:

S.No	Name of Books/Authors/Publishers	Year of Publication
1	S. M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press.	2021
2	R. E. Walpole, R. H. Myers, S.L. Myers, Probability and Statistics for Engineers and Scientists, Pearson, Ninth Edition.	2013
3	S. C. Gupta & V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons.	2017
4	P. L. Meyer, Introductory Probability and Statistical Application, Oxford and IBH Publishing.	2002
5	K. S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Application, Wiley, Second Edition.	2001

Practical List	
S. No.	**List of Experiments**
1	Transportation of Data Set to SPSS Editor
2	Merging of Data set & providing missing values
3	Pictographical representation of data using Bar diagram and Pie chart
4	Drawing of Histogram and distribution curve
5	Descriptive Statistics
6	Correlation between two random variables
7	Regression Analysis
8	Hypothesis Testing 't' - test
9	Chi Square test
10	ANOVA One Way

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC 206: Analysis and Design of Algorithms	L	T	P	Data Structures
	3	1	0	

Course Objective: To introduce the concept of algorithmic efficiency by analyzing various algorithms such as Searching, Sorting, Divide-and-Conquer algorithms and to know detail about Greedy Paradigm, Principle of Dynamic Programming, Back Tracking, Branch and Bound, and Computational Complexity.

Course Outcome (CO):

CO1	Recall the different paradigms of algorithm design and identify criteria for determining the correctness of algorithms.
CO2	Explain the concepts of asymptotic notation and its role in analyzing the running time of algorithms.
CO3	Design and implement algorithms using various algorithmic paradigms, and apply asymptotic analysis to evaluate their efficiency.
CO4	Analyze the limitations of different algorithmic paradigms and differentiate between tractable and intractable problems, developing strategies for solving computationally intractable problems.
CO5	Evaluate and solve real-world inter-disciplinary problems, including sorting, tree and graph problems, and recurrence relations, by applying appropriate algorithms and analyzing their performance.

S.No.	Contents	Contact hours
UNIT 1	**Introduction:** Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Recurrence Relation, Master's Theorem, Correctness of Algorithm. **Divide and Conquer Approach:** Introduction, Analysis of Run time and Correctness of divide and conquer based Searching and Sorting algorithms, Heap sort, Strassen's matrix multiplication.	**8**
UNIT 2	**Greedy Method:** Overview of the greedy paradigm examples of exact optimization solutions: minimum cost spanning tree, **approximate solutions:** Knapsack problem, Kruskal's algorithm and Prim's algorithm for finding Minimum cost spanning tree, Dijkstra's algorithm for single source shortest path problem.	**9**
UNIT 3	**Dynamic programming:** Principle of dynamic programming. **Applications:** Bellman Ford Algorithm for single source shortest path problem, Floyd-Warshall algorithm for all pair shortest path problem, 0/1 Knapsack Problem, Matrix chain multiplication, Traveling salesman Problem, longest Common sequence (LCS).	**8**

17/2/16

UNIT 4	**Back tracking:** Overview, 8-queen problem, and 0/1 Knapsack problem, Subset Sum Problem, Traveling Salesman problem. **Branch and bound:** LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem.	**8**
UNIT 5	**Computational Complexity:** Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, **examples:** Circuit Satisfiability, Vertex cover, Subset Sum problem, Randomized Algorithms, String Matching, NP-Hard and NP- Completeness, Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials and FFT, Number Theoretic Algorithms.	**9**
	TOTAL	**42**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1	Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C., *Introduction to algorithms*, The MIT Press, 4th Edition, ISBN: 978-0-262-04630-5.	2022
2	Horowitz, E., Sahni, S., & Rajasekaran, S., *Computer algorithms C++: C++ and pseudocode versions*, W. H. Freeman, ISBN: 978-0716783152.	1997
3	Baase, S., & Van Gelder, A., *Computer algorithms: Introduction to design and analysis*, Pearson Education India, 3rd Edition, ISBN: 978-0201612448.	1999

Details of Course

Course Title	Course Structure			Pre-Requisite
MC207: Modern Algebra	L	T	P	Basic knowledge of set theory
	3	1	0	

Course Objective: To impart the knowledge of algebraic structure of Groups, Rings, Integral Domains and Fields.

Course Outcome (CO):

CO1	Identify different algebraic structures like groups, rings, fields etc. and to apply them in various science related problems.
CO2	Apply concepts of abstract algebra with various scientific tools to evolve new ideas to solve practical problems.
CO3	Demonstrate problem solving skills in the context of abstract algebra topics through consideration of examples, pattern exploration, conjecture, proof construction, and generalization of results.
CO4	Apply algebraic concepts such as groups and ring theory to model, analyze and solve real-world problems.
CO5	Comprehend abstract definitions and theorem statements by building examples and non-examples of definitions, and drawing conclusions using definitions and theorems given mathematical information.

S. No.	Contents	Contact hours
UNIT 1	Groups, Abelian groups, Subgroups, Centre of a group, Order of a group and an element, Cyclic groups, groups of prime order. Cayley's digraph of cyclic groups.	8
UNIT 2	Permutation groups, Alternating subgroup, Important examples of groups such as S3(Symmetric group of order 6), K4 (Klein's 4 –group) and Q8 (Quaternion group) groups. Cosets, Lagrange's Theorem for finite groups, Normal subgroup, Quotient group.	9
UNIT 3	Group Homomorphism, Isomorphism, Kernel of group homomorphism, Fundamental theorem of group homomorphism, Cayley's theorem.	9
UNIT 4	Ring, Subring, Integral domain, Field, Ideal of a ring, Quotient ring, Ring homomorphism, Isomorphism, and some elementary properties.	8
UNIT 5	Prime ideal, Maximal ideal, Ring of polynomials and their properties.	8
	Total	42

17/4/22

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	Joseph A. Gallian; Contemporary Abstract Algebra, Narosa Publishing House, 10th Edition.	2021
2.	N. S. Gopalakrishnan, University Algebra, New Age International Publishers, 4th Edition.	2021
3.	I. N. Herstein; Topics in Algebra, Wiley Eastern Limited, 2nd Edition.	2006
4.	Khanna and Bhamri; A course in Abstract Algebra, Vikas Publishing House, 5th Edition.	2017
5.	D. S. Dummit and R. M. Foote; Abstract Algebra, John Wiley and Sons, 3rd Edition.	2011

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC208: Linear Algebra	L	T	P	NIL
	3	1	0	

Course Objective: The objective of this paper is to impart knowledge of vector space, linear transformation, bilinear form and Inner Product spaces.

Course Outcome (CO):

CO1	Explain computational techniques and algebraic skills essential for the study of systems of linear equations and matrix algebra.
CO2	Apply geometric properties and strategies to model and solve problems of vector spaces.
CO3	Compute and recognize the properties of special matrices.
CO4	Apply eigenvectors in obtaining canonical forms of matrices.
CO5	Describe inner product spaces, bilinear forms and positive definiteness of real quadratic forms.

S. No.	Contents	Contact hours
UNIT 1	Vector spaces, Properties of vector spaces, Subspaces, Linear dependence and independence, Linear span, Bases and Dimension, Linear Sum, Direct Sum, Quotient Spaces.	8
UNIT 2	Linear transformations, Range and Null spaces, Rank–Nullity theorem and its application, Inverse linear transformation, Representation of linear transformations by matrices, Change of basis, Dual space, Dual bases .	10
UNIT3	Transpose of a linear transformation, Eigenvalues and Eigenvectors, Cayley–Hamilton Theorem, Diagonalization, Minimal polynomials, Jordan canonical form.	8
UNIT 4	Inner product spaces, norm of a vector, orthogonality, orthonormal set, orthonormal basis, Gram-Schmidt orthonormalization, orthogonal projections, Linear functional and adjoints, Hermitian, self-adjoint.	8
UNIT 5	Unitary and normal operators, Bilinear forms, Symmetric and skew-symmetric bilinear forms, Real quadratic forms and it's characterization.	8
	Total	42

17/4/21

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1	K. Hoffmann and R. Kunze, Linear Algebra, 2nd Edition , Pearson Education	2015
2	G. Hadley, Linear Algebra, Narosa publication	2002
3	Gilbert Strang, Linear Algebra and its applications, Cengage Learning, 4th edition	2007
4	Serge Lang, Introduction to Linear Algebra, Springer	2004

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC 209: Database Management System	L	T	P	NIL
	3	0	2	

Course Objective: To provide knowledge about the principles, concepts and applications of Database Management System.

Course Outcome (CO):

CO1	Define and explain fundamental RDBMS principles, data models, relational design, and SQL.
CO2	Design ER models to represent various applications, convert them into relational schemas, and apply relational algebra and SQL for queries.
CO3	Apply normalization techniques to optimize database design and ensure data integrity.
CO4	Compare and contrast various file structures, indexing, and hashing techniques for efficient data retrieval and storage.
CO5	Apply transaction processing and concurrency control techniques to maintain data consistency and recovery.

S.No.	Contents	Contact hours
UNIT 1	**Introduction:** Database system concepts and its architecture, Data models, Schema and instances, Data independence, Database language and interface, Data definition languages, Data manipulation languages. **Data modelling using Entity Relationship Model:** ER model concept, Notation for ER diagrams, Mapping constraints, Keys, Super key, Candidate key, Primary key, Generalizations, Aggregation, Transforming ER diagrams to tables, Extended ER model.	8
UNIT 2	**Relational Data Model and Language:** Relational data model concepts, Integrity constraints, Keys domain constraints, Referential integrity, Assertions, Triggers, Database language, Relational algebra, Relational calculus, Domain and Tuple calculus, Data definition, queries, and updates in SQL, NoSQL databases.	9
UNIT 3	**Database Design:** Functional dependencies, Normal forms, 1NF, 2NF, 3NF, and BCNF, Multivalued dependencies, Fourth normal form, Join dependencies, Fifth normal forms, Lossless join decompositions, Normalization using FD, MVD and JDs.	8
UNIT 4	**File Organization, Indexing and Hashing:** Basic concepts, Static hashing, Dynamic hashing, Ordered indices, Multi-level indexes, B-Tree index files, B+ Tree index files, Buffer management.	8
UNIT 5	**Transaction processing concepts:** Transaction processing system, Schedule and recoverability, Testing of serializability, Serializability of schedules, Conflict and view serializable schedule, Recovery from transaction failures, Deadlock handling. **Concurrency Control Techniques:** Locking Techniques, Time stamping protocols, Multiple granularities and Multi-version schemes.	9
	TOTAL	42

17/4/24

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1	Elmasri, R., & Navathe, S. B., *Fundamentals of database systems*.. Addison-Wesley, 6th Edition, ISBN: 978-0-13-608620-8.	2010
2	Silberschatz, A., Korth, H. F., & Sudarshan, S., *Database system concepts*. McGraw-Hill, 7th Edition, ISBN: 978-0-07-802215-9.	2019
3	Ramakrishnan, R., & Gehrke, J., *Database management systems*. McGraw-Hill, 3rd Edition, ISBN: 978-0-07-246563-1.	2003

PRACTICALS LIST	
1	Design an ER diagram for a chosen/given application/project.
2	Write SQL queries to implement the following DDL statements: a. Create table b. Create a table with constraints: NOT NULL, UNIQUE, DEFAULT, CHECK, PRIMARY KEY, FOREIGN KEY c. Alter table: Add and Drop a column, Add and Drop a constraint, Rename column d. Drop table
3	Write SQL queries to implement DML statements: Insert, Update, Delete, Truncate.
4	Write SQL queries to implement SELECT statements: a. with and without WHERE clause, using Boolean operators, logical operators, IN, BETWEEN, LIKE etc. b. using GROUP BY and HAVING c. using ORDER BY
5	Write SQL queries to perform aggregate functions: SUM, MAX, MIN, AVG, COUNT.
6	Write SQL queries to perform Nested queries with various JOIN operations: a. INNER JOIN b. EQUI JOIN c. NATURAL JOIN d. LEFT OUTER JOIN e. RIGHT OUTER JOIN f. FULL OUTER JOIN
7	Write SQL query to create a view.
8	Write SQL queries using in-built functions like Date, Current date, Interval, etc.
9	Write SQL queries to create and modify the Indexes.
10	Write SQL queries to implement Triggers.
11	Write SQL queries to implement the following transaction statements: a. Commit b. Savepoint c. Rollback

Details of Course:

Course Title	Course Structure			Pre-Requisite
MC210: Differential Equations	L	T	P	Basic knowledge of calculus and matrix
	3	0	2	

Course Objective: To impart the knowledge of ordinary and partial differential equations and to analyze and solve the physical problems.

Course Outcome (CO):

CO1	Evaluate linear systems of differential equations, both homogeneous and non-homogeneous by matrix method and Sturm-Liouville boundary value problems including orthogonality properties.
CO2	Analyse the stability of linear and non-linear differential equations through phase portrait diagram.
CO3	Formulate partial differential equations, evaluate linear, quasi linear and non-linear first order PDEs and address Cauchy's problem for first order PDE.
CO4	Solve homogeneous and non- homogeneous linear PDE with constant coefficients and classify second order PDE to determine characteristics.
CO5	Apply the method of separation of variables to solve initial and boundary value problem including heat equation, wave equation and Laplace equation.

S. No.	Contents	Contact hours
UNIT 1	Ordinary differential equations I: Solutions of linear system of differential equations (homogenous and non-homogenous) by matrix method, solution of Sturm-Liouville boundary values problems including characteristic functions and orthogonality.	8
UNIT 2	Ordinary differential equations II: Linear and non-linear autonomous systems, Phase plane, Paths, Critical Points and its types, Stability of the critical points, Phase plane analysis, Lyapunov's direct method, periodic solutions, limit cycle.	8
UNIT 3	Partial differential equations I (PDEs): Formation of PDEs, LinearandQuasi-linear first order PDEs (Lagrange form), Cauchy's problem for first order PDEs, Non-linear first order PDEs: Standard forms and Charpit's method.	8
UNIT 4	Partial differential equations II: Linear homogeneous and non-homogeneous second and higher order PDEs with constant coefficients, Classification of second order PDEs, Characteristic equations and characteristic curves, method of separation of variables.	9

17/2/22

UNIT 5	Applications of partial differential equations: Solutions of one-dimensional heat equation, one-dimensional wave equation, two-dimensional heat equation, two dimensional Laplace equation in Cartesian and polar coordinates.	9
	Total	**42**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication /Reprint
1.	Martin Braun, Differential equations and their applications, Springer, 4th Ed.	1993
2.	S. L. Ross, Introduction to Ordinary Differential Equations, John Wiley & Sons, 4th Ed.	1989
3.	R.K Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa, 5th Ed.	2017
4.	K S Rao, Introduction to Partial Differential Equations, Prentice Hall India, 3rd Ed.	2011
5.	G.F. Simmons, Differential equation with Applications and Historical Notes CRC Press, 3rd Ed.	2017
6.	Peter V. O'Neil, Beginning Partial Differential equations, Wiley Publication, 3rd Ed.	2014

Practical List	
S. No.	**List of Experiments**
1	Write a program in MATLAB to solve homogeneous and non-homogeneous linear system of differential equations using matrix-method. [CO 1]
2	Write a program in MATLAB to solve Initial Value Problems of homogeneous and non-homogeneous linear system of differential equations using matrix-method. [CO 1]
3	Write a program in MATLAB to solve Sturm Liouville boundary value problem to obtain characteristic values and characteristic functions. [CO 1]
4	Write a program in MATLAB to analyse the stability of linear and non-linear differential equations through phase portrait diagram. [CO 2]
5	Write a program in MATLAB to solve quasi-linear equations using Lagrange's method. [CO 3]
6	Write a program in MATLAB to solve non-linear PDE using Charpit's method. [CO 3]
7	Write a program in MATLAB to solve higher order linear homogeneous partial differential equations with constant coefficients. [CO 4]
8	Write a program in MATLAB to solve one-dimensional heat equation using method of separation of variables. [CO 5]
9	Write a program in MATLAB to solve one-dimensional wave equation using method of separation of variables. [CO 5]
10	Write a program in MATLAB to solve Laplace equation using method of separation of variables. [CO 5]