Mathematics-II					
Prerequisite: None		L	T	P	C
Total hours: 28		2	1	0	3
Course Content					Hrs.
Unit 1	Matrix Algebra: Row echelon form, Rank of a matrix, Solution of linear simultaneous equations, Eigenvalues and Eigenvectors of a matrix, Cayley- Hamilton theorem (Statement only), Diagonalization of a matrix.				8
Unit 2	Ordinary Differential Equations: Exact differential equations, Solution of second and higher order linear differential equations with constant coefficients using operator method, Cauchy-Euler equations. Reduction of order, Method of variation of parameters, Matrix method for system of linear differential equations.				8
Unit 3	Fourier Series: Fourier series and its convergence, Fourier series of even and odd functions, Fourier half-range series.				4
Unit 4	Laplace Transform: Laplace and inverse Laplace transform of some standard functions, Shifting theorems, Laplace transform of derivatives and integrals, Convolution theorem, Heaviside unit step function and Dirac delta function, Applications of Laplace transform.				8
Text Books					
1.	Kreyszig E., Advanced Engineering Mathematics, 10th Edition, Wiley, 2011.				
2.	Zill D. G. and Wright W. S., Advanced Engineering Mathematics, 4th Edition, Viva, 2011.				
Reference books					
1.	Jain R. K. and Iyengar S. R. K., Advanced Engineering Mathematics, 5th Edition, Narosa Publishing House, 2016.				
2.	Strang G., Linear Algebra and its Applications, 4th edition, Cengage Learning, 2006.				
3.	O'Neil P. V., Advanced Engineering Mathematics, 8th Edition, Cengage Learning, 2017.				
4.	Grewal B.S., Higher Engineering Mathematics, 44th Edition, Khanna publishers, 2021.				

Real Analysis					
Prerequisite:		L	T	P	C
Total hours: 42		3	1	0	4
Course Content					Hrs.
Unit 1	Bounded subsets of R, infimum, supremum, concept of infinity, completeness axiom, Archimedean property, Intervals, Finite, countable and uncountable sets, decimal expansion.				8
Unit 2	Sequences of real numbers, Subsequences, Monotone sequences, monotone convergence theorem, Limit infimum, Limit Supremum, Bolzano-Weierstrass theorem, Cauchy sequence, and completeness. infinite series, absolute convergence, tests for convergence, Cauchy criterion.				8
Unit 3	Limit and continuity of functions, sequential criterion for limit, Continuity and compactness, Continuity and connectedness, uniform continuity, Lipschitz function, continuous extension theorem.				8
Unit 4	Derivative, mean value theorems and applications, L'Hopital rule, Taylor's theorem, Indian contribution to find the series of Pi and trigonometric functions, Riemann integral, fundamental theorem of calculus, Darboux integral, improper integral.				10
Unit 5	Sequence of functions, pointwise and uniform convergence, Interchange of limits, series of functions, test for uniform convergence, Weierstrass-M test, power series, Weierstrass approximation theorem.				8
Text Books					
1.	Ross K.A., Elementary Analysis, Springer-Verlag New York, 2nd ed. 2013.				
2.	Bartle R. G. & Sherbert D. R., Introduction to Real Analysis (IV ed.), Wiley publications, 2011.				
Reference books					
1.	Rudin W., Real and Complex Analysis, McGraw Hill Education (India), 2023.				
2.	Bali N. P., Real Analysis, New Age International Private Limited, 2nd Ed., 2023.				
3.	Ghorpade S.R. and Limaye B.V., A course in calculus and real analysis. Undergraduate Texts in Mathematics. Springer, New York, 2nd Ed., 2018.				
4.	Carothers N. L., Real Analysis, Cambridge University Press, 2000.				

5.	Apostol T. M., Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
6.	Goldberg R.R., Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt Ltd, 1970.
7.	Raju C. K., Cultural Foundations of Mathematics, Pearson Longman, 2007.

History of Mathematics and Computing					
Pre-requisite: None		L	T	P	C
Total hours: 14		1	0	0	1
Course Content					Hrs.
Unit 1	Mathematics: Introduction to Indian Mathematics, place-value system. Clock and time calculation.				6
Unit 2	Śulba Sūtras, concept of Śūnya and Ananta, value of Pi, an introduction to geocentric astronomy and trigonometry, binary mathematics and combinatorial problems				8
Text Books					
1.	Plofker K., Mathematics in India, 500 BCE-1800 CE, Princeton University Press, New Jersy, 2009.				
2.	Raju C.K., Cultural Foundations of Mathematics: The Nature of Mathematical Proof and the Transmission of the Calculus from India to Europe in the 16th CE, Pearson education, 2007				
3.	Williams M.R., A history of computing technology, John Wiley & Sons, 1997				
4.	Davis M., The universal computer: The road from Leibniz to Turing, AK Peters/CRC Press, 2018				
Reference books					
1.	Jhunjhunwala A., Indian Mathematics - An Introduction, New Age International (P) Ltd, 1993.				
2.	Gupta R., Ancient Indian Mathematics Historical and Cultural Highlights, NCERT, India, 1997.				
3.	Bhanu Murthy T.S., A Modern Introduction to Ancient Indian Mathematics, New Age International Pvt Ltd Publishers, 2009.				
4.	Datta B. and Singh A.N., History of Hindu Mathematics: A Source Book, Asia Publishing House, 1962.				

Data Structures and Algorithms					
Pre-requisite: None		L	T	P	C
Total hours: 42		3	0	0	3
Course Content					Hrs.
Unit 1	Fundamentals of Data Structures, Memory Allocation, Abstract Data Types, Asymptotic Notations, Arrays, Lists Stack Implementation, Stack applications. Queue Implementation, Sequential, Circular, and Dequeue representation, Dynamic Queue implementation, Queue applications.				8
Unit 2	Searching and Sorting: Linear and Binary search, Bubble Sort, Selection Sort, Insertion Sort, Merge sort, Quick sort, Counting sort, Bucket sort, Radix sort, Heap sort, Comparisons of sorting algorithms.				8
Unit 3	Hashing and Hash Tables: Hash functions, Open and closed hashing, Dynamic and extendible hashing, Hash collision, chaining, Hash Tables and Probing Techniques.				8
Unit 4	Trees: Binary Tree and its representations, Tree traversal, Binary Search Tree, Threaded binary trees, Representing list as binary trees, Dynamic implementation of Binary tree and AVL tree, Tree applications, Interval tree, M-way search Tree, B-Tree and its variants, B+ Tree, Heaps and its applications.				10
Unit 5	Graphs Algorithms: DFS and BFS, Dijkstra and Prims algorithms. Introduction to advanced data structures such as advanced lists, n-ary Tree, Self-Balancing BSTs, Trie Segment tree, Binary indexed tree, Suffix array and suffix tree, K-dimensional tree, Disjoint set and so on.				8
Course Outcomes • Develop a solid understanding of fundamental data structures such as arrays, linked lists, trees, and graphs, and their associated algorithms for insertion, deletion, and traversal. • Analyze and compare the time and space complexity of different data structures and algorithms, and make informed decisions for algorithm selection based on problem requirements. • Understand data structures and algorithms to solve computational problems efficiently, and design and implement algorithmic solutions for common programming tasks.					

• Collaborate with peers to solve programming challenges and algorithmic puzzles, and effectively communicate solutions and insights.		
Text Books		
1.	Cormen T., Lieserson C., Rivest R., and Stein C., Introductions to Algorithms, Prentice-Hall/India, 3rd edition, 2009	
2.	Tenenbaum A.M, Langsam Y., Augenstein M.J., Data Structures Using C, 2019	
Reference Books		
1.	Cormen T., Leiserson C., Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, PHI, 2nd Edition, 2023.	
2.	Sahni S., Data Structures, Algorithms, And Applications in C++, Silicon Pr, 2004.	
3.	Aho A.V., Hop croft J.E., Ullman J.D., Data Structures and algorithms, Pearson, 1982.	
4.	Anany L., Introduction to design & Analysis of Algorithms, 3nd Edition, Pearson, 2017.	

Data Structures and Algorithms Lab					
Pre-requisite: Basic Programming Skills		L	T	P	C
Total hours: 24		0	0	2	1
Course Content					Hrs.
The following topics are broad areas. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with concerned theory courses.					
1.	Arrays and Linked List: Creation of arrays, singly, double and circular linked list and performing various operations on them (updating/adding/deletion an element in the begin/middle/end of the list).				2
2.	Stack and Queue: Programs involving implementations and applications of stacks and queues (array and linked list implementations, Dynamic Queue implementation, applications like balanced brackets problem, infix to postfix conversion).				2
3.	Searching: Linear Search, Binary Search, Median Search, Hash Table.				2
4.	Sorting: Bubble, Merge, Quick, Radix, Bucket, and Count; Time and Space, creation of heap from the given list of elements, conversion of min heap to max heap (and vice versa), heap-sort				4
5.	Complexity analysis of searching and sorting algorithms.				4
6.	Non-Linear Data Structure: Binary Tree, K-ary Tree, Binary Search Tree, Threaded Tree, AVL Tree, B Tree, B+ Tree, Priority Queue using Binary Heap.				6
7.	Graph: Adjacency Matrix and List; Graph Traversal using DFS and BFS				4
Course Outcomes • Gain practical experience in implementing data structures and algorithms through hands-on laboratory exercises and programming assignments. • Implement and analyze the performance of fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs, using programming languages. • Design and implement algorithmic solutions to various computational problems, and evaluate their efficiency and correctness through experimentation and analysis. • Demonstrate proficiency in implementing and evaluating data structures and algorithms using programming languages and development environments commonly used in the field.					
Text Books					
1.	Cormen T., Lieserson C., Rivest R., and Stein C., Introductions to				

	Algorithms, Prentice-Hall/India, 3rd edition, 2009
2.	Tenenbaum A.M., Langsam Y., Augenstein J.M., Data Structures Using C, 2019
Reference Books	
1.	Thomas H.C., Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, PHI, 2nd Edition, 2023
2.	Sahni S., Data Structures, Algorithms, And Applications In C++, Silicon Pr, 2004.
3.	Aho A.V., Hop croft J.E., Ullman J.D., Data Structures and algorithms, Pearson, 1982