B. Tech. (Computer Engineering / Computer Science and Engineering / Computer Technology and Allied) Syllabus Aligned with the New Education Policy 2020 Effective from AY 2025 - 2026 (All Years)

(Affiliated Colleges)

Note: Refer this Syllabus for Second Year in Computer Engineering / Computer Technology / Computer Science and Engineering / Computer Science and Cyber Security with branch codes (11242, 11245,)

Department of Computer Engineering

Dr. Babasaheb Ambedkar Technological University, Lonere - 402103

www.cse.dbatu.ac.in

Teaching Scheme		Semester III Engineering Mathematics - III	Examination Scheme	
TH	3	**Course Objectives:**	CA	20
PR	-	1. Able to comprehend the fundamental knowledge of the Laplace and inverse Laplace transforms and their derivatives for elementary functions	MSE	20
CR	3	2. Able to apply the properties of Laplace and inverse Laplace transforms to solve simultaneous linear and linear differential equations with constant coefficients.	ESE	60
		3. Able to conceptualise the definitions and properties of Fourier transforms and to solve boundary value problems using Fourier transforms.		
		4. Able to find the solutions of partial differential equations governing real-world problems.		
		5. Able to conceptualise limit, continuity, derivative and integration of complex functions, complex integrals useful in real-world problems.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Laplace Transform:** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.	08 Hrs
2	**Inverse Laplace Transform:** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.	07 Hrs
3	**Fourier Transform:** Definitions – integral transforms; Fourier integral theorem (without proof); Fourier sine and cosine integrals; Complex form of Fourier integrals; Fourier sine and cosine transforms; Properties of Fourier transforms; Parseval's identity for Fourier Transforms.	07 Hrs
4	**Partial Differential Equations and Their Applications:** Formation of Partial differential equations by eliminating arbitrary constants and functions; heat Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications	08 Hrs

to find solutions of one-dimensional flow equation ($ie.\ \frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial t^2}$), and one-dimensional wave equation ($ie.\ \frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$).

5	**Functions of Complex Variables:** Analytic functions; Cauchy-Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).	07 Hrs

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & Co. Pvt. Ltd., New Delhi.
3. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, McGraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

Teaching Scheme		Semester III Data Structures	Examination Scheme	
TH	3	**Course Objectives:**	CA	20
PR	-	1. Explain fundamental concepts of data, data types, data structures, and Abstract Data Types (ADT), and analyse algorithms in terms of time and space complexity.	MSE	20
CR	3	2. Solve computational problems by applying appropriate data structures such as arrays, hash tables, stacks, queues, and linked lists.	ESE	60
		3. Implement tree and graph data structures, including binary trees, binary search trees, heaps, and adjacency matrix representations, and perform related operations and traversals.		
		4. Demonstrate proficiency in searching and sorting algorithms, including sequential, binary search, skip lists, insertion sort, selection sort, and radix sort, along with file handling techniques.		
		5. Select and implement suitable data structures and algorithms to develop efficient, maintainable, scalable software solutions.		

COURSE CONTENT

Unit No.	Topic	Hours
1	Data, Data types, Data structure, Abstract Data Type (ADT), representation of Information, characteristics of an algorithm, program, analysing programs. **Arrays and Hash Tables:** Concept of sequential organisation, linear and non-linear data structures, storage representation, array processing, sparse matrices, transpose of sparse matrices, Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.	06 Hrs
2	**Stacks and Queues:** Introduction, stack and queue as ADT, representation and implementation of stack and queue using sequential and linked allocation, Circular queue and its implementation, Application of stack for expression evaluation and expression conversion, recursion, priority queue.	06 Hrs
3	**Linked Lists:** Concept of linked organization, singly and doubly linked list, and dynamic storage management, circular linked list, operations such as insertion, deletion, concatenation, traversal of linked list, dynamic memory management, garbage collection.	06 Hrs
4	**Trees and Graphs:** Basic terminology, binary trees and their representation, insertion and deletion of nodes in binary trees, binary search tree and its traversal, threaded binary tree, Heap, Balanced Trees, Terminology and representation of graphs using adjacency matrix, Warshall's algorithm.	07 Hrs
5	**Searching and Sorting:** Sequential, binary searching, skip lists – dictionaries, linear list representation, skip list representation, operations – insertion, deletion, and searching. Insertion sort, selection sort, radix sort, and File handling.	07 Hrs

Reference Books:

1. Horowitz and Sahani, Fundamentals of Data Structures, Universities Press, 2nd Edition, 2008.
2. Thomas Cormen, Introduction to Algorithms, PHI Publication, 2nd Edition, 2002.
3. Venkatesan & Rose, Data Structures, Wiley Publication, 1st Edition, 2015.
4. Goodrich & Tamassia, Data Structures & Algorithms in C++, Wiley Publication, 2nd Edition, 2011.
5. R. G. Dromey, How to Solve it by Computer, 2nd Impression, Pearson Education.
6. Kyle Loudon, Mastering Algorithms with C: Useful Techniques from Sorting to Encryption, O'Reilly Media, 1st Edition, 1999.

Text Books:

1. Mark Allen Weiss, Data structures and algorithms analysis in C++, Pearson Education, 4th Edition, 2013.
2. S. Lipschutz, Data Structures, McGraw-Hill Publication, Revised 1st Edition, 2014.
3. Y. Langsm, M. Augenstin, A. Tanenbaum, Data Structure using C and C++, Prentice Hall India Learning Private Limited, 2nd Edition, 1998.
4. Trembley and Sorenson, Introduction to Data Structures, PHI Publication, 2nd Revised Edition, 1983.
5. Vishal Goyal, Lalit Goyal, A Simplified Approach To Data Structure, SPD Publication, 1st Edition, 2014.

Teaching Scheme		Semester III Discrete Mathematics	Examination Scheme	
TH	3	**Course Objectives:**	CA	20
PR	-	1. Apply principles of propositional and predicate logic to model, analyze, and validate logical arguments using truth tables, standard forms, rules of inference, and quantifiers.	MSE	20
CR	3	2. Use set theory, functions, and relations to represent, manipulate, and reason about mathematical structures and their properties.	ESE	60
		3. Solve combinatorial problems using counting principles, recurrence relations, and graph theory concepts, including paths, connectivity, colouring, and spanning trees.		
		4. Implement algorithms for graph and tree problems such as shortest paths, minimal spanning trees, Huffman coding, and topological sorting.		
		5. Analyse and apply algebraic structures, including groups, rings, fields, and Boolean algebras, to formulate and solve problems in computer science and related domains.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Propositional Logic:** Propositions, truth values, Truth tables for operators, Truth Tables of Compound Propositions, Precedence of Logical Operators. **Propositional Equivalences:** Logical Equivalences, Constructing New Logical Equivalences, Normal Forms. **Predicates and Quantifiers:** Predicates, Quantifiers: Universal and Existential, Quantifiers with Restricted Domains, Precedence of Quantifiers, Binding Variables, Logical Equivalences Involving Quantifiers, Negating Quantified Expressions, Translating from English into Logical Expressions, Examples from Lewis Carroll, Nested Quantifiers: Understanding Statements Involving Nested Quantifiers, The Order of Quantifiers, Negating Nested Quantifiers. **Rules of Inference:** Valid Arguments in Propositional Logic, Rules of Inference for Propositional Logic, Using Rules of Inference to Build Arguments, Resolution, Fallacies.	09 Hrs
2	**Basic notions in set Theory:** Sets, Venn Diagrams, Subsets, The Size of a Set, Power Sets, Cartesian Products, Set operations, Set Identities, Generalized Unions and Intersections, Cardinality of Sets. **Functions:** Introduction, Subjective, Injective, Bijective, inverse functions, Composition of functions. **Relations:** Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Equivalence classes and partitions, Partial Ordering, Hasse Diagram, Topological Sort.	09 Hrs
3	**Combinatorics:** Applications of Recurrence Relations, Solving Linear Recurrence Relations.	06 Hrs

4	**Graph:** Some Special Simple Graphs, Bipartite Graphs, New Graphs from Old, Shortest path problems, Euler and Hamiltonian paths, Isomorphic graphs, Planar graphs, Connectivity, Matching Coloring. **Trees:** Prefix Codes, Huffman coding, Spanning trees and cut sets, Minimal spanning trees, Kruskal's and Prim's algorithms for minimal spanning trees.	07 Hrs
5	**Algebraic Structures and Morphism:** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields, Boolean Algebra and Boolean Ring.	05 Hrs

Text Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2008.

Reference Books:

1. Lipschutz, Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2009.
2. V. K. Balakrishnan, Schaum's Outline of Graph Theory, McGraw-Hill Publication, 1st Edition, 1997.
3. Eric Gossett, Discrete Mathematics with Proof, Wiley Publication, 2nd Edition, 2009.
4. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Publication, 6th Edition, 2010.
5. Y. N. Singh, Discrete Mathematical Structures, Wiley Publication, 1st Edition, 2010.
6. Dr. Sukhendu Dey, Graph Theory with Applications, SPD Publication, 1st Edition, 2012.

Teaching Scheme		Semester III Object-Oriented Programming	Examination Scheme	
TH	2	**Course Objectives:**	CA	20
PR	-	1. To explain the fundamental properties of OOP. 2. To describe the usefulness of basic OO abstractions like class, Methods, and Interfaces. 3. To apply code reuse techniques through inheritance. 4. To apply design OO libraries for designing UI and other programmatic features.	MSE	20
CR	2		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Classes and Objects** (Java)**:** Introduction, Java Class Libraries, Typical Java Development Environment, Memory Concepts, Arithmetic. Classes, Objects, Methods and Instance Variables, Declaring a Class with a Method and Instantiating an Object of a Class, Declaring a Method, Instance variables, set Methods and get Methods, Primitive Types vs. Reference type double Types, Initializing Objects with Constructors, floating point numbers. Contro Statements and Array	05 Hrs
2	**Modulization in Java: Java Package, importing packages,** Methods: static methods, static Fields, scope of declaration, method overloading, and Java API packages.	05 Hrs
3	**Inheritance and Polymorphism in Java:** Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, constructors in subclasses, object class. Polymorphism: Abstract classes and methods, final methods and classes, polymorphism examples, and Interfaces.	05 Hrs
4	**Exception-handling:** Exception-handling overview, handling Arithmetic Exceptions and Input Mismatch Exceptions, when to use exception handling, Java exception hierarchy, finally block. Java Iterator Methods Parametrized Classes in Java.	06 Hrs

Text Books:

1. Paul Deitel and Harvey Detail, Java: How to Program, Pearson's Publication, 9th Edition.

Reference Books:

1. Joel Murach and Michael Urban, Murach's Beginning Java with Eclipse, Murach's Publication, 1st Edition, 2016. Doug Lowe, Java All-in-One For Dummies, Wiley Publication, 4th Edition,2014.

2. Herbert Schildt, Java: The Complete Reference, McGraw-Hill Publication, 9th Edition.
3. Patrick Niemeyer, Daniel Leuck, Learning Java, O'Reilly Media, 4th Edition, 2013.
4. JavaScript: The Good Parts‖, Douglas Crockford, O‘Reilly, ISBN: 9782744055973.

Teaching Scheme		Semester III Digital Electronics	Examination Scheme	
TH	2	**Course Objectives:**	CA	20
PR	-	1. To acquaint the students with the fundamental principles of two-valued logic and various devices to implement logical operations on variables.	MSE	20
CR	2	2. To lay the foundation for further studies in areas such as communication, VHDL, and computer.	ESE	60
		3. Understand the principles of asynchronous counters and design them to meet specific counting requirements.		
		4. Solve real-world problems related to arithmetic operations, code conversion, counter applications, and other digital logic scenarios.		

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction:** Digital signals, digital circuits, AND, OR, NOT, NAND, NOR, and Exclusive-OR operations, Boolean algebra, examples of IC gates.	05 Hrs
2	**Number Systems:** binary, signed binary, octal hexadecimal number, binary arithmetic, one‘s and two‘s complements arithmetic, codes, error detecting and correcting codes.	05 Hrs
3	**Combinational Logic Design:** Standard representations for logic functions, K-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto four variables), and don’t care conditions.	05 hrs
4	**Design Examples:** Arithmetic Circuits, BCD-to-7 segment decoder, Code converters. Adders and their use as subtractors, look-ahead carry, ALU, Digital Comparator, Parity generators/checkers, Design of Multiplexers and Demultiplexers, and Decoders.	05 Hrs
5	**Sequential Circuits and Systems:** 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J-K-T, and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, a special counter IC‘s, asynchronous sequential counters, applications of counters.	06 Hrs

Text/Reference Books:

1. R. P. Jain, Modern Digital Electronics, McGraw-Hill Education, 2009.
2. M. Morris Mano, Digital Logic and Computer Design, 4th edition, Prentice Hall of India, 2013.

3. Anand Kumar, Fundamentals of digital circuits, 1st edition, Prentice Hall of India, 2001.
4. Pedroni V. A., Digital Circuit Design with VHDL, Prentice Hall India, 2nd Edition, 2001.

Teaching Scheme		Semester III Universal Human Values - II	Examination Scheme	
TH	3	**Course Objectives:** 1. Explain the concept of value education, self-exploration, and the relationship between happiness, prosperity, and basic human aspirations. 2. Distinguish between the needs of the self and the body, and apply methods to achieve harmony within the individual and between the self and the body. 3. Demonstrate understanding of harmony in the family and society by applying foundational values such as trust and respect in human relationships. 4. Analyse the interconnectedness and mutual fulfilment among the four orders of nature and relate it to sustainable living and coexistence. 5. Apply a holistic understanding of human values to professional ethics, decision-making, and strategies for value-based life and profession.	CA	20
PR	-		MSE	20
CR	3		ESE	60

COURSE CONTENT

Unit No.	Topic	Hours
1	**Introduction to Value Education:** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity, Current Scenario, Method to Fulfill the Basic Human Aspirations.	05 Hrs
2	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health.	05 Hrs
3	**Harmony in the Family and Society:** Harmony in the Family, the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order	04 Hrs
4	**Harmony in the Nature (Existence):** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	05 Hrs
5	**Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education,	05 Hrs

Humanistic Constitution and Universal Human Order, Competence in Professional Ethics- Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Teaching Scheme		Semester III Life of Chhatrapati Shivaji Maharaj	Examination Scheme	
TH	1	**Course Objectives:**	CA	50
PR	-	1. Analyse Shivaji Maharaj's military strategies, including guerrilla warfare, fortress defence, naval power, and intelligence networks, in historical and tactical contexts.	MSE	-
CR	1	2. Evaluate Shivaji Maharaj's leadership, management practices, and innovations in logistics, fortifications, and military technology.	ESE	-
		3. Interpret Shivaji Maharaj's views on women's rights, religious tolerance, democracy, and nationalism, and relate them to contemporary socio-political values.		

COURSE CONTENT

Unit No.	Topic	Hours
1	Shivaji Maharaj as a Great Conqueror, Master Strategist and innovator in Military Tactics Guerrilla Warfare (Ganimi Kava), Fortress Strategy, Avoidance of Direct Confrontation, Diplomacy and Alliances, Naval Power.	05 Hrs
2	Shivaji Maharaj's Management and leadership strategies, Architecture and metallurgy of Raigad Fort, Use of Light Cavalry, Intelligence Network, Asymmetric Warfare, Logistics and Supply Chains, Fortifications and Military Architecture	05 Hrs
3	Shivaji Maharaj's views about Women's rights, their dignity and religious views. His views on Democracy & Nationalism	05 Hrs

Teaching Scheme	Semester III Data Structures Laboratory	Examination Scheme
PR: 2 CR:1		CA: 60 ESE: 40

List of Experiments:

1. Write a program to implement a stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement a circular queue using arrays.
5. Write a program to implement double ended queue (dequeue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.
8. Write a program to implement a queue using two stacks such that dequeue operation runs in constant time and dequeue operation runs in linear time.
9. Write programs to implement the following data structures: (a) Single linked list, (b) Double linked list, (c) Circular linked list
10. Write a program to implement a stack using a linked list such that the push and pop operations of the stack still take O (1) time.
11. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it. (a) Minimum key (b), Maximum key, (c) Search for a given key, (d) Find predecessor of a node, (e) Find successor of a node, (f) Delete a node with given key.
12. Write a program to implement hashing with (a) Separate Chaining and (b) Open addressing methods.
13. Implement the following sorting algorithms: (a) Insertion sort, (b) Merge sort, (c) Quick sort, (d) Heap sort.
14. Write programs for the implementation of graph traversals by applying: (a) BFS, (b) DFS.

Teaching Scheme	Semester III Object-Oriented Programming in Java Laboratory	Examination Scheme
PR: 2 CR: 1		CA: 60 ESE:40

List of Experiments:

1. Programs on Operators, Arithmetic Promotion, and Method Calling.
2. Programs on Classes: String and Math.
3. Write a program to demonstrate the following Function concepts
   i. Function overloading
   ii. Constructors of all types
   iii. Default parameters, returning by reference
4. Programs on dealing with Arrays.
5. Programs on Classes: String and Math.
6. Programs on Inheritance and Polymorphism.
7. Programs on Interfaces, block initializers, final Modifier, as well as static and dynamic binding.
8. Programs on Exception Handling.
9. Write a Java program that illustrates the following
   a) Creation of a simple package.
   b) Accessing a package.
   c) Implementing interfaces.
10. Create a simple GUI using JFrame, JButton, JLabel, and JTextField. Handle user events using action listeners.
11. Demonstrate usage of List, Set, and Map. Iterate using an enhanced for-loop and an Iterator.

Teaching Scheme	Semester III Digital Electronics Laboratory	Examination Scheme
PR: 2 CR: 1		CA: 60 ESE: 40

List of Experiments

1. Study of gates – AND; OR; NOT; NAND; NOR; EX-OR; EX-NOR
2. Verification of Boolean Theorems using basic gates.
3. Design a circuit to convert a binary number to its two's complement representation.
4. Design and realize a given function using K-maps and verify its performance.
5. Verify
    a. Demorgan's Theorem for 2 variables.
    b. The sum-of product and product-of-sum expressions using universal gates.
6. Design and implement
    a. Full Adder using basic logic gates.
    b. Full subtractor using basic logic gates.
7. Implementation of 4x1 multiplexer using Logic Gates.
8. To verify the truth tables of S-R; J-K; T and D type flip flops.
9. Design, and Verify the 4- Bit Synchronous Counter.
10. Design, and Verify the 4-Bit Asynchronous Counter.
11. Design and implementation of a simple digital system (Mini Project).