Vertical – 1
Major

Sem. – III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2343111	Applied Mathematics Thinking-I	02	-	01	02	-	01	03

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II					
2343111	Applied Mathematics Thinking-I	20	20	40	60	2	25	--	125

Note: * One hour of tutorial class to be conducted for full class as practice/problem solving/discussion/theory.

Course Objectives: Students will be able to learn:

1. To familiarize with the Laplace Transform, Inverse Laplace Transform of various functions, and its applications.
2. To acquaint oneself with the concept of Fourier series, its complex form, and enhance problem-solving skills.
3. To familiarize the concept of complex variables, C-R equations with applications.
4. The fundamental knowledge of Trees, Graphs, etc.
5. To study the basic techniques of statistics, including correlation, regression, and curve fitting, for data analysis, Machine learning, and AI.
6. To understand some advanced topics of probability, random variables with their Distributions and expectations.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Apply the concept of Laplace transform to solve the real integrals in engineering problems.	L1, L2
2	Apply the concept of inverse Laplace transform of various functions in engineering problems.	L1, L2
3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems.	L1, L2, L3
4	Find orthogonal trajectories and analytic function by using basic concepts of complex variable theory.	L1, L2, L3
5	Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning and AI.	L2, L3
6	Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.	L1, L2

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Applied Mathematics I, Applied Mathematics-II	01	--
I	**Laplace Transform**	Definition of Laplace transform, Condition of Existence of Laplace transform,	**06**	**CO1**

		Laplace Transform of Standard Functions likee^{at}, $sin(at)$, $cos(at)$, $sinh(at)$, $cosh\,(at)$and t^n, $n\geq 0$. Properties of Laplace Transform: Linearity, First Shifting Theorem, Change of scale Property, multiplication by *t*, Division by *t (division by t^2 not included),* Laplace Transform of derivatives (up to second derivative) and integrals (Properties without proof) Evaluation of real integrals by using Laplace Transformation. **Self-learning Topics:** Heaviside's Unit Step function, Second shifting theorem, Laplace Transform. Of Periodic functions, Dirac Delta Function.		
II	**Inverse Laplace Transform**	Inverse Laplace Transform, Linearity property, use of standard formulae to find inverse Laplace Transform, finding Inverse Laplace transform using derivatives, Partial fractions method to find inverse Laplace transform. (only up to s^3 in denominator) Inverse Laplace transform using Convolution theorem (without proof) Applications to solve initial and boundary value problems involving ordinary differential equations (up to 2^{nd} order differential equation) **Self-learning Topics:** Partial fractions method to find inverse Laplace transform. (with s^4 in denominator), Inverse Laplace transform using derivatives and its properties.	**06**	**CO1, CO2**
III	**Fourier Series**	Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof) Fourier series of periodic function with period2 ⌜ and2*l*, Fourier series of even and odd functions (simple functions only, piecewise continuous function not to be included) Hal Frange Sine and Cosine Series. **Self-learning Topics:** Complex form of Fourier Series, orthogonal and orthonormal set of functions, Fourier Transform.	**05**	**CO3**
IV	**Complex Variables**	Analytic function, necessary and sufficient conditions for *f*(z) to be analytic (without proof), Cauchy-Riemann equations in cartesian coordinates (without proof, Polar form not included) Milne-Thomson method to determine analytic function *f*(z) when real (u)or imaginary part (v) is given Harmonic function, Harmonic conjugate, and orthogonal trajectories **Self-learning Topics:** Cauchy-Riemann equations in polar coordinates, conformal mapping, linear, bilinear mapping, cross ratio, fixed points, and standard transformations.	**05**	**CO4**
V	**Statistical Techniques**	Kar lPearson's Coefficient of correlation(r) Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks) Lines of regression Fitting of first- and second-degree curves. **Self-learning Topics:** Covariance, fitting of exponential curve.	**04**	**CO5**
VI	**Probability**	Discrete and continuous random variable with probability distribution and probability density function. Expectation of random variable with mean, variance and standard deviation, moment generating function up to two moments.	**04**	**CO6**

		Self-learning topics: Total probability theorem, Bayes' theorem, Skewness and Kurtosis of distribution (data).		
Note: No questions will be asked in the end-semester exam from self-study topics. However, students are encouraged to explore these topics for a better understanding of the subject.				

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited.
3. Advanced Engineering Mathematics, R.K. Jainand S.R.K. Iyengar, Narosapublication,

References:

1. Complex Variables and Applications, Brown and Churchill, McGraw-Hill Education.
2. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill education.
3. Theory and Problems of Fourier Analysis, Murray Spiegel, Schaum'sOutlineSeries.
4. Higher Engineering Mathematics, H. K. Dass
5. Text book of Engineering Mathematics, N. P. Bali and Dr. Manish Goyal

Online References:

Sr. No.	Website Name
1.	https://www.nptel.ac.in
2	Higher Engineering Mathematics by H.K.Dass
3	Higher Engineering Mathematics by B.V. Raamana

List Of Tutorials :

Tutorial No	Tutorial Topic	Hours
1	Laplace Transform	1
2	Inverse Laplace Transform	1
3	Application Of Laplace Transform	1
4	Fourier Series (Full range)	1
5	Half Range Fourier Series	1
6	Complex Variables	1
7	Statistical Techniques	1
8	Probability	1

Term Work:

General Instructions:

1. Students must be encouraged to write at least 6 class tutorials on the entire syllabus.
2. A group of 4-6 students should be assigned a self-learning topic. Students should prepare a presentation/problem solving of 10-15 15minutes. This should be considered as a mini project in

Applied Mathematics. This project should be graded for 10 marks depending on the performance of the students.

The distribution of Term Work marks will be as follows–

1	Attendance (Theory and Tutorial)	05marks
2	Class Tutorials on entire syllabus	10marks
3	Mini project	10marks

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II.

End Semester Theory Examination:

- **Question paper format**

- Question Paper will comprise a total of **six questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**

- **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

- A total of **four questions** need to be answered.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2343112	Advance Data Structure & Analysis	03	–	--	03	--	--	03

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II					
2343112	Advance Data Structure & Analysis	20	20	40	60	02	--	--	100

Course Objective: Students will able to learn:

Sr. No.	Course Objectives
1	To learn mathematical background for analysis of algorithm
2	To learn various advanced data structures.
3	To learn greed approach to solve problems.
4	To learn backtracking algorithm and maximum flow networks.
5	To learn dynamic programming methods.
6	To understand the concept of pattern matching.

Course Outcomes:

On successful completion, of course, learner/student will be able to:

Sr.No.	Course Outcomes	Cognitive Levels of Attainment as per Bloom's Taxonomy
1	Understand methods for analysis of algorithms and solve recurrence problems.	L1, L2
2	Choose appropriate advanced data structures for a given problem and calculate its complexity.	L2, L3, L4
3	Analyze the greedy programming technique to solve problems.	L2, L3, L4, L5
4	Evaluate and analyze the backtracking algorithm and understand maximum flow networks.	L2, L3, L4, L5
5	Analyze the dynamic programming technique to solve problems.	L2, L3, L4, L5
6	Select a proper pattern matching algorithm for a given problem.	L3, L4, L5

Detailed Syllabus:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mappings
0	**Prerequisite**	Overview of Data Structures: Revision of basic data structures (arrays, stacks, queues, linked lists, trees).	**01**	
I	**Introduction to Analysis of Algorithms**	Fundamentals of the analysis of algorithms: Time and Space complexity, Asymptotic notation, Recurrence Relations: Methods to solve recurrence relations in algorithms (Substitution, Recursion tree, Master theorem). **Self-learning Topics:** Solve problems on analysis of algorithms.	**03**	**CO1**

II	**Advanced Data Structures**	Introduction. AVL trees, B tree, B tree operations, B+ tree, Red-Black Trees, tries data structures, time complexity analysis of all problems. Graphs, Representation, Graph Traversals: Breadth First Search, Depth First Search. **Self-learning Topics:** Solve problems on AVL trees, B tree, B+ tree etc.	**08**	**CO2**
III	**Greedy algorithms and Applications**	Introduction and properties of greedy algorithms, Fractional Knapsack problem, Minimum Spanning Trees (Prim's and Kruskal's algorithms), Job sequencing with deadlines, Optimal storage on tapes, Analysis of All problems. **Self-learning Topics:** Solve problems on Spanning Trees, Knapsack etc.	**06**	**CO3**
IV	**Backtracking and Maximum flow Networks**	Backtracking Techniques: Introduction, N-Queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles. Introduction to flow networks, Augmenting Paths Residual Network, Ford Fulkerson method, Applications of Flow Networks in real-world problems. **Self-learning Topics:** Solve problems N-Queens, Hamiltonian cycles, Augmenting Paths Residual Network etc.	**07**	**CO4**
V	**Dynamic Algorithms**	Introduction Dynamic algorithms, Greedy vs. Dynamic algorithms, Single source shortest path- Dijkstra's Algorithm, Bellman Ford Algorithm, All pair shortest path- Floyd Warshall Algorithm, 0/1 knapsack problem, Travelling salesman problem, Analysis of All problems. **Self-learning Topics:** Solve problems on shortest path- Dijkstra's Algorithm etc.	**08**	**CO5**
VI	**String Matching Algorithms**	Introduction. Naïve string matching algorithm, Rabin-Karp algorithm, Knuth-Morris-Pratt(KMP) algorithm, Longest common subsequence(LCS), Analysis of All problems, **Applications:** Text searching, DNA sequencing, and data compression. **Self-learning Topics:** Solve problems on DNA sequencing, and data compression.	**06**	**CO6**
Note: No questions will be asked in the end-semester exam from self-study topics. However, students are encouraged to explore these topics for a better understanding of the subject.				

Text Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Introduction to Algorithms	Cormen, Leiserson, Rivest, Stein	PHI	3rd Edition	2011
2	Algorithm Design	Jon Kleinberg, Éva Tardos	Pearson	1st Edition	2006
3	Data Structures and Algorithm Analysis in C++	Mark Allen Weiss	Pearson	4th Edition	2013
4	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson	3rd Edition	2011
5	Algorithms	Robert Sedgewick, Kevin Wayne	Addison-Wesley	4th Edition	2011

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	NPTEL	https://archive.nptel.ac.in/courses/106/106/106106200/	M1
2	NPTEL	https://archive.nptel.ac.in/courses/106/105/106105085/	M2
3	NPTEL	https://archive.nptel.ac.in/courses/106/104/106104120/	M3
4	Coursera	https://www.coursera.org/learn/algorithms-part1	M1-M3
5	MIT OpenCourseWare	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/	M1-M6

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II.

End Semester Theory Examination:

- **Question paper format**

- Question Paper will comprise a total of **six questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**

- **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

- A total of **four questions** need to be answered.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2343113	Database Management System & Application	03	–	--	03	--	--	03

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II					
2343113	Database Management System & Application	20	20	40	60	02	--	--	100

Course Objective: Students will be able to learn:

Sr. No.	Course Objectives
1	To learn the basics and understand the need for database management systems for real-world applications.
2	To construct a conceptual data model for real-world applications
3	To Build a Relational Model from ER/EER.
4	To introduce the concept of SQL to store and retrieve data efficiently.
5	To demonstrate notions of normalization for database design.
6	To understand the concepts of transaction processing- concurrency control & recovery procedures.

Course Outcomes:

On successful completion, of course, learner/student will be able to:

Sr.No.	Course Outcomes	Cognitive Levels of Attainment as per Bloom's Taxonomy
1	Identify the need of Database Management System.	L1, L2
2	Design conceptual model for real life applications.	L6
3	Create Relational Model for real life applications	L6
4	Formulate query using SQL commands.	L3
5	Apply the concept of normalization to relational database design.	L3
6	Demonstrate the concept of transaction, concurrency and recovery.	L2

Detailed Syllabus:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mappings
0	**Prerequisite**	C, Python Programming.	**02**	--
I	**Database System Concepts, Architecture,**	Introduction, Characteristics of Databases, File system v/s Database system, Data abstraction and Data Independence, DBMS system architecture, Database Administrator (DBA), Role of DBA.	**05**	CO1

	and Applications	**Applications:** Banking Systems, E-Commerce, Telecommunications, Healthcare Systems, Social Media Platforms, Education Systems, Airline Reservation Systems, Government Applications. **Self-learning Topics:** Identify the types of Databases.		
II	**The Entity-Relationship Model**	Conceptual Modeling of a database, The Entity-Relationship (ER) Model, Entity Type, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Weak entity Types. Generalization, Specialization and Aggregation, Extended Entity-Relationship (EER) Model. **Self-learning Topics:** Design an ER model for any real-time case study.	**05**	CO2
III	**Relational Model & Relational Algebra**	Introduction to Relational Model, Relational Model Constraints and Relational Database Schemas, Concept of Keys: Primary Kay, Secondary key, Foreign Key, Mapping the ER and EER Model to the Relational Model, Introduction to Relational Algebra, Relational Algebra expressions for Unary Relational Operations, • Set Theory operations, • Binary Relational operation Relational Algebra Queries **Self-learning Topics:** Map the ER model designed in module II to relational schema.	**05**	CO3
IV	**Structured Query Language (SQL) & Indexing**	Overview of SQL, Data Definition Commands, Set Operations, Aggregate Function, null values, Data Manipulation commands, Data Control commands, Complex Retrieval Queries using Group By, Recursive Queries, nested Queries, Integrity constraints in SQL. Database Programming with JDBC, Security and authorization: Grant & Revoke in SQL Functions and Procedures in SQL and cursors. Indexing: Basic Concepts, Ordered Indices, Index Definition in SQL **Self-learning Topics:** Physical design of database for the relational model designed in module III and fire various queries.	**08**	CO4
V	**Relational Database Design**	Design guidelines for relational Schema, Functional Dependencies, Database tables and normalization, The need for normalization, The normalization process, Improving the design, Definition of Normal Forms- 1NF, 2NF, 3NF & The Boyce-Codd Normal Form (BCNF). **Self-learning Topics:** Consider any real-time application and normalization up to 3NF/BCNF	**07**	CO5
VI	**Transactions Management and Concurrency and Recovery**	Transaction: Transaction concept, State Diagram, ACID Properties, Transaction Control Commands, Concurrent Executions, Serializability – Conflict and View, Concurrency Control: Lock-based-protocols, Deadlock handling Timestamp-based protocols, Recovery System: Recovery Concepts, Log based recovery. **Self-learning Topics:** Study the various deadlock situations which may occur for a database designed in module V.	**07**	CO6
Note: No questions will be asked in the end-semester exam from self-study topics. However, students are encouraged to explore these topics for a better understanding of the subject.				

Text Books:

1. Korth, Slberchatz, Sudarshan, Database System Concepts, 6th Edition, McGraw Hill

2. Elmasri and Navathe, Fundamentals of Database Systems, 6th Edition, Pearson education

3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH

References:

1. Peter Rob and Carlos Coronel, ―Database Systems Design, Implementation and Management‖, Thomson Learning, 9th Edition.
2. SQL & PL / SQL for Oracle 11g Black Book, Dreamtech Press
3. G. K. Gupta : "Database Management Systems", McGraw – Hill

Online References:

Sr. No.	Website Name
1.	https://www.nptel.ac.in
2.	https://www.oreilly.com
3.	https://www.coursera.org/

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

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End Semester Theory Examination:

- **Question paper format**

- Question Paper will comprise a total of **six questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**

- **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

- A total of **four questions** need to be answered.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2343114	Automata Theory	03	–	--	03	--	--	03

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II					
2343114	Automata Theory	20	20	40	60	02	--	--	100

Course Objectives: Students will able to learn:

Sr. No.	Course Objectives
1	To learn fundamentals of Regular and Context Free Grammars and Languages.
2	To understand the relation between Regular Language and Finite Automata and machines.
3	To learn how to design Automata's as Acceptors, Verifiers and Translators.
4	To understand the relation between Regular Languages, Contexts free Languages, PDA and TM.
5	To learn how to design PDA as acceptor and TM as Calculators.
6	To learn applications of Automata Theory.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Explain, analyze and design Regular languages, Expression and Grammars.	L2, L4, L6
2	Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.	L6
3	Analyze and design Context Free languages and Grammars.	L4, L6
4	Design different types of Push down Automata as Simple Parser.	L6
5	Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.	L6
6	Develop understanding of applications of various Automata.	L6

Prerequisite: Basic Mathematical Fundamentals: Sets, Logic, Relations, Functions.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Basic Mathematical Fundamentals: Sets, Logic, Relations, Functions.	02	-

I	Introduction and Regular Languages	Languages: Alphabets and Strings. Regular Languages: Regular Expressions, Regular Languages, Regular Grammars, RL and LL grammars, Closure properties **Self-learning Topics:** Practice exercise on Regular Expressions. Identify the tools also.	**05**	CO1
II	Finite Automata	Finite Automata: FA as language acceptor or verifier, NFA (with and without ε) , DFA, RE to NFA, NFA to DFA, Reduced DFA , NFA-DFA equivalence, FA to RE. Finite State Machines with output : Moore and Mealy machines. Moore and Mealy M/C conversion. Limitations of FA. **Self-learning Topics:** Practice exercise on FA and NFA	**09**	CO2
III	Context Free Grammars	Context Free Languages: CFG, Leftmost and Rightmost derivations, Ambiguity, Simplification and Normalization (CNF & GNF) and Chomsky Hierarchy (Types 0 to 3) **Self-learning Topics:** Practice numerical or exercise on CFG	**08**	CO3
IV	Push Down Automata	Push Down Automata: Deterministic (single stack) PDA, Equivalence between PDA and CFG. Power and Limitations of PDA. **Self-learning Topics:** List the examples of PDA.	**05**	CO4
V	Turing Machine	Turing Machine: Deterministic TM, Variants of TM, Halting problem, Power of TM. **Self-learning Topics:** Practice numerical of TM.	**07**	CO5
VI	Applications of Automata	Applications of FA, CFG, PDA & TM. Introduction to Compiler & Its phases. **Self-learning Topics:** Case study on any one compiler.	**03**	CO2, CO3, CO4, CO5, CO6
Note: No questions will be asked in the end-semester exam from self-study topics. However, students are encouraged to explore these topics for a better understanding of the subject.				

Text books

1. J.C. Martin, "Introduction to languages and the Theory of Computation", TMH.
2. Kavi Mahesh, "Theory of Computation A Problem Solving Approach", Wiley India
3. A. V. Aho, R. Shethi, Monica Lam , J.D. Ulman , "Compilers Principles, Techniques and Tools ",Pearson Education.

References

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
2. Daniel I.A. Cohen, "Introduction to Computer Theory", John Wiley & Sons.
3. Vivek Kulkarni," Theory of Computation", Oxford University.
4. N. Chandrashekhar, K.L.P. Mishra, "Theory of Computer Science, Automata Languages & Computations", PHI publications.
5. J. J. Donovan, " Systems Programming", TMH.

Online References:

Sr. No.	Website Name
1.	https://www.nptel.ac.in
2.	https://online.stanford.edu
3.	https://www.coursera.org/

Assessment:
Internal Assessment Test (IAT) for 20 marks each:

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End Semester Theory Examination:

- **Question paper format**

- Question Paper will comprise a total of **six questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**

- **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

- A total of **four questions** need to be answered.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2343115	ADSA Lab	--	2	--	--	1	--	1

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II					
2343115	ADSA Lab	--	--	--	--	--	25	25	50

Lab Objective: The course aims to

Sr. No	Lab Objectives
1	To learn mathematical background for analysis of algorithm
2	To learn various advanced data structures.
3	To learn greed approach to solve problems.
4	To learn backtracking algorithm and maximum flow networks.
5	To learn dynamic programming methods.
6	To understand the concept of pattern matching.

Lab Outcomes: Upon completion of the course students will be able to:

Sr. No.	Lab Outcomes	Cognitive Levels of Attainment as per Bloom's Taxonomy
1	Understand methods for analysis of algorithms and solve recurrence problems.	L1, L2
2	Choose appropriate advanced data structures for a given problem and calculate its complexity.	L2, L3, L4
3	Analyze the greedy programming technique to solve problems.	L2, L3, L4, L5
4	Evaluate and analyze the backtracking algorithm and understand maximum flow networks.	L2, L3, L4, L5
5	Analyze the dynamic programming technique to solve problems.	L2, L3, L4, L5
6	Select a proper pattern matching algorithm for a given problem.	L3, L4, L5

Hardware & Software Requirements:

Hardware Requirement:	Software requirement:
PC i3 processor and above	Turbo/Borland C complier

DETAILED SYLLABUS:

Sr. No.	Name of Module	Suggested list of Practical	Hours	LO Mappings
I	**Introduction to Analysis of Algorithms**	1. Implement Merge sort and Quicksort for the given list of integer values and find space and time complexity. 2. Implementation of randomized quicksort algorithm and find space and time complexity. 3. Implementation of hash functions and its associated algorithms.	**04**	**LO1**
II	**Advanced Data Structures**	4. Construct Binary Search Tree for given sequence of integers and perform Pre-order, In-order and Post-order traversal of constructed tree. Analyze complexities. 5. Implement Insert, Delete, Search and Display operations on Binary Search Tree and analyze space and time complexity. 6. Implementation of operations on B/B+-trees.	**05**	**LO2**
III	**Greedy algorithms and Applications**	7. Implement solution for a 0-1 knapsack problem using dynamic programming. 8. Implement Prim's and Kruskal's algorithms. 9. Implement solution for job sequencing with deadlines problems.	**05**	**LO3**
IV	**Backtracking and Maximum flow Networks**	10. Implement N-Queen's problem using Back Tracking. 11. Implement Sum of subsets problem for a given set of distinct numbers using backtracking. 12. Implement graph coloring, 13. Implement Hamiltonian cycles. 14. Implementation of Ford-Fulkerson algorithm.	**04**	**LO4**
V	**Dynamic Algorithms**	15. Implementation of Bellman-Ford algorithm. 16. Implement Floyd Warshall Algorithm. 17. Implement Travelling salesman problem.	**04**	**LO5**
VI	**String Matching Algorithms**	18. Implement Naïve string matching algorithm. 19. Implement Rabin-Karp algorithm. 20. Implement KMP algorithm. 21. Implement Longest common subsequence. 22. Implement any one application.	**04**	**LO6**

Text Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Introduction to Algorithms	Cormen, Leiserson, Rivest, Stein	PHI	3rd Edition	2011
2	Algorithm Design	Jon Kleinberg, Éva Tardos	Pearson	1st Edition	2006
3	Data Structures and Algorithm Analysis in C++	Mark Allen Weiss	Pearson	4th Edition	2013

4	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson	3rd Edition	2011
5	Algorithms	Robert Sedgewick, Kevin Wayne	Addison-Wesley	4th Edition	2011

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	NPTEL	https://archive.nptel.ac.in/courses/106/106/106106200/	M1
2	NPTEL	https://archive.nptel.ac.in/courses/106/105/106105085/	M2
3	NPTEL	https://archive.nptel.ac.in/courses/106/104/106104120/	M3
4	Coursera	https://www.coursera.org/learn/algorithms-part1	M1-M3
5	MIT OpenCourseWare	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/	M1-M6

Assessment :
Term Work: Term work shall consist of at least 10-12 practical's based on above list. Also Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Oral & Practical exam will be held based on Practicals.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2343116	SQL Lab	--	2	--	--	1	--	1

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II					
2343116	SQL Lab	--	--	--	--	--	25	25	50

Lab Objective: The course aims to

Sr. No	Lab Objectives
1	To identify and define problem statements for real life applications.
2	To construct conceptual data model for real life applications.
3	To Build Relational Model from ER/EER and demonstrate usage of relational algebra.
4	To Apply SQL to store and retrieve data efficiently.
5	To implement database connectivity using JDBC.
6	To understand the concepts of transaction processing- concurrency control & recovery procedures.

Lab Outcomes: Upon completion of the course, students will be able to:

Sr. No.	Lab Outcomes	Cognitive Levels of Attainment as per Bloom's Taxonomy
1	Define problem statement and Construct the conceptual model for real life application.	L1, L3, L4, L6
2	Create and populate a RDBMS using SQL.	L3, L4
3	Formulate and write SQL queries for efficient information retrieval	L3, L4
4	Apply view, triggers and procedures to demonstrate specific event handling.	L1, L3, L4
5	Demonstrate database connectivity using JDBC.	L3
6	Demonstrate the concept of concurrent transactions.	L3, L4

Prerequisite: C and Python Programming.

Hardware & Software Requirements:

Hardware Requirement:	Software requirement:
PC i3 processor and above	Any SQL Compiler, Python/Java Programming Language

DETAILED SYLLABUS:

Sr. No.	Experiment List	Hours	LO Mapping
1.	Identify real world problem and develop the problem statement. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.	**02**	LO1
2.	Mapping ER/EER to Relational schema model.	**02**	LO1
3.	Create a database using DDL and apply integrity constraints.	**02**	LO2, LO3
4.	Perform data manipulations operations on populated database.	**02**	LO3
5.	Perform Authorization using Grant and Revoke.	**02**	LO2, LO3
6.	Implement Basic and complex SQL queries.	**02**	LO3, LO4
7.	Implementation of Views and Triggers.	**02**	LO4
8.	Demonstrate database connectivity using JDBC.	**02**	LO5
9.	Execute TCL commands.	**02**	LO4
10.	Implement functions and procedures in SQL	**02**	LO3, LO4
11.	Implementation of Cursor.	**03**	LO3, LO4
12.	Implementation and demonstration of Transaction and Concurrency control techniques using locks.	**03**	LO6

Note: Guidelines for the conduction of practical.

- **Faculty will assign one real-world case study or application to a group of 3 students, and each group is to perform the above list of experiments and then apply to their assigned case study or application.**
- **Learner must prepare a Journal of the above experiment list along with a report of their assigned case study/application.**

Text Books:

1. Korth, Slberchatz, Sudarshan, Database System Concepts, 6th Edition, McGraw Hill
2. Elmasri and Navathe, Fundamentals of Database Systems, 6th Edition, Pearson education
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH

References:

1. Peter Rob and Carlos Coronel, ―Database Systems Design, Implementation and Management‖, Thomson Learning, 9th Edition.
2. SQL & PL / SQL for Oracle 11g Black Book, Dreamtech Press
3. G. K. Gupta : "Database Management Systems", McGraw – Hill

Online References:

Sr. No.	Website Name
1.	https://www.nptel.ac.in
2.	https://www.oreilly.com
3.	https://www.coursera.org/

Assessment :
Term Work: Term work shall consist of 10-12 practical's based on above list. Also Term work Journal must include at report of assigned case study/application as an assignment.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Report of Case Study/Application) + 5 Marks (Attendance)

Practical & Oral Exam: An Oral & Practical exam will be held based on the above list of 10-12 Practicals.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2343611	Mini-Project - Full Stack Java Programming	–	2*+2	–	–	2	--	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II					
2343611	Mini-Project - Full Stack Java Programming	--	--	--	--	--	50	25	75

Lab Objectives:

Sr. No.	Lab Objectives
The Lab experiments aims:	
1	To set up development environments for Java full-stack projects.
2	To develop a web interface using front-end technologies.
3	To build RESTful web services using Spring Boot.
4	To implement database CRUD operations using Hibernate/JPA.
5	To integrate front-end and back-end applications.
6	To deploy the application and present the capstone project.

Lab Outcomes:

Sr. No.	Lab Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, the learner/student will be able to:		
1	Setup and configure full-stack Java development environment.	L1, L2
2	Develop responsive user interfaces with HTML, CSS, and React.js.	L1, L2, L3
3	Create RESTful APIs using Spring Boot framework.	L1, L2, L3
4	Perform CRUD operations with MySQL database integration.	L1, L2, L3, L4
5	Integrate front-end and back-end with secure API endpoints.	L1, L2, L3, L4
6	Deploy full-stack application on cloud platform and present capstone.	L1, L2, L3, L4, L5, L6

Prerequisite: C /Python programming. Basic commands of Windows and Linux operating systems.

Hardware & Software Requirements:

Hardware Requirement:	**Software requirement:**
PC i3 processor and above. 8GB RAM (minimum), 16GB recommended, 256GB SSD recommended, Stable internet connection.	JDK 17+, IntelliJ IDEA / Eclipse, VS Code, MySQL / MongoDB, Postman, Git, GitHub, Spring Boot, Angular CLI., Node.js & npm (for frontend React.js)AWS / Heroku Account for Deployment

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping
I	**Introduction to Full Stack Java**	Overview of full-stack development: Definition of Full Stack Development, Components of Full Stack: Frontend, Backend, Database, DevOps, Full Stack Developer Roles & Skills, Technology Stack Overview: Frontend: HTML, CSS, JavaScript, React.js, Backend: Java, Spring Boot, Database: MySQL, Tools: Git, Docker, Postman, Real-world applications of full stack, Java SE concepts: JVM, JDK, JRE, Data types, Variables, Operators, Control Statements, Introduction to OOP- Basic of OOP, Packages and Import statements, Exception Handling Basics, Introduction to Java EE- Need for Java EE in enterprise applications, Multi-tier architecture, MVC Architecture- Model: Business logic, Data management, View: User interface, Controller: Request handling, linking model and view. **Self-Learning Topics:** Application Servers vs. Web Servers, Java EE vs. Spring Boot: Modern development trends. MVC in Java Web Development.	**04**	**LO1**
II	**HTML 5, CSS 3 with Bootstrap**	**HTML Basics & Structure**: Learn HTML5 structure, semantic elements, character effects, document spacing, and working with tables, lists, and hyperlinks. **Responsive Web Design**: Learn to build websites that adapt to different screen sizes and devices using media queries, flexible layouts, and mobile-first design principles. **Image Handling & Forms**: Understand image roles, adding images to web pages, using images as links, and handling user input through various form elements (text fields, checkboxes, radio buttons, etc.). **CSS3 Fundamentals**: Explore CSS syntax, selectors, text formatting, fonts, colors, borders, and advanced features like CSS Grid. **Bootstrap Introduction & Components**: Get started with Bootstrap, utilizing grid systems and essential components like headers, dropdowns, and navigation bars.React.js basics, Fetch API, Axios for API calls. **Self-Learning Topics:** JavaScript DOM Manipulation, CSS Flexbox, Version Control with Git.	**04**	**LO2**
III	**Back-end development with Java**	Spring Boot introduction- What is Spring Framework? Why Spring Boot? Features of Spring Boot: Auto-configuration, Starter dependencies, embedded server, Spring Initializr, Project structure overview: pom.xml, application. Properties, Running your first Spring Boot application, RESTful API development- What is REST? REST vs. SOAP,HTTP Methods: GET, POST, PUT, DELETE, RESTful API Design principles, Creating REST Controllers in Spring Boot, Mapping HTTP methods to controller methods, Understanding Request Mapping, Get Mapping, Post Mapping, etc., Controllers and Services- Role of Controller in MVC, Defining Controllers in Spring Boot, @RestController vs. @Controller, Service layer responsibilities, Creating Service classes and injecting them	**05**	**LO3**

		using @Autowired, Dependency Injection concepts, Repositories- Introduction to Spring Data JPA, Configuring database connection in Spring Boot (H2/MySQL), Entity classes and @Entity annotation, JpaRepository and CrudRepository interfaces, Basic CRUD operations: save(), findById(), findAll(), deleteById(), Exception Handling- Importance of exception handling, @ExceptionHandler annotation, Creating global exception handlers with @ControllerAdvice, Custom exception classes, Standard error responses (HTTP status codes, error messages).. **Self-Learning Topics:** Advanced Techniques of REST API and JPA.		
IV	**Database Integration**	Introduction to MySQL- What is a relational database? Introduction to RDBMS, Basics of MySQL: Database, Tables, Records, Primary & Foreign Keys, MySQL Workbench or command-line interface, Database design basics: ER diagrams, normalization, Setting up MySQL: installation, creating databases, tables, Introduction to SQL: Data Definition Language (DDL): CREATE, ALTER, DROP, Data Manipulation Language (DML): INSERT, UPDATE, DELETE, SELECT, CRUD operations- What is CRUD: Create, Read, Update, Delete, Writing SQL queries for CRUD operations: INSERT INTO table, SELECT FROM table, UPDATE table SET, DELETE FROM table, Filtering and Sorting data: WHERE, ORDER BY, LIKE, LIMIT, Using Aggregate Functions: COUNT, AVG, SUM, MAX, MIN, Joins: INNER JOIN, LEFT JOIN, JPA & Hibernate ORM, Repository interfaces, Query methods- Introduction to JpaRepository and Crud Repository interfaces, Default CRUD methods: save(), findById(), findAll(), deleteById(), Creating custom query methods using method naming conventions: findByName(), findByAgeGreaterThan(), etc.Pagination and Sorting with Spring Data JPA, Introduction to @Query annotation for custom JPQL/SQL queries, Native queries vs. JPQL.. **Self-Learning Topics:** JPQL Advanced Queries, Transactions in JPA, Optimizing JPA Performance.	**04**	**LO4**
V	**Full Stack Integration**	Connecting React frontend with Spring Boot backend- Overview of frontend-backend communication in full-stack applications, Setting up React app (Vite/CRA), Axios or Fetch API for making HTTP requests, Configuring CORS in Spring Boot for cross-origin access, Calling Spring Boot REST API from React components, Handling API responses in React (state management with useState/useEffect), API testing (Postman)- Introduction to Postman and its features, Creating API collections in Postman, Sending GET, POST, PUT, DELETE requests, Testing APIs with different payloads, Setting up environment variables in Postman, Automating tests with Postman scripts (basics), Error handling- Backend: Handling exceptions using @ControllerAdvice and @ExceptionHandler, Sending structured error responses (HTTP status codes, error messages, timestamps), Frontend: Handling API errors in React using try-catch and Axios interceptors, Displaying error messages to users in the React UI, Logging errors for debugging and maintenance, JWT for authentication- What is JWT? Structure of JWT: Header, Payload, Signature, Stateless authentication vs. session-based, Generating JWTs in Spring Boot, Validating and parsing JWTs, Security configuration using Spring Security, Storing JWT securely (localStorage/sessionStorage), Securing Frontend & Backend with JWT- Adding Authorization header in API requests from React, Protecting backend endpoints using JWT authorization, Role-based access control (RBAC) basics, Frontend: Securing routes and redirecting unauthenticated users, Refresh token strategy (basic	**05**	**LO4, LO5**

		concept). **Self-Learning Topics:** Students can secure full-stack applications with JWT, protect API endpoints, and manage authentication flow.		
VI	**Deployment & Capstone Project**	Docker basics- What is Docker? Containers vs. Virtual Machines, Docker architecture: Images, Containers, Docker Daemon, Docker Hub, Setting up Docker environment, Writing Dockerfile: Basic syntax, Creating images for Java and Node.js applications, Docker commands:`docker build`, `docker run`, `docker ps`, `docker stop`, `docker rm`, `docker exec`, Managing Docker images and containers, Overview of docker-compose (introductory level), Deploying Spring Boot application- Creating Dockerfile for Spring Boot, Multi-stage builds for optimized Docker images, Exposing application port using `EXPOSE`, Environment variables and configuration management, Building and running Spring Boot Docker container, Accessing REST API from a containerized Spring Boot app, Hosting React application- Building React app for production (`npm run build`), Serving static files using NGINX or simple Node.js server, Writing Dockerfile for React application, Connecting React container to Spring Boot container, Basics of Docker networking (`docker network create`), Running both containers simultaneously using docker-compose, Capstone project implementation & presentation- Finalizing capstone project scope: features, architecture, roles, Implementing core functionalities (CRUD operations, authentication, API integration), Containerizing and deploying complete full-stack application, Preparing project documentation and presentation slides, Presenting project flow: architecture diagram, tech stack, demo. **Self-Learning Topics:** Full deployment with advanced techniques.	**04**	**LO6**

Textbooks:

1. "Spring in Action" by Craig Walls
2. "Pro Spring Boot 3" by Felipe Gutierrez
3. "React Up & Running" by Stoyan Stefanov
4. "Java: The Complete Reference" by Herbert Schildt

Reference Books:

1. "Full Stack Development with Spring Boot and React" by Juha Hinkula
2. "Building Java Programs" by Stuart Reges, Marty Stepp

Online Resources:

Sr. No.	Website Name
1.	Spring Boot Official Documentation — https://spring.io/projects/spring-boot
2.	React.js Official Documentation — https://react.dev/
3.	FreeCodeCamp Full Stack JavaScript Tutorials — https://www.freecodecamp.org/
4.	Docker Documentation — https://docs.docker.com/
5.	MySQL Documentation — https://dev.mysql.com/doc/
6.	Postman Learning Center — https://learning.postman.com/
7.	Spring Initializr (https://start.spring.io/)

List of Experiments.

Sr No	List of Experiments	Hrs
01	Setup Java, Spring Boot, and React development environment.	01
02	Develop a static web page using HTML, CSS, and Bootstrap.	02
03	Build a dynamic front-end using React.js with API calls.	04
04	Develop a RESTful web service using Spring Boot.	02
05	Integrate MySQL database with Spring Boot application.	02
06	Implement JWT authentication in a Spring Boot application.	04
07	Connect React front-end with Spring Boot backend APIs.	04
08	Deploy the application using Docker and GitHub.	06
Sr No	**List of Assignments**	**Hrs**
01	Create a personal portfolio website using HTML, CSS, and React.	02
02	Develop a basic CRUD API using Spring Boot.	02
03	Implement a login and registration system with JWT.	02
04	Perform database operations using JPA Repository.	02
05	Build a single-page application (SPA) with React.js.	02
06	Deploy an integrated full-stack application on cloud/GitHub Pages.	02

Sr No	Capstone Mini- Project List (Sample Ideas)
01	**E-commerce Web Application** — Complete shopping system with admin dashboard.
02	**Online Library Management System** — For managing books, users, and borrowing transactions.
03	**Job Portal Application** — For job seekers and recruiters.
04	**Online Food Ordering System** — With user authentication, menu, and payment gateway.
05	**Student Course Registration System** — For colleges/universities.
06	**Event Management System** — Event creation, management, ticket booking.

Note:- Capstone Mini-Project Guidelines.

1. **Objective of the Capstone Mini-Project:-** The capstone Mini-Project aims to enable students to design, develop, deploy, and present a real-world full-stack application using the Java technology stack, applying concepts of frontend, backend, database management, RESTful APIs, containerization (Docker), security (JWT), and deployment practices.

Students will work in a group of 4 students teams to build a functional application that solves a specific problem or fulfills a business need.

2. **Project Scope & Expectations**:- **Project Scale:** Should involve at least 2–3 core modules (e.g., User Management, Dashboard, Reporting). **Technology Stack: Frontend:** React.js (with API integration), **Backend:** Spring Boot REST API, **Database:** MySQL with JPA/Hibernate, **Security:** JWT-based authentication, **Deployment:** Docker containers, optional Docker Compose, **Integration:** End-to-end integration between frontend, backend, and database.**Testing:** API testing with Postman; frontend and backend error handling. **Documentation:** Source code, design documentation, API documentation, and user manual. **Presentation:** Live demo, project report, and presentation slides.

3. **Project Deliverables:- Project Proposal:** Problem statement, Objectives, Project scope, Technology stack.**Design Documentation:** System architecture diagram (MVC, API flow), Database schema (ER diagram), UI wireframes/mockups, **Implementation:** Frontend and backend code repositories (GitHub or equivalent), RESTful API endpoints, JWT authentication and role-based access control, Containerized deployment with Docker, **Testing:**Test cases and screenshots (Postman / frontend validation), **Final Report:** Introduction, methodology, results, testing summary, and conclusion, Challenges faced and solutions applied, Future scope. **Presentation:** 8–10 minutes demo, Architecture explanation, Live application demo, Q&A session.

Guidelines for Capstone Mini-Project

- Students shall form a group of 3 to 4 students, and a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do the survey and identify needs, which shall be converted into a problem statement for the mini project in consultation with the faculty supervisor/head of department/internal committee of faculty.
- Students' hall submits an implementation plan in the form of a Gantt/PERT/CPM chart, which will cover the weekly activity of a mini-project.
- A log book to be prepared by each group, wherein the group can record weekly work progress, and the guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during the mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand the problem effectively, propose multiple solutions, and select the best possible solution in consultation with the guide/ supervisor.
- Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and a report to be compiled in a standard format of the University of Mumbai.

Guidelines for Assessment of Capstone Mini-Project:

Term Work

- The review/ progress monitoring committee shall be constituted by the head of departments of each institute. The progress of the mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment, focus shall also be on each individual student, assessment based on the individual's contribution in group activity, their understanding, and response to questions.
- Distribution of Term work marks for both semesters shall be as below;
    - Marks awarded by guide/supervisor based on above practical list and assignment completed by the students 10
    - Marks awarded by guide/supervisor for Capstone Project Completion: 10
    - Quality of Project report & Project Review 05

Review/progress monitoring committee may consider following points for assessment based of the semester project as mentioned in general guidelines.

- In this case in students' group shall complete project in all aspects including,
    - Identification of need/problem
    - Proposed final solution
    - Procurement of components/systems
    - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
    - First shall be for the finalisation of problem and proposed solution
    - Second shall be for the implementation, testing and validation of solution.

Assessment criteria of Capstone Mini-Project.

Capstone Mini-Project shall be assessed based on following criteria;

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions/ Novelty in solutions.
4. Feasibility of proposed problem solutions and selection of best solution
5. Collection of Dataset.
6. Cost effectiveness
7. Societal impact
8. Innovativeness

9. Cost effectiveness and Societal impact
10. Full functioning of working model as per stated requirements
11. Effective use of skill sets
12. Effective use of standard engineering norms
13. Contribution of an individual's as member or leader
14. Clarity in written and oral communication

Guidelines for Assessment of Capstone Mini-Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the University of Mumbai.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Assessment :

Term Work: Term Work shall consist of list of all practicals' based on the above list. Also, the Term work Journal must include at least 2 assignments and Mini-Project Report.

Term Work Marks: 50 Marks (Total marks) = 10 Marks (Experiment) + 5 Marks (Assignments) + 30 Marks (Capstone Mini- Project with full prototype/ product demo, testing, validation and Report) + 5 Marks (Attendance).

Oral Exam: An Oral exam will be held based on the Capstone Mini-Project.

Sem.- III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2993511	Entrepreneurship Development	--	2*+2	-	-	2*+2	-	2

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-I	IAT-II	IAT-I + IAT-II				
2993511	Entrepreneurship Development	--	--	--	--	50	--	50

Note: * Two hours of practical class to be conducted for full class as demo/discussion/theory.

Lab Objectives:

1. To introduce students to entrepreneurship concepts and startup development.
2. To develop business idea generation, validation, and business model preparation.
3. To provide hands-on experience in market research, financial planning, and business pitching.
4. To enhance problem-solving and decision-making skills in entrepreneurial ventures.
5. To familiarize students with government schemes and support systems for entrepreneurs.
6. To develop communication and presentation skills required for business pitching.

Lab Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the fundamental concepts of entrepreneurship and business models.
2. Conduct market research and develop business plans.
3. Utilize financial planning and cost analysis for startups.
4. Apply entrepreneurial skills to identify and solve business challenges.
5. Develop prototypes using open-source software for business operations.
6. Pitch business ideas effectively with structured presentations.

DETAILED SYLLABUS

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	**Prerequisite**	Fundamentals of communication and leadership skills.	01	--
I	**Introduction to Entrepreneurship**	Definition, Characteristics, and Types of Entrepreneurs. Entrepreneurial Motivation and Traits. Start-up Ecosystem in India. Challenges in Entrepreneurship	**02**	**LO1**
II	**Business Idea Generation &**	Ideation Techniques: Design Thinking, Brainstorming, Mind	**04**	**LO2**

	Validation	Mapping. Business Model Canvas (BMC). Market Research & Customer Validation. Minimum Viable Product (MVP) Concept.		
III	**Business Planning & Strategy**	Writing a Business Plan. SWOT Analysis and Competitive Analysis. Financial Planning and Budgeting. Risk Assessment and Management	**04**	**LO3**
IV	**Funding and Legal Framework**	Sources of Funding: Bootstrapping, Angel Investors, Venture Capital Government Schemes & Start-up India Initiatives. Business Registration & Legal Formalities. Intellectual Property Rights (IPR) & Patents	**05**	**LO4**
V	**Marketing & Digital Presence**	Branding and Digital Marketing. Social Media Marketing & SEO. Customer Relationship Management (CRM). E-commerce & Online Business Models	**05**	**LO5**
VI	**Business Pitching & Prototype Development**	Pitch Deck Preparation & Presentation Techniques. Prototyping with Open-source Tools. Elevator Pitch & Investor Pitch. Case Studies of Successful Start-ups	**05**	**LO6**

Text Books:

1. "Entrepreneurship Development and Small Business Enterprises" – Poornima M. Charantimath, Pearson, 3rd Edition, 2021.
2. "Innovation and Entrepreneurship" – Peter F. Drucker, Harper Business, Reprint Edition, 2019.
3. "Startup and Entrepreneurship: A Practical Guide" – Rajeev Roy, Oxford University Press, 2022.
4. "Essentials of Entrepreneurship and Small Business Management" – Norman Scarborough, Pearson, 9th Edition, 2021.
5. "The Lean Startup" – Eric Ries, Crown Publishing, 2018.

References:

1. "Disciplined Entrepreneurship: 24 Steps to a Successful Startup" – Bill Aulet, MIT Press, 2017.
2. "Zero to One: Notes on Startups, or How to Build the Future" – Peter Thiel, 2014.
3. "The $100 Startup" – Chris Guillebeau, Crown Business, 2019.
4. "Business Model Generation" – Alexander Osterwalder & Yves Pigneur, Wiley, 2020.
5. "Blue Ocean Strategy" – W. Chan Kim & Renée Mauborgne, Harvard Business Review Press, 2019.

Online Resources:

Website Name
1. Startup India Portal – https://www.startupindia.gov.in 2. MIT OpenCourseWare – Entrepreneurship – https://ocw.mit.edu/courses/sloan-school-of-management/ 3. Coursera – Entrepreneurship Specialization – https://www.coursera.org/specializations/entrepreneurship

4. Harvard Business Review – Entrepreneurship Articles – https://hbr.org/topic/entrepreneurship
5. Udemy – Startup & Business Courses – https://www.udemy.com/courses/business/entrepreneurship/

List of Experiments.

Sr No	List of Experiments	Hrs
01	Business Idea Generation using Mind Mapping.	02
02	Conducting Market Research & Customer Validation.	02
03	Preparing a Business Model Canvas for a Startup Idea.	02
04	Developing a Financial Plan & Break-even Analysis.	02
05	Creating a Website using WordPress/Wix.	02
06	Social Media Marketing Campaign using Open-source Tools.	02
07	Digital Prototyping using Figma/Inkscape.	02
08	Business Pitch Deck Preparation & Presentation.	02
09	Exploring Government Schemes for Startups.	02
10	Legal Compliance & IPR Basics (Case Study).	02

Sr No	List of Assignments / Tutorials	Hrs
01	a. Write a report on any successful entrepreneur and their startup journey. b. Conduct SWOT analysis for a real-life startup.	02
02	Develop a business idea and create a one-page business plan.	02
03	Conduct market research using surveys & present findings.	02
04	Design a simple logo and branding strategy for a startup.	02
05	Create a financial model and cost estimation for a startup.	02
06	Make a case study report on startup failure analysis.	02

List of Open-Source Software
1. Canva – Designing pitch decks, social media posts, and branding materials. 2. Trello / Asana – Project management for startups. 3. GIMP / Inkscape – Graphic design and logo creation. 4. WordPress / Wix – Website development for startups. 5. OpenCart / PrestaShop – E-commerce website setup. 6. Figma – UI/UX design and prototyping. 7. LibreOffice Calc – Financial planning and budgeting. 8. Google Suite (Docs, Sheets, Slides) – Documentation and presentations. 9. Python (Pandas, Flask, Django) – Data analytics and web application development. 10. MailChimp – Email marketing and customer engagement.

Assessment :

Term Work: Term Work shall consist of at least 08 to 10 practicals' based on the above list. Also, Term work Journal must include at least 6 assignments.

Term Work Marks: 50 Marks (Total marks) = 20 Marks (Experiment) + 15 Marks (Assignments) + 5 Marks (Attendance)+ 10 Marks (Report)

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2993512	Environmental Science	--	2*+2	-	--	2*+2	-	2

		Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I+IAT-II					
2993512	Environmental Science	--	--	--	--	--	50	--	50

Note: * Two hours of practical class to be conducted for full class as demo/discussion/theory.

Rationale:

Most of the engineering branches are offspring of applied sciences, and their practices have a significant impact on the environment. Understanding environmental studies is essential for engineers to develop sustainable solutions, minimize ecological footprints, and promote responsible resource management. This course equips students with the knowledge of ecosystems, biodiversity, pollution control, and environmental laws, enabling them to integrate sustainability into engineering practices.

Lab Objectives:

1. To understand the scope, importance, and role of environmental studies in public awareness and health.
2. To study different natural resources, their issues, and sustainable conservation.
3. To understand ecosystem types, structures, and functions.
4. To explore biodiversity, its importance, threats, and conservation.
5. To learn about pollution types, causes, effects, and control measures.
6. To understand environmental challenges, sustainability, and ethics.

Lab Outcomes:

1. Explain the significance of environmental studies and the role of IT in environment and health.
2. Describe resource types, associated problems, and conservation methods.
3. Classify ecosystems and explain their role in ecological balance
4. Analyze biodiversity levels and conservation strategies, especially in India.
5. Explain pollution impacts and suggest preventive measures.
6. Discuss environmental issues and propose sustainable solutions.

DETAILED SYLLABUS:

Unit Name	Topic Name	Topic Description	Hours	LO Mapping

I	**The Multidisciplinary Nature of Environmental Studies**	Definition, scope and importance. Need for public awareness, Role of information technology in environment and human health. Human population and the environment: Population growth, variation among nations. Population Explosion- family welfare program. Environment and human health Women and child welfare	**03**	LO1
II	**Natural Resources**	Renewable and non-renewable resources. Natural resources & associated problems: a) Forest resources: b) Water resources: Natural resources & associated problems c) Mineral resources: d) Food resources: e) Energy resources: Role of an individual in conservation of natural resources: f) Equitable use of resources for sustainable lifestyles.	**04**	LO2
III	**Ecosystems**	Concepts of an ecosystem. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries). Case study on various ecosystems in India.	**05**	LO3
IV	**Biodiversity and its Conservation**	Introduction-Definition: genetic species and ecosystem diversity. Bio-geographical classification of India Value of biodiversity : Consumptive use, productive use, social, ethical, aesthetic and option values, Bio-diversity at global, national, local levels India as a mega diversity nation Case study on Bio diversity in India.	**05**	LO4
V	**Environmental Pollution Definition**	Causes, effects and control measures of: a) Air pollution b) Water pollution c) Soil pollution. Solid waste management: Causes, effect and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Case study on Pollution Disaster management: floods, earthquake, cyclone and landslides. Carbon Credits for pollution prevention	**05**	LO5

VI	**Social Issues and Environment**	From unsustainable to sustainable development Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: issues and possible solution. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Consumerism and waste products. Environment protection act. Public awareness Case study on Environmental Ethics	**04**	LO6

Textbooks

1. Environmental Science: Towards a Sustainable Future, G. Tyler Miller and Scott Spoolman, 13th Edition, Cengage Learning 2021
2. Environmental Management: Text and Cases, Bala Krishnamoorthy, 3rd Edition, PHI Learning, Publication Year: 2016
3. Green IT: Concepts, Technologies, and Best Practices, Markus Allemann, Springer 2008
4. Sustainable IT: Slimming Down and Greening Up Your IT Infrastructure, David F. Linthicum, IBM Press 2009
5. Environmental Modelling: Finding Solutions to Environmental Problems, David L. Murray, Cambridge University Press 2016
6. Remote Sensing and Image Interpretation, Thomas M. Lillesand, Ralph W. Kiefer, and Jonathan W. Chipman, 9th Edition, John Wiley & Sons 2020
7. Business Ethics: Concepts and Cases, Manuel Velasquez, Pearson 2012

Reference Books

1. Environmental Law and Policy in India, Shyam Divan and Armin Rosencranz, 2nd Edition, Oxford University Press 2018
2. The International Handbook of Environmental Laws, David Freestone and Jonathon L. Rubin, Edward Elgar Publishing 2000
3. E-Waste Management: Challenges and Opportunities in Developing Countries, Ruediger Kuehr and Ram K. Jain, Springer 2008
4. The E-Waste Handbook: Managing Electronic Waste, Klaus Hieronymi, Ruediger Kuehr, and Ram K. Jain, Earthscan 2009
5. Environmental Ethics: An Introduction, J. Baird Callicott, University of Georgia Press1999

Online References:

Sr. No.	Website Name
1.	Centre for Science and Environment (CSE), Website: cseindia.org
2.	Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India
3.	CSIR-National Environmental Engineering Research Institute (NEERI)

List of Experiments.

Sr No	List of Experiments	Hrs

01	Study of Environmental Components and Ecosystems.	2
02	Visit and Report on Solid Waste Management Plant.	2
03	Study of Renewable Energy Sources (Solar, Wind, Biogas).	2
04	Analysis of Air and Water Quality Parameters.	2
05	Study of Local Biodiversity and Conservation Methods.	2
06	Awareness Activity on Environmental Issues.	2
07	Rainwater Harvesting System Design	2
08	Case Study on Environmental Pollution & Control Measures.	2
09	Report on Climate Change Impact and Adaptation.	2
10	Study of Environmental Laws and Acts.	2
11	Study of Disaster Management Techniques.	2
12	Report on Role of IT in Environmental Protection.	2

Sr No	List of Assignments / Tutorials	Hrs
01	Prepare a report on Renewable and Non-Renewable Resources.	2
02	Write a case study on Ecosystem Types in India	2
03	Write a report on Biodiversity in India.	2
04	Prepare a report on Pollution Types and Control Measures.	2
05	Prepare a report on Environmental Ethics and Sustainability.	2
06	Prepare a case study report on Global Warming and Climate Change.	2
07	Report on Role of an Individual in Environmental Protection.	2
08	Write a report on Disaster Management Techniques.	2
09	Prepare a report on Environmental Laws and Acts in India.	2
10	Case Study on E-waste Management and Recycling Techniques.	2

Assessment :

Term Work: Term Work shall consist of at least 10 to 12 practical's based on the above list. Also, Term work Journal must include at least 8 to 10 assignments.

Term Work Marks: 50 Marks (Total marks) = 20 Marks (Experiment) + 15 Marks (Assignments) + 5 Marks (Attendance)+ 10 Marks (Report)