

**COURSE STRUCTURE****II YEAR – I SEMESTER**

| Sl. No               | Category                 | Course Code | Course Title   | L | T | P | Credits   |
|----------------------|--------------------------|-------------|--|---|---|---|-----------|
| 1                    | BS&H                     | 23BM304T    | Discrete Mathematics & Graph Theory                                      | 3 | 0 | 0 | 3         |
| 2                    | BS&H                     | 23HM301T    | Universal Human Values - Understanding Harmony and Ethical Human Conduct | 2 | 1 | 0 | 3         |
| 3                    | Engineering Science      | 23DS301T    | Introduction to Data Science   | 3 | 0 | 0 | 3         |
| 4                    | Professional Core        | 23CS301T    | Advanced Data Structures & Algorithms Analysis                           | 3 | 0 | 0 | 3         |
| 5                    | Professional Core        | 23CS302T    | Object-Oriented Programming Through JAVA                                 | 3 | 0 | 0 | 3         |
| 6                    | Professional Core        | 23CS301P    | Advanced Data Structures and Algorithms Analysis Laboratory              | 0 | 0 | 3 | 1.5       |
| 7                    | Professional Core        | 23CS302P    | Object-Oriented Programming Through JAVA Laboratory                      | 0 | 0 | 3 | 1.5       |
| 8                    | Skill Enhancement course | 23AI301S    | Python programming   | 0 | 1 | 2 | 2         |
| 9                    | Audit Course             | 23BC301T    | Environmental Science  | 2 | 0 | 0 | -         |
| <b>Total Credits</b> |                          |             |  |   |   |   | <b>20</b> |

**II YEAR – II SEMESTER**

| Sl. No   | Category                          | Course Code | Course Title                           | L | T | P | Credits   |
|--|-----------------------------------|-------------|--|---|---|---|-----------|
| 1  | Management Course- I              | 23ME405T    | Optimization Techniques                | 2 | 0 | 0 | 2         |
| 2  | Engineering Science/Basic Science | 23BM403T    | Statistical methods for Data science   | 3 | 0 | 0 | 3         |
| 3  | Professional Core                 | 23DS401T    | Data Engineering                       | 3 | 0 | 0 | 3         |
| 4  | Professional Core                 | 23IT401T    | DBMS                                   | 3 | 0 | 0 | 3         |
| 5  | Professional Core                 | 23EC306T    | Computer Organization and Architecture | 3 | 0 | 0 | 3         |
| 6  | Professional Core                 | 23DS401P    | Data Engineering Lab                   | 0 | 0 | 3 | 1.5       |
| 7  | Professional Core                 | 23IT401P    | DBMS Lab                               | 0 | 0 | 3 | 1.5       |
| 8  | Skill Enhancement course          | 23DS401S    | Exploratory Data Analysis with Python  | 0 | 1 | 2 | 2         |
| 9  | BS&H                              | 23HM401P    | Design Thinking & Innovation           | 1 | 0 | 2 | 2         |
| <b>Total Credits</b>   |                                   |             |  |   |   |   | <b>21</b> |
| Mandatory Community Service Project Internship of 08 weeks duration during summer vacation |                                   |             |  |   |   |   |           |



**COURSE CONTENT****UNIT I- Mathematical Logic:**

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

**UNIT II - Set Theory:**

Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

**UNIT III -Combinatorics and Recurrence Relations:**

Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.  
Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving In homogeneous Recurrence Relations

**UNIT IV - Graph Theory:**

Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations : Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,

**UNIT V - Multi Graphs:**

Multi graphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

**TEXT BOOKS**

1. Discrete Mathematical Structures with Applications to Computer Science, J.P. Tremblay and P.Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics – A Computer Oriented Approach, C.L.Liu and D.P.Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Mathematical Foundations of Computer Science, Dr. D.S.C, Prism Books Pvt Ltd.

**REFERENCE BOOKS**

1. Discrete Mathematics for Computer Scientists and Mathematicians, J.L.Mott, A.Kandel and T.P.Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernard Kolman, Robert C.Busby and Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S.K.Chakraborty and B.K.Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K.H.Rosen, 7th Edition, Tata McGraw Hill.
5. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

**WEB RESOURCES**

1. [https://onlinecourses.nptel.ac.in/noc24\\_ma42/preview](https://onlinecourses.nptel.ac.in/noc24_ma42/preview)
2. [https://en.wikipedia.org/wiki/Set\\_theory](https://en.wikipedia.org/wiki/Set_theory)
3. <https://www.geeksforgeeks.org/discrete-mathematics-types-of-recurrence-relations-set-2/>
4. <https://nptel.ac.in/courses/111106102>
5. <https://en.wikipedia.org/wiki/Multigraph>

**II Year I Semester****UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY  
and ETHICAL HUMAN CONDUCT****(Common to CE, EEE, ME, ECE, CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS) and  
CSE(CYBER SECURITY))**

|                        |        |                                 |          |
|------------------------|--------|---------------------------------|----------|
| <b>Course Category</b> | HSMC   | <b>Course Code</b>              | 23HM301T |
| <b>Course Type</b>     | Theory | <b>L-T-P-C</b>                  | 2-1-0-3  |
| <b>Prerequisites</b>   |        | <b>Internal Assessment</b>      | 30       |
|                        |        | <b>Semester End Examination</b> | 70       |
|                        |        | <b>Total Marks</b>              | 100      |

| <b>COURSE OUTCOMES</b>  |  |                              |
|---|--|------------------------------|
| <b>Upon successful completion of the course, the student will be able to:</b> |  | <b>Blooms Taxonomy Level</b> |
| <b>CO1</b>  | Understand the significance of value inputs in a classroom and start applying them in their life and profession  | K1                           |
| <b>CO2</b>  | Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. | K2                           |
| <b>CO3</b>  | Understand the role of a human being in ensuring harmony in Family And Society.  | K1                           |
| <b>CO4</b>  | Appraise the role of a human being in ensuring harmony in Nature/Existence.  | K2                           |
| <b>CO5</b>  | Distinguish between ethical and unethical practices to actualize a harmonious environment wherever they work.  | K2                           |

| <b>Contribution of Course Outcomes towards achievement of Program Outcomes<br/>(1 – Low, 2 - Medium, 3 – High)</b> |            |            |            |            |            |            |            |            |            |             |             |             |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO</b>  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
| <b>CO1</b>   |            |            |            |            |            | 3          |            |            |            |             |             |             |
| <b>CO2</b>   |            |            |            |            |            | 3          |            |            | 3          | 3           |             | 3           |
| <b>CO3</b>   |            |            |            |            |            | 3          |            | 2          |            |             |             | 3           |
| <b>CO4</b>   |            |            |            |            |            | 3          | 3          |            |            |             |             |             |
| <b>CO5</b>   |            |            |            |            |            | 3          |            | 3          |            |             |             |             |

**COURSE CONTENT**

**UNIT – I Introduction to Value Education:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, self-exploration as the Process for Value Education, Continuous Happiness and Prosperity-the basic human aspirations, Happiness and Prosperity- Current Scenario, Method to Fulfill the Basic Human Aspirations.

**Practice Sessions:** PS1 Sharing about Oneself , PS2 Exploring Human Consciousness, PS3 Exploring Natural Acceptance

**UNIT – II Harmony in 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

**Practice Sessions:** PS4 Exploring the difference of Needs of self and body, PS5 Exploring Sources of Imagination in the self, PS6 Exploring Harmony of self with the body

**UNIT – III Harmony in the Family and Society:** Harmony in the family - the Basic Unit of Human Interaction, 'Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Other Feelings, Justice in Human – to - Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

**Practice Sessions:** PS7 Exploring the Feeling of Trust, PS8 Exploring the Feeling of Respect, PS9 Exploring Systems to fulfil Human Goal

**UNIT – IV 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

**Practice Sessions:** PS10 Exploring the Four Orders of Nature, PS11 Exploring Co-existence in Existence

**UNIT – V 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, 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.

**Practice Sessions:** PS12 Exploring Ethical Human Conduct, PS13 Exploring Humanistic Models in Education, PS14 Exploring Steps of Transition towards Universal Human Order

**Text books and Teachers Manual**

1. A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 - R R Gaur, R Asthana, G P Bagaria
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 - R R Gaur, R Asthana, G P Bagaria

**Reference Books**

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, 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 – PanditSunderlal
9. Rediscovering India - by Dharampal

**Web References:**

1. <https://fdp-si.aicte-india.org>
2. [https://www.youtube.com/playlist?list=PLWDeKF97v9SP\\_Kt6jqzA3pZ3yA7g\\_OAQz](https://www.youtube.com/playlist?list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz)

**II Year I Semester  
Introduction To Data Science**

|                        |                   |                                 |          |
|------------------------|-------------------|---------------------------------|----------|
| <b>Course Category</b> | Professional Core | <b>Course Code</b>              | 23DS301T |
| <b>Course Type</b>     | Theory            | <b>L-T-P-C</b>                  | 3-0-0-3  |
| <b>Prerequisites</b>   |                   | <b>Internal Assessment</b>      | 30       |
|                        |                   | <b>Semester End Examination</b> | 70       |
|                        |                   | <b>Total Marks</b>              | 100      |

**COURSEOBJECTIVES**

|          |  |
|----------|--|
| <b>1</b> | Knowledge and expertise to become a data scientist.                                    |
| <b>2</b> | Essential concepts of statistics and machine learning that are vital for data science. |
| <b>3</b> | Significance of exploratory data analysis (EDA) in data science.                       |
| <b>4</b> | Critically evaluate data visualizations presented on the dash boards                   |
| <b>5</b> | Suitability and limitations of tools and techniques related to data science process    |

**COURSEOUTCOMES**

| <b>Upon successful completion of the course, the student will be able to:</b> |  | <b>Cognitive Level</b> |
|---|--|------------------------|
| <b>CO1</b>  | Enumerate various steps in data science process.   | K2                     |
| <b>CO2</b>  | Apply programming tips and general techniques for handling large data.                       | K3                     |
| <b>CO3</b>  | Elaborate the application and principles of No SQL databases.                                | K2                     |
| <b>CO4</b>  | Demonstrate the usage of graph databases and Python libraries for text mining and analytics. | K3                     |
| <b>CO5</b>  | Create an interactive dashboard with relevant tools.   | K4                     |

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

**Contribution of Course Outcomes towards achievement of Program: Outcomes  
(1 – Low, 2 - Medium, 3 –High)**

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b> | 3   | 2   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | -    | 2    | 2    | 1    |
| <b>CO2</b> | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 1    |
| <b>CO3</b> | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 1    |
| <b>CO4</b> | 3   | 2   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 1    |
| <b>CO5</b> | 3   | 2   | 3   | 2   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 2    |



## **COURSE CONTENT**

**UNIT I:** Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

**Data Science process:** Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

**UNIT II:** Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

**Handling large data:** problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

**UNIT III: NoSQL movement for handling Bigdata:** Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

**UNIT IV: Tools and Applications of Data Science:** Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

**UNIT V: Data Visualization and Prototype Application Development:** Data Visualization options, Cross filter, the JavaScript Map Reduce library, Creating an interactive dashboard with dc.js, Dashboard development tools.  
Applying the Data Science process for real-world problem-solving scenarios as a detailed case study.

### **Textbooks:**

- 1) Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dream tech press, 2016
- 2) Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics

### **Reference Books:**

1. Joel Grus, "Data Science From Scratch", O'Reilly, 2019
2. Doing Data Science: Straight Talk From The Frontline, 1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
3. Data Science and analytics with Python, Sandhya Arora and Latesh Malik, Universities Press

### **Web References:**

- 1) <https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners>
- 2) <https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts>
- 3) <https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python>
- 4) <https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn>



**II Year I Semester**  
**Advanced Data Structures & Algorithm Analysis**  
(Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), CSE (Cyber Security), IT)

|                        |                   |                                       |          |
|------------------------|-------------------|---------------------------------------|----------|
| <b>Course Category</b> | Professional Core | <b>Course Code</b>                    | 23CS301T |
| <b>Course Type</b>     | Theory            | <b>L-T-P-C</b>                        | 3-0-0-3  |
| <b>Prerequisites</b>   |                   | <b>Continuous Internal Assessment</b> | 30       |
|                        |                   | <b>Semester End Examination</b>       | 70       |
|                        |                   | <b>Total Marks</b>                    | 100      |

| <b>COURSE OBJECTIVES</b>                |   |
|---|---|
| The main objectives of the course is to |   |
| <b>1</b>                                | Provide knowledge on advance data structures frequently used in Computer Science domain |
| <b>2</b>                                | Develop skills in algorithm design techniques popularly used                            |
| <b>3</b>                                | Understand the use of various data structures in the algorithm design                   |

| <b>COURSE OUTCOMES</b>  |  |                        |
|---|--|------------------------|
| <b>Upon successful completion of the course, the student will be able to:</b> |  | <b>Cognitive Level</b> |
| <b>CO1</b>  | Analyze algorithms for Height balanced trees such as AVL trees, B-Trees                                      | K1                     |
| <b>CO2</b>  | Analyze algorithms for Priority queues, Graph Traversals, Sortings   | K2                     |
| <b>CO3</b>  | List and describe various algorithmic approaches and Solve problems using divide and conquer & greedy Method | K3                     |
| <b>CO4</b>  | Analyze design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches      | K4                     |
| <b>CO5</b>  | Demonstrate NP-Hard and NP-Complete problems, Cook's theorem   | K2                     |

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

| <b>Contribution Of Course Outcomes Towards Achievement Of Program Outcomes</b><br>(1 – Low, 2 - Medium, 3 – High) |     |     |     |     |     |     |     |     |     |      |      |      |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| <b>CO1</b>  | 3   | 3   | 3   | 3   | 1   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO2</b>  | 3   | 3   | 3   | 3   | 1   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO3</b>  | 3   | 3   | 3   | 3   | 1   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO4</b>  | 3   | 3   | 3   | 3   | 1   | -   | -   | -   | -   | -    | -    | -    |
| <b>CO5</b>  | 3   | 3   | 3   | 3   | 1   | -   | -   | -   | -   | -    | -    | -    |





**COURSE CONTENT**

**UNIT – I:**

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications

**UNIT – II:**

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications  
Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen’s matrix multiplication, Convex Hull

**UNIT – III:**

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths– General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

**UNIT – IV:**

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

**UNIT – V:**

NP Hard and NP Complete Problems: Basic Concepts, Cook’s theorem NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP) NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

**Textbooks:**

1. Fundamentals of Data Structures in C++, Ellis Horowitz; Sartaj Sahni; Dinesh Mehta 2<sup>nd</sup> Edition, ISBN: 9788173716065 ,Year: 2008, Universities Press.
2. Computer Algorithms in C++, Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, 2<sup>nd</sup> Edition ISBN:9788173716119, University Press.

**Reference Books:**

1. Data Structures and program design in C, Robert Kruse, Pearson Education, Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill, 2<sup>nd</sup> Edition, Published on 1 July 2017.
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 31 August 2019 First Edition.
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI, January 1988
6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub, January 2008
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

**Online Learning Resources:**

1. [https://www.tutorialspoint.com/advanced\\_data\\_structures/index.asp](https://www.tutorialspoint.com/advanced_data_structures/index.asp)
2. <http://peterindia.net/Algorithms.html>
3. Abdul Bari, [Introduction to Algorithms \(youtube.com\)](https://www.youtube.com/watch?v=...)

**II Year I Semester****Object Oriented Programming Through Java****(Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), CSE (Cyber Security), IT)**

|                        |                   |                                       |          |
|------------------------|-------------------|---------------------------------------|----------|
| <b>Course Category</b> | Professional Core | <b>Course Code</b>                    | 23CS302T |
| <b>Course Type</b>     | Theory            | <b>L-T-P-C</b>                        | 3-0-0-3  |
| <b>Prerequisites</b>   |                   | <b>Continuous Internal Assessment</b> | 30       |
|                        |                   | <b>Semester End Examination</b>       | 70       |
|                        |                   | <b>Total Marks</b>                    | 100      |

**COURSE OBJECTIVES**

The learning objectives of this course are to:

|   |   |
|---|---|
| 1 | Identify Java language components and how they work together in applications  |
| 2 | Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries. |
| 3 | Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications        |
| 4 | Understand how to design applications with threads in Java  |
| 5 | Understand how to use Java APIs for program development   |

**COURSE OUTCOMES****Upon successful completion of the course, the student will be able to:**

|            |  | <b>Cognitive Level</b> |
|------------|--|------------------------|
| <b>CO1</b> | Apply the fundamentals of Java to solve problems                           | K3                     |
| <b>CO2</b> | Differentiate the application of decision and iteration control structures | K2                     |
| <b>CO3</b> | Implement classes and method overloading concepts                          | K3                     |
| <b>CO4</b> | Apply the concepts of inheritance and packages                             | K3                     |
| <b>CO5</b> | Implement Java programs using exceptions and multithreading                | K3                     |

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes****(1 – Low, 2 - Medium, 3 – High)**

| <b>CO</b>  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b> | 3          | 3          | 3          | 2          | 3          | -          | -          | -          | -          | -           | -           | -           |
| <b>CO2</b> | 3          | 3          | 3          | 2          | 3          | -          | -          | -          | -          | -           | -           | -           |
| <b>CO3</b> | 3          | 3          | 3          | 3          | 3          | -          | -          | -          | -          | -           | -           | -           |
| <b>CO4</b> | 3          | 3          | 3          | 3          | 3          | -          | -          | -          | -          | -           | -           | -           |
| <b>CO5</b> | 3          | 3          | 3          | 3          | 3          | -          | -          | -          | -          | -           | -           | -           |

**COURSE CONTENT****UNIT I**

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

**Data Types, Variables, and Operators** :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator ( = ), Basic Arithmetic Operators, Increment (++) and Decrement ( - -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

**Control Statements**: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?., Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

**UNIT II**

**Classes and Objects**: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

**Methods**: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

**UNIT III**

**Arrays**: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

**Inheritance**: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

**Interfaces**: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

**UNIT IV**

**Packages and Java Library**: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. Time .Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

**Exception Handling**: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throw able, Unchecked Exceptions, Checked Exceptions.

**Java I/O and File**: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)



#### UNIT V

**String Handling in Java:** Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

**Multithreaded Programming:** Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. **Java Database Connectivity:** Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface

**Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events

#### Text Books:

- 1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
- 2) Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
- 3) JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4<sup>th</sup> Edition, Pearson.

#### References Books:

- 1) The complete Reference Java, 11<sup>th</sup> edition, Herbert Schildt, TMH
- 2) Introduction to Java programming, 7<sup>th</sup> Edition, Y Daniel Liang, Pearson

#### Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_012880464547618816347\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)

**II Year I Semester  
Data Science Lab**

|                        |                   |                                 |           |
|------------------------|-------------------|---------------------------------|-----------|
| <b>Course Category</b> | Professional Core | <b>Course Code</b>              | 23DS301P  |
| <b>Course Type</b>     | Laboratory        | <b>L-T-P-C</b>                  | 0-0-3-1.5 |
| <b>Prerequisites</b>   |                   | <b>Internal Assessment</b>      | 30        |
|                        |                   | <b>Semester End Examination</b> | 70        |
|                        |                   | <b>Total Marks</b>              | 100       |

**COURSEOBJECTIVES**

|          |   |
|----------|---|
| <b>1</b> | The main objective of the course is to inculcate the basic understanding of Data Science and its practical implementation using Python. |
|----------|---|

**COURSEOUTCOMES**

| <b>Upon successful completion of the course, the student will be able to:</b> |   | <b>Cognitive Level</b> |
|---|---|------------------------|
| <b>CO1</b>  | Perform various operations on numpy arrays              | K3                     |
| <b>CO2</b>  | Importing data from different file formats using pandas | K3                     |
| <b>CO3</b>  | Draw different types of charts using matplotlib         | K3                     |

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

**Contribution of Course Outcomestowardsachievement of Program: Outcomes (1  
– Low, 2 - Medium, 3 –High)**

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b> | 3   | 3   | 2   | 3   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 3    |
| <b>CO2</b> | 2   | 2   | 3   | 2   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 3    |
| <b>CO3</b> | 3   | 3   | 3   | 2   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 3    |



***List of Experiments***

1. Creating a NumPy Array
  - a. Basic nd array
  - b. Array of zeros
  - c. Array of ones
  - d. Random numbers in nd array
  - e. An array of your choice
  - f. I matrix in NumPy
  - g. Evenly spaced nd array
2. The Shape and Reshaping of NumPy Array
  - a. Dimensions of NumPy array
  - b. Shape of NumPy array
  - c. Size of NumPy array
  - d. Reshaping a NumPy array
  - e. Flattening a NumPy array
  - f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
  - a. Expanding a NumPy array
  - b. Squeezing a NumPy array
  - c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
  - a. Slicing 1-D NumPy arrays
  - b. Slicing 2-D NumPy arrays
  - c. Slicing 3-D NumPy arrays
  - d. Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays
  - a. Stacking nd arrays
  - b. Concatenating nd arrays
  - c. Broadcasting in Numpy Arrays
6. Perform following operations using pandas
  - a. Creating data frame
  - b. concat()
  - c. Setting conditions
  - d. Adding a new column
7. Perform following operations using pandas
  - a. Filling NaN with string
  - b. Sorting based on column values
  - c. groupby()
8. Read the following file formats using pandas
  - a. Text files
  - b. CSV files
  - c. Excel files
  - d. JSON files
9. Read the following file formats
  - a. Pickle files
  - b. Image files using PIL
  - c. Multiple files using Glob
  - d. Importing data from database



10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
  - a. Feature Scaling
  - b. Feature Standardization
  - c. Label Encoding
  - d. One Hot Encoding
12. Perform following visualizations using matplotlib
  - a. Bar Graph
  - b. Pie Chart
  - c. Box Plot
  - d. Histogram
  - e. Line Chart and Subplots
  - f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python SciKit- Learn & NLTK
15. Python program to implement with Python NLTK/Spicy/PyNLPI.

**Web References:**

1. <https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/>
2. <https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/>
3. <https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/>
4. <https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/>
5. <https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6>.
6. <https://www.nltk.org/book/ch01.html>

**II Year I Semester****Object Oriented Programming Through Java Laboratory****(Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), CSE (Cyber Security), IT)**

|                        |                   |                                       |           |
|------------------------|-------------------|---------------------------------------|-----------|
| <b>Course Category</b> | Professional Core | <b>Course Code</b>                    | 23CS302T  |
| <b>Course Type</b>     | Laboratory        | <b>L-T-P-C</b>                        | 0-0-3-1.5 |
| <b>Prerequisites</b>   |                   | <b>Continuous Internal Assessment</b> | 30        |
|                        |                   | <b>Semester End Examination</b>       | 70        |
|                        |                   | <b>Total Marks</b>                    | 100       |

**COURSE OBJECTIVES**

The aim of this course is to

|          |  |
|----------|--|
| <b>1</b> | Practice object oriented programming in the Java programming language  |
| <b>2</b> | Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism |
| <b>3</b> | Illustrate inheritance, Exception handling mechanism, JDBC connectivity  |
| <b>4</b> | Construct Threads, Event Handling, implement packages, Java FX GUI   |

**COURSE OUTCOMES**

| <b>Upon successful completion of the course, the student will be able to:</b> |  | <b>Cognitive Level</b> |
|---|--|------------------------|
| <b>CO1</b>  | Implement object oriented concepts using Java                | K3                     |
| <b>CO2</b>  | Apply the concepts of inheritance and packages.              | K3                     |
| <b>CO3</b>  | Implement Java programs using exceptions and multithreading. | K3                     |

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes****(1 – Low, 2 - Medium, 3 – High)**

| <b>CO</b>  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO1</b> | 3          | 3          | 3          | 3          | 1          | -          | -          | -          | -          | -           | -           | -           |
| <b>CO2</b> | 3          | 3          | 3          | 3          | 1          | -          | -          | -          | -          | -           | -           | -           |
| <b>CO3</b> | 3          | 3          | 3          | 3          | 1          | -          | -          | -          | -          | -           | -           | -           |
| <b>CO4</b> | 3          | 3          | 3          | 3          | 1          | -          | -          | -          | -          | -           | -           | -           |





**Experiments covering the Topics:**

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

**Sample Experiments:**

**Exercise – 1:**

- a) Write a JAVA program to display default value of all primitive data type of JAVA
- b) Write a java program that display the roots of a quadratic equation  $ax^2+bx=0$ . Calculate the discriminate D and basing on value of D, describe the nature of root.

**Exercise - 2**

- a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
- c) Write a JAVA program using StringBuffer to delete, remove character.

**Exercise - 3**

- a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- b) Write a JAVA program implement method overloading.
- c) Write a JAVA program to implement constructor.
- d) Write a JAVA program to implement constructor overloading.

**Exercise - 4**

- a) Write a JAVA program to implement Single Inheritance
- b) Write a JAVA program to implement multi level Inheritance
- c) Write a JAVA program for abstract class to find areas of different shapes

**Exercise - 5**

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
- c) Write a JAVA program that implements Runtime polymorphism

**Exercise - 6**

- a) Write a JAVA program that describes exception handling mechanism
- b) Write a JAVA program Illustrating Multiple catch clauses
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) Write a JAVA program for creation of User Defined Exception

**Exercise - 7**

- a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds,(Repeat the same by implementing Runnable)
- b) Write a program illustrating **is Alive** and **join ()**
- c) Write a Program illustrating Daemon Threads.
- d) Write a JAVA program Producer Consumer Problem

**Exercise – 8**

- a) Write a JAVA program that import and use the user defined packages
- b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
- c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

**Exercise – 9**

- a) Write a java program that connects to a database using JDBC
- b) Write a java program to connect to a database using JDBC and insert values into it.
- c) Write a java program to connect to a database using JDBC and delete values from it

**II Year I Semester****Python Programming****Common to CSE,IT, CSE (AI&ML),CSE (AI), CSE (DS),CSE(Cyber Security)**

|                        |                       |                                       |          |
|------------------------|-----------------------|---------------------------------------|----------|
| <b>Course Category</b> | Skill Enhanced Course | <b>Course Code</b>                    | 23AI301S |
| <b>Course Type</b>     |                       | <b>L-T-P-C</b>                        | 0-1-2-2  |
| <b>Prerequisites</b>   |                       | <b>Continuous Internal Assessment</b> | 30       |
|                        |                       | <b>Semester End Examination</b>       | 70       |
|                        |                       | <b>Total Marks</b>                    | 100      |

**COURSE OBJECTIVES**

|          |  |
|----------|--|
| <b>1</b> | Introduce core programming concepts of Python programming language   |
| <b>2</b> | Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries   |
| <b>3</b> | Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these |

**COURSE OUTCOMES**

| <b>Upon successful completion of the course, the student will be able to :</b> |  | <b>Cognitive Level</b> |
|--|--|------------------------|
| <b>CO1</b>   | Develop essential programming skills in computer programming concepts like data types, control statements. | K3                     |
| <b>CO2</b>   | Apply the basics of programming in the Python language.  | K3                     |
| <b>CO3</b>   | Solve coding tasks related Dictionaries, tuples and sets.  | K3                     |
| <b>CO4</b>   | Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming. | K3                     |
| <b>CO5</b>   | Apply the basics of Numpy and pandas related to the Data Science   | K3                     |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b> | 3   | 2   | 1   | 1   | 1   | -   | -   | -   | -   | -    | -    | 1    | 3    | 3    | 2    |
| <b>CO2</b> | 3   | 2   | 1   | 1   | 1   | -   | -   | -   | -   | -    | -    | 1    | 3    | 3    | 2    |
| <b>CO3</b> | 3   | 2   | 1   | 1   | 1   | -   | -   | -   | -   | -    | -    | 1    | 3    | 3    | 2    |
| <b>CO4</b> | 3   | 2   | 2   | 3   | 3   | -   | -   | -   | -   | -    | -    | 1    | 3    | 3    | 2    |
| <b>CO5</b> | 3   | 2   | 2   | 3   | 3   | -   | -   | -   | -   | -    | -    | 1    | 3    | 3    | 2    |



## COURSE CONTENT

### UNIT-I:

Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

**Parts of Python Programming Language:** Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

**Control Flow Statements:** if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

### Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Write a program to add and multiply complex numbers
5. Write a program to print multiplication table of a given number.

### UNIT – II

**Functions:** Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, \*args and \*\*kwargs, Command Line Arguments.

**Strings:** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

**Lists:** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

### Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
  - i. Addition
  - ii. Insertion
  - iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

### UNIT – III

**Dictionaries:** Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

**Tuples and Sets:** Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

### Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

**UNIT – IV**

**Files:** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

**Object-Oriented Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

**Sample Experiments:**

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

**UNIT – V**

**Introduction to Data Science:** Functional Programming, JSON and XML with Python, NumPy with Python, Pandas.

Visual Aids for EDA(Exploratory Data Analysis): Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart

**Sample Experiments:**

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
  - a) Apply head () function to the pandas data frame
  - b) Perform various data selection operations on Data Frame
6. Apply different visualization techniques using sample dataset
  - a) Line Chart b) Bar Chart c) Scatter Plots d)Bubble Plot
7. Generate Scatter Plot using seaborn library for iris dataset
8. Apply following visualization Techniques for a sample dataset
  - a) Area Plot b) Stacked Plot c) Pie chart d) Table Chart

**Reference Books:**

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2ndEdition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
4. Python : The Complete Reference, by Martin C Brown, McGraw Hill India.

**Online Learning Resources/Virtual Labs:**

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>



**II Year I Semester**  
**Environmental Science**  
(Common to all branches)

|                           |                |   |                              |
|---------------------------|----------------|---|------------------------------|
| Course Category           | BASIC SCIENCES | Course Code   | 23BC301T                     |
| Course Type prerequisites | Theory         | L-T-P-C<br>Internal Assessment<br>Semester End Examination<br>Total Marks | 2 -0-0--0<br>30<br>70<br>100 |

| S.No. | Course Objectives   |
|-------|---|
| 1     | To make the students to get awareness on environment  |
| 2     | To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life |
| 3     | To save earth from the inventions by the engineers.   |

| COURSE OUTCOMES   |  | Cognitive Level |
|---|--|-----------------|
| <b>Upon successful completion of the course, the student will be able to:</b> |  |                 |
| CO1   | Grasp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.  | K2              |
| CO2   | Understand flow and bio-geo- chemical cycles and ecological pyramids.  | K2              |
| CO3   | Understand various causes of pollution and solid waste management and related preventive measures.           | K2              |
| CO4   | Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation. | K2              |
| CO5   | Illustrate the casus of population explosion, value education and welfare programmes.                        | K3              |

| Contribution of Course Outcomes towards achievement of Program |     |     |     |     |     |     |     |     |     |      |      |      |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Outcomes (1 – Low, 2 - Medium, 3 – High)                       |     |     |     |     |     |     |     |     |     |      |      |      |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1  | 1   | 0   | 1   | 0   | 0   | 1   | 2   | 0   | 0   | 0    | 1    | 0    |
| CO2  | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0    | 0    | 0    |
| CO3  | 0   | 0   | 0   | 0   | 2   | 0   | 1   | 0   | 0   | 0    | 0    | 0    |
| CO4  | 0   | 0   | 0   | 0   | 1   | 1   | 3   | 0   | 0   | 0    | 0    | 0    |
| CO5  | 0   | 0   | 0   | 0   | 0   | 0   | 3   | 1   | 0   | 0    | 0    | 0    |



## **COURSE CONTENT**

### **UNIT – I**

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies, Energy resources-Renewable and non-renewable resources (Biomass).

### **UNIT – II**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a)Forest ecosystem, b)Grassland ecosystem, c)Desert ecosystem, e)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)(Primary Treatment)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hotspots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **UNIT – III**

Environmental Pollution: Definition, Cause, effects and control measures of: a)Air Pollution, b)Water pollution, c)Soil pollution, d)Marine pollution, e)Noise pollution, f)Thermal pollution, g)Nuclear hazards (Primarytreatment)

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

### **UNIT – IV**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics (Issues and possible solutions) –Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.



**UNIT – V**

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Viral infections -Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

**Textbooks:**

1. Erach Bharucha, Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

**Reference Books:**

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

**Online Learning Resources:**

- [https://onlinecourses.nptel.ac.in/noc23\\_hs155/preview](https://onlinecourses.nptel.ac.in/noc23_hs155/preview)
- [https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product\\_category=course&placement\\_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science](https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science)
- <http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf>
- <https://www.youtube.com/watch?v=5QxxaVfgQ3k>



**II Year II Semester**  
**Optimization Techniques**  
(Common to IT, CSE(AIML), CSE(AI), CSE(DS))

|                        |                       |                                       |          |
|------------------------|-----------------------|---------------------------------------|----------|
| <b>Course Category</b> | Management Course – I | <b>Course Code</b>                    | 23ME405T |
| <b>Course Type</b>     | Theory                | <b>L-T-P-C</b>                        | 2-0-0-2  |
| <b>Prerequisites</b>   |                       | <b>Continuous Internal Assessment</b> | 30       |
|                        |                       | <b>Semester End Examination</b>       | 70       |
|                        |                       | <b>Total Marks</b>                    | 100      |

| <b>COURSE OBJECTIVES</b> |  |
|--------------------------|--|
| 1                        | To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.                                    |
| 2                        | To state single variable and multi variable optimization problems, without and with constraints.   |
| 3                        | To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.                                   |
| 4                        | To state transportation and assignment problem as a linear programming problem to determine Simplex method.  |
| 5                        | To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems. |

| <b>COURSE OUTCOMES</b>  |  | <b>Cognitive Level</b> |
|---|--|------------------------|
| <b>Upon successful completion of the course, the student will be able to:</b> |  |                        |
| <b>CO1</b>  | State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.  | K2                     |
| <b>CO2</b>  | Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.                               | K3                     |
| <b>CO3</b>  | Apply and Solve transportation and assignment problem by using Linear programming Simplex method.  | K3                     |
| <b>CO4</b>  | Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.                     | K3                     |
| <b>CO5</b>  | Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution. | K4                     |

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

| <b>Contribution of Course Outcomes towards achievement of Program Outcomes</b><br>(1 – Low, 2 - Medium, 3 – High) |     |     |     |     |     |     |     |     |     |      |      |      |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| <b>CO1</b>  | 3   | 3   | 3   | 2   | 3   | -   | -   | -   | -   | -    | 3    | -    |
| <b>CO2</b>  | 3   | 3   | 3   | 1   | 3   | -   | -   | -   | -   | -    | 3    | -    |
| <b>CO3</b>  | 3   | 3   | 3   | 1   | 3   | -   | -   | -   | -   | -    | 3    | -    |
| <b>CO4</b>  | 3   | 3   | 3   | 2   | 3   | -   | -   | -   | -   | -    | 3    | -    |
| <b>CO5</b>  | 3   | 3   | 3   | 1   | 3   | -   | -   | -   | -   | -    | 3    | -    |





## COURSE CONTENT

### UNIT I

**Introduction:** Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.

**Classical Optimization Techniques:** Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

### UNIT II

**Linear Programming:** Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm.

### UNIT III

**Transportation Problem:** Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

### UNIT IV

**Nonlinear Programming:** Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method, Univariate method, steepest descent method. Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method, Basic approaches of Interior and Exterior penalty function methods,

### UNIT V

**Dynamic Programming:** Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

#### Textbooks:

1. Engineering optimization: Theory and practice, S. S. Rao, New Age International (P) Limited, 3rd edition, 1998.
2. Introductory Operations Research, H.S. Kasene & K.D. Kumar, Springer (India), Pvt. Ltd.

#### Reference Books:

1. “Optimization Methods in Operations Research and systems Analysis”, by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research, Dr. S. D. Sharma, Kedarnath, Ramnath & Co.

#### Online Learning Resources:

1. <http://www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html>
2. <https://nptel.ac.in/courses/110106062>
3. <https://nptel.ac.in/courses/111/105/111105039/>
4. <https://nptel.ac.in/courses/106/108/106108056/>
5. <https://nptel.ac.in/courses/112/105/112105235/>
6. [https://onlinecourses.nptel.ac.in/noc21\\_me43/preview](https://onlinecourses.nptel.ac.in/noc21_me43/preview)
7. [https://www.nptel.ac.in/content/syllabus\\_pdf/112103301.pdf](https://www.nptel.ac.in/content/syllabus_pdf/112103301.pdf)





## **COURSE CONTENT**

### **UNIT I**

#### **Data Visualization and Distributions:**

Data Visualization Techniques: Introduction to Statistical methods – Exploratory Data Analysis-Charts (Line, Pie, Bar); Plots (Bubble, Scatter); Maps (Heat, Dot Distribution); Diagrams (Trees and Matrices) – Principal Components Analysis

Introduction to Data Distributions - Probability Distributions – discrete (binomial, Poisson), Continuous Distributions (Normal, exponential).

### **UNIT II**

#### **Hypothesis Testing:**

Introduction to Parametric Estimation-Parametric Confidence Intervals

Choosing a Statistic-Hypothesis Testing – Parametric test : the T-test-Applications to Hypothesis Tests – Pair wise comparisons.

### **UNIT III**

Linear Regression and Multiple Regression:

Regression: Linear Regression, Curvilinear Regression: Exponential Regression- Polynomial Regression - Power Model.

Practical Examples - The nature of the ‘relationship’ - Multiple Linear Regression – Important measurements of the regression estimate - Multiple Regression with Categorical Explanatory Variables – Inference in Multiple Regression-Variable Selection.

### **UNIT IV**

#### **Time Series:**

Time series: Significance of Time series analysis, Components of Time series, Secular trend : Graphic method, Semi-average method, Method of moving averages, Method of least squares : straight line and non-linear trends, Logarithmic methods–Exponential trends, Growth curves, Seasonal Variations : Method of simple averages, Ratio-to-trend method, ratio-to-moving average method, Link relative method. (**Textbook:** K.Murugesan, P.Gurusamy, “Probability, Statistics and Random Processes”)

### **UNIT V**

#### **Logistic Regression:**

The classification problem – Logistic Regression Setup-Interpreting the Results-Comparing Models-Classification Using Logistic Regression

## **TEXT BOOKS**

1. Elizabeth Purdom, "Statistical methods for Data science"
2. K.Murugesan, P.Gurusamy, “Probability, Statistics and Random Processes”

## **REFERENCE BOOKS**

1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference–Testing of Hypotheses, Prentice Hall of India,2014.
2. Robert VHogg, Elliot A Tannis and DaleL. Zimmerman, Probability and Statistical Inference, 9<sup>th</sup> edition, Pearson publishers,2013.
3. Chris Chatfield, “The analysis of time series an introduction,”5<sup>th</sup>edition, Chapman &Hall/CRC.
4. Peter J.Brockwell, Richard A.Davis, “Introduction to Timeseries and Forecasting, ”Second edition, Springer.

## **WEB RESOURCES**

1. <https://rafalab.dfci.harvard.edu/dsbook-part-1/dataviz/distributions.html>
2. [https://en.wikipedia.org/wiki/Statistical\\_hypothesis\\_test](https://en.wikipedia.org/wiki/Statistical_hypothesis_test)
3. [https://en.wikipedia.org/wiki/Linear\\_regression](https://en.wikipedia.org/wiki/Linear_regression)
4. [https://en.wikipedia.org/wiki/Time\\_series](https://en.wikipedia.org/wiki/Time_series)
5. <https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-logistic-regression/>





## **COURSE CONTENT**

**UNIT-I: Introduction to Data Engineering:** Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities, Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

**UNIT-II: Data Engineering Life Cycle:** Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

**Major undercurrents across the Data Engineering Life Cycle:** Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

**UNIT-III: Designing Good Data Architecture:** Enterprise Architecture, Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts.

**Data Generation in Source Systems:** Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

**UNIT-IV: Storage:** Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lake house.

**Ingestion:** Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

**UNIT-V: Queries, Modeling and Transformation:** Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.

**Serving Data for Analytics, Machine Learning and Reverse ETL:** General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

### **Text Books:**

1. JoeReis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc., June 2022, ISBN: 9781098108304

### **Reference Books:**

1. Paul Crickard, Data Engineering with Python, Packt Publishing, October 2020.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021

### **Web References:**

1. <https://courses.cs.duke.edu/fall15/compsci290.1/>
2. [https://www.youtube.com/playlist?list=PL3MmuxUbc\\_hKihpnNQ9qtTmWYy26bPrSb](https://www.youtube.com/playlist?list=PL3MmuxUbc_hKihpnNQ9qtTmWYy26bPrSb)



**II Year II Semester  
Database Management Systems  
Common to AI, CSE(CS),CSE, DS, IT**

|                        |                   |                                 |          |
|------------------------|-------------------|---------------------------------|----------|
| <b>Course Category</b> | Professional Core | <b>Course Code</b>              | 23IT401T |
| <b>Course Type</b>     | Theory            | <b>L-T-P-C</b>                  | 3-0-0-3  |
| <b>Prerequisites</b>   |                   | <b>Internal Assessment</b>      | 30       |
|                        |                   | <b>Semester End Examination</b> | 70       |
|                        |                   | <b>Total Marks</b>              | 100      |

| <b>COURSEOBJECTIVES</b> |  |
|-------------------------|--|
| <b>1</b>                | To introduce Data models and Entity Relationship Model Representation  |
| <b>2</b>                | To give a good formal foundation on the relational model of data and usage of Relational Algebra   |
| <b>3</b>                | To introduce the concepts of basic SQL as a universal Database language  |
| <b>4</b>                | To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization |
| <b>5</b>                | To provide an overview of concurrent execution ,deadlocks and indexing techniques  |

| <b>COURSEOUTCOMES</b>   |   |                        |
|---|---|------------------------|
| <b>Upon successful completion of the course, the student will be able to:</b> |   | <b>Cognitive Level</b> |
| <b>CO1</b>  | Implementing E-R Models on different examples                   | K3                     |
| <b>CO2</b>  | Describe a relational database and object-oriented database     | K3                     |
| <b>CO3</b>  | Create, maintain and manipulate a relational database using SQL | K3                     |
| <b>CO4</b>  | Design a database with understanding on Normalization.          | K2                     |
| <b>CO5</b>  | Determining and describing the concurrent execution ,deadlocks  | K3                     |

K1:Remember,K2:Understand,K3:Apply,K4:Analyze,K5:Evaluate,K6: Create

| <b>Contribution of Course Outcomes towards achievement of Program Outcomes(1-Low,2-Medium,3-High)</b> |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| <b>CO1</b>  | 3   | 1   | 3   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 2    | 3    | -    |
| <b>CO2</b>  | 3   | 3   | 3   | -   | -   | -   | -   | -   | 1   | -    | -    | -    | 2    | 2    | 2    |
| <b>CO3</b>  | 3   | 3   | 3   | 2   | -   | -   | -   | -   | 1   | -    | 2    | -    | 2    | 2    | 2    |
| <b>CO4</b>  | 3   | 3   | 3   | -   | -   | -   | -   | -   | 1   | -    | 3    | -    | 2    | 2    | 2    |
| <b>CO5</b>  | 3   | 2   | 1   | -   | -   | -   | -   | -   | 1   | -    | -    | -    | 2    | -    | 2    |



## **COURSECONTENT**

### **UNIT-I**

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database. Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

### **UNIT-II**

Relational Model: Introduction to relational model, concepts of domain, attribute, Tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

### **UNIT-III**

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

### **UNIT-IV**

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), MVD, Fourth normal form (4NF), Fifth Normal Form (5NF).

### **UNIT-V**

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm. Introduction to Indexing Techniques: B+ Trees, operations on B+ Trees, Hash Based Indexing:

## **TEXT BOOKS**

1. Database Management Systems, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts, 5<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

## **REFERENCEBOOKS**

1. Introduction to Database Systems, 8/e C.J. Date, PEA.
2. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
3. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

## **WEB RESOURCES**

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01275806667282022456\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview)



**II Year II Semester**  
**Computer Organization And Architecture**

|                        |                          |                                       |          |
|------------------------|--------------------------|---------------------------------------|----------|
| <b>Course Category</b> | Professional Core        | <b>Course Code</b>                    | 23EC306T |
| <b>Course Type</b>     | Theory                   | <b>L-T-P-C</b>                        | 3-0-0-3  |
| <b>Prerequisites</b>   | Basics of Number Systems | <b>Continuous Internal Assessment</b> | 30       |
|                        |                          | <b>Semester End Examination</b>       | 70       |
|                        |                          | <b>Total Marks</b>                    | 100      |

| <b>COURSEOBJECTIVES</b>        |   |
|--------------------------------|---|
| <b>The student will learn:</b> |   |
| <b>1</b>                       | Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals |
| <b>2</b>                       | Describe memory hierarchy concepts  |
| <b>3</b>                       | Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices                         |

| <b>COURSE OUTCOMES</b>  |   |                        |
|---|---|------------------------|
| <b>Upon successful completion of the course, the student will be able to:</b> |   | <b>Cognitive Level</b> |
| <b>CO1</b>  | Understanding the data representation of a digital computer system. Relate Postulates of Boolean algebra and minimize combinational functions and analyze combinational circuits. |                        |
| <b>CO2</b>  | Design and analyze sequential circuits and study the basic structure of computers   |                        |
| <b>CO3</b>  | Understand the basic concepts of computer arithmetic, organization.   |                        |
| <b>CO4</b>  | Understand the concepts of memory organization.   |                        |
| <b>CO5</b>  | Understand the concepts of I/O Organization.  |                        |

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

| <b>Contribution of Course Outcomes towards achievement of Program Outcomes</b><br>(1 – Low, 2 - Medium, 3 – High) |            |            |            |            |            |            |            |            |            |             |             |             |             |             |
|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO</b>   | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> |
| <b>CO1</b>  | 2          | 2          | 2          | 2          | 2          |            |            |            |            |             | 2           | 2           | 2           | 2           |
| <b>CO2</b>  | 2          | 2          | 2          | 2          | 2          |            |            |            |            |             | 2           | 2           | 2           | 2           |
| <b>CO3</b>  | 2          | 2          | 2          | 2          | 2          |            |            |            |            |             | 2           | 2           | 2           | 2           |
| <b>CO4</b>  | 2          | 2          | 2          | 2          | 2          |            |            |            |            |             | 2           | 2           | 2           | 2           |
| <b>CO5</b>  | 2          | 2          | 2          | 2          | 2          |            |            |            |            |             | 2           | 2           | 2           | 2           |





## **COURSE CONTENT**

**UNITI: Digital Computers and Data Representation :** Introduction, Numbering Systems, Decimal to Binary Conversion, Binary Coded Decimal Numbers, Weighted Codes, Self-Complementing Codes, Cyclic Codes, Error Detecting Codes, Error Correcting Codes, Hamming Code for Error Correction, Alphanumeric Codes, ASCII Code

**Data Representation:** Data types, Complements, Fixed Point Representation, Floating Point Representation.

**Boolean Algebra and Logical gates:** Boolean Algebra :Theorems and properties, Boolean functions, canonical and standard forms , minimization of Boolean functions using algebraic identities; Karnaugh map presentation and minimization using two and three variable Maps; Logical gates ,universal gates and Two- level realizations using gates : AND-OR, OR-AND, NAND-NAND and NOR-NOR structures

**UNITII: Digital logic circuits:** Combinatorial Circuits: Introduction, Combinatorial Circuit Design Procedure, Implementation using universal gates, Multi - bit adder, Multiplexers, Demultiplexers, Decoders Sequential Switching Circuits: Latches and Flip-Flops, Ripple counters using T flip-flops;

**Synchronous counters:** Shift Registers; Ring counters

**UNITIII: Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Booth multiplication algorithm, Division Algorithms, Floating-point Arithmetic Operations.

**Register Transfer language and micro instructions:** Bus memory transfer, arithmetic and logical micro-operations, shift and rotate micro-operations

Basic Computer Organization and Design: Stored program concept, computer Registers, common bus system, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input-Output configuration and program Interrupt.

**UNITIV: Micro programmed Control:** Control memory, Address sequencing, micro program example, design of control unit. Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation

**Program Control:** conditional Flags and Branching

**UNITV: Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

**Input-Output Organization:** Input-Output Interface, A synchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

### **Text Books:**

1. Digital Logic and Computer Design, Morris Mano, 11<sup>th</sup> Edition, Pearson.
2. Computer System Architecture, 3<sup>rd</sup> Edition, M. Morris Mano, PHI

### **Reference Books:**

1. Digital Logic and Computer Organization, Rajaraman, Radhakrishnan, PHI, 2006
2. Computer Organization, 5<sup>th</sup> Edition, Hamacher, Vranesic, Zaky, TMH, 2002
3. Computer Organization & Architecture: Designing for Performance, 7<sup>th</sup> Edition, William Stallings, PHI, 2006

**II Year II Semester  
Data Engineering Lab**

|                        |                              |                                 |           |
|------------------------|------------------------------|---------------------------------|-----------|
| <b>Course Category</b> | Professional Core            | <b>Course Code</b>              | 23DS4019  |
| <b>Course Type</b>     | Laboratory                   | <b>L-T-P-C</b>                  | 0-0-3-1.5 |
| <b>Prerequisites</b>   | Introduction to Data Science | <b>Internal Assessment</b>      | 30        |
|                        |                              | <b>Semester End Examination</b> | 70        |
|                        |                              | <b>Total Marks</b>              | 100       |

**COURSEOBJECTIVES**

|          |   |
|----------|---|
| <b>1</b> | The main objective of this course is to teach how build data engineering infrastructure and data pipelines. |
|----------|---|

**COURSEOUTCOMES**

| <b>Upon successful completion of the course, the student will be able to:</b> |   | <b>Cognitive Level</b> |
|---|---|------------------------|
| <b>CO1</b>  | Build our Data Engineering Infrastructure         | K3                     |
| <b>CO2</b>  | Demonstrate Reading and Writing files             | K3                     |
| <b>CO3</b>  | Build Data Pipelines and integrate with Dashboard | K3                     |
| <b>CO4</b>  | Deploy the Data Pipeline in production            | K3                     |

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

**Contribution of Course Outcomes towards achievement of Program: Outcomes  
(1 – Low, 2 - Medium, 3 –High)**

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>CO1</b> | 2   | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 2    |
| <b>CO2</b> | 2   | 3   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 2    |
| <b>CO3</b> | 2   | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 2    |
| <b>CO4</b> | 2   | 3   | 3   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    | 2    |



**Experiments:**

1. Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elastic search, Kibana, PostgreSQL, pgAdmin4
3. Reading and Writing files
  - a. Reading and writing files in Python
  - b. Processing files in Airflow
  - c. NiFi processors for handling files
  - d. Reading and writing data to data bases in Python
  - e. Databases in Airflow
  - f. Database processors in NiFi
4. Working with Databases
  - a. Inserting and extracting relational data in Python
  - b. Inserting and extracting NoSQL database data in Python
  - c. Building database pipelines in Airflow
  - d. Building database pipelines in NiFi
5. Cleaning, Transforming and Enriching Data
  - a. Performing exploratory data analysis in Python
  - b. Handling common data issues using pandas
  - c. Cleaning data using Airflow
6. Building the Data Pipeline
7. Building a Kibana Dash Board
8. Perform the following operations
  - a. Staging and validating data
  - b. Building idempotent data pipelines
  - c. Building atomic data pipelines
9. Version Control with the NiFi Registry
  - a. Installing and configuring the NiFi Registry
  - b. Using the Registry in NiFi
  - c. Versioning your data pipelines
  - d. Using git- persistence with the NiFi Registry
10. Monitoring Data Pipelines
  - a. Monitoring NiFi in the GUI
  - b. Monitoring NiFi using processors
  - c. Monitoring NiFi with Python and the REST API
11. Deploying Data Pipelines
  - a. Finalizing your data pipelines for production
  - b. Using the NiFi variable registry
  - c. Deploying your data pipelines
12. Building a Production Data Pipeline
  - a. Creating a test and production environment
  - b. Building a production data pipeline
  - c. Deploying a data pipeline in production

**Reference Books:**

1. Paul Crickard, Data Engineering with Python, Packt Publishing, October 2020.

**Web References:**

1. <https://courses.cs.duke.edu/fall15/compsci290.1/>
2. [https://www.youtube.com/playlist?list=PL3MmuxUbc\\_hKihpnNQ9qtTmWYy26bPrSb](https://www.youtube.com/playlist?list=PL3MmuxUbc_hKihpnNQ9qtTmWYy26bPrSb)



**II Year II Semester  
Database Management Systems Laboratory  
Common to AI,CSE(CS),CSE, DS ,IT**

|                        |                   |                                 |           |
|------------------------|-------------------|---------------------------------|-----------|
| <b>Course Category</b> | Professional Core | <b>Course Code</b>              | 23IT401P  |
| <b>Course Type</b>     | Laboratory        | <b>L-T-P-C</b>                  | 0-0-3-1.5 |
| <b>Prerequisites</b>   |                   | <b>Internal Assessment</b>      | 30        |
|                        |                   | <b>Semester End Examination</b> | 70        |
|                        |                   | <b>Total Marks</b>              | 100       |

| <b>COURSEOBJECTIVES</b> |   |
|-------------------------|---|
| <b>1</b>                | Populate and query a data base using SQL DDL/DML Commands                                 |
| <b>2</b>                | Declare and enforce integrity constraints on a database                                   |
| <b>3</b>                | Writing Queries using advanced concepts of SQL  |
| <b>4</b>                | Programming PL/SQL including procedures, functions, cursors, triggers and JDBC connection |

| <b>COURSEOUTCOMES</b>  |   |                        |
|--|---|------------------------|
| <b>Up on successful completion of the course, the student will be able to:</b> |   | <b>Cognitive Level</b> |
| <b>CO1</b>   | Create data base tables and perform various operations            | K3                     |
| <b>CO2</b>   | Implement PL/SQL programs   | K3                     |
| <b>CO3</b>   | Create stored packages for variables, cursors and JDBC connection | K3                     |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| <b>Contribution of Course Out comes to wards achievement of Program:<br/>Outcomes (1 – Low, 2 -Medium, 3 –High)</b> |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| <b>CO1</b>  | 2   | 2   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 2    | 1    |
| <b>CO2</b>  | 3   | 2   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 2    | 1    |
| <b>CO3</b>  | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -    | -    | 1    | 2    | 3    | 2    |



### LIST OF EXPERIMENTS

**Note:** For performing the experiments consider any case study (ATM/ Banking/Library/Hospital management systems)

- 1 Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
- 2 Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
- 3 Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.  
Queries using Conversion functions (to\_char, to\_number and to\_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next\_day, add\_months, last\_day, months\_between, least, greatest, trunc, round, to\_char, to\_date)
- 4 i. Create a simple PL/SQL program which includes declaration section, executable section, and exception handling section (Ex. Student mark can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
- 5 ii. Insert data into student table and use COMMIT, ROLL BACK and SAVEPOINT in PL/SQL block.
- 6 Develop program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
- 7 Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT-IN Exceptions, USER defined Exceptions, RAISE-APPLICATION ERROR.
- 8 Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
- 9 Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
- 10 Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT OF clause and CURSOR variables.
- 11 Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
- 12 Create a table and perform the search operation on table using indexing and non-indexing techniques.
- 13 Write a Java program that connects to a database using JDBC
- 14 Write a Java program to connect to a database using JDBC and insert values into it
- 15 Write a Java program to connect to a database using JDBC and delete values from it

### TEXTBOOKS/SUGGESTED READING:

- 1 Oracle: The Complete Reference by Oracle Press
- 2 Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
- 3 Rick FVanderLans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007





## COURSE CONTENT

### UNIT-I

**Exploratory Data Analysis Fundamentals:** Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.

**Sample Experiments:**

1. a) Download Dataset from Kaggle using the following link:  
<https://www.kaggle.com/datasets/sukhmanibedi/cars4u>  
b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib, sea born)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into pandas data frame
4. Selecting rows and columns in the data frame

### UNIT-II

**Visual Aids for EDA:** Technical requirements, Line chart, Bar charts, Scatter plot using sea born, Polar chart, Histogram, Choosing the best chart

**Case Study:** EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

**Sample Experiments:**

1. Apply different visualization techniques using sample dataset  
a) Line Chart b) Bar Chart c) Scatter Plots d) Bubble Plot
2. Generate Scatter Plot using sea born library for iris dataset
3. Apply following visualization Techniques for a sample dataset  
b) Area Plot b) Stacked Plot c) Pie chart d) Table Chart
4. Generate the following charts for a dataset.  
c) Polar Chart b) Histogram c) Lollipop chart
5. Case Study: Perform Exploratory Data Analysis with Personal Email Data

### UNIT-III

**Data Transformation:** Merging database-style data frames, Concatenating along with an axis, Merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges.

**Sample Experiments:**

1. Perform the following operations  
d) Merging Data frames  
e) Reshaping with Hierarchical Indexing  
f) Data Deduplication  
g) Replacing Values
2. Apply different Missing Data handling techniques  
h) NaN values in mathematical Operations  
i) Filling in missing data  
j) Forward and Backward filling of missing values  
k) Filling within dex values  
l) Interpolation of missing values
3. Apply different data transformation techniques Renaming axis indexes  
m) Discretization and Binning  
n) Permutation and Random Sampling  
o) Dummy variables



#### UNIT-IV

**Descriptive Statistics:** Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, Calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis

**Sample Experiments:**

1. Study the following Distribution Techniques on a sample data
  - a) Uniform Distribution
  - b) Normal Distribution
  - c) Gamma Distribution
  - d) Exponential Distribution
  - e) Poisson Distribution
  - f) Binomial Distribution
2. Perform Data Cleaning on a sample dataset.
3. Compute measure of Central Tendency on a sample dataset
  - g) Mean b)Median c)Mode
4. Explore Measures of Dispersion on a sample dataset
  - h) Variance b) Standard Deviation c) Skewness d) Kurtosis
5.
  - a) Calculating percentile on sample dataset
  - b) Calculate Inter Quartile Range(IQR) and Visualize using Box Plots
6. Perform the following analysis on automobile dataset.
  - i) Bivariate analysis b)Multivariate analysis
7. Perform Time Series Analysis on Open Power systems dataset

#### UNIT-V

**Model Development and Evaluation:** Unified machine learning workflow, Data preprocessing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, Best model selection and evaluation, Model deployment

**Case Study:** EDA on Wine Quality Data Analysis

**Sample Experiments:**

1. Perform hypothesis testing using stats models library
  - a) Z-Test b)T-Test
2. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score.
3. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

**Text Book:**

1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.

**References:**

1. RonaldK .Pearson, Exploratory Data Analysis Using R, CRCPress, 2020
2. Radhika Datar, Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, 1st Edition, Packt Publishing, 2019

**Web References:**

1. <https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python>
2. <https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-eda-using-python/#h-conclusion>
3. <https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook>



**II Year II Semester****DESIGN THINKING & INNOVATION****(Common to CE, EEE, ME, ECE, CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS) and CSE(CYBER SECURITY))**

|                        |        |   |           |
|------------------------|--------|---|-----------|
| <b>Course Category</b> | BS&H   | <b>Course Code</b>  | 23HM401P  |
| <b>Course Type</b>     | Theory | <b>L-T-P-C</b>  | 1 -0 -2-2 |
| <b>Prerequisites</b>   |        | <b>Internal Assessment<br/>Semester End Examination<br/>Total Marks</b> | 30<br>70  |

| <b>Course Outcomes</b>   |   | <b>Blooms<br/>Taxonomy Level</b> |
|--|---|----------------------------------|
| <b>Upon successful completion of the course, the student will be able to</b> |   |                                  |
| <b>CO 1</b>  | Define the concepts related to design thinking.                               | K1                               |
| <b>CO 2</b>  | Explain the fundamentals of Design Thinking and innovation.                   | K2                               |
| <b>CO 3</b>  | Apply the design thinking techniques for solving problems in various sectors. | K3                               |
| <b>CO 4</b>  | Analyze to work in a multidisciplinary environment.                           | K4                               |
| <b>CO 5</b>  | Evaluate the value of creativity.   | K5                               |

| <b>Contribution of Course Outcomes towards achievement of Program Outcomes<br/>(1 – Low, 2 - Medium, 3 – High)</b> |            |            |            |            |            |            |            |            |            |             |             |             |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>CO</b>  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
| <b>CO1</b>   | 1          | 1          | 3          |            | 1          | 3          |            |            |            |             | 1           | 1           |
| <b>CO2</b>   |            |            | 3          |            | 2          | 3          |            |            |            |             |             |             |
| <b>CO3</b>   |            | 1          | 3          |            |            | 3          |            |            | 1          |             |             | 1           |
| <b>CO4</b>   |            |            | 3          |            |            | 3          |            |            |            |             |             |             |
| <b>CO5</b>   |            |            | 3          |            |            | 3          |            |            |            |             | 3           | 2           |



## **COURSE CONTENT**

### **UNIT – I Introduction to Design Thinking**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

### **UNIT - II Design Thinking Process**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development

**Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

### **UNIT - III Innovation**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

### **UNIT - IV Product Design**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

**Activity:** Importance of modeling, how to set specifications, Explaining their own product design.

### **UNIT – V Design Thinking in Business Processes**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

**Activity:** How to market our own product, about maintenance, Reliability and plan for startup.

#### **Textbooks:**

1. Tim Brown, Change by design, 1/e, Harper Collins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

#### **Reference Books:**

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William Lidwell, Kritina Holden, & Jill Butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough, H., The era of open innovation, 2003.

#### **Web Resources:**

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- [https://swayam.gov.in/nd1\\_noc19\\_mg60/preview](https://swayam.gov.in/nd1_noc19_mg60/preview)
- [https://onlinecourses.nptel.ac.in/noc22\\_de16/preview](https://onlinecourses.nptel.ac.in/noc22_de16/preview)