



**B. Tech in CSE (Artificial Intelligence & Machine Learning)**

**Scheme Of Teaching and Examination**

**(Effective From Academic Year 2024-2025)**

**SEMESTER III**

| Sl<br>No | Course and<br>Course Code |         | Course Title                               | Teaching<br>Hours/Week |          |          | credits   | Examination |            |            |
|----------|---------------------------|---------|--------------------------------------------|------------------------|----------|----------|-----------|-------------|------------|------------|
|          |                           |         |                                            | L                      | T        | P        |           | CIE         | SEE        | TOTAL      |
| 1.       | AEC                       | 0CS330T | Machine Learning                           | 3                      | 1        | 0        | 4         | 50          | 50         | 100        |
| 2.       | ETC I                     | 0CS331T | Data visualization and<br>storytelling     | 3                      | 0        | 0        | 3         | 50          | 50         | 100        |
| 3.       | ETC II                    | 0CS332T | Design and Analysis of<br>Algorithms       | 3                      | 0        | 0        | 3         | 50          | 50         | 100        |
| 4.       | ETC III                   | 0CS333T | Operating System                           | 2                      | 1        | 0        | 3         | 50          | 50         | 100        |
| 5.       | VAC I                     | 0SC205T | Fundamental of<br>environmental sciences   | 2                      | 0        | 0        | 2         | 25          | 25         | 50         |
| 6.       | VAC II                    | 0MG213I | Universal Human Values                     | 2                      | 0        | 0        | 2         | 50          | 00         | 50         |
| 7.       | AEC                       | 0CS330P | Machine Learning LAB                       | 0                      | 0        | 2        | 1         | 25          | 25         | 50         |
| 8.       | ETC I                     | 0CS331P | Data visualization and<br>storytelling LAB | 0                      | 0        | 2        | 1         | 25          | 25         | 50         |
| 9        | ETC II                    | 0CS332P | Design and Analysis of<br>Algorithms LAB   | 0                      | 0        | 2        | 1         | 25          | 25         | 50         |
|          |                           |         | <b>TOTAL</b>                               | <b>15</b>              | <b>2</b> | <b>6</b> | <b>20</b> | <b>350</b>  | <b>300</b> | <b>650</b> |

**SDA-Skill Development Activities, ASC-Applied Science Course, ESC-Engineering Science Courses, ETC-Emerging Technology Course, AEC-Ability Enhancement Course, HSMS-Humanity and Social Science and management Course, SDC- Skill Development Course, CIE-Continuous Internal Evaluation, SEE- Semester End Examination, I- only CIE Exam**



**1. Machine Learning**

|                                   |                            |                                   |         |
|-----------------------------------|----------------------------|-----------------------------------|---------|
| <b>Program name</b>               | B. TECH (computer science) | <b>Semester</b>                   | III     |
| <b>Courses title</b>              | <b>Machine Learning</b>    |                                   |         |
| <b>Courses code</b>               | 0CS330T                    | <b>No. of credits</b>             | 03      |
| <b>Contact hours</b>              | 40 hours                   | <b>Duration of Exam</b>           | 2 hours |
| <b>Formative assessment marks</b> | 50                         | <b>Summative Assessment marks</b> | 50      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------|
| <b>COURSE TITLE:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Machine Learning</b> | <b>40 Hrs</b> |
| <b>Course objectives:</b> The goal of the course is to<br>1. To provide in-depth knowledge of machine learning concepts and techniques.<br>2. To develop skills for implementing machine learning algorithms using Python.<br>3. To introduce modern tools and frameworks used in machine learning.<br>4. To teach students the best practices for model evaluation and selection.<br>5. To enable students to solve real-world problems using machine learning |                         |               |
| <b>MODULE-1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         | <b>8</b>      |
| <b>Introduction to Machine Learning</b><br>Definition and importance of machine learning, Types of machine learning (supervised, unsupervised, reinforcement), Applications of machine learning, Overview of the machine learning pipeline, Key challenges in machine learning.                                                                                                                                                                                 |                         |               |
| <b>MODULE-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         | <b>8</b>      |
| <b>Data Preprocessing and Exploration</b><br>Data cleaning and preparation, Handling missing data, Data transformation and normalization, Feature engineering and selection, Exploratory data analysis (EDA) using Python, Visualization tools and techniques (matplotlib, seaborn).                                                                                                                                                                            |                         |               |
| <b>MODULE-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         | <b>8</b>      |
| <b>Supervised Learning Algorithms</b><br>Linear regression, Logistic regression, Decision trees, Support Vector Machines (SVM), K-Nearest Neighbors (KNN), Ensemble methods (Random Forest, Gradient Boosting), Model evaluation and metrics (accuracy, precision, recall, F1-score)                                                                                                                                                                            |                         |               |
| <b>MODULE-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         | <b>8</b>      |
| <b>Unsupervised Learning Algorithms</b><br>Clustering algorithms (K-Means, Hierarchical Clustering, DBSCAN), Dimensionality reduction techniques (PCA, t-SNE), Association rule learning, Anomaly detection, Evaluating clustering algorithms.                                                                                                                                                                                                                  |                         |               |



| MODULE-5                                                                                                                                                                                                                                                          | 8 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <b>Advanced Topics and Case Studies</b><br>Neural networks and deep learning basics, Natural Language Processing (NLP), Time series analysis, Model deployment and scaling, Ethical considerations in machine learning, Real-world case studies and applications. |   |

**Text Book:**

1. "Pattern Recognition and Machine Learning" by Christopher M. Bishop, Springer.
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, O'Reilly Media.

**Reference Book:**

1. Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili, Packt Publishing.
2. Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning" by Chris Albon, O'Reilly Media.
3. Deep Learning with Python" by François Chollet, Manning Publications.

**COURSE OUTCOME**

- CO1 Understand the fundamental concepts of machine learning.
- CO2 Preprocess and explore data using Python
- CO3 Implement and evaluate supervised learning algorithms.
- CO4 Apply unsupervised learning techniques to identify patterns in data.
- CO5 Explore advanced machine learning topics and their applications.

Note: Alternative to this subject, students are allowed to enrolled in similar NPTEL course. Details are given below.

|                                                      |                                                                                                                         |            |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------|
| Subject Name:<br>Introduction to<br>Machine Learning | <a href="https://onlinecourses.nptel.ac.in/noc24_cs51/preview">https://onlinecourses.nptel.ac.in/noc24_cs51/preview</a> | IIT-Madras |
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**2. Data visualization and storytelling**

|                      |                                     |                            |         |
|----------------------|-------------------------------------|----------------------------|---------|
| Program name         | B. TECH (computer science)          | Semester                   | III     |
| Courses title        | Data visualization and storytelling |                            |         |
| Courses code         | 0CS331T                             | No. of credits             | 03      |
| Contact hours        | 40 hours                            | Duration of Exam           | 2 hours |
| Formative assessment | 50                                  | Summative Assessment marks | 50      |



|       |  |  |  |
|-------|--|--|--|
| marks |  |  |  |
|-------|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------|
| <b>COURSE TITLE:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Data visualization and storytelling</b> | <b>40 Hrs</b> |
| <b>Course objectives:</b> The goal of the course is to<br>1. To provide an in-depth understanding of data visualization principles.<br>2. To develop skills for creating effective and engaging visual representations of data.<br>3. To introduce modern tools and techniques for data visualization.<br>4. To teach students how to use Excel and Power BI for data storytelling.<br>5. To enable students to present data insights in a compelling and understandable manner |                                            |               |
| <b>MODULE-1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                            | <b>8</b>      |
| <b>Introduction to Data Visualization</b><br>Definition and importance of data visualization, Principles of good data visualization, Types of data visualizations, Choosing the right chart type, Understanding the audience, Visual storytelling basics.                                                                                                                                                                                                                       |                                            |               |
| <b>MODULE-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            | <b>8</b>      |
| <b>Data Visualization using Excel</b><br>Excel charting basics, Advanced charting techniques, PivotTables and PivotCharts, Data cleaning and preparation, Conditional formatting, Using Excel functions for data visualization, Creating dashboards in Excel, Best practices for Excel visualizations.                                                                                                                                                                          |                                            |               |
| <b>MODULE-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            | <b>8</b>      |
| <b>Introduction to Power BI</b><br>Overview of Power BI, Connecting to data sources, Data modeling in Power BI, Creating visualizations in Power BI, Using DAX for data analysis, Interactive dashboards and reports, Sharing and collaborating with Power BI, Power BI service vs Power BI Desktop.                                                                                                                                                                            |                                            |               |
| <b>MODULE-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            | <b>8</b>      |
| <b>Advanced Power BI Techniques</b><br>Advanced data modeling, Custom visuals in Power BI, Advanced DAX functions, Data storytelling with Power BI, Using Power Query for data transformation, Power BI integration with other tools, Best practices for Power BI dashboards, Case studies and real-world applications.                                                                                                                                                         |                                            |               |
| <b>MODULE-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            | <b>8</b>      |
| <b>Data Storytelling Principles</b><br>Crafting a data narrative, Using data to support a story, Designing for impact, Ethical considerations in data storytelling, Tools and techniques for effective storytelling, Case studies of successful data stories, Visualizing qualitative data, Combining quantitative and qualitative data.                                                                                                                                        |                                            |               |



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### Text Book:

1. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic, Wiley.
2. "Data Visualization with Excel Dashboards and Reports" by Dick Kusleika, Wiley.

### Reference Book:

1. "The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios" by Steve Wexler, Jeffrey Shaffer, and Andy Cotgreave, Wiley.
2. "Pro DAX with Power BI: Business Intelligence with PowerPivot and SQL Server Analysis Services Tabular" by Philip Seamark, Apress.
3. "Practical Power BI: A Guide to Self-Service Data Analytics with Excel 2016 and Power BI Desktop" by Devin Knight, Brian Knight, Mitchell Pearson, and Manuel Quintana, Apress.

### COURSE OUTCOME

- CO1 Understand the fundamental principles of data visualization..
- CO2 Create effective data visualizations using Excel
- CO3 Utilize Power BI for advanced data visualization and analysis.
- CO4 Apply advanced techniques in Power BI for data storytelling.
- CO5 Develop compelling data narratives to communicate insights effectively.

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### 3.Design and Analysis of Algorithms

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|-----------------------------------|------------------------------------------|-----------------------------------|---------|
| <b>Program name</b>               | B. TECH (computer science)               | <b>Semester</b>                   | III     |
| <b>Courses title</b>              | <b>Design and Analysis of Algorithms</b> |                                   |         |
| <b>Courses code</b>               | 0CS332T                                  | <b>No. of credits</b>             | 03      |
| <b>Contact hours</b>              | 40 hours                                 | <b>Duration of Exam</b>           | 2 hours |
| <b>Formative assessment marks</b> | 50                                       | <b>Summative Assessment marks</b> | 50      |

|                      |                                          |               |
|----------------------|------------------------------------------|---------------|
| <b>COURSE TITLE:</b> | <b>Design and Analysis of Algorithms</b> | <b>40 Hrs</b> |
|----------------------|------------------------------------------|---------------|



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Course objectives:</b> The goal of the course is to<br>1. To introduce students to algorithm design techniques and analysis methods.<br>2. To teach students how to analyse the time and space complexity of algorithms.<br>3. To provide hands-on experience in implementing and evaluating algorithms.<br>4. To familiarize students with various algorithmic paradigms and problem-solving strategies.<br>5. To enable students to design efficient algorithms for real-world problems. |          |
| <b>MODULE-1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>8</b> |
| <b>Introduction to Algorithm Design and Analysis</b><br>Overview of algorithm design paradigms, Asymptotic analysis (Big O notation), Recursion and divide-and-conquer approach, Greedy algorithms, Dynamic programming.                                                                                                                                                                                                                                                                      |          |
| <b>MODULE-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>8</b> |
| <b>Sorting and Searching Algorithms</b><br>Analysis and implementation of sorting algorithms (Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Heap sort), Binary search, Hashing and hash-based searching.                                                                                                                                                                                                                                                               |          |
| <b>MODULE-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>8</b> |
| <b>Graph Algorithms</b><br>Graph representation and traversal (BFS, DFS), Shortest path algorithms (Dijkstra's algorithm, Bellman-Ford algorithm), Minimum spanning tree algorithms (Prim's algorithm, Kruskal's algorithm), Topological sorting.                                                                                                                                                                                                                                             |          |
| <b>MODULE-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>8</b> |
| <b>Dynamic Programming</b><br>Introduction to dynamic programming, Memoization and tabulation techniques, Applications of dynamic programming (Longest common subsequence, Matrix chain multiplication, Knapsack problem), Optimal substructure and overlapping subproblems.                                                                                                                                                                                                                  |          |
| <b>MODULE-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>8</b> |
| <b>Advanced Topics in Algorithm Design</b><br>NP-completeness and approximation algorithms, Backtracking and branch-and-bound techniques, Randomized algorithms, String matching algorithms (Knuth-Morris-Pratt, Rabin-Karp), Parallel and distributed algorithms.                                                                                                                                                                                                                            |          |

**Text Book:**

- 1 "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, The MIT Press
- 2 "Algorithm Design" by Jon Kleinberg and Éva Tardos, Pearson.

**Reference Book:**

- 3 "The Algorithm Design Manual" by Steven S. Skiena, Springer.



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4 "Algorithms" by Robert Sedgewick and Kevin Wayne, Addison-Wesley Professional.

5 "Algorithm Design and Applications" by Michael T. Goodrich and Roberto Tamassia, Wiley.

**COURSE OUTCOME**

CO1 Understand various algorithm design paradigms and analysis techniques.

CO2 Analyze the time and space complexity of algorithms using Big O notation.

CO3 Implement and evaluate sorting, searching, and graph algorithms.

CO4 Apply dynamic programming techniques to solve optimization problems efficiently.

CO5 Design and analyze algorithms for complex computational problems.

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#### 4. Operating System

|                                   |                            |                                   |         |
|-----------------------------------|----------------------------|-----------------------------------|---------|
| <b>Program name</b>               | B. TECH (computer science) | <b>Semester</b>                   | III     |
| <b>Courses title</b>              | <b>Operating System</b>    |                                   |         |
| <b>Courses code</b>               | 0CS333T                    | <b>No. of credits</b>             | 03      |
| <b>Contact hours</b>              | 40 hours                   | <b>Duration of Exam</b>           | 2 hours |
| <b>Formative assessment marks</b> | 50                         | <b>Summative Assessment marks</b> | 50      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          |               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------|
| <b>COURSE TITLE:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Design and Analysis of Algorithms</b> | <b>40 Hrs</b> |
| <b>Course objectives:</b> The goal of the course is to <ol style="list-style-type: none"> <li>1. To Demonstrate the need for OS and different types of OS.</li> <li>2. To discuss suitable techniques for management of different resources.</li> <li>3. To demonstrate different APIs/Commands related to processor, memory, storage and file system management.</li> </ol>                                                                                                                                                                                                                                                                                     |                                          |               |
| <b>MODULE-1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          | <b>8</b>      |
| <b>Introduction to operating systems, System structures:</b> What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. <b>Operating System Services:</b> User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot. |                                          |               |
| <b>MODULE-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          | <b>8</b>      |
| <b>Process Management:</b> Process concept; Process scheduling; Operations on processes; Inter process communication. <b>Multi-threaded Programming:</b> Overview; Multithreading models; Thread Libraries; Threading issues. <b>Process Scheduling:</b> Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling.                                                                                                                                                                                                                                                                                           |                                          |               |
| <b>MODULE-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          | <b>8</b>      |
| <b>Process Synchronization:</b> Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; <b>Deadlocks:</b> System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.                                                                                                                                                                                                                                                                                              |                                          |               |
| <b>MODULE-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          | <b>8</b>      |
| <b>Memory Management:</b> Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.<br><b>Virtual Memory Management:</b> Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.                                                                                                                                                                                                                                                                                                                                                                     |                                          |               |



| MODULE-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 8 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <p><b>File System, Implementation of File System:</b> File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; <b>Implementing File system:</b> File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.</p> <p><b>Secondary Storage Structure, Protection:</b> Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; <b>Protection:</b> Goals of protection, Principles of protection, Domain of protection, Access matrix.</p> |   |

#### Text Book:

- 1 Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2015.
- 2 William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.

#### Reference Book:

- 1 Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition
- 2 D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013..

#### COURSE OUTCOME

- CO1 Explain the structure and functionality of operating system.
- CO2 Apply appropriate CPU scheduling algorithms for the given problem.
- CO3 Analyse the various techniques for process synchronization and deadlock handling.
- CO4 Apply the various techniques for memory management .
- CO5 Explain file and secondary storage management strategies.
- CO6 Describe the need for information protection mechanisms.

Note: Alternative to this subject, students are allowed to enrolled in similar NPTEL course. Details are given below.

|                                                   |                                                                                                                           |               |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------|
| Subject Name:<br>Operating System<br>Fundamentals | <a href="https://onlinecourses.nptel.ac.in/noc24_cs108/preview">https://onlinecourses.nptel.ac.in/noc24_cs108/preview</a> | IIT Kharagpur |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------|

#### 5.FUNDAMENTAL OF ENVIRONMENTAL SCIENCES

|              |                                       |          |     |
|--------------|---------------------------------------|----------|-----|
| Program name | BTech                                 | Semester | III |
| Course title | FUNDAMENTAL OF ENVIRONMENTAL SCIENCES |          |     |



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|                            |          |                            |         |
|----------------------------|----------|----------------------------|---------|
| Course code                | OSC205T  | No. of credits             | 02      |
| Contact hours              | 25 hours | Duration of exam           | 2 hours |
| Formative Assessment marks | 25       | Summative Assessment marks | 25      |

|                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                    |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>COURSE TITLE:</b>                                                                                                                                                                                                                                                                                                                                                                                    | <b>FUNDAMENTAL OF ENVIRONMENTAL SCIENCES</b>                                                                                                                                                                                                                                                                                                                       | <b>25 Hrs</b> |
| <p>The goal of the course FUNDAMENTAL OF ENVIRONMENTAL SCIENCES is to:</p> <ul style="list-style-type: none"> <li>Investigate the complexities of the natural environment and our relationship with it.</li> <li>Explore the problems we face in understanding our natural environment and in living sustainability.</li> <li>Develop scientific, interpretive and creative thinking skills.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                    |               |
| <b>MODULE-1</b>                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                    |               |
| <b>Introduction</b>                                                                                                                                                                                                                                                                                                                                                                                     | Multidisciplinary nature of environmental studies – Definition -Scope and importance-Need for public awareness.                                                                                                                                                                                                                                                    | 05            |
| <b>MODULE-2</b>                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                    |               |
| <b>Natural Resources &amp; hazards</b>                                                                                                                                                                                                                                                                                                                                                                  | Renewable and non-renewable -Problems associated - Forest Resources-Water resources-Mineral resources-Food resources-Energy resources-Land resources and their conservation. Environmental Hazards: Definition- Causes - Effects and control measures of air - Water-Soil-Marine-Noise-Thermal -Nuclear pollutions -Solid waste management-Prevention of pollution | 10            |
| <b>MODULE-3</b>                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                    |               |
| <b>Social Issues and the Environment</b>                                                                                                                                                                                                                                                                                                                                                                | Unsustainable to sustainable development, Environmental ethics, Climate changes, global warming, Wildlife protection act, Public awareness,- Human Population and the Environment- Population growth - Population explosion - Human rights - Value education - Role of information technology in environment and human health - HIV/Aids -Women and child welfare. | 10            |

#### Suggested Text Book(s):

- Desai R.G, “Environmental studies”, Himalaya Pub. House.
- Agarwal, K.C, “Environmental Biology”, Nidi Publ. Ltd. Bikaner, 2001.

#### Suggested Reference Book(s):

- BharuchaErach, “The Biodiversity of India”, Mapin Publishing Pvt. Ltd.
- Jadhav, H &BhosaleV.M.,“Environmental Protection and Laws”, Himalaya Pub. House,



Delhi. 1995.

3. Rao M N. &Datta, A.K.,“Waste Water treatment”, Oxford & IBH Publ. 1987

**E-Learning Resource(s):**

- [https://onlinecourses.nptel.ac.in/noc23\\_hs155/preview](https://onlinecourses.nptel.ac.in/noc23_hs155/preview)
- [https://onlinecourses.swayam2.ac.in/cec19\\_bt03/preview](https://onlinecourses.swayam2.ac.in/cec19_bt03/preview)

**COURSE OUTCOMES**

| Course Outcomes |                                                                                                                                                                                                                           |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1:            | Gain in-depth knowledge on natural processes and resources that sustain life and govern economy.                                                                                                                          |
| CO2:            | Understand the consequences of human actions on the web of life, global economy, and quality of human life                                                                                                                |
| CO3:            | Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development. |

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**6. UNIVERSAL HUMAN VALUES**

|                                   |                               |                                   |         |
|-----------------------------------|-------------------------------|-----------------------------------|---------|
| <b>PROGRAM NAME</b>               | <b>B. Tech</b>                | <b>SEMESTER</b>                   | III     |
| <b>COURSE TITLE</b>               | <b>UNIVERSAL HUMAN VALUES</b> |                                   |         |
| <b>COURSE CODE</b>                | 0MG213I                       | <b>NO. OF CREDITS</b>             | 02      |
| <b>CONTACT HOURS</b>              | 30 hours                      | <b>DURATION OF EXAM</b>           | 2 hours |
| <b>FORMATIVE ASSESSMENT MARKS</b> | 50                            | <b>SUMMATIVE ASSESSMENT MARKS</b> | 00      |

|                     |                               |               |
|---------------------|-------------------------------|---------------|
| <b>COURSE TITLE</b> | <b>UNIVERSAL HUMAN VALUES</b> | <b>30 Hrs</b> |
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| <b>Course objective(s):</b> <ol style="list-style-type: none"><li><b>To introduce students to the concept of human values</b>, exploring their importance in shaping personal beliefs, ethical decision-making, and societal behavior.</li><li><b>To develop students' ability to apply core human values</b> such as empathy, honesty, and respect in everyday situations, enhancing moral reasoning and ethical conduct</li><li><b>To encourage the integration of human values into professional and personal life</b>, fostering social responsibility, emotional intelligence, and sustainable relationships in a modern context.</li></ol> |           |
| <b>MODULE-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>10</b> |
| <b>Introduction to Human Values</b><br>Meaning of Human Values, The Nature of Values, Role of Values in Shaping Personal Identity, Values and Ethical Decision Making, Self-Reflection and Awareness, Values in Social Context, Impact of Values on Behavior and Actions, Cultural and Societal Influence on Values, Evolution of Personal Values.                                                                                                                                                                                                                                                                                               |           |
| <b>MODULE-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>10</b> |
| <b>Core Human Values and Virtues</b><br>Core Human Values, Virtues and Character Building, Compassion and Empathy, Honesty and Integrity, Respect and Responsibility, Fairness and Justice, Courage and Patience, Emotional Intelligence and Virtues, Role of Virtues in Social Relationships, Developing Moral Courage, Impact of Virtues on Personal and Social Life.                                                                                                                                                                                                                                                                          |           |
| <b>MODULE-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>10</b> |
| <b>Application of Human Values in Modern Life.</b><br>Human Values in Personal Development, Values in Professional Life, Values in Family and Relationships, Human Values in Social Responsibility, Values in Global Citizenship, The Role of Values in Ethical Decision-Making, Overcoming Challenges through Human Values, Impact of Technology on Human Values, Sustainability and Human Values, Role of Values in Conflict Resolution, Values and Emotional Well-being.                                                                                                                                                                      |           |

#### Text and Reference Book(s)

- "Human Values in Education" by D. K. Agarwal
- "The Essence of Human Values" by Swami Vivekananda
- "Human Values: A Study" by S. Radhakrishnan
- "Education and Human Values" by R. K. Sharma



**ರೈ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ**  
**Rai Technology University**  
(Estd. under Karnataka Act. No. 40 of 2013)

### Course Outcomes

**At the end of this course, students will be able to:**

- CO1 Students will understand the importance of core human values** like honesty, empathy, and respect in everyday life.
- CO2 Students will be able to apply these values** in making ethical decisions and building positive relationships.
- CO3 Students will learn how human values affect society** and how to use them to address real-world challenges.

BOS

Registrar



## 7.MACHINE LEARNING LAB

|                                   |                             |                                   |         |
|-----------------------------------|-----------------------------|-----------------------------------|---------|
| <b>Program name</b>               | B. TECH (computer science)  | <b>Semester</b>                   | II      |
| <b>Courses title</b>              | <b>MACHINE LEARNING LAB</b> |                                   |         |
| <b>Courses code</b>               | 0CS330P                     | <b>No. of credits</b>             | 02      |
| <b>Contact hours</b>              | 30 hours                    | <b>Duration of exam</b>           | 2 hours |
| <b>Formative assessment marks</b> | 25                          | <b>Summative Assessment marks</b> | 25      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|
| <b>COURSE TITLE:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>MACHINE LEARNING LAB</b> | <b>30 Hrs</b> |
| <b>Course objectives:</b> This course will enable students to <ol style="list-style-type: none"> <li>1. To provide in-depth knowledge of machine learning concepts and techniques.</li> <li>2. To develop skills for implementing machine learning algorithms using Python.</li> <li>3. To introduce modern tools and frameworks used in machine learning.</li> <li>4. To teach students the best practices for model evaluation and selection.</li> <li>5. To enable students to solve real-world problems using machine learning</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |               |
| <b>List of Experiments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             | <b>30</b>     |
| <ol style="list-style-type: none"> <li>1. Clean and prepare datasets by handling missing data, performing data transformation, and normalization.</li> <li>2. Apply feature engineering techniques to create new features and select relevant features for model training.</li> <li>3. Conduct exploratory data analysis (EDA) using Python libraries like matplotlib and seaborn to visualize and analyse data distributions and relationships.</li> <li>4. Implement linear regression and logistic regression models to perform regression and classification tasks, respectively.</li> <li>5. Build decision tree, support vector machine (SVM), and k-nearest neighbors (KNN) classifiers for supervised learning tasks.</li> <li>6. Explore ensemble methods such as random forest and gradient boosting for improving model performance.</li> <li>7. Evaluate model performance using appropriate metrics like accuracy, precision, recall, and F1-score.</li> <li>8. Apply clustering algorithms like K-Means, Hierarchical Clustering, and DBSCAN for grouping similar data points together.</li> <li>9. Utilize dimensionality reduction techniques such as Principal Component Analysis (PCA) and t-Distributed Stochastic Neighbor Embedding (t-SNE) for visualizing high-dimensional data.</li> <li>10. Implement association rule learning and anomaly detection algorithms for discovering interesting patterns and outliers in data.</li> <li>11. Evaluate clustering algorithms using metrics like silhouette score and Davies–Bouldin index.</li> <li>12. Learn basics of neural networks and deep learning for building more complex models capable of learning from large datasets.</li> <li>13. Explore natural language processing (NLP) techniques for analysing and processing textual data.</li> <li>14. Apply time series analysis methods for forecasting future trends and patterns in time series</li> </ol> |                             |               |



data.

15. Deploy machine learning models to production environments and scale them to handle real-world demands.

16. Discuss ethical considerations in machine learning, including fairness, transparency, and privacy.

17. Analyse real-world case studies and applications of machine learning across various domains and industries.

#### Text Book:

3. "Pattern Recognition and Machine Learning" by Christopher M. Bishop, Springer.
4. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, O'Reilly Media.

#### Reference Book:

4. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili, Packt Publishing.
5. "Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning" by Chris Albon, O'Reilly Media.
6. "Deep Learning with Python" by François Chollet, Manning Publications.

#### COURSE OUTCOME

- CO1 Understand the fundamental concepts of machine learning.
- CO2 Preprocess and explore data using Python
- CO3 Implement and evaluate supervised learning algorithms.
- CO4 Apply unsupervised learning techniques to identify patterns in data.
- CO5 Explore advanced machine learning topics and their applications.



**8. Data visualization and storytelling Lab**

|                                   |                                                |                                   |         |
|-----------------------------------|------------------------------------------------|-----------------------------------|---------|
| <b>Program name</b>               | B. TECH (computer science)                     | <b>Semester</b>                   | III     |
| <b>Courses title</b>              | <b>Data visualization and storytelling Lab</b> |                                   |         |
| <b>Courses code</b>               | 0CS331P                                        | <b>No. of credits</b>             | 01      |
| <b>Contact hours</b>              | 30 hours                                       | <b>Duration of Exam</b>           | 2 hours |
| <b>Formative assessment marks</b> | 25                                             | <b>Summative Assessment marks</b> | 25      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                |               |
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| <b>COURSE TITLE:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Data visualization and storytelling Lab</b> | <b>30 Hrs</b> |
| <b>Course objectives:</b> The goal of the course is to<br>1. To provide an in-depth understanding of data visualization principles.<br>2. To develop skills for creating effective and engaging visual representations of data.<br>3. To introduce modern tools and techniques for data visualization.<br>4. To teach students how to use Excel and Power BI for data storytelling.<br>5. To enable students to present data insights in a compelling and understandable manner                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                |               |
| <b>List Of Experiment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                | <b>30</b>     |
| 1 Create simple data visualizations using basic chart types (e.g., bar charts, line charts) to represent various datasets.<br>2. Apply principles of good data visualization, such as clarity, accuracy, and relevance, to enhance the effectiveness of visualizations.<br>3. Use Excel to create basic charts, including bar charts, line charts, and pie charts, to visualize data.<br>4. Apply formatting options and customize chart elements to improve visual clarity and aesthetics in Excel.<br>5. Explore advanced chart types in Excel, such as waterfall charts, histogram charts, and radar charts, to represent complex data.<br>6. Utilize features like trendlines, error bars, and dual-axis charts to enhance data representation in Excel.<br>7. Create PivotTables to summarize and analyse large datasets efficiently in Excel.<br>8. Generate Pivot Charts to visualize PivotTable data dynamically and gain insights into data trends and patterns in Excel.<br>9. Connect to various data sources and import data into Power BI for visualization.<br>10. Design interactive dashboards and reports in Power BI to visualize and analyse data effectively.<br>11. Build data models in Power BI using relationships and measures to create meaningful insights from raw data.<br>12. Utilize DAX (Data Analysis Expressions) for advanced data analysis and calculations in Power BI.<br>13. Implement advanced data modelling techniques, including complex relationships and |                                                |               |



calculated columns, to handle intricate datasets in Power BI.

14. Incorporate custom visuals and extensions in Power BI to enhance visualization capabilities and address specific business needs.

15. Craft compelling data narratives by structuring and presenting data in a storytelling format to convey insights effectively.

16. Use visual storytelling techniques to engage the audience and communicate key messages using data.

17. Discuss ethical considerations in data storytelling, including data privacy, bias, and transparency, to ensure responsible data usage and interpretation.

18. Evaluate the impact of data storytelling on different stakeholders and society as a whole.

19. Analyse case studies of successful data stories and identify best practices and lessons learned.

20. Apply data storytelling principles and techniques to real-world scenarios to create impactful visualizations and narratives.

#### Text Book:

3. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knafl, Wiley.
4. "Data Visualization with Excel Dashboards and Reports" by Dick Kusleika, Wiley.

#### Reference Book:

4. "The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios" by Steve Wexler, Jeffrey Shaffer, and Andy Cotgreave, Wiley.
5. "Pro DAX with Power BI: Business Intelligence with PowerPivot and SQL Server Analysis Services Tabular" by Philip Seamark, Apress.
6. "Practical Power BI: A Guide to Self-Service Data Analytics with Excel 2016 and Power BI Desktop" by Devin Knight, Brian Knight, Mitchell Pearson, and Manuel Quintana, Apress.

#### COURSE OUTCOME

CO1 Understand the fundamental principles of data visualization..

CO2 Create effective data visualizations using Excel

CO3 Utilize Power BI for advanced data visualization and analysis.

CO4 Apply advanced techniques in Power BI for data storytelling.

CO5 Develop compelling data narratives to communicate insights effectively.



### 9.Design and Analysis of Algorithms LAB

|                                   |                                              |                                   |         |
|-----------------------------------|----------------------------------------------|-----------------------------------|---------|
| <b>Program name</b>               | B. TECH (computer science)                   | <b>Semester</b>                   | III     |
| <b>Courses title</b>              | <b>Design and Analysis of Algorithms LAB</b> |                                   |         |
| <b>Courses code</b>               | 0CS332P                                      | <b>No. of credits</b>             | 01      |
| <b>Contact hours</b>              | 30 hours                                     | <b>Duration of Exam</b>           | 2 hours |
| <b>Formative assessment marks</b> | 25                                           | <b>Summative Assessment marks</b> | 25      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                              |               |
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| <b>COURSE TITLE:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Design and Analysis of Algorithms LAB</b> | <b>30 Hrs</b> |
| <b>Course objectives:</b> The goal of the course is to<br>1. To introduce students to algorithm design techniques and analysis methods.<br>2. To teach students how to analyse the time and space complexity of algorithms.<br>3. To provide hands-on experience in implementing and evaluating algorithms.<br>4. To familiarize students with various algorithmic paradigms and problem-solving strategies.<br>5. To enable students to design efficient algorithms for real-world problems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                              |               |
| <b>List Of Experiment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                              | <b>30</b>     |
| 1. Analyze and implement sorting algorithms like Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, and Heap sort to understand their efficiency and performance characteristics.<br>2. Implement binary search algorithm for searching elements in a sorted array efficiently.<br>3. Develop algorithms for hashing and perform hash-based searching to retrieve data from hash tables.<br>4. Implement graph representation and traversal algorithms such as Breadth-First Search (BFS) and Depth-First Search (DFS) to explore graph structures.<br>5. Design and implement algorithms for solving shortest path problems using Dijkstra's algorithm and BellmanFord algorithm.<br>6. Develop algorithms for finding minimum spanning trees using Prim's algorithm and Kruskal's algorithm to efficiently connect all nodes in a graph.<br>7. Implement topological sorting algorithm to order vertices in a directed acyclic graph.<br>8. Apply dynamic programming techniques including memoization and tabulation to solve optimization problems like the Longest Common Subsequence, Matrix Chain Multiplication, and Knapsack problem.<br>9. Explore advanced topics in algorithm design such as NP-completeness and approximation algorithms to understand the limits of algorithmic efficiency.<br>10. Implement backtracking and branch-and-bound techniques to solve combinatorial optimization problems efficiently.<br>11. Develop randomized algorithms to solve problems where randomness is used to simplify computations. |                                              |               |



|                                                                                                                                               |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--|
| 12. Implement string matching algorithms like Knuth-Morris-Pratt (KMP) and Rabin-Karp to efficiently find occurrences of a pattern in a text. |  |
| 13. Explore parallel and distributed algorithms for solving problems on parallel computing architectures and distributed systems.             |  |

**Text Book:**

- 1 "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, The MIT Press
- 2 "Algorithm Design" by Jon Kleinberg and Éva Tardos, Pearson.

**Reference Book:**

- 3 "The Algorithm Design Manual" by Steven S. Skiena, Springer.
- 4 "Algorithms" by Robert Sedgewick and Kevin Wayne, Addison-Wesley Professional.
- 5 "Algorithm Design and Applications" by Michael T. Goodrich and Roberto Tamassia, Wiley.

**COURSE OUTCOME**

- CO1 Understand various algorithm design paradigms and analysis techniques.
- CO2 Analyze the time and space complexity of algorithms using Big O notation.
- CO3 Implement and evaluate sorting, searching, and graph algorithms.
- CO4 Apply dynamic programming techniques to solve optimization problems efficiently.
- CO5 Design and analyze algorithms for complex computational problems.