



Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

No 27, Thayanur, Tiruchirappalli - 620009

**Regulations 2024**  
**Undergraduate Degree**  
**B.E. / B. Tech./B.Des.**  
**Full Time Programmes**  
**Curriculum and Syllabus**

**CARE COLLEGE OF ENGINEERING:: TIRUCHIRAPPALLI 620 009**  
**(AN AUTONOMOUS INSTITUTION)**  
**REGULATION 2024**  
**CURRICULUM AND SYLLABUS FOR FIRST YEAR**  
**CHOICE BASED CREDIT SYSTEM**

**B.E. COMPUTER SCIENCE AND ENGINEERING**

**SEMESTER I**

| S. No                        | Course Code | Course Title                            | Category | Periods per week |   |    | No of Contact Periods | Credits |
|------------------------------|-------------|-----------------------------------------|----------|------------------|---|----|-----------------------|---------|
|                              |             |                                         |          | L                | T | P  |                       |         |
| THEORY COURSES               |             |                                         |          |                  |   |    |                       |         |
| 1                            | U24MA111    | Matrices and Calculus                   | BSC      | 3                | 1 | 0  | 4                     | 4       |
| 2                            | U24GE111    | Problem solving using Python            | ESC      | 3                | 0 | 0  | 3                     | 3       |
| 3                            | U24HS111    | Heritage of Tamils                      | HSMC     | 1                | 0 | 0  | 1                     | 1       |
| THEORY CUM PRACTICAL COURSES |             |                                         |          |                  |   |    |                       |         |
| 4                            | U24HS123    | Communicative English for Engineers     | HSMC     | 3                | 0 | 2  | 5                     | 4       |
| 5                            | U24PH113    | Engineering Physics                     | BSC      | 3                | 0 | 2  | 5                     | 4       |
| 6                            | U24CY113    | Engineering Chemistry                   | BSC      | 3                | 0 | 2  | 5                     | 4       |
| PRACTICAL COURSES            |             |                                         |          |                  |   |    |                       |         |
| 7                            | U24GE122    | Problem solving using Python Laboratory | ESC      | 0                | 0 | 4  | 4                     | 2       |
| TOTAL                        |             |                                         |          | 16               | 1 | 10 | 27                    | 22      |

**SEMESTER II**

| S. No                        | Course Code | Course Title                                 | Category | Periods per week |   |    | No of Contact Periods | Credits |
|------------------------------|-------------|----------------------------------------------|----------|------------------|---|----|-----------------------|---------|
|                              |             |                                              |          | L                | T | P  |                       |         |
| THEORY COURSES               |             |                                              |          |                  |   |    |                       |         |
| 1                            | U24MA221    | Discrete Mathematics                         | BSC      | 3                | 1 | 0  | 4                     | 4       |
| 2                            | U24PH221    | Physics for Information Science              | BSC      | 3                | 0 | 0  | 3                     | 3       |
| 3                            | U24CS211    | C Programming                                | ESC      | 3                | 0 | 0  | 3                     | 3       |
| 4                            | U24EC221    | Digital Principles and Computer Organization | ESC      | 3                | 0 | 0  | 3                     | 3       |
| 5                            | U24HS211    | Tamils and Technology                        | HSMC     | 1                | 0 | 0  | 1                     | 1       |
| THEORY CUM PRACTICAL COURSES |             |                                              |          |                  |   |    |                       |         |
| 6                            | U24HS223    | Technical English for Engineers              | HSMC     | 2                | 0 | 2  | 4                     | 3       |
| PRACTICAL COURSES            |             |                                              |          |                  |   |    |                       |         |
| 7                            | U24EE232    | Engineering Practices for Circuit Branches   | ESC      | 0                | 0 | 4  | 4                     | 2       |
| 8                            | U24CS222    | C Programming Laboratory                     | ESC      | 0                | 0 | 4  | 4                     | 2       |
| 9                            | U24EM212    | Professional Development                     | EEC      | 0                | 0 | 2  | 2                     | 1       |
| TOTAL                        |             |                                              |          | 15               | 1 | 12 | 28                    | 22      |

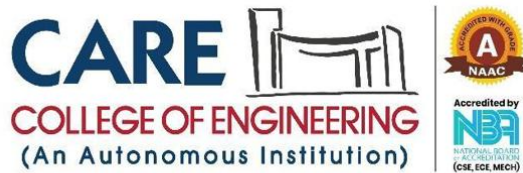


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Accredited by NAAC with 'A' Grade & NBA (CSE, ECE, MECH)  
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## Department of Computer Science and Engineering

### Regulation 2024 Third Semester Curriculum

| Sl. No | Course Code | Course Name                            | Category     | No. of periods/week |          |           | Total Periods | Credits   |
|--------|-------------|----------------------------------------|--------------|---------------------|----------|-----------|---------------|-----------|
|        |             |                                        |              | L                   | T        | P         |               |           |
| 1      | U24MA321    | Probability and Queueing Theory        | BSC          | 3                   | 1        | 0         | 4             | 4         |
| 2      | U24CS311    | Operating Systems                      | PCC          | 3                   | 0        | 0         | 3             | 3         |
| 3      | U24CS321    | Data Structures                        | PCC          | 3                   | 0        | 0         | 3             | 3         |
| 4      | U24CS331    | Object Oriented Programming using Java | PCC          | 3                   | 0        | 0         | 3             | 3         |
| 5      | U24CS341    | Software Engineering                   | PCC          | 3                   | 0        | 0         | 3             | 3         |
| 6      | U24CS352    | Data Structures Laboratory             | PCC          | 0                   | 0        | 4         | 4             | 2         |
| 7      | U24CS362    | Object Oriented Programming Laboratory | PCC          | 0                   | 0        | 4         | 4             | 2         |
| 8      | U24CS372    | Operating Systems Laboratory           | PCC          | 0                   | 0        | 4         | 4             | 2         |
| 9      | U24EM312    | Design Thinking and Innovation         | EEC          | 0                   | 0        | 2         | 2             | 1         |
|        |             |                                        | <b>Total</b> | <b>15</b>           | <b>2</b> | <b>14</b> | <b>31</b>     | <b>23</b> |



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**Department of Computer Science and Engineering**  
**R2024 Fourth Semester Curriculum**

| S. No | Course Code | Course Title                                 | Category     | Periods per week |          |           | No of Contact Periods | Credits   |
|-------|-------------|----------------------------------------------|--------------|------------------|----------|-----------|-----------------------|-----------|
|       |             |                                              |              | L                | T        | P         |                       |           |
| 1     | U24CS411    | Computer Network Architecture and Protocols  | PCC          | 3                | 0        | 0         | 3                     | 3         |
| 2     | U24CS421    | Database Management Systems                  | PCC          | 3                | 0        | 0         | 3                     | 3         |
| 3     | U24CS431    | Theory of Computation                        | PCC          | 3                | 0        | 0         | 3                     | 3         |
| 4     | U24CS441    | Design and Analysis of Algorithms            | PCC          | 3                | 0        | 0         | 3                     | 3         |
| 5     | U24EM411    | Aptitude and Reasoning – I                   | EEC          | 1                | 0        | 0         | 1                     | 1         |
| 6     | U24CS453    | Web Technologies                             | PCC          | 1                | 0        | 4         | 5                     | 3         |
| 7     | U24CS462    | Database Management Systems Laboratory       | PCC          | 0                | 0        | 4         | 4                     | 2         |
| 8     | U24CS472    | Networks Laboratory                          | PCC          | 0                | 0        | 4         | 4                     | 2         |
| 9     | U24CS482    | Design and Analysis of Algorithms Laboratory | PCC          | 0                | 0        | 4         | 4                     | 2         |
| 10    | U24EM422    | Soft skills and Personality Development – I  | EEC          | 0                | 0        | 2         | 2                     | 1         |
|       |             |                                              | <b>Total</b> | <b>14</b>        | <b>0</b> | <b>18</b> | <b>32</b>             | <b>23</b> |



**CARE COLLEGE OF ENGINEERING, TIRUCHIRAPPALLI 620 009**  
**(AN AUTONOMOUS INSTITUTION)**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**B.E. COMPUTER SCIENCE AND ENGINEERING**  
**REGULATION 2024 CURRICULUM AND SYLLABUS**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**  
**FIFTH SEMESTER**

| SL. NO                        | COURSE CODE | COURSE NAME                                  | CATEGORY | PERIODS PER WEEK |   |    | TCP | C  | CIA | ESE |
|-------------------------------|-------------|----------------------------------------------|----------|------------------|---|----|-----|----|-----|-----|
|                               |             |                                              |          | L                | T | P  |     |    |     |     |
| THEORY COURSES                |             |                                              |          |                  |   |    |     |    |     |     |
| 1                             | U24CS511    | Mobile Computing                             | PCC      | 3                | 0 | 0  | 3   | 3  | 40  | 60  |
| 2                             | U24CS521    | Compiler Design                              | PCC      | 3                | 0 | 0  | 3   | 3  | 40  | 60  |
| 3                             | U24CSFS02   | UI and UX Design                             | PEC      | 1                | 0 | 4  | 5   | 3  | 50  | 50  |
| 4                             | U24EM511    | Aptitude and Reasoning – II                  | EEC      | 2                | 0 | 0  | 2   | 2  | 100 | -   |
| 5                             | U24MG511    | Leadership and Team Management               | EEC      | 2                | 0 | 0  | 2   | 2  | 40  | 60  |
| THEORY CUM LABORATORY COURSES |             |                                              |          |                  |   |    |     |    |     |     |
| 6                             | U24CS533    | Embedded Systems and IoT System Design       | PCC      | 1                | 0 | 4  | 5   | 3  | 50  | 50  |
| 7                             | U24CS543    | Artificial Intelligence & Machine Learning   | PCC      | 3                | 0 | 2  | 5   | 4  | 50  | 50  |
| PRACTICAL COURSES             |             |                                              |          |                  |   |    |     |    |     |     |
| 8                             | U24CS552    | Mobile Application Development Laboratory    | PCC      | 0                | 0 | 4  | 4   | 2  | 60  | 40  |
| 9                             | U24EM522    | Soft Skills and Personality Development – II | EEC      | 0                | 0 | 2  | 2   | 1  | 100 | -   |
| 10                            | U24MC21     | Environmental Science                        | MC       | 3                | 0 | 0  | 3   | 0  | 100 | -   |
|                               |             | Total                                        |          | 18               | 0 | 16 | 34  | 23 |     |     |

**ASSESSMENT SCHEME**

| Sl. No | Course Type | L | T | P | C | CIA Weightage (Theory) |    |    |    | CIA  | ESE |      | CIA (W) | ESE (W) | Min. Marks to Pass for 100 |       |
|--------|-------------|---|---|---|---|------------------------|----|----|----|------|-----|------|---------|---------|----------------------------|-------|
|        |             |   |   |   |   | T1                     | A1 | T2 | A2 | Prac | Th  | Prac |         |         | ESE                        | Total |
| 1      | U24CS511    | 3 | 0 | 0 | 3 | 60                     | 40 | 60 | 40 | -    | 100 | -    | 40      | 60      | 45                         | 50    |
| 2      | U24CS521    | 3 | 0 | 0 | 3 | 60                     | 40 | 60 | 40 | -    | 100 | -    | 40      | 60      | 45                         | 50    |
| 3      | U24CSFS02   | 1 | 0 | 4 | 3 | -                      | -  | 60 | 40 | 100  | -   | 100  | 50      | 50      | 45                         | 50    |
| 4      | U24EM511    | 2 | 0 | 0 | 2 | -                      | -  | -  | -  | -    | -   | -    | 100     | -       | -                          | 50    |
| 5      | U24MG511    | 2 | 0 | 0 | 2 | 60                     | 40 | 60 | 40 | -    | 100 | -    | 40      | 60      | 45                         | 50    |
| 6      | U24CS533    | 1 | 0 | 4 | 3 | -                      | -  | 60 | 40 | 100  | -   | 100  | 50      | 50      | 45                         | 50    |
| 7      | U24CS543    | 3 | 0 | 2 | 4 | 60                     | 40 | 60 | 40 | 100  | 70  | 30   | 50      | 50      | 45                         | 50    |
| 8      | U24CS552    | 0 | 0 | 4 | 0 | -                      | -  | -  | -  | 100  | -   | 100  | 60      | 40      | 45                         | 50    |
| 9      | U24EM522    | 0 | 0 | 2 | 0 | -                      | -  | -  | -  | -    | -   | -    | 100     | -       | -                          | 50    |
| 10     | U24MC21     | 3 | 0 | 0 | 3 | -                      | -  | -  | -  | -    | -   | -    | 100     | -       | -                          | 50    |

(W) – Weightage



**Course Objectives:**

- To develop the use of matrix algebra techniques those are needed to engineers for practical applications.
- To familiarize the students with differential calculus.
- To introduce the methods of solving linear and nonlinear ordinary differential equations.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.

**UNIT I MATRICES****9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane

**UNIT II DIFFERENTIAL CALCULUS****9+3**

Functions of single variable – Limit of the function- Continuity and Differentiability - Mean value Theorems - Partial derivatives - Total derivative - Taylor series (in one and two variables) - Maxima and Minima (in one and two variables).

**UNIT III ORDINARY DIFFERENTIAL EQUATION****9+3**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

**UNIT IV INTEGRAL CALCULUS****9+3**

Evaluation of definite and improper integrals - Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals.

**UNIT V VECTOR CALCULUS****9+3**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**TOTAL: 60 PERIODS****Text Books**

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 44<sup>th</sup> Edition, New Delhi, 2015.
2. Erwin Kreyszig, E., "Advanced Engineering Mathematics", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016

**Reference Books**

1. Anton, H, Bivens. I and Davis. S, " Calculus ", Wiley, 10<sup>th</sup> Edition, 2016
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5<sup>th</sup> Edition, 2016.
3. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

| Course Outcomes: At the end of the course, the students will be able to |                                                                                          |     |     |     |     |     |     |     |     |      |      |      |                 |      |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-----------------|------|
| CO                                                                      | Course Outcome Statement                                                                 |     |     |     |     |     |     |     |     |      |      |      | Knowledge level |      |
| CO1                                                                     | Apply the matrix algebra methods for solving practical problems.                         |     |     |     |     |     |     |     |     |      |      |      | Applying        |      |
| CO2                                                                     | Apply differential calculus tools in solving various Engineering problems.               |     |     |     |     |     |     |     |     |      |      |      | Applying        |      |
| CO3                                                                     | Apply various techniques in solving differential equations.                              |     |     |     |     |     |     |     |     |      |      |      | Applying        |      |
| CO4                                                                     | Apply double and triple integration techniques in solving areas and volumes.             |     |     |     |     |     |     |     |     |      |      |      | Applying        |      |
| CO5                                                                     | Evaluate of line, surface and volume integrals using Gauss, Stokes and Green's Theorems. |     |     |     |     |     |     |     |     |      |      |      | Applying        |      |
| CO-PO/PSO Mapping                                                       |                                                                                          |     |     |     |     |     |     |     |     |      |      |      |                 |      |
| CO                                                                      | PO1                                                                                      | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1            | PSO2 |
| CO1                                                                     | 3                                                                                        | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |                 |      |
| CO2                                                                     | 3                                                                                        | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |                 |      |
| CO3                                                                     | 3                                                                                        | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |                 |      |
| CO4                                                                     | 3                                                                                        | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |                 |      |
| CO5                                                                     | 3                                                                                        | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |                 |      |
| Avg.                                                                    | 3                                                                                        | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |                 |      |

**U24GE111**

**PROBLEM SOLVING USING PYTHON**

**L T P C**  
**3 0 0 3**

**Course Objectives:**

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

**UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING**

**9**

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS**

**9**

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT III CONTROL FLOW, FUNCTIONS, STRINGS**

**9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

**UNIT IV LISTS, TUPLES, DICTIONARIES**

**9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

**UNIT V FILES, MODULES, PACKAGES**

**9**

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file,

Voter's age validation, Marks range validation (0-100).

**TOTAL: 45 PERIODS**

### Text Books

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

### Reference Books

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. <https://www.python.org/>
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                                                               |                        |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                                                               | <b>Knowledge level</b> |
| CO1                                                                            | Develop algorithmic solutions to simple computational problems.                                                               | Applying               |
| CO2                                                                            | Write simple python programs using the basic data types, expressions and Statements.                                          | Applying               |
| CO3                                                                            | Write simple Python programs using conditionals and loops for solving problems and decompose a Python program into functions. | Applying               |
| CO4                                                                            | Represent compound data types using Python lists, tuples, dictionaries etc.                                                   | Applying               |
| CO5                                                                            | Read and write data from/to files in Python programs.                                                                         | Applying               |

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

**U24HS111 தமிழர் மரபு / HERITAGE OF TAMILS**

**L T P C**  
**1 0 0 1**

### Course Objectives:

- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thina in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

### UNIT I LANGUAGE AND LITERATURE

**3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yath and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III FOLK AND MARTIAL ARTS 3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV THINAI CONCEPT OF TAMILS 3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**TOTAL: 15 PERIODS**

**Text Books**

1. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S. Singaravelu) (Published by: International Institute of Tamil Studies).
3. Historical Heritage of the Tamils (Dr.S.V .Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M. Valarmathi) (Published by: International Institute of Tamil Studies).
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author).
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                    |                        |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                    | <b>Knowledge level</b> |
| CO1                                                                            | Describe the various types of Tamil Literature.                                    | Understanding          |
| CO2                                                                            | Discuss about Tamil Arts and Sculpture.                                            | Understanding          |
| CO3                                                                            | Explain the Tamil Folks and Martial Arts.                                          | Understanding          |
| CO4                                                                            | Summarize the Thinaï Concepts of Tamil.                                            | Understanding          |
| CO5                                                                            | Review the contribution of Tamil Culture to Indian Culture and National Movements. | Understanding          |

| <b>CO-PO/PSO Mapping</b> |     |     |     |     |     |          |     |          |          |          |      |      |      |      |
|--------------------------|-----|-----|-----|-----|-----|----------|-----|----------|----------|----------|------|------|------|------|
| CO                       | PO1 | PO2 | PO3 | PO4 | PO5 | PO6      | PO7 | PO8      | PO9      | PO10     | PO11 | PO12 | PSO1 | PSO2 |
| CO1                      |     |     |     |     |     | 2        |     | 2        | 2        | 3        |      |      |      |      |
| CO2                      |     |     |     |     |     | 2        |     | 2        | 2        | 3        |      |      |      |      |
| CO3                      |     |     |     |     |     | 2        |     | 2        | 2        | 3        |      |      |      |      |
| CO4                      |     |     |     |     |     | 2        |     | 2        | 2        | 3        |      |      |      |      |
| CO5                      |     |     |     |     |     | 2        |     | 2        | 2        | 3        |      |      |      |      |
| <b>Avg.</b>              |     |     |     |     |     | <b>2</b> |     | <b>2</b> | <b>2</b> | <b>3</b> |      |      |      |      |

**Course Objectives:**

To improve the communicative competence of learners

- To learn to use basic grammatical structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in both informal and professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

**UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION****1**

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

**UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION****8**

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh / Yes or No / and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

**UNIT II NARRATION AND SUMMATION****9**

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing; Short Report on an event (field trip etc.) Grammar -Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

**UNIT III DESCRIPTION OF A PROCESS / PRODUCT****9**

Reading - Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

**UNIT IV CLASSIFICATION AND RECOMMENDATIONS****9**

Reading - Newspaper articles; Journal reports -and Non-Verbal Communication (tables, pie charts etc.). Writing - Note-making / Note-taking (\*Study skills to be taught, not tested); Writing recommendations; Transferring information from non-verbal (chart, graph etc., to verbal mode) Grammar - Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

**UNIT V EXPRESSION****9**

Reading - Reading editorials; and Opinion Blogs; Writing - Essay Writing (Descriptive or narrative), Dialogue-writing. Grammar - Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions - Content vs Function words.

**TOTAL: 45 PERIODS****Sl. No. Practical - List of experiments:**

- 1 Listening comprehension
- 2 Telephone conversation & Introductions (listening & speaking)
- 3 Mock Interviews
- 4 Narrating personal experiences

- 5 Short Oral Presentations
- 6 Advertising a product
- 7 Situational conversation – 3 in a team
- 8 Creating educational videos
- 9 Group discussion
- 10 ICT based presentations

**TOTAL: 30 PERIODS**

### Text Books

1. Communication Book, Portfolio Penguin, 2018. Authored by Mikael Krogerus, Roman Tschäppeler. ISBN-13 : 978-0241982280.
2. Communicative English for Engineers and Professionals, Pearson Education India, 2010. Authored by Bhatnagar Nitin, ISBN: 9788131732045, 8131732045
3. English for Science & Technology, Cambridge University Press, 2021. Authored by Dr.Veena Selvam, Dr.Sujatha Priyadarshini, Dr.Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Jeevani, Department of English, Anna University.

### Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. English For Technical Communication (With CD) By Aysha Viswamohan, McGraw Hill Education, ISBN: 0070264244, 2008.
3. How to win at Interviews & Group Discussions, Abhishek Publications, 2014. Authored by D.S. Cheema, ISBN: 9788182475175, 8182475171.

| Course Outcomes: At the end of the course, the students will be able to |                                                                                    |                 |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------|
| CO                                                                      | Course Outcome Statement                                                           | Knowledge level |
| CO1                                                                     | Explain different points of view during discussions.                               | Applying        |
| CO2                                                                     | Prepare for formal ICT based presentations and video creation.                     | Applying        |
| CO3                                                                     | Construct English sentences in both formal and informal contexts.                  | Applying        |
| CO4                                                                     | Interpret technical texts, audio materials and visual representation.              | Understanding   |
| CO5                                                                     | Write letters, definitions, descriptions, narrations and essays on various topics. | Applying        |

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

**U24PH113**

**ENGINEERING PHYSICS**

**L T P C**  
**3 0 2 4**

### Course Objectives:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves, optics and its applications.
- To introduce the basics knowledge of lasers and fibre optics.
- Equipping the students to successfully understand the importance of quantum mechanics.
- To make the students understand the basics of crystal structure and its importance in studying materials properties.

### UNIT I MECHANICS

**9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM

Rotation of rigid bodies: Rotational kinematics – Theorems of M.I –moment of inertia of continuous bodies – torque – rotational dynamics of rigid bodies — gyroscope - torsional pendulum – double pendulum

## **UNIT II ELECTROMAGNETIC WAVES AND OPTICS**

**9**

Maxwell's equations - wave equation; Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - Producing electromagnetic waves - Cell-phone reception.

Reflection and refraction of light waves - interference –Michelson interferometer –Theory of air wedge and experiment.

## **UNIT III LASERS AND FIBRE OPTICS**

**9**

Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO<sub>2</sub> laser, semiconductor laser –Basic applications of lasers in industry.

Fiber optics: Principle, Numerical aperture and acceptance angle –types of optical fibers (material, refractive index, mode)- fibre optic communication- losses associated with optical fibers- fibre optic sensors: pressure and displacement- medical endoscope.

## **UNIT IV QUANTUM MECHANICS**

**9**

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization – particle in a infinite potential well: 1D- particle in a infinite potential well; 2D and 3D Boxes (Qualitative).

## **UNIT V CRYSTAL PHYSICS**

**9**

Crystal structures: Crystal structures: BCC, FCC and HCP – crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burgers vector and elastic strain energy- Slip systems, plastic deformation of materials and Miller indices –distance between successive planes – crystalline and non-crystalline material.

**TOTAL: 45 PERIODS**

### **Sl. No. Practical – List of experiments (Any Seven experiments)**

- 1 Determination of rigidity modulus – Torsion pendulum
- 2 Determination of Young's modulus by non-uniform bending method
- 3 Determination of wavelength using Laser.
- 4 Determination of Numerical aperture and acceptance angle in an optical fiber.
- 5 Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
- 6 Determination of thickness of a thin wire – Air wedge method
- 7 Determination of band gap of a semiconductor
- 8 Determination of Young's modulus by uniform bending method.
- 9 Compact disc- Determination of width of the groove using laser.
- 10 Simple harmonic oscillations of cantilever.
- 11 Spectrometer - Determination of wavelength of Mercury Spectrum using diffraction grating.
- 12 Michelson's interferometer -Determine the wave length of monochromatic light.
- 13 Melde's Experiment - Determine the Frequency of a tuning fork.

**TOTAL: 30 PERIODS**

### **Text Books**

1. D. Kleppner and R. Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M. Purcell and D.J. Morin, Electricity and Magnetism, Cambridge Univ. Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

### **Reference Books**

1. Gaur R K and Gupta S L, "Engineering Physics", Dhanpat Rai Publications, 2018.
2. Charles Kittel, "Introduction to Solid State Physics", Wiley India Pvt. Ltd, 7th ed., 2017.
3. D. K. Mynbaev and Lowell L. Scheiner, Fiber Optic Communication Technology, 2011, 1st Edition, Pearson, USA.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                      |                        |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                      | <b>Knowledge level</b> |
| CO1                                                                            | Apply the principles of mechanics to solve problems.                                 | Applying               |
| CO2                                                                            | Apply the knowledge of the Maxwell's equations for electromagnetic waves and optics. | Applying               |
| CO3                                                                            | Apply the knowledge on the concepts of laser and their applications in fiber optics. | Applying               |
| CO4                                                                            | Apply quantum mechanical principles towards the formation of energy bands.           | Applying               |
| CO5                                                                            | Describe the basics of crystals, their structures and defects.                       | Understanding          |

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

U24CY113

ENGINEERING CHEMISTRY

**L T P C**  
**3 0 2 4**

#### Course Objectives:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

#### UNIT I WATER AND ITS TREATMENT

9

**Water:** Sources and impurities, Water quality parameters - color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic.

**Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water-Reverse Osmosis.

**Boiler troubles** - Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming.

**Treatment of boiler feed water:** Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

#### UNIT II NANO CHEMISTRY

9

Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic);

**Types of nanomaterials:** Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications of nanomaterials** in medicine, agriculture, energy, electronics and catalysis.

#### UNIT III PHASE RULE AND COMPOSITES

9

**Phase rule:** Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

**Composites:** Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Nano**

**Composites:** Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

#### UNIT IV FUELS AND COMBUSTION

9

**Fuels:** Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

**Combustion of fuels:** Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method.

#### UNIT V ENERGY SOURCES AND STORAGE DEVICES

9

**Nuclear energy:** light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of Silicon (si) Solar cell, Wind energy, Geo thermal energy.

**Batteries:** Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion battery; Electric vehicles - working principles; Fuel cells: H<sub>2</sub>-O<sub>2</sub> fuel cell, microbial fuel cell; Super capacitors: Storage principle, types and examples.

**TOTAL: 45 PERIODS**

##### Sl. Practical – List of experiments No.

1. Determination of types and amount of alkalinity in a water sample. - Split the first experiment into two.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Determination of strength of acids in a mixture of acids using conductivity meter.
7. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
8. Conductometric titration of strong acid vs strong base.
9. Estimation of iron content of the given solution using potentiometer.
10. Estimation of sodium /potassium present in water using a flame photometer.

**TOTAL: 30 PERIODS**

##### Text Books:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.

##### Reference Books:

1. Mary Francisca. L.J, Engineering Chemistry-I, 1, 2004.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

| Course Outcomes: At the end of the course, the students will be able to |                                                                                                                                                                                                                        |                 |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                                      | Course Outcome Statement                                                                                                                                                                                               | Knowledge level |
| CO1                                                                     | Describe the water treatment processes and calculate the quality parameters of different types in Water Samples and Apply the appropriate method to find the PH, conductance and potential values of various solutions | Understanding   |
| CO2                                                                     | Apply the concepts of nano science in Engineering Applications.                                                                                                                                                        | Applying        |
| CO3                                                                     | Apply the knowledge of phase rule and composites for material selection requirements                                                                                                                                   | Applying        |
| CO4                                                                     | Identify the types of fuels and calculate the calorific value, explosive range for engineering processes.                                                                                                              | Understanding   |
| CO5                                                                     | Apply suitable energy resources for Engineering sectors.                                                                                                                                                               | Applying        |

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

**U24GE122      PROBLEM SOLVING USING PYTHON LABORATORY**      **L      T      P      C**  
**0      0      4      2**

#### Course Objectives:

- To learn about Variables, Operators available and how to write loops and decision statements in Python.
- To learn and Implement programs using non recursive and recursive functions.
- To Learn and execute a program using different Data Types - String, List, advance List, Dictionary, Tuple, Sets, Python Modules and packages.
- To learn how to read and write files in Python and also learn to use exception handling in Python applications for error handling.
- To build a mini project using fundamental programming constructs like variables, conditional logic, looping, and function and other required modules.

#### Sl. No.      Practical – List of experiments

- 1      Environment Setup and execute Basic Exercise to learn about Variables, Operators available in python.
- 2      Execute programs using Python Control Flow -Python Loops and Control Statements
- 3      Implement programs using String and array in python.
- 4      Write functions and pass arguments [Non-Recursive, Recursive] in Python
- 5      Execute program to learn different Data Types in python- String, List, advance List, Dictionary, Tuple, Sets
- 6      Learn and execute programs using Python Modules and packages.
- 7      Execute program using Python Directory and Files Management.
- 8      Implement program to learn about python exception handling
- 9      Mini project [ Group project- demo and presentation]

**TOTAL: 60 PERIODS**

#### Text Books

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.

#### Reference Books

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. <https://www.python.org/>
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                                                     |                        |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                                                     | <b>Knowledge level</b> |
| CO1                                                                            | Understand and make use of Variables, Operators available and how to write loops and decision statements in Python. | Applying               |
| CO2                                                                            | Execute programs to implement non recursive and recursive functions in python.                                      | Applying               |
| CO3                                                                            | Write Python Programs using core data structures like array, string, Lists, Set, Dictionaries and use Tuples.       | Applying               |
| CO4                                                                            | Use and carry out examples to handle File Systems and exception handling in Python.                                 | Applying               |
| CO5                                                                            | Deconstruct exemplary applications in Python.                                                                       | Analysing              |

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

**U24MA221**

**DISCRETE MATHEMATICS**

**L T P C**  
**3 1 0 4**

**Course Objectives:**

- To extend a student's logical and mathematical maturity and ability to deal with abstraction problems.
- To understand the basic concepts of combinatory.
- To introduce graph models and their basic concepts.
- To familiarize the applications of algebraic structures.
- To understand the concepts of sets, relation, function and Boolean algebra which are widely used in computer science and engineering.

**UNIT I LOGIC**

**9+3**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Rules of inference.

**UNIT II COMBINATORICS**

**9+3**

Mathematical induction – The basics of counting – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle.

**UNIT III SETS, RELATION, FUNCTION AND BOOLEAN ALGEBRA**

**9+3**

Basic concepts of Set theory - Laws of Set theory - Partition of set, Relations - Types of Relations: Equivalence relation, Partial ordering relation - Functions: Injective, Surjective, Bijective functions, Compositions of functions, Identity and Inverse functions. – Boolean algebra.

**UNIT IV ALGEBRAIC STRUCTURES**

**9+3**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Normal subgroup and cosets – Lagrange theorem.

**UNIT V GRAPHS**

**9+3**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – matching - coloring

**TOTAL: 60 PERIODS**

**Text Books**

1. Rosen. K.H., "Discrete Mathematics and its Applications", 7<sup>th</sup> Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2. Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30<sup>th</sup> Reprint, 2011.

**Reference Books**

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                           |                        |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                           | <b>Knowledge level</b> |
| CO1                                                                            | Apply truth tables to evaluate logical propositions.                                      | Applying               |
| CO2                                                                            | Apply basic counting techniques to solve combinatorial problems.                          | Applying               |
| CO3                                                                            | Apply graph matching ideas in various matching related problems.                          | Applying               |
| CO4                                                                            | Apply the concepts and properties of algebraic structures to solve the problem.           | Applying               |
| CO5                                                                            | Apply the concepts of set theory and Boolean algebra in computer science and engineering. | Applying               |

| CO-PO/PSO Mapping |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO                | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1               | 3   | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |      |      |
| CO2               | 3   | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |      |      |
| CO3               | 3   | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |      |      |
| CO4               | 3   | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |      |      |
| CO5               | 3   | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |      |      |
| Avg.              | 3   | 3   | 3   |     |     |     |     |     | 2   | 2    |      | 3    |      |      |

**U24PH221****PHYSICS FOR INFORMATION SCIENCE**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**Course Objectives:**

- Ascertain about the concepts and properties of semiconductor materials.
- Describe about semiconductor devices and its applications.
- Understand basics of magnetic behaviour of materials and its applications.
- Apply optical properties of materials to the optoelectronics devices.
- Interpret the basics of quantum structures and their applications in Nano devices.

**UNIT I SEMICONDUCTOR PHYSICS****9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in P-type semiconductors – Variation of carrier concentration with temperature — Carrier transport in Semiconductor: drift and diffusion – Ohmic contacts – Schottky diode.

**UNIT II SEMICONDUCTOR DEVICES****9**

PN Junction diode and its characteristics – Zener diode and its characteristics – Transistors – FET – JFET – MOSFET – BJT – Basic logic gates (OR, NOT, AND, NAND, NOR) CNOT gate.

**UNIT III MAGNETIC PROPERTIES OF MATERIALS****9**

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility – Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples

and uses–Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

#### UNIT IV OPTICAL PROPERTIES OF MATERIALS

9

Classification of optical materials – carrier generation and recombination processes – photo current in a P-N diode – solar cell– LED – Organic LED – LCD – Laser diodes – Optical data storage techniques.

#### UNIT V NANOSTRUCTURES AND QUANTUM COMPUTING

9

Introduction – quantum confinement – quantum structures: quantum wells, wires and dots — band gap of nanomaterials. Quantum cellular automata – Quantum system for information processing – quantum states – classical bits – quantum bits or qubits – multiple qubits – advantage of quantum computing over classical computing.

**TOTAL: 45 PERIODS**

#### Text Books

1. Jasprit Singh, “Semiconductor Devices: Basic Principles”, Wiley (Indian Edition), 2007.
2. S.O. Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 2018.
3. Parag K. Lala, Quantum Computing: A Beginner’s Introduction, McGraw-Hill Education (Indian Edition), 2020.
4. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.

#### Reference Books

1. R. Murugasen, Modern Physics, S. Chand & Company, 2018.
2. R.F. Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3. B. Rogers, J. Adams and S. Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2014.
4. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009.

| Course Outcomes: At the end of the course, the students will be able to |                                                                                      |                 |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------|
| CO                                                                      | Course Outcome Statement                                                             | Knowledge level |
| CO1                                                                     | Describe the basic knowledge of semiconductor physics and its applications.          | Understanding   |
| CO2                                                                     | Describe the mechanism involved in construction and working of semiconductor diodes. | Understanding   |
| CO3                                                                     | Discuss the knowledge of Magnetic Properties of Materials.                           | Understanding   |
| CO4                                                                     | Illustrate the Optical properties of Materials.                                      | Understanding   |
| CO5                                                                     | Describe the basics of Quantum Structures and Quantum Computing.                     | Understanding   |

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

U24CS211

**C PROGRAMMING**

**L T P C**  
**3 0 0 3**

#### Course Objectives:

- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop applications in C using functions, and pointers.
- To develop applications in C using structures.
- To do input/output and file handling in C.

**UNIT I BASICS OF C PROGRAMMING****9**

Introduction to programming paradigms - Structure of C program - C programming: Data Types –Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives – Compilation process.

**UNIT II ARRAYS AND STRINGS****9**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

**UNIT III FUNCTIONS AND POINTERS****9**

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers –Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

**UNIT IV STRUCTURES****9**

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Self-referential structures – Dynamic memory allocation - Singly linked list – typedef.

**UNIT V FILE PROCESSING****9**

Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments.

**TOTAL: 45 PERIODS****Text Books**

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2021.
2. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2022.

**Reference Books**

1. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication.
2. Juneja, B. L and Anita Seth, “Programming in C”, CENGAGE Learning India Pvt. Ltd., 2011.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                         |                        |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                         | <b>Knowledge level</b> |
| CO1                                                                            | Develop simple applications in C using basic constructs                 | Applying               |
| CO2                                                                            | Design and implement applications using arrays and strings              | Applying               |
| CO3                                                                            | Develop and implement applications in C using functions and pointers.   | Applying               |
| CO4                                                                            | Develop applications in C using structures.                             | Applying               |
| CO5                                                                            | Design applications using sequential and random access file processing. | Applying               |

| CO-PO/PSO Mapping |          |            |          |            |          |          |          |     |          |          |             |             |      |      |
|-------------------|----------|------------|----------|------------|----------|----------|----------|-----|----------|----------|-------------|-------------|------|------|
| CO                | PO1      | PO2        | PO3      | PO4        | PO5      | PO6      | PO7      | PO8 | PO9      | PO10     | PO11        | PO12        | PSO1 | PSO2 |
| CO1               | 3        | 3          | 1        | 2          | 2        | 1        | 1        |     | 2        | 2        | 1           | 3           |      |      |
| CO2               | 3        | 2          | 1        | 2          | 2        |          |          |     | 2        | 2        | 1           | 2           |      |      |
| CO3               | 3        | 3          | 1        | 2          | 3        |          |          |     | 2        | 2        | 1           | 2           |      |      |
| CO4               | 3        | 1          |          | 1          | 1        |          |          |     | 2        | 2        | 1           | 2           |      |      |
| CO5               | 3        | 2          | 1        | 2          | 2        | 1        | 1        |     | 2        | 2        | 1           | 3           |      |      |
| <b>Avg.</b>       | <b>3</b> | <b>2.2</b> | <b>1</b> | <b>1.8</b> | <b>2</b> | <b>1</b> | <b>1</b> |     | <b>2</b> | <b>2</b> | <b>1.00</b> | <b>2.40</b> |      |      |

## U24EC221 DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

**L T P C**  
**3 0 0 3**

### Course Objectives:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

### UNIT I COMBINATIONAL LOGIC

**9**

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers.

### UNIT II SYNCHRONOUS SEQUENTIAL LOGIC

**9**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

### UNIT III COMPUTER FUNDAMENTALS

**9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

### UNIT IV PROCESSOR

**9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

### UNIT V MEMORY AND I/O

**9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

**TOTAL: 45 PERIODS**

### Text Books

1. M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware / Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

### Reference Books

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.

2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2016.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                           |                        |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                           | <b>Knowledge level</b> |
| CO1                                                                            | Design various combinational digital circuits using logic gates.                          | Applying               |
| CO2                                                                            | Design sequential circuits and analyze the design procedures.                             | Applying               |
| CO3                                                                            | Explain the fundamentals of computer systems and analyze the execution of an instruction. | Analyzing              |
| CO4                                                                            | Analyze different types of control design and identify hazards.                           | Analyzing              |
| CO5                                                                            | Describe the characteristics of various memory systems and I/O communication.             | Understanding          |

| <b>CO-PO/PSO Mapping</b> |            |            |            |            |            |            |            |            |            |             |             |             |             |             |
|--------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO</b>                | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> |
| <b>CO1</b>               | 3          | 3          | 3          | 3          | 3          | 2          | 1          | 1          | 1          | 1           | 2           | 3           | 2           | 3           |
| <b>CO2</b>               | 3          | 3          | 3          | 3          | 2          | 1          | 1          | 1          | 1          | 1           | 2           | 3           | 1           | 2           |
| <b>CO3</b>               | 3          | 3          | 3          | 3          | 2          | 2          | 1          | 1          | 1          | 1           | 2           | 3           | 2           | 3           |
| <b>CO4</b>               | 3          | 3          | 3          | 3          | 1          | 1          | 1          | 1          | 1          | 1           | 1           | 2           | 1           | 3           |
| <b>CO5</b>               | 3          | 3          | 3          | 3          | 1          | 2          | 1          | 1          | 1          | 1           | 1           | 2           | 1           | 2           |
| <b>Avg.</b>              | <b>3</b>   | <b>3</b>   | <b>3</b>   | <b>3</b>   | <b>1.8</b> | <b>1.6</b> | <b>1</b>   | <b>1</b>   | <b>1</b>   | <b>1</b>    | <b>1.6</b>  | <b>2.6</b>  | <b>1.4</b>  | <b>2.6</b>  |

U24HS211

**தமிழரும் தொழில்நுட்பமும் /  
TAMILS AND TECHNOLOGY**

**L    T    P    C**  
**1    0    0    1**

**Course Objectives:**

- To facilitate the student to understand weaving and technology of sangam age.
- To create an awareness on structural design of Tamils during sangam age.
- To help students to distinguish between all the levels of manufacturing technology in ancient period.
- To understand the ancient knowledge of agriculture and irrigation technology.
- To enable the students to understand the digitalization of Tamil Language.

**UNIT I WEAVING AND CERAMIC TECHNOLOGY**

**3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY**

**3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**UNIT III MANUFACTURING TECHNOLOGY**

**3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY**

**3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING****3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS****Text Books**

1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).
3. Historical Heritage of the Tamils (Dr.S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies).
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.P illay) (Published by: The Author).
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                        |                        |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                        | <b>Knowledge level</b> |
| CO1                                                                            | Review the Weaving and Ceramic Technology during Tamil Sangam Age.                     | Understanding          |
| CO2                                                                            | Describe the Construction Technology and various Architecture during Tamil Sangam Age. | Understanding          |
| CO3                                                                            | Discuss the Manufacturing Technology with Archaeological Evidences.                    | Understanding          |
| CO4                                                                            | Explain the Agriculture and Irrigation Technology during Tamil Sangam Age.             | Understanding          |
| CO5                                                                            | Describe Tamil Software and Digitalization Tamil Literatures.                          | Understanding          |

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

**U24HS223****TECHNICAL ENGLISH FOR ENGINEERS**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>0</b> | <b>2</b> | <b>3</b> |

**Course Objectives:**

- To engage learners in meaningful language activities to improve their LSRW skills.
- To enhance learners' awareness of general rules of writing for specific audiences.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

**UNIT I MAKING COMPARISONS****6**

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases.

**UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6**

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds.

**UNIT III PROBLEM SOLVING 6**

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences.

**UNIT IV REPORTING OF EVENTS AND RESEARCH 6**

Reading –Newspaper articles; Writing – Proposal writing - Picture description - Accident Report, Survey Report. Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions.

**UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 6**

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

**TOTAL: 30 PERIODS****Sl. No. List of experiments**

- 1 Role Play Exercises Based on Workplace Contexts
- 2 Understanding lexical items via movie clippings – Individual task
- 3 Discussing news stories
- 4 Dialogues (with cue cards)-Understanding common technology terms
- 5 Pronunciation, Intonation, Stress and Rhythm (Level 1)
- 6 Pronunciation, Intonation, Stress and Rhythm (Level 2)
- 7 Public Speech: Talking about self in a Professional Setting, Introduction of Speakers, Vote of thanks - 3 in a team
- 8 Writing a short article (Can be compiled as a magazine)
- 9 Verbal ability exercises for competitive examinations
- 10 Visume

**TOTAL: 30 PERIODS****Text Books**

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021 Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Jovani, Department of English, Anna University.
3. Better English Pronunciation, (2005), J.D. O'Connor, Second Edition, ISBN-13:978-0521682589.

**Reference Books**

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. A Modern Approach to Verbal & Non-Verbal Reasoning - Includes Latest Questions and their Solutions, Revised Edition, R.S. Aggarwal, January 2018.

| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                              |                        |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                              | <b>Knowledge level</b> |
| CO1                                                                            | Articulate English with proper pronunciation, intonation, stress and rhythm. | Applying               |
| CO2                                                                            | Develop verbal ability skills for attending competitive examinations.        | Applying               |
| CO3                                                                            | Employ speaking and writing skills in professional contexts.                 | Applying               |
| CO4                                                                            | Write effective resumes in the context of job search.                        | Applying               |
| CO5                                                                            | Interpret the denotative and connotative meanings of technical texts.        | Understanding          |

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

**U24CE232 ENGINEERING PRACTICES FOR CIRCUIT BRANCHES**

**L T P C**  
**0 0 4 2**

**Course Objectives:**

- To gain practical experience in characterizing electronic devices
- To solder and test simple electronic circuits on PCB
- To verify KVL and KCL using series and parallel circuits
- To perform various electrical joints in common household electrical wire work.
- To measure of electrical quantities in different electrical circuits

**ELECTRONIC ENGINEERING PRACTICES**

- 1 Study of Electronic Components and Equipment
- 2 Resistor Value using Colour coding
- 3 Generation of AC signal using Function Generator and Measurement of its parameter using CRO / DSO
- 4 Study of logic gates - AND, OR, NOT, NOR, NAND and XOR
- 5 Soldering simple electronic circuits and checking continuity.
- 6 Verification of KVL and KCL using series and parallel circuits
- 7 Controlling smart devices using Mobile phone
- 8 Study of troubleshooting steps in Mobile Repairing

**ELECTRICAL ENGINEERING PRACTICES**

- 1 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2 Fluorescent lamp wiring.
- 3 Stair case wiring
- 4 Measurement of electrical quantities – voltage, current, power and power factor in RLC circuit.
- 5 Measurement of energy using a single-phase energy meter.
- 6 Measurement of resistance to earth of electrical equipment.

| Course Outcome Statement |                                                                             |                 |
|--------------------------|-----------------------------------------------------------------------------|-----------------|
| CO                       | At the end of the course, the students will be able to                      | Knowledge Level |
| CO1                      | Analyze the characteristics of basic electronic devices                     | Applying        |
| CO2                      | Perform simple electronic circuits on PCB                                   | Applying        |
| CO3                      | Solve KVL and KCL using series and parallel circuits                        | Applying        |
| CO4                      | Perform various electrical joints in common household electrical wire work. | Applying        |
| CO5                      | Calculate electrical quantities in different electrical circuits            | Applying        |

| CO-PO/PSO Mapping |          |            |            |     |     |          |     |          |          |          |      |            |      |      |
|-------------------|----------|------------|------------|-----|-----|----------|-----|----------|----------|----------|------|------------|------|------|
| CO                | PO1      | PO2        | PO3        | PO4 | PO5 | PO6      | PO7 | PO8      | PO9      | PO10     | PO11 | PO12       | PSO1 | PSO2 |
| CO1               | 3        | 3          |            |     |     |          |     | 2        | 3        | 2        |      | 2          |      |      |
| CO2               | 3        | 2          | 2          |     |     |          |     | 2        | 3        | 2        |      | 2          |      |      |
| CO3               | 3        | 3          | 3          |     |     |          |     | 2        | 3        | 2        |      |            |      |      |
| CO4               | 3        | 2          |            |     |     | 2        |     | 2        | 3        | 2        |      | 3          |      |      |
| CO5               | 3        | 2          | 2          |     |     | 2        |     | 2        | 3        | 2        |      | 3          |      |      |
| <b>Avg.</b>       | <b>3</b> | <b>2.4</b> | <b>2.3</b> |     |     | <b>2</b> |     | <b>2</b> | <b>3</b> | <b>2</b> |      | <b>2.5</b> |      |      |

U24CS222

C PROGRAMMING LABORATORY

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### Course Objectives:

- To develop programs in C using basic constructs.
- To develop applications in C using strings.
- To develop applications in C using pointers, functions.
- To develop applications in C using structures.
- To develop applications in C using file processing.

### S. No

### List of Experiments

- 1 Programs using, I/O statements and expressions.
- 2 Programs using decision-making constructs.
- 3 Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
- 4 Check whether a given number is Armstrong number or not?
- 5 Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
  - 5 if it is a perfect cube.
  - 4 if it is a multiple of 4 and divisible by 6.
  - 3 if it is a prime number.
 Sort the numbers based on the weight in the increasing order as shown below  
 <10, its weight>, <36, its weight> <89, its weight>
- 6 Populate an array with height of persons and find how many persons are above the average height.
- 7 Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
- 8 From a given paragraph perform the following using built-in functions:
  - a. Find the total number of words.
  - b. Capitalize the first word of each sentence.
  - c. Replace a given word with another word.
- 9 Solve towers of Hanoi using recursion.
- 10 Sort the list of numbers using pass by reference.
- 11 Generate salary slip of employees using structures and pointers.
- 12 Compute internal marks of students for five different subjects using structures and functions.
- 13 Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
- 14 Count the number of account holders whose balance is less than the minimum balance using sequential access file.
- 15 Create a “Railway reservation system” with the following modules: Booking, Availability checking, Cancellation and Prepare chart

## S. No

## List of Experiments

| Course Outcome Statement |                                                                         |                 |
|--------------------------|-------------------------------------------------------------------------|-----------------|
| CO                       | At the end of the course, the students will be able to                  | Knowledge Level |
| CO1                      | Develop C programs for simple applications                              | Applying        |
| CO2                      | Develop C programs for constructs, arrays and strings.                  | Applying        |
| CO3                      | Develop C programs involving functions and recursion                    | Applying        |
| CO4                      | Develop C programs involving pointers, and structures.                  | Applying        |
| CO5                      | Design applications using sequential and random-access file processing. | Applying        |

| CO-PO/PSO Mapping |          |            |          |            |          |          |          |     |            |            |          |            |      |      |
|-------------------|----------|------------|----------|------------|----------|----------|----------|-----|------------|------------|----------|------------|------|------|
| CO                | PO1      | PO2        | PO3      | PO4        | PO5      | PO6      | PO7      | PO8 | PO9        | PO10       | PO11     | PO12       | PSO1 | PSO2 |
| CO1               | 3        | 3          | 1        | 2          | 2        | 1        | 1        |     | 1          | 2          | 1        | 3          |      |      |
| CO2               | 3        | 2          | 1        | 2          | 2        |          |          |     | 1          | 1          | 1        | 2          |      |      |
| CO3               | 3        | 3          | 1        | 2          | 3        |          |          |     | 1          | 1          | 1        | 2          |      |      |
| CO4               | 3        | 1          |          | 1          | 1        |          |          |     | 2          | 1          | 1        | 2          |      |      |
| CO5               | 3        | 2          | 1        | 2          | 2        | 1        | 1        |     | 1          | 2          | 1        | 3          |      |      |
| <b>Avg.</b>       | <b>3</b> | <b>2.2</b> | <b>1</b> | <b>1.8</b> | <b>2</b> | <b>1</b> | <b>1</b> |     | <b>1.2</b> | <b>1.4</b> | <b>1</b> | <b>2.4</b> |      |      |

U24EM212

PROFESSIONAL DEVELOPMENT

|   |   |   |   |
|---|---|---|---|
| L | T | P | C |
| 0 | 0 | 2 | 1 |

## Course Objectives:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations

| Sl. No | List of exercises                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | <b>MS WORD: (10 Periods)</b><br>Create and format a document<br>Working with tables<br>Working with Bullets and Lists<br>Working with styles, shapes, smart art, charts<br>Inserting objects, charts and importing objects from other office tools<br>Creating and Using document templates<br>Inserting equations, symbols and special characters<br>Working with Table of contents and References, citations<br>Insert and review comments<br>Create bookmarks, hyperlinks, endnotes footnote<br>Viewing document in different modes<br>Working with document protection and security<br>Inspect document for accessibility |
| 2      | <b>MS EXCEL: 10 Periods</b><br>Create worksheets, insert and format data<br>Work with different types of data: text, currency, date, numeric etc.<br>Split, validate, consolidate, Convert data<br>Sort and filter data<br>Perform calculations and use functions:<br>(Statistical, Logical, Mathematical, date, Time etc.,)                                                                                                                                                                                                                                                                                                  |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | Work with Lookup and reference formulae<br>Create and Work with different types of charts<br>Use pivot tables to summarize and analyse data<br>Perform data analysis using own formulae and functions<br>Combine data from multiple worksheets using own formulae and built-in functions to generate results<br>Export data and sheets to other file formats<br>Working with macros<br>Protecting data and Securing the workbook                                             |
| 3                      | <b>MS POWERPOINT: 10 Periods</b><br>Select slide templates, layout and themes<br>Formatting slide content and using bullets and numbering<br>Insert and format images, smart art, tables, charts<br>Using Slide master, notes and handout master<br>Working with animation and transitions<br>Organize and Group slides<br>Import or create and use media objects: audio, video, animation<br>Perform slideshow recording and Record narration and create presentable videos |
| <b>Total: 30 Hours</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| <b>Course Outcomes: At the end of the course, the students will be able</b> |                                                                                                                                                                  |                        |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                   | <b>Course Outcome Statement</b>                                                                                                                                  | <b>Knowledge Level</b> |
| CO1                                                                         | Create quality documents, by structuring and organizing content for their day to day technical and academic requirements using MS Word                           | Applying               |
| CO2                                                                         | Perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding using MS Excel                     | Applying               |
| CO3                                                                         | Create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects using MS Power Point | Applying               |
| CO4                                                                         | Prepare an effective report using MS word and MS Excell on any subject content                                                                                   | Applying               |
| CO5                                                                         | Present the report using MS Power Point                                                                                                                          | Applying               |

| <b>CO-PO/PSO Mapping</b> |     |     |     |     |     |     |     |     |          |          |      |          |      |      |
|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|----------|----------|------|----------|------|------|
| CO                       | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9      | PO10     | PO11 | PO12     | PSO1 | PSO2 |
| CO1                      |     |     |     |     |     |     |     |     | 2        | 2        |      | 2        |      |      |
| CO2                      |     |     |     |     |     |     |     |     | 2        | 2        |      | 2        |      |      |
| CO3                      |     |     |     |     |     |     |     |     | 2        | 2        |      | 2        |      |      |
| CO4                      |     |     |     |     |     |     |     |     | 2        | 2        |      | 2        |      |      |
| CO5                      |     |     |     |     |     |     |     |     | 2        | 2        |      | 2        |      |      |
| <b>Avg.</b>              |     |     |     |     |     |     |     |     | <b>2</b> | <b>2</b> |      | <b>2</b> |      |      |

**B.E. Computer Science and Engineering  
R2024 Third Semester Syllabus**

|                 |                                        |          |          |          |          |
|-----------------|----------------------------------------|----------|----------|----------|----------|
| <b>U24MA321</b> | <b>PROBABILITY AND QUEUEING THEORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                 |                                        | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b> |

**Course Objectives:**

- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions with applications to engineering which can describe the real-life phenomenon.
- To understand the concept of queueing models and their applications in engineering.
- To understand the significance of advanced queueing models.
- To provide the required mathematical support for real life problems and develop probabilistic models which can be used in several areas of science and engineering.

**UNIT I PROBABILITY AND RANDOM VARIABLES 9+3**

Probability – Axioms of probability – Conditional probability – Baye’s theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions-Functions of Random variable.

**UNIT II TWO – DIMENSIONAL RANDOM VARIABLES 9+3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.

**UNIT III RANDOM PROCESSES**

**9+3**

Classification – **Stationary process: SSS process and WSS process**– Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

**UNIT IV QUEUEING MODELS**

**9+3**

Markovian queues – Birth and Death processes –Kendal's Notation – Little’s formula- Single and multiple server queueing models (M/M/1):(Infinite /FIFO),(M/M/s):(Infinite /FIFO),(M/M/1):(k /FIFO),(M/M/s):(k /FIFO)

**UNIT V ADVANCED QUEUEING MODELS**

**9+3**

Finite source models – M/G/1 queue – Pollaczek Khinchin formula – M/D/1– Series queues – Open and Closed Jackson networks.

**TOTAL: 60 PERIODS**

**Text Books**

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4<sup>th</sup> Edition, 2014.
2. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 2<sup>nd</sup> Edition, 2014.
3. M.B.K .Moorthy, K. Subramania, A. Santha, "Probability and Queueing Theory", Scitech Publications, 2015.
4. T. Veerarajan, "Probability, Statistics and Random Process", 3<sup>rd</sup> edition, Tata McGraw Hill Publishing Company limited, 2008.

**Reference Books**

1. Taha, H.A., "Operations Research", 11<sup>th</sup> Edition, Pearson India Education Services, Delhi, 2023.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2<sup>nd</sup> Edition, John Wiley and Sons, 2016.
3. Scott L. Miller, Donald. G. Childers, "Probability and Random Process", An imprint of Elsevier, 2011.
4. J. Medhi, Stochastic Models in Queueing Theory, 2nd Edition, Academic Press, 2003 (Elsevier India Edition, 2006).

**Course Outcomes**

| CO  | At the end of the course, the students will be able to                                       | Knowledge level |
|-----|----------------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply a fundamental knowledge of the Probability Concepts.                                   | Applying        |
| CO2 | Apply the concepts based on two Dimensional Random variables.                                | Applying        |
| CO3 | Apply random Process technique to find simple solutions to the Mathematical Problems.        | Applying        |
| CO4 | Apply the concepts and acquire skills in queueing Models.                                    | Applying        |
| CO5 | Apply real Life Time phenomenon which evolve with respect to time in a probabilistic manner. | Applying        |

**CO-PO/PSO Mapping**

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

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**U24CS311****Operating Systems**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**Course Objective:**

1. To understand the fundamental principles and functions of operating systems.
2. To explore process management for efficient computing.
3. To analyze advanced memory management and its role in performance optimization.
4. To understand storage management, file systems and their implementation.
5. To gain insights into virtualization, and mobile operating systems.

**Unit I : INTRODUCTION AND PROCESS 8**

Operating Systems Overview and Evolution - Objectives and Functions - Structures – Operating Systems Services - User Operating System Interface - System Calls – System Services - Design and Implementation - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication.

**Unit II PROCESS MANAGEMENT 10**

Threads - Multithread Models – Threading Issues; CPU Scheduling - Scheduling algorithms - Process Synchronization - The Critical-Section problem – Peterson’s Solution – Mutex Locks – Semaphores – Monitors – Liveness – Classical problems of synchronization; Deadlock - Methods, prevention, avoidance, detection, Recovery.

**Unit III MEMORY MANAGEMENT 10**

Contiguous Memory Allocation – Paging - Structure of the Page Table – Swapping; Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames.

**Unit IV STORAGE MANAGEMENT 10**

Disk Scheduling, - Disk Management – RAID Structure; I/O Systems – I/O Hardware - Kernel I/O subsystem; File-System Interface - File concept - Access methods - Directory Structure - Directory Organization and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management - Recovery.

**Unit V VIRTUAL MACHINES AND MOBILE OS 7**

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

**Total Periods: 45****TEXT BOOKS**

- 1 Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Concepts”, 10<sup>th</sup> Edition, John Wiley and Sons Inc., 2018.
- 2 William Stallings, "Operating Systems: Internals and Design Principles", 9<sup>th</sup> Edition, Prentice Hall, 2019.
- 3 Andrew S. Tanenbaum, Herbert Bos, “Modern Operating Systems”, Pearson, 5th Edition, 2022.

**REFERENCE BOOKS**

- 1 Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", 2020.
- 2 Daniel Bovet and Marco Cesati, “Understanding the Linux Kernel”, 3rd Edition, O'Reilly Media, 2020.

- 3 Richard Blum and Christine Bresnahan, “Linux Command Line and Shell Scripting Bible”, 4th Edition, Wiley, 2021.

### ONLINE REFERENCES

1. <https://archive.nptel.ac.in/Courses/106/105/106105214/>
2. [https://onlinecourses.nptel.ac.in/noc21\\_cs72](https://onlinecourses.nptel.ac.in/noc21_cs72)
3. [https://onlinecourses.nptel.ac.in/noc21\\_cs88](https://onlinecourses.nptel.ac.in/noc21_cs88)

### Course Outcomes

| CO  | At the end of the course, the students will be able to                                 | Knowledge Level |
|-----|----------------------------------------------------------------------------------------|-----------------|
| CO1 | Describe the basic components of operating system.                                     | Understanding   |
| CO2 | Apply scheduling and synchronization algorithms to manage processes efficiently.       | Applying        |
| CO3 | Analyze different memory management techniques and their impact on system performance. | Analyzing       |
| CO4 | Apply the file system and I/O management techniques to optimize storage                | Applying        |
| CO5 | Compare the features and architectures of virtualization and mobile operating systems. | Understanding   |

### CO-PO/PSO Mapping

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 2   | 2   | 3   |     |     |     | 2   | 2   | 2    | 3    | 3    | 3    |
| CO2  | 3   | 3   | 3   | 3   |     |     |     | 2   | 2   | 2    | 3    | 3    | 3    |
| CO3  | 3   | 3   | 2   | 3   |     |     |     | 2   | 2   | 2    | 3    | 3    | 3    |
| CO4  | 3   | 3   | 3   | 3   |     |     |     | 2   | 2   | 2    | 3    | 3    | 3    |
| CO5  | 3   | 2   | 2   | 3   |     |     |     | 2   | 2   | 2    | 3    | 3    | 3    |
| Avg. | 3   | 2.6 | 2.4 | 3   |     |     |     | 2   | 2   | 2    | 3    | 3    | 3    |

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**U24CS321**

**DATA STRUCTURES**  
(Common to B.Tech. AI&DS)

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### Course Objective:

1. To insights the concepts of ADTs.
2. To learn linear data structures–list, stack and queue.
3. To apply sorting, searching and hashing algorithms.
4. To apply tree data structures.
5. To apply Graph structures.

### Unit I LISTS

**9**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists–Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.

**Unit II STACK AND QUEUE 9**

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions - Infix to Postfix conversion–Function Calls– Queue ADT–Operations–Circular Queue–DeQueue – Applications of Queues.

**Unit III SEARCHING, SORTING AND HASHING TECHNIQUES 9**

Searching – Linear Search – Binary Search. Sorting – Merge Sort – Quick Sort - Insertion sort – Bubble sort – Selection sort – Shell sort — Hashing –Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

**Unit IV TREE 9**

Tree ADT – Tree Traversals-Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – B-Tree – B+Tree – Priority Queue (Heaps) – Binary Heap

**Unit V GRAPH 9**

Graph Definition – Representation of Graphs – Types of Graphs - Breadth- first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort –Dijkstra's algorithm – Minimum Spanning Tree –Prim's algorithm –Kruskal's algorithm

**Total Periods: 45****TEXT BOOKS**

- 1 Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, Data Structures & Algorithms in Python”, John Wiley & Sons Inc., 2021.
- 2 Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015.

**REFERENCE BOOKS**

- 1 Thomas H. Cormen, Charles E Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms” Fourth Edition, PHI, 2022
- 2 Kruse, “Data Structures and Program Design”, Pearson Education, 2006

**ONLINE REFERENCES**

1. <https://nptel.ac.in/courses/106/102/106102064/>
2. <https://nptel.ac.in/courses/106/106/106106133/>

**Course Outcomes**

| CO  | At the end of the course, the students will be able to                                  | Knowledge Level |
|-----|-----------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply linked list including singly, double and circular list for solving Problems       | Applying        |
| CO2 | Apply linear data structure including stack, queue and dequeue to solve a given problem | Applying        |
| CO3 | Analyze the various searching and sorting algorithms.                                   | Applying        |
| CO4 | Apply appropriate algorithms for tree applications                                      | Applying        |
| CO5 | Apply appropriate algorithms for graph applications                                     | Applying        |

**CO-PO/PSO Mapping**

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

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**U24CS331**

**Object Oriented Programming using Java**  
(Common to B.Tech. AI&DS)

**L T P C**  
**3 0 0 3**

**Course Objective:**

- To understand Object Oriented Programming concepts and basics of Java programming language.
- To learn the principles of packages, inheritance and interfaces
- To apply a java application with threads and an exception handling mechanism
- To apply generic classes and use I/O streams and string classes
- To design and build Graphical User Interface Application using JAVA FX

**Unit I INTRODUCTION TO OOP AND JAVA 9**

Overview of OOP-Features of Object Oriented Programming –Java Buzzwords – Overview of Java– Data Types, Variables and Arrays –Operators – Control Statements – Programming Structures in Java -Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments.

**Unit II INHERITANCE, PACKAGES AND INTERFACES 9**

Overloading Methods –Objects as Parameters- Returning Objects-Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages –Packages and Member Access –Importing Packages – Interfaces.

**Unit III EXCEPTION HANDLING AND MULTITHREADING 9**

Exception Handling basics – Try and Catch - Multiple catch – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication-Suspending –Resuming, and Stopping Threads –Multithreading.

**Unit IV I/O, GENERICS, STRING HANDLING 9**

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

**Unit V JAVA FX EVENT HANDLING, CONTROLS AND COMPONENTS 9**

JAVA FX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – Border Pane – StackPane – GridPane.Menu-Menu bars-MenuItem.

**Total Periods: 45**

**TEXT BOOKS**

- 1 Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, New Delhi, 2021.
- 2 Herbert Schildt, “Introducing JavaFX 8 Programming”, 1st Edition, McGraw Hill Education, New Delhi, 2021.

**REFERENCE BOOKS**

- 1 Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11th Edition, Prentice Hall, 2018.
- 2 K. Arnold and J. Gosling, “The JAVA programming language”, Third edition, Pearson Education, 2000.

**ONLINE REFERENCES**

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. [https://onlinecourses.nptel.ac.in/noc21\\_cs56/preview](https://onlinecourses.nptel.ac.in/noc21_cs56/preview)
3. <https://www.hackerrank.com/domains/java>
4. <https://www.codechef.com/wiki/java>

**Course Outcome**

| CO  | At the end of the course, the students will be able to                                                            | Knowledge Level |
|-----|-------------------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply the basic concepts of OOP.                                                                                  | Applying        |
| CO2 | Apply the principles of packages, inheritance and interfaces                                                      | Applying        |
| CO3 | Apply the exception handling mechanisms and multithreaded model to solve real world problems                      | Applying        |
| CO4 | Develop Java applications with I/O packages, string classes, Collections and generics concepts                    | Applying        |
| CO5 | Implement the concepts of event handling and JavaFX components and controls for developing GUI based applications | Applying        |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 3   | 3   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO2  | 3   | 3   | 3   | 3   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO3  | 3   | 3   | 3   | 3   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO4  | 3   | 3   | 3   | 3   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO5  | 3   | 3   | 3   | 3   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| Avg. | 3   | 3   | 3   | 3   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**U24CS341****Software Engineering**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**Course Objective:**

- To understand the software life cycle models.
- To understand the importance of the software development process.
- To understand the significance of UML models.
- To apply designing and testing principles in software development process.
- To develop correct and robust software products

**Unit I INTRODUCTION****9**

Introduction to Software Engineering – Software Process – Perspective Process Model – Specialized Process Model – Specialized Process Model – Unified Process Model – Agile process – Extreme programming- XP Process.

**Unit II REQUIREMENTS ANALYSIS AND MODELLING****9**

Requirements Engineering – Functional and Non-Functional Requirements – Eliciting Requirements – Developing Use case – Requirement Model - Negotiation Requirements – Validation Requirements – Requirement Analysis – Modelling: Domain Analysis and Modelling – Scenario Based Modelling – UML Model – Data Modelling – Class Based Modelling.

**Unit III SOFTWARE DESIGN****9**

Design process – Design Concepts-Design Model– Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow– User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

**Unit IV SOFTWARE TESTING STRATEGIES****9**

Introduction to Software Testing – Software Testing Life Cycle (STLC) – Strategic Approach to Software Testing – Strategic Issues – Test Strategies for Conventional Software – Unit Testing – Integration Testing – System Testing – The Art of Debugging – Conventional Applications: Basis Path Testing – Control Structure Testing – Black Box Testing – White Box Testing – Model Based Testing– Testing Object Oriented Applications- CASE TOOLS.

**Unit V SOFTWARE PROJECT MANAGEMENT****9**

Software Project Management: Estimation – LOC, FP Based Estimation, Six sigma and CMM levels, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection – Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

**Total Periods: 45****TEXT BOOKS**

- 1 R.S. Pressman, “Software Engineering – A Practitioner’s Approach”, Ninth Edition, McGraw Hill, International Edition, 2024.
- 2 Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.

**REFERENCE BOOKS**

- 1 Bernd Bruegge and Allen H. Dutoit, “Object-Oriented Software Engineering: Using UML, Patterns and Java”, Third Edition, Pearson Education, 2009.
- 2 Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.

**ONLINE REFERENCES**

1. <https://nptel.ac.in/courses/106/105/106105182/>
2. <https://www.udemy.com/topic/software-testing/>

**Course Outcomes**

| CO  | At the end of the course, the students will be able to                        | Knowledge Level |
|-----|-------------------------------------------------------------------------------|-----------------|
| CO1 | Compare various Software Development Lifecycle Models                         | Analyzing       |
| CO2 | Develop the UML model for software projects.                                  | Applying        |
| CO3 | Develop suitable models for designing application software.                   | Applying        |
| CO4 | Apply software testing procedures in software development process.            | Applying        |
| CO5 | Construct the software project management and software maintenance practices. | Applying        |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 2   | 2   | 2   |     |     | 3   | 3   | 2    | 3    | 3    | 3    |
| CO2  | 3   | 3   | 2   | 2   | 2   |     |     | 3   | 3   | 2    | 3    | 3    | 3    |
| CO3  | 3   | 3   | 2   | 2   | 2   |     |     | 3   | 3   | 2    | 3    | 3    | 3    |
| CO4  | 3   | 3   | 2   | 2   | 2   |     |     | 3   | 3   | 2    | 3    | 3    | 3    |
| CO5  | 3   | 3   | 2   | 2   | 2   |     |     | 3   | 3   | 2    | 3    | 3    | 3    |
| Avg. | 3   | 3   | 2   | 2   | 2   |     |     | 3   | 3   | 2    | 3    | 3    | 3    |

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**U24CS352**

**DATA STRUCTURES LABORATORY**  
(Common to B.Tech. AI&DS)

**L T P C**  
**0 0 4 2**

**Course Objective:**

- To demonstrate array implementation of linear data structure algorithms.
- To implement the applications using Stack.
- To implement the applications using Linked list
- To implement Binary search tree and AVL tree algorithms.
- To implement the Heap algorithm.
- To implement Dijkstra's algorithm.
- To implement Prim's algorithm
- To implement Sorting, Searching and Hashing algorithms

**Sl.**  
**No**

**List of experiments**

- 1 Design and develop a Python-based application that implements Stack, Queue, and Circular Queue using arrays. Apply these data structures to solve practical problems such as browser history navigation (Stack), customer service ticketing system (Queue), and a circular buffer for real-time data streaming (Circular Queue).

- 2 Design and develop an application that utilizes a linked list to manage dynamic data efficiently. Apply it to real-world scenarios such as contact management in a phonebook, playlist management in a music player.
- 3 Design and develop an application that implements Stack and Queue Abstract Data Types (ADTs) to solve practical problems such as expression evaluation (infix to postfix conversion).
- 4 Design and develop an application that demonstrates the real-world use of List, Stack, and Queue ADTs. Implement scenarios such as task management using a Queue, expression evaluation using a Stack, and dynamic data storage using a List in a contact management system or social media feed.
- 5 Design and develop an application that implements Binary Search Trees (BST) to efficiently manage and retrieve data. Apply BST to solve real-world problems such as contact management in a phonebook, auto-suggestion in search engines.
- 6 Develop an application that implements AVL Trees to maintain balanced and efficient data retrieval. Apply AVL Trees to real-world scenarios such as optimizing database indexing, managing dynamic leaderboards in gaming applications, or implementing auto-balancing dictionaries for fast search operations.
- 7 Implement heaps using priority queues, applying them to problems like task scheduling and resource allocation.
- 8 Develop an application that implements Dijkstra's Algorithm to find the shortest path in a network. Apply this algorithm to real-world scenarios such as GPS-based navigation systems, network routing optimization, or emergency response route planning.
- 9 Develop an application that implements Prim's Algorithm to find the Minimum Spanning Tree (MST) of a network. Apply this algorithm to solve real-world problems such as optimizing road networks, minimizing wiring costs in circuit design, or designing efficient communication networks.
- 10 Develop an application that implements Linear Search and Binary Search to efficiently retrieve data from a dataset. Apply these searching techniques to real-world scenarios such as product search in an e-commerce platform, student record retrieval in a database, or keyword search in a text document.
- 11 Develop an application that implements Insertion Sort and Selection Sort to efficiently organize and manage data. Apply these sorting techniques to real-world scenarios such as ranking student grades, arranging customer transaction records, or sorting a list of product prices in an e-commerce platform.
- 12 Develop an application that implements Merge Sort to efficiently sort large datasets. Apply Merge Sort in real-world scenarios such as sorting customer transaction records in an e-commerce platform, organizing log files in a server, or optimizing search results in a database system.
- 13 Develop an application that implements Open Addressing techniques, including Linear Probing and Quadratic Probing, for efficient hash table management. Apply these techniques to solve real-world problems such as fast data retrieval in database indexing, caching mechanisms in web browsers, or duplicate detection in large datasets.

**Total Periods: 60**

**Course Outcomes:**

| CO  | At the end of the course, the students will be able to | Knowledge Level |
|-----|--------------------------------------------------------|-----------------|
| CO1 | Apply Linear data structure -Linked lists.             | Applying        |
| CO2 | Apply Stacks and Queue for real time applications.     | Applying        |
| CO3 | Apply Binary Search tree and AVL tree operations.      | Applying        |
| CO4 | Develop applications using graph algorithms.           | Applying        |
| CO5 | Analyze the various searching and sorting algorithms.  | Analysing       |

**CO-PO/PSO Mapping**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3    | 3    |
| CO2 | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3    | 3    |
| CO3 | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3    | 3    |
| CO4 | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3    | 3    |
| CO5 | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3    | 3    |
| Avg | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3    | 3    |

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**U24CS362**

**Object Oriented Programming Laboratory**  
(Common to B.Tech. AI&DS)

**L T P C**  
**0 0 4 2**

**Course Objective:**

- To build real-world applications using java.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, Exception handling and file processing.
- To develop applications using multithreading
- To Build applications using generic programming
- To Develop the java application using JavaFX controls and events programming

**Sl**  
**No**

**List of Experiments**

- 1 Develop a Java application that allows users to search and sort data efficiently. Implement sequential search and binary search to find specific records (e.g., student details, product inventory). Integrate selection sort and insertion sort to organize datasets, such as sorting customer orders by date or arranging exam scores in ascending order.
- 2 Develop a Java application that implements Stack and Queue data structures using classes and objects. Apply these structures to real-world scenarios such as managing browser history (Stack) and handling customer requests in a service center (Queue).
- 3 Develop a Java application that demonstrates multilevel inheritance by simulating a real-world scenario, such as a company's employee management system. Implement a class hierarchy where a base class Person is extended by Employee, which is further extended by specialized roles like Manager or Developer. Include methods to display employee details and calculate salaries based on roles.
- 4 Create an abstract class Shape with two integer attributes and an abstract method print Area(). Implement three subclasses: Rectangle, Triangle, and Circle, each overriding print Area() to calculate and display their respective areas.

- 5 Develop a Java application that demonstrates the use of the extends keyword with interfaces. Implement a real-world scenario such as a payment system where multiple payment methods (Credit Card, PayPal, UPI) extend a common payment interface to ensure seamless transactions.
- 6 Develop a Java application that demonstrates exception handling by creating user-defined exceptions. Apply this in a real-world scenario, such as validating user input in a banking system, handling insufficient balance exceptions in an ATM simulation, or managing invalid login attempts in an authentication system.
- 7 Develop a Java-based multi-threaded application to simulate the Producer-Consumer problem using Threads. Implement synchronization techniques to ensure proper coordination between producers and consumers, such as managing a shared buffer for real-world applications like job scheduling in an operating system or message queues in a communication system.
- 8 Develop a Java application that performs essential file operations such as creating, reading, writing, and deleting files. Implement real-world use cases like logging system activities, managing user data, or handling configuration files for an application.
- 9 Develop a Java application that performs essential file operations such as creating, reading, writing, and deleting files. Implement real-world use cases like logging system activities, managing user data, or handling configuration files for an application.
- 10 Develop a JavaFX-based desktop application that utilizes various controls, layouts, and menus to create an interactive user interface. Implement features such as a to-do list manager, a student record system, or a simple inventory management system, ensuring a user-friendly experience with responsive design.
- 11 Write a java program that connects to a database using JDBC  
Develop a Java-based application that connects to a database using JDBC. Implement functionality to insert user data, such as a registration form for a library management system, employee records for an HR system, or product details for an inventory management system  
Develop a Java-based application that connects to a database using JDBC. Implement functionality to manage and delete records, such as removing outdated user information from a customer database or deleting inactive product listings from an inventory system.

**Total Periods: 60**

### Course Outcomes

| CO  | At the end of the course, the students will be able to                              | Knowledge Level |
|-----|-------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply java programs using object-oriented programming concepts                      | Applying        |
| CO2 | Apply object-oriented concepts such as package, exceptions for simple applications. | Applying        |
| CO3 | Apply multithreading concept for simple java program.                               | Applying        |
| CO4 | Develop Simple application using generic classes.                                   | Applying        |
| CO5 | Create GUIs and event driven programming applications for real world problems.      | Applying        |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 3   | 3    | 3    | 3    | 3    |
| CO2  | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 3   | 3    | 3    | 3    | 3    |
| CO3  | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 3   | 3    | 3    | 3    | 3    |
| CO4  | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 3   | 3    | 3    | 3    | 3    |
| CO5  | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 3   | 3    | 3    | 3    | 3    |
| Avg. | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 3   | 3    | 3    | 3    | 3    |

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**U24CS372**

**Operating Systems Laboratory**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

**Course Objective:**

- To understand and practice basic UNIX commands and shell programming.
- To implement and analyze CPU scheduling algorithms.
- To simulate memory management techniques.
- To develop programs for file organization and allocation strategies.
- To install, configure, and manage operating systems using virtualization.

**Sl  
No**

**List of Experiments**

1. Install a Windows operating system on a new computer, ensuring proper partitioning, driver installation, and system configuration
2. Illustrate basic UNIX commands to manage files, handle processes, and navigate directories effectively. Provide real-world scenarios where these commands are useful.
3. You are working as a system administrator, and your organization requires frequent backups of important files. Write a shell script that automates the process of copying specific files from one directory to another at regular intervals. Additionally, modify the script to perform simple arithmetic operations, such as calculating the total size of the copied files. Test and demonstrate your script with sample files.
4. Develop a program that creates a child process using the fork() system call. The parent process should wait for the child process to complete before exiting. Display the Process ID (PID) of both parent and child processes using getpid(). Additionally, implement proper resource management by closing any unnecessary file descriptors using the close() system call.
5. Design and implement a scheduling that allows users to input process details (arrival time, burst time, priority, etc.) and visualize the execution of different CPU scheduling algorithms (FCFS, SJF, Round Robin, and Priority Scheduling). Analyze the turnaround time and waiting time for each algorithm and compare their efficiency
6. A company wants to develop a multi-process application where one process generates real-time sensor data, and another process analyzes it. Implement a solution using inter-process communication (IPC) with pipes or shared memory to enable seamless data transfer between these processes. Demonstrate how the sender and receiver processes interact and ensure efficient data handling.
7. Develop a multi-threaded program where multiple processes attempt to write to a shared resource (e.g., a log file or a critical section of memory). Use semaphores to ensure mutual exclusion, preventing race conditions and ensuring only one process accesses the resource at a time. Test the implementation with multiple concurrent processes and analyze its effectiveness.

8. A bank manages loan requests from multiple customers. To prevent resource deadlock, the bank follows a safe resource allocation strategy. Develop a program that takes customer loan requests, checks for safe resource allocation using the Banker's Algorithm, and determines whether the request should be granted or denied. Test your program with different scenarios to validate its effectiveness in avoiding deadlocks.
9. A multi-user banking system processes multiple transactions simultaneously. To prevent deadlocks, the system needs an efficient resource allocation strategy. Develop a simulation where multiple processes request resources dynamically. Implement a deadlock prevention technique such as resource ordering, preemption, or circular wait avoidance. Demonstrate how your algorithm ensures that deadlocks do not occur while maintaining system efficiency.
10. A university's computer lab is experiencing memory fragmentation issues due to inefficient memory allocation. As a system developer, design and implement a paging technique that efficiently manages memory allocation and translation between logical and physical addresses. Your solution should include a page table for address mapping and handle page faults effectively. Simulate a scenario where multiple processes request memory, and demonstrate how paging resolves fragmentation issues.
11. Design and implement a memory management system that simulates dynamic memory allocation using First Fit, Best Fit, and Worst Fit strategies. Given a set of memory block sizes and incoming process sizes, develop a program that efficiently allocates memory and evaluates the performance of each strategy in terms of fragmentation and allocation success rate.
12. Design and develop a memory management system that simulates page replacement in an operating system. Implement FIFO, LRU, and Optimal page replacement algorithms to manage page faults efficiently. Compare the performance of these algorithms by running different reference string inputs and analyze which algorithm minimizes page faults the most in various scenarios.
13. A company maintains employee records in a file system. Each employee's details (ID, Name, Department, and Salary) need to be stored efficiently. Implement a program that organizes these records using Sequential, Indexed, and Linked file organization methods. Compare their efficiency in terms of search time and storage utilization.
14. Design and develop a program that simulates file storage in an operating system by implementing Sequential, Indexed, and Linked file allocation strategies. Given a set of files with varying sizes, your program should allocate disk blocks efficiently, handle file access requests, and display the allocation structure for each method.
15. Design and develop a disk scheduling application that allows users to input a sequence of disk requests and visualize the execution of FCFS, SSTF, and LOOK scheduling algorithms. Compare their performance based on seek time and total head movement.
16. Install a Linux guest operating system using VMware or VirtualBox.

**Total Periods: 60****Course Outcomes**

| CO  | At the end of the course, the students will be able to                             | Knowledge Level |
|-----|------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply the basic UNIX commands and shell scripting for process and file management. | Applying        |
| CO2 | Analyze the various CPU scheduling algorithms.                                     | Analyzing       |
| CO3 | Compare memory allocation and page replacement techniques.                         | Analyzing       |
| CO4 | Apply file organization and allocation strategies for storage systems.             | Applying        |
| CO5 | Apply the disk scheduling algorithms for optimal performance.                      | Applying        |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3  | PO4  | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO | PSO |
|------|-----|-----|------|------|-----|-----|-----|-----|-----|------|------|-----|-----|
| CO1  | 3   | 2   |      |      | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3   | 3   |
| CO2  | 3   | 3   | 2    | 2    | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3   | 3   |
| CO3  | 3   | 3   | 2    | 3    | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3   | 3   |
| CO4  | 3   | 2   | 3    | 2    | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3   | 3   |
| CO5  | 3   | 3   | 2    | 2    | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3   | 3   |
| Avg. | 3   | 2.6 | 2.25 | 2.25 | 3   | 2   | 3   | 3   | 3   | 2    | 2    | 3   | 3   |

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

|                 |                                                                                                               |          |          |          |          |
|-----------------|---------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|
| <b>U24EM312</b> | <b>DESIGN THINKING AND INNOVATION</b>                                                                         | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                 | (Common to B.E. Civil, CSE and Mechanical and B./Tech. AIDS in Third Semester and B.E. ECE in Fifth Semester) | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**Course Objective:**

- Empathizing with users to uncover their real problems and desires.
- Promoting out-of-the-box thinking to develop unique and effective solutions.
- Using prototyping, testing, and refining ideas to ensure the best outcome.
- Testing assumptions early to prevent costly mistakes and enhance decision-making.
- Creating innovative products, services, or processes that improve market competitiveness.

| Sl No                | List of Exercises                                                                                                    | No of periods |
|----------------------|----------------------------------------------------------------------------------------------------------------------|---------------|
| 1                    | Design Thinking – models – Why design thinking? Case Studies. Innovation – 7Cs of Innovation. Identify a case study. | 4             |
| 2                    | Empathize – tools - customer Journey map – case studies – Empathize the identified case study                        | 4             |
| 3                    | Analyze – tools, multi-whys, case study, conflict of interest. Analyze the identified case study                     | 4             |
| 4                    | Ideate and solve – brainstorming – TRIZ method, trial and error method – Solve the identified case study             | 4             |
| 5                    | Prototype/process and test – tools and methods – create a prototype for the identified case study                    | 4             |
| 6                    | Iterate to improve the prototype/process – revisit the methods to improve the prototype.                             | 8             |
| 7                    | Submit the report and final prototype/process of the case study.                                                     | 2             |
| <b>Total Periods</b> |                                                                                                                      | <b>30</b>     |

**Text Books**

- 1 Pavan Soni, Design your thinking, Penguin Random House India Pvt, Ltd., India, 2022
- 2 Don Norman, The Desing of everyday things, Basic Books, New York, 2013

## Reference Books

- 1 B.K. Chakravarthy, Janaki Krishnamoorthi, Innovation by Design Lessons from Post Box Design & Development, Springer, New Delhi 2013
- 2 Balaramadurai, Karmic Design Thinking, 2020
- 3 Design by Innovation NPTEL Course B.K. Chakravarthy IIT Bombay  
<https://nptel.ac.in/courses/107101086>
- 4 Design Thinking and Innovation NPTEL Course Ravi Poovaiah, IIT Bombay  
[https://onlinecourses.swamyam2.ac.in/aic23\\_gel7/preview](https://onlinecourses.swamyam2.ac.in/aic23_gel7/preview)
- 5 Design Thinking A Premier NPTEL Course, Prof. Ashwin Mahalingam, Prof. Bala Ramadurai, IIT Madras [https://onlinecourses.nptel.ac.in/noc22\\_mg32/preview](https://onlinecourses.nptel.ac.in/noc22_mg32/preview)

## Course Outcomes

| CO  | At the end of the course, the students will be able to                            | Knowledge Level |
|-----|-----------------------------------------------------------------------------------|-----------------|
| CO1 | Apply the tools to empathize the identified case study                            | Applying        |
| CO2 | Analyze the data and information to conceptualize the solution for the case study | Analyzing       |
| CO3 | Ideate and solve the case study using appropriate tools                           | Applying        |
| CO4 | Create a prototype/process of the case study                                      | Creating        |
| CO5 | Iterate to improvise the prototype/process of the case study                      | Analyzing       |

## CO-PO/PSO Mapping

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1     | 2   | 2   |     |     | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    |      |
| CO2     | 2   | 2   |     |     | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    |      |
| CO3     | 2   | 2   |     |     | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    |      |
| CO4     | 2   | 2   |     |     | 2   | 2   | 2   | 2   | 2   | 2    | 2    |      | 3    |
| CO5     | 2   | 2   |     |     | 2   | 2   | 2   | 2   | 2   | 2    | 2    |      | 3    |
| Average | 2   | 2   |     |     | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 3    |

**CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

**B.E. Computer Science and Engineering**  
**Fourth Semester Syllabus**

| U24CS411                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | COMPUTER NETWORK ARCHITECTURE AND PROTOCOLS | L | T | P | C |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                             | 3 | 0 | 0 | 3 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>● To understand the protocol layering and physical level communication.</li><li>● To Apply data-link layer functions and protocols to configure and troubleshoot wired and wireless communication systems.</li><li>● To explore the functions of the network layer and the various routing protocols.</li><li>● To Implement and manage transport protocols to ensure reliable end-to-end communication services.</li><li>● To familiarize the application protocols for internet and network services.</li></ul> |                                             |   |   |   |   |

|                                                                                                                                                                                                                          |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Unit I-INTRODUCTION AND PHYSICAL LAYER</b>                                                                                                                                                                            | <b>9</b> |
| Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.                          |          |
| <b>Unit II-DATA-LINK LAYER</b>                                                                                                                                                                                           | <b>9</b> |
| Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices. |          |
| <b>Unit III-NETWORK LAYER</b>                                                                                                                                                                                            | <b>9</b> |
| Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP Distance Vector Routing-Link State Routing                                                                                           |          |
| <b>Unit IV-TRANSPORT LAYER</b>                                                                                                                                                                                           | <b>9</b> |
| Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.                                                                                      |          |
| <b>Unit V-APPLICATION LAYER</b>                                                                                                                                                                                          | <b>9</b> |
| WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP                                                                                                                                                                     |          |

**Total: 45 Periods**

**Text Books**

|   |                                                                                                                                           |
|---|-------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021. |
| 2 | William Stallings, Data and Computer Communications, 11th Edition, Pearson, 2022.                                                         |
| 3 | Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.                              |



**Reference Books**

|   |                                                                                                      |
|---|------------------------------------------------------------------------------------------------------|
| 1 | Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks" 6th Edition, Pearson, 2021.          |
| 2 | Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Sixth Edition, March 2021. |
| 3 | W. Richard Stevens, "TCP/IP Illustrated, Volume 1: The Protocols", Addison-Wesley, 2021.             |

**Web Recourses:**

1. <https://nptel.ac.in/courses/106/105/106105183>
2. <https://www.coursera.org/learn/computer-networking>
3. <https://www.edx.org/course/computer-networking-essentials>
4. <https://www.youtube.com/playlist?list=PLBlnK6fEyqRjD1KYvT6pgTZq-W4zYxT3i>
5. <https://www.geeksforgeeks.org/computer-network-tutorials/>

**Course Outcomes**

| CO  | At the end of the course, the students will be able to                                                                  | Knowledge Level |
|-----|-------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Explain the basic concepts of computer networks, protocol architectures, and physical layer technologies.               | Understanding   |
| CO2 | Apply data-link layer protocols and MAC techniques in both wired and wireless network environments.                     | Applying        |
| CO3 | Analyze IP addressing and network-layer protocols to evaluate efficient routing and communication strategies.           | Analyzing       |
| CO4 | Apply transport layer protocols to establish reliable and controlled end-to-end communication.                          | Applying        |
| CO5 | Apply application-layer protocols to support services such as web access, file transfer, email, and network monitoring. | Applying        |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 2   | -   | -   | 3   | -   | -   | 3   | 3   | -    | 3    | 3    | 2    |
| CO2  | 3   | 3   | -   | -   | 2   | -   | -   | 3   | 3   | -    | 3    | 2    | 2    |
| CO3  | 2   | 2   | -   | -   | 2   | -   | -   | 3   | 3   | -    | 3    | 2    | 2    |
| CO4  | 2   | 3   | -   | -   | 2   | -   | -   | 3   | 3   | -    | 3    | 2    | 3    |
| CO5  | 3   | 2   | -   | -   | 2   | -   | -   | 3   | 3   | -    | 3    | 3    | 2    |
| Avg. | 2.6 | 2.4 | -   | -   | 2.2 | -   | -   | 3   | 3   | -    | 3    | 2.4  | 2.2  |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24CS421 | DATABASE MANAGEMENT SYSTEMS<br>(Common to B. Tech AI&DS) | L | T | P | C |
|----------|----------------------------------------------------------|---|---|---|---|
|          |                                                          | 3 | 0 | 0 | 3 |

**Course Objective:**

- To introduce the fundamental concepts of database systems and help students model real-world data and relationships using Entity-Relationship (ER) diagrams.
- To develop the ability to formulate and solve data retrieval and manipulation problems using relational algebra and SQL, including complex query operations.
- To provide a strong foundation in database design by applying normalization techniques to eliminate data redundancy and update anomalies in relational databases.
- To explain the concepts of transaction management and concurrency control, enabling students to handle concurrent transactions and implement recovery mechanisms in database applications.
- To expose students to advanced database technologies, including distributed databases, NoSQL systems, and database security mechanisms, for building scalable and secure applications.

**UNIT – I INTRODUCTION TO DATABASE SYSTEMS 9**

Introduction to Databases– File System Vs Database System – Data Models – Schemas and Instances – DBMS Architecture – Centralized – Client Server – Database Applications–Entity-Relationship Model – Entity-Relationship Diagrams - Enhanced-ER Model

**UNIT-II - RELATIONAL DATABASES 9**

Relational Model – Constraints – Keys – Dependencies – Relational Algebra – Unary, Binary, Set and Extended Relational Algebra operations – SQL– Data Definition – Data Manipulation and Retrieval Queries – Nested Queries – Joins – Views– Cursors – Procedures – Functions – Triggers – Embedded and Dynamic SQL

**Unit III - Database Design 9**

Dependencies and Normal forms, - functional dependencies, 1NF, 2NF, 3NF and BCNF, 4NF, and 5NF, Domain Key Normal Form, Query processing and Query optimization

**Unit – IV – Transactions 9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm

**Unit V – Advanced Database concepts 9**

Distributed Databases-Architecture-Transaction Processing- XML Database - NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases- Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection

**Total Periods: 45**

**Text Books**

|   |                                                                                                                      |
|---|----------------------------------------------------------------------------------------------------------------------|
| 1 | Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, Tata McGraw Hill, 2019 |
| 2 | Ramez Elmasri and Navathe, "Fundamentals of Database Systems", 7th Ed., Pearson, 2021                                |

**Reference Books**

|   |                                                                                                                                                               |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | C. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", 8th ed, Pearson Education, 2006                                              |
| 2 | Andreas Meier, Michael Kaufmann, "SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management", 1st Edition 2019. |

**Online References**

1. <https://nptel.ac.in/courses/106105175>
2. [https://onlinecourses.nptel.ac.in/noc25\\_cs40/](https://onlinecourses.nptel.ac.in/noc25_cs40/)
3. <https://www.scaler.com/topics/course/dbms/>

**Course Outcomes**

| CO  | At the end of the course, the students will be able to                                                                                                                  | Knowledge Level |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply data and relationship among data of a real time application using ER model                                                                                        | Applying        |
| CO2 | Formulate solutions to a broad range of query problems using relational algebra/ SQL                                                                                    | Applying        |
| CO3 | Apply normalization theory to normalize the relations in RDBMS to avoid redundancy and anomalies                                                                        | Applying        |
| CO4 | Explain the impact and consequences of concurrent transactions, deadlock and their recovery in a realistic database application.                                        | Understanding   |
| CO5 | Describe advanced database concepts including distributed databases, NoSQL models, and database security techniques to design and manage scalable, secure data systems. | Understanding   |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 3   | 2   | 3   | 2   | -   | 2   | -   | 2    | 2    | 3    | 3    |
| CO2  | 3   | 3   | 3   | 2   | 3   | 2   | -   | 2   | -   | 2    | 2    | 3    | 3    |
| CO3  | 3   | 3   | 3   | 2   | 2   | 2   | -   | 2   | -   | 2    | 2    | 3    | 3    |
| CO4  | 3   | 2   | 2   | 2   | 2   | 2   | -   | 2   | -   | 2    | 2    | 3    | 3    |
| CO5  | 3   | 2   | 2   | 2   | 3   | 2   | -   | 2   | -   | 2    | 2    | 3    | 3    |
| Avg. | 3   | 2.6 | 2.6 | 2   | 2.6 | 2   | -   | 2   | -   | 2    | 2    | 3    | 3    |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24CS431 | THEORY OF COMPUTATION | L | T | P | C |
|----------|-----------------------|---|---|---|---|
|          |                       | 3 | 0 | 0 | 3 |

**Course Objective:**

- To understand the foundations of computation including automata theory
- To construct regular expressions for regular languages.
- To apply CFG for designing Push down automata
- To model the Turing machine and its variants.
- To analyze the undecidability of languages

|                                                                                                                                                                                                                                                                                                                               |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I-FINITE AUTOMATA</b>                                                                                                                                                                                                                                                                                                 | <b>9</b> |
| Automata theory- Need of automata theory - Introduction to formal proof – Additional forms of proof –Inductive Proofs- Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – NFA with Epsilon transitions – Equivalence of NFA ,DFA and Epsilon NFA – Minimization of DFA    |          |
| <b>UNIT II-REGULAR EXPRESSION AND REGULAR LANGUAGE</b>                                                                                                                                                                                                                                                                        | <b>9</b> |
| Regular Expression - Operators of regular expression –Building regular expression - Algebraic laws for Regular expressions - Regular expression to FA - DFA to Regular expression – Regular Language –Closure properties of regular language – Pumping Lemma for regular Languages                                            |          |
| <b>UNIT III-CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA</b>                                                                                                                                                                                                                                                                   | <b>9</b> |
| Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar– Derivations and Parse trees – Ambiguity in grammar–Context Free Language - Push Down Automata (PDA): Deterministic Pushdown Automata-Definition – Languages of pushdown automata- Moves - Instantaneous descriptions - CFG to PDA-PDA to CFG       |          |
| <b>UNIT IV-NORMAL FORMS AND TURING MACHINES</b>                                                                                                                                                                                                                                                                               | <b>9</b> |
| Normal forms for CFGs: Chomsky Normal Form- Greibach Normal Form – Closure properties of CFLs - Pumping lemma for CFLs-Turing Machine : Basic model - Definition and representation - Instantaneous Description - Language acceptance by TM - TM as Computer of Integer functions – Programming Techniques for Turing Machine |          |
| <b>UNIT V-UNDECIDABILITY</b>                                                                                                                                                                                                                                                                                                  | <b>9</b> |
| Unsolvable Problems and Computable Functions –PCP-MPCP- Recursive and recursively enumerable languages – Properties - Universal Turing machine -Tractable and Intractable problems- P and NP completeness – Kruskal's algorithm – Travelling Salesman Problem                                                                 |          |

**Total : 45 Periods**

### Text Books

|   |                                                                                                                                                      |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2008-Reprint |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------|



|   |                                                                                                                                              |
|---|----------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2 <sup>nd</sup> Edition, Prentice Hall of India, 2015. |
|---|----------------------------------------------------------------------------------------------------------------------------------------------|

**Reference Books**

|   |                                                                                                                                                           |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Peter Linz, "An Introduction to Formal Language and Automata", 7th Edition, Jones & Bartlett, 2023.                                                       |
| 2 | K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata Languages and Computation", 3rd Edition, Prentice Hall of India, 2010.-Reprint |

**Web Source References:**

|   |                                                                                                                                                               |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <a href="https://nptel.ac.in/courses/106104148">https://nptel.ac.in/courses/106104148</a>                                                                     |
| 2 | <a href="https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/">https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/</a> |
| 3 | <a href="https://www.edx.org/course/automata-theory">https://www.edx.org/course/automata-theory</a>                                                           |
| 4 | <a href="https://www.udemy.com/course/theory-of-computation-toc/">https://www.udemy.com/course/theory-of-computation-toc/</a>                                 |
| 5 | <a href="https://www.coursera.org/courses?query=theory%20of%20computation">https://www.coursera.org/courses?query=theory%20of%20computation</a>               |

**Course Outcomes**

| At the end of the course, the students will be able to |                                                                                                   |                 |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                          | Knowledge Level |
| CO1                                                    | Explain the fundamental concepts of automata theory, including formal proofs and finite automata. | Understanding   |
| CO2                                                    | Apply regular expressions for modeling finite automata                                            | Applying        |
| CO3                                                    | Apply context free grammar for modeling Pushdown Automata                                         | Applying        |
| CO4                                                    | Design Turing machine for computational functions                                                 | Applying        |
| CO5                                                    | Discuss about the undecidability of languages                                                     | Understanding   |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 3   | 3   |     |     |     |     |     |      | 3    |      | 2    |
| CO2  | 3   | 3   | 3   | 3   |     |     |     |     |     |      | 3    |      | 2    |
| CO3  | 3   | 3   | 3   | 3   |     |     |     |     |     |      | 3    |      | 2    |
| CO4  | 3   | 3   | 3   | 3   |     |     |     |     |     |      | 3    |      | 2    |
| CO5  | 3   | 3   | 3   | 3   |     |     |     |     |     |      | 3    |      | 2    |
| Avg. | 3   | 3   | 3   | 3   |     |     |     |     |     |      | 3    |      | 2    |



| U24CS441                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | DESIGN AND ANALYSIS OF ALGORITHM<br>(Common to B. Tech AI&DS) | L | T | P | C |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                               | 3 | 0 | 0 | 3 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>• Understand the fundamental concepts of algorithms and their efficiency analysis.</li><li>• Apply various algorithm design techniques across different paradigms.</li><li>• Develop skills to analyze and optimize algorithm performance in diverse scenarios.</li><li>• Evaluate the theoretical limitations of algorithmic approaches and computational power.</li><li>• Apply appropriate strategies for solving complex and hard computational problems.</li></ul> |                                                               |   |   |   |   |

**Unit I-INTRODUCTION 9**

Notion of an Algorithm–Fundamentals of Algorithmic Problem Solving–Important Problem Types–Fundamentals of the Analysis of Algorithm Efficiency–Analysis Framework-Asymptotic Notations and their properties – Empirical analysis - Mathematical analysis of Recursive and Non-recursive algorithms - Visualization

**Unit-II-BRUTE FORCE AND DIVIDE-AND-CONQUER 9**

Brute Force – String Matching-Exhaustive Search-Traveling Salesman- Problem-Knapsack Problem-Assignment problem. Divide and Conquer Methodology– Multiplication of Large Integers and Strassen’s Matrix Multiplication– Closest-Pair and Convex-Hull Problems. Decrease and Conquer- Topological Sorting – Transform and Conquer: Presorting – Heaps and Heap Sort.

**Unit-III-DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9**

Dynamic programming –Principle of optimality-Coin changing problem– Warshall’s and Floyd’s algorithms –Optimal Binary Search Trees – Multistage graph - Knapsack Problem and Memory functions. Greedy Technique – Dijkstra’s algorithm - Huffman Trees and codes – 0/1 Knapsack problem.

**Unit-IV-ITERATIVE IMPROVEMENT 9**

The Simplex Method-The Maximum-Flow Problem–Maximum Matching in Bipartite Graphs - The Stable marriage Problem

**Unit-V-BACKTRACKING AND BRANCH AND BOUND 9**

Lower – Bound Arguments - P, NP, NP-Complete and NP Hard Problems. Backtracking– N-Queen problem–Hamiltonian Circuit Problem - Subset Sum Problem. Branch and Bound –LIFO Search and FIFO search – Assignment Problem- Knapsack Problem–Traveling Salesman Problem.

**Total Periods: 45****Text Books**

|   |                                                                                                                     |
|---|---------------------------------------------------------------------------------------------------------------------|
| 1 | Anany Levitin, “Introduction to the Design and Analysis of Algorithms ”, 3 <sup>rd</sup> Edition, Pearson Education |
|---|---------------------------------------------------------------------------------------------------------------------|



**Reference Books**

|   |                                                                                                                                                                   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms / C++ ", Second Edition , Universities Press, 2019                                 |
| 2 | Thomas H Cormen, Charles ELeiserson, Ronald L Rivest , Clifford Stein, "Introduction to Algorithms", 4 <sup>th</sup> Edition, PHI Learning Private Limited, 2022. |
| 3 | Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2013.                                         |
| 4 | S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, Second Edition, 2023.                                                                   |

**Online References:**

- <https://nptel.ac.in/courses/106/101/106101060/>
- <https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/>
- <https://www.classcentral.com/course/swayam-design-and-analysis-of-algorithms-3984>
- <https://www.coursera.org/learn/analysis-of-algorithms>

**Course Outcomes**

| CO  | At the end of the course, the students will be able to                                               | Knowledge level |
|-----|------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply mathematical techniques to analyze the efficiency of recursive and non-recursive algorithms.   | Applying        |
| CO2 | Solve algorithmic problems using brute force, divide – and – conquer strategies.                     | Applying        |
| CO3 | Implement and apply dynamic programming and greedy techniques to develop efficient solutions.        | Applying        |
| CO4 | Employ iterative improvement methods to address optimization problems.                               | Applying        |
| CO5 | Apply backtracking and branch-and-bound techniques to solve problems with computational limitations. | Applying        |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 2   | 3   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO2  | 3   | 3   | 3   | 2   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO3  | 3   | 3   | 3   | 2   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO4  | 3   | 3   | 3   | 2   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| CO5  | 3   | 3   | 3   | 2   | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |
| Avg. | 3   | 3   | 2.8 | 2.2 | 2   |     |     | 2   | 2   |      | 3    | 3    | 3    |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2– Moderate (Medium), 1– Slight (Low)



|          |                            |   |   |   |   |
|----------|----------------------------|---|---|---|---|
| U24EM411 | APTITUDE AND REASONING – I | L | T | P | C |
|          |                            | 1 | 0 | 0 | 1 |

**Course Objective:**

- Enhance analytical and logical reasoning skills to solve problems efficiently.
- Strengthen understanding of basic arithmetic, algebra, geometry, and data interpretation.
- Train students to approach problems systematically and apply suitable techniques.
- Foster quick thinking and reduce error rates through practice and time-bound exercises.

**Syllabus**

| Topic titles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No of periods |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>Quantitative aptitude</b> <ul style="list-style-type: none"> <li>• Numbers: Number series, arithmetic progression, geometric progression</li> <li>• HCF and LCM: Highest common factor – split method, division method, Least Common Multiples – prime factor method, division method.</li> <li>• Simplification – BODMAS rule</li> <li>• Average and Percentage</li> <li>• Simple and Compound Interest</li> <li>• Profit, loss and discounts</li> <li>• Ratio and proportion: Ratio – compound ratio, inverse ratio. Proportion – direct proportion, inverse proportion</li> <li>• Mixture and alligation: Mixture, alligation, mean concentration</li> <li>• Problems based on ages</li> <li>• Partnerships: Simple partnership, compound partnership</li> </ul> | 20            |
| <b>Reasoning:</b> <ul style="list-style-type: none"> <li>• Number series and letter series</li> <li>• Odd one out</li> <li>• Coding and decoding</li> <li>• Missing characters/numbers and analogies</li> <li>• Blood relations problems</li> <li>• Direction sense tests</li> <li>• Sequencing and ranking test</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10            |

**References**

|   |                                                                                                                           |
|---|---------------------------------------------------------------------------------------------------------------------------|
| 1 | R.V. Praveen, “Quantitative Aptitude and Reasoning”, 3rd Edition , Eastern Economy Edition, PHI Learning, New Delhi, 2016 |
| 2 | Dr. R.S. Aggarwal, “ Quantitative Aptitude”, S Chand Publishing, New Delhi 2017                                           |
| 3 | Dr. R.S. Aggarwal, “A Modern Approach to Verbal & Non-Verbal Reasoning”, S Chand Publishing, New Delhi 2017               |



|   |                                                                             |
|---|-----------------------------------------------------------------------------|
| 4 | <a href="https://www.indiabix.com/">https://www.indiabix.com/</a>           |
| 5 | <a href="https://www.geeksforgeeks.org/">https://www.geeksforgeeks.org/</a> |
| 6 | <a href="https://faceprep.in/">https://faceprep.in/</a>                     |
| 7 | <a href="https://prepinsta.com/">https://prepinsta.com/</a>                 |
| 8 | <a href="https://www.javatpoint.com/">https://www.javatpoint.com/</a>       |

### Course Outcomes

| At the end of the course, the students will be able to |                                                                                                                          |                 |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                                                 | Knowledge Level |
| CO1                                                    | Solve quantitative aptitude problems involving arithmetic, algebra, percentages, ratios, etc., using logical approaches. | Applying        |
| CO2                                                    | Analyze problems and apply reasoning strategies such as deduction, inference, and pattern recognition.                   | Analysing       |
| CO3                                                    | Solve problems in simple and compound interest, profit, loss and discount                                                | Applying        |
| CO4                                                    | Solve problems based on ages and partnership                                                                             | Applying        |
| CO5                                                    | Demonstrate improved performance in time-bound aptitude tests through consistent practice.                               | Applying        |

### CO-PO/PSO Mapping

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO2  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO3  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO4  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO5  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| Avg. |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |

For CO-PO/PSO Mapping: 3 – Substantial (High), 2– Moderate (Medium), 1– Slight (Low)



| U24CS453                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | WEB TECHNOLOGIES<br>(Common to B. Tech AI&DS) | L | T | P | C |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                               | 1 | 0 | 4 | 3 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>• Develop structured web pages using HTML5 and CSS 3 by incorporating control elements</li><li>• Understand and apply modern client-side technologies</li><li>• Develop basic server-side web applications that integrate front-end forms with back-end processing</li><li>• Develop PHP applications that interact with XML in web systems</li><li>• Develop web application using frameworks and tool</li></ul> |                                               |   |   |   |   |

**Unit I-WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0**

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

**Unit II-CLIENT SIDE PROGRAMMING**

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling- Validation-Built-in-objects-Event Handling- DHTML with JavaScript, JQuery introduction- JSON introduction.

**Unit III-SERVER SIDE PROGRAMMING**

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies and End points concepts - DATABASE CONNECTIVITY: JDBC.

**Unit IV-PHP and XML**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL.

**Unit V-INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS**

Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Forms, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django, UI & UX.

**Total :15 Periods**

| Practical – List of experiments |                                                                                                                                                                                                                                                                                                                              |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                               | Design an interactive web page for a travel agency using HTML image maps. Embed a world map image and define hot spots on specific countries. When each hot spot is clicked, display related information such as tourist attractions or travel packages for that country.                                                    |
| 2                               | Design a personal web page to showcase profile, hobbies, and contact information. To demonstrate your understanding of web design principles, create the web page using inline, internal, and external CSS styles. Ensure that each type of CSS is clearly applied and visually reflected in different sections of the page. |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Design an online registration form for a student portal. The form should validate user inputs such as name, email, password, and mobile number on the client side using DHTML (JavaScript + HTML + CSS). Create a dynamic web page that displays real-time validation feedback without reloading the page.             |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | You have joined as a trainee web administrator at a software company. Your first task is to set up an Apache Tomcat web server on a Windows/Linux system to deploy Java-based web applications. Document the complete installation steps, configuration process, and how to verify the server is running successfully. |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Develop a college portal using Java Servlets.<br>i) Create a web application where users can submit data through an HTML form, and the data should be processed using a Servlet.<br>ii) implement session tracking to maintain user information (like username or login status) across multiple pages.                 |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Design and implement a three-tier web application using Java, JSP, and a MySQL database to conduct an online examination. The application should include features for student login, question retrieval, answer submission, and result generation.                                                                     |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Develop a dynamic website using PHP for a small business. The site should handle form submissions, perform server-side validation, and interact with a MySQL database to store user data. Create and test PHP programs that demonstrate these features effectively.                                                    |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Design a data exchange format for a college admission system. Use XML to store student data, define the structure using XML Schema (XSD), and format the output using XSLT. Demonstrate how XML and XSLT can be used to separate data from presentation and ensure validation through schema.                          |
| <b>Total : 60</b><br><b>Total: 15 +60 =75</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                        |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>1. Internet and World Wide Web: How to Program by Paul Deitel, Harvey Deitel, and Abbey Deitel 5th Edition, Pearson , 2021</li> <li>2. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing.</li> <li>3. Uttam K.Roy, “Web Technologies”, Oxford University Press, 2011.</li> <li>4. Learning Angular – 3rd Edition by Aristeidis Bampakos &amp; Pablo Deeelman , 2020</li> </ol> |                                                                                                                                                                                                                                                                                                                        |

**Reference Books**

1. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2017
2. Stephen Wynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition, 1999
3. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2011.
4. Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1st edition, O'Reilly

**Web Resources :**

1. <https://developer.mozilla.org/en-US/>
2. <https://www.freecodecamp.org/>



| <b>Course Outcomes: At the end of the course, the students will be able to</b> |                                                                                                                             |                        |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>CO</b>                                                                      | <b>Course Outcome Statement</b>                                                                                             | <b>Knowledge Level</b> |
| <b>CO1</b>                                                                     | Construct a basic website using HTML and Cascading Style Sheets                                                             | Applying               |
| <b>CO2</b>                                                                     | Construct a dynamic web page with validation using Java Script objects and by applying different event handling mechanisms. | Applying               |
| <b>CO3</b>                                                                     | Develop server side programs using Servlets and JSP                                                                         | Applying               |
| <b>CO4</b>                                                                     | Construct simple web pages in PHP and to represent data in XML format.                                                      | Applying               |
| <b>CO5</b>                                                                     | Develop interactive web applications                                                                                        | Applying               |

**CO PO MAPPING**

| CO         | PO1      | PO2        | PO3        | PO4      | PO5        | PO6        | PO7        | PO8      | PO9        | PO10       | PO11     | PSO1       | PSO2     |
|------------|----------|------------|------------|----------|------------|------------|------------|----------|------------|------------|----------|------------|----------|
| <b>CO1</b> | 3        | 2          | 3          | 3        | 3          | 3          | 3          | 2        | 3          | 3          | 3        | 3          | 3        |
| <b>CO2</b> | 3        | 2          | 2          | 3        | 2          | 3          | 3          | 2        | 3          | 2          | 3        | 3          | 3        |
| <b>CO3</b> | 3        | 3          | 3          | 3        | 3          | 2          | 3          | 2        | 2          | 3          | 3        | 2          | 3        |
| <b>CO4</b> | 3        | 3          | 3          | 3        | 2          | 2          | 2          | 2        | 3          | 3          | 3        | 2          | 3        |
| <b>CO5</b> | 3        | 2          | 3          | 3        | 2          | 2          | 2          | 2        | 2          | 3          | 3        | 3          | 3        |
| <b>Ave</b> | <b>3</b> | <b>2.4</b> | <b>2.8</b> | <b>3</b> | <b>2.4</b> | <b>2.4</b> | <b>2.6</b> | <b>2</b> | <b>2.6</b> | <b>2.8</b> | <b>3</b> | <b>2.6</b> | <b>3</b> |

**For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)**



|          |                                                                                       |          |          |          |          |
|----------|---------------------------------------------------------------------------------------|----------|----------|----------|----------|
| U24CS462 | <b>DATABASE MANAGEMENT SYSTEMS LABORATORY</b><br><b>(Common to B. Tech AI&amp;DS)</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|          |                                                                                       | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

**Course Objective:**

- To enable students to understand and use SQL commands for data definition, manipulation, and control to manage database tables effectively.
- To train students in writing SQL queries, including simple, nested, and join queries with aggregate functions, for efficient data retrieval and report generation.
- To introduce techniques for optimizing and simplifying database access, **including** the creation and use of Views, Indexes, and Synonyms for real-time applications and reporting.
- To expose students to advanced SQL features, such as stored procedures, functions, triggers, and exception handling, and demonstrate how to integrate them within applications.
- To provide practical knowledge in developing GUI-based database applications, enabling real-time interaction with backend databases.

**List of experiments**

1. Create a database to manage student admissions. Design SQL tables using Data Definition Language (DDL) commands with appropriate integrity constraints like PRIMARY KEY, FOREIGN KEY, NOT NULL, and UNIQUE. Ensure data consistency and relational integrity among Student, Department, and Course tables.
2. Write DML queries to perform data manipulation by inserting new student details, update their phone number, address based on student request, and delete records of students those who have graduated.
3. Demonstrate the use of DCL (GRANT, REVOKE) and TCL (COMMIT, ROLLBACK, SAVEPOINT) to manage permissions and control transactions effectively in the students' management system.
4. Write SQL queries to retrieve required information using simple queries, nested queries, subqueries, and different types of joins for the student management reports. Demonstrate how each query type helps in fetching meaningful data for academic analysis and reporting.
5. Write SQL queries using aggregation operators (like SUM, AVG, MAX, MIN, COUNT) to summarize students' marks and use GROUP BY to group results by department or subject, and apply ORDER BY to display the results in a meaningful order. Generate reports such as average marks per department, highest marks in each subject, and total number of students per batch.
6. A college database manages student records, admission numbers, and frequently accessed data from multiple tables. To improve performance and simplify access, create indexes for tables, implement Views for reporting, and Synonyms to simplify object names. Demonstrate the creation and usage of Views, indexes, and Synonyms in this scenario with appropriate SQL queries.
7. Write simple PL/SQL programs to automate repetitive database operations like inserting records, validating student marks, and calculating totals using conditional and loop constructs. Create and test PL/SQL blocks using variables, IF conditions, and loops to perform basic database tasks.



8. Create stored procedures to calculate total and average marks and a function to determine the result status (Pass/Fail) for students' academic assessment system. Demonstrate the use of both procedures and functions with sample data.
9. Create SQL triggers for the automatic update of student's arrear count status based on end semester results.
10. Implement exception handling to ensure that the test marks should be between 0 and 100 else catch and handle these errors gracefully without crashing.
11. Create an XML-based database to store student details such as name, roll number, department, and email. Design the XML file and validate it using an appropriate XML Schema Definition (XSD) to ensure data integrity. Ensure the XML follows the correct structure and all fields meet the defined constraints.
12. Develop a student record system for a training institute. The system must store data such as student name, course, contact info, and enrollment status using a NoSQL database like MongoDB. Design and create a simple NoSQL database with appropriate collections and insert sample documents to represent at least 5 students.
13. Develop a simple GUI based database application and incorporate all the above-mentioned features
  - a. Inventory management system
  - b. Library Management system
  - c. Ticket reservation system
  - d. Food ordering system
  - e. Examination registration system

#### Course Outcomes:

| CO  | Course Outcome Statement                                                                                                                                        | Knowledge Level |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply SQL data definition, manipulation, and control commands to create, manage, and maintain relational database tables                                        | Applying        |
| CO2 | Perform efficient data retrieval operations using Views, simple, nested, and join queries, along with aggregate functions to generate meaningful reports.       | Applying        |
| CO3 | Optimize and simplify database access in real-time applications by creating and using Views, Indexes, and Synonyms for better performance and easier reporting. | Applying        |
| CO4 | Develop and use advanced SQL features, such as stored procedures, functions, triggers, and exception handling, and integrate them within database applications. | Applying        |
| CO5 | Design and develop GUI-based applications that interact with relational databases for real-time data operations and user interface integration.                 | Applying        |

#### CO – PO MAPPING

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 3    | 3    | 3    | 3    |
| CO2 | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 3    | 3    | 3    | 3    |
| CO3 | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 3    | 3    | 3    | 3    |
| CO4 | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 3    | 3    | 3    | 3    |
| CO5 | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 3    | 3    | 3    | 3    |
| Ave | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 3    | 3    | 3    | 3    |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24CS472                                                                                                                                                                                                                                                                                                                                                                     | NETWORKS LABORATORY | L | T | P | C |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                              |                     | 0 | 0 | 4 | 2 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>● To Evaluate the behavior of various communication protocols across different network scenarios.</li><li>● To Compare routing algorithms based on performance metrics and design principles.</li><li>● To Interpret network simulation results to assess topology design and protocol performance.</li></ul> |                     |   |   |   |   |

| Sl. No                   | List of experiments                                                                                                                                                                                                                                                                                                   |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                        | Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.                                                                                                                                                      |
| 2                        | Examine how a basic HTTP web client uses TCP sockets to connect to a server, send a GET request, and receive a web page. Understand the role of TCP in reliable data transfer, the structure of HTTP messages, and how socket programming enables low-level web communication.                                        |
| 3                        | Analyze the use of TCP sockets in implementing network applications such as an a)Echo Client-Server b)Chat system. Understand how TCP ensures reliable, bidirectional communication, and examine how socket programming enables message transmission, reception, and real-time interaction between networked systems. |
| 4                        | Explore the simulation of a Domain Name System (DNS) using UDP sockets, focusing on how hostname-to-IP resolution is performed. Understand the role of UDP in connectionless communication and evaluate how socket programming is used to replicate DNS query-response behavior.                                      |
| 5                        | Classify network traffic by capturing packets using a tool like Wireshark. Understand the structure of various protocol headers (such as TCP, UDP, IP, and HTTP) and evaluate how data is transmitted across networks by interpreting packet-level information.                                                       |
| 6                        | Compare the simulation of ARP and RARP protocols to understand how IP addresses are mapped to MAC addresses and vice versa. Evaluate the role of these protocols in network layer communication and examine how socket programming or data structures can be used to mimic address resolution behavior.               |
| 7                        | Analyze and study the network behavior under different congestion scenarios using Network Simulator tools.                                                                                                                                                                                                            |
| 8                        | Compare and study the performance characteristics of TCP and UDP protocols under various network conditions through simulation.                                                                                                                                                                                       |
| 9                        | Distinguish the simulation of Distance Vector and Link State routing algorithms to understand how routing tables are built and updated in a network. Evaluate the efficiency, convergence behavior, and information exchange mechanisms used in dynamic routing protocols.                                            |
| 10                       | Analyze the simulation of an error detection and correction mechanism such as Cyclic Redundancy Check (CRC). Understand how redundancy bits are used to detect transmission errors and evaluate the effectiveness of CRC in ensuring data integrity during communication.                                             |
| <b>Total :60 Periods</b> |                                                                                                                                                                                                                                                                                                                       |



**Course Outcomes:**

| CO  | At the end of the course, the students will be able to                                                          | Knowledge Level |
|-----|-----------------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Apply the basic network diagnostic tools and protocol analysers to examine network behavior.                    | Applying        |
| CO2 | Develop socket-based network applications using TCP and UDP protocols for client-server communication.          | Analysing       |
| CO3 | Simulate core networking protocols and services like DNS, ARP/RARP using programming construct                  | Analysing       |
| CO4 | Analyze routing and congestion control mechanisms through simulation tools like NS2                             | Analysing       |
| CO5 | Evaluate error detection and correction techniques and protocol performance through experiments and simulation. | Analysing       |

**Text Books:**

1. Computer Networks, Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education /PHI 2021

**Reference Books:**

1. .Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022

**CO-PO/PSO Mapping**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | 2   | 2   | 2   | 2   | 3   | -   | -   | 2   | 2   | 2    | 2    | 2    | 2    |
| CO2 | 3   | 2   | 2   | 2   | 3   | -   | -   | 2   | 2   | 2    | 2    | 3    | 3    |
| CO3 | 3   | 2   | 2   | 2   | 3   | -   | -   | 2   | 2   | 2    | 2    | 3    | 3    |
| CO4 | 2   | 3   | 3   | 3   | 3   | -   | -   | 2   | 2   | 2    | 3    | 3    | 3    |
| CO5 | 2   | 3   | 2   | 2   | 2   | -   | -   | 2   | 2   | 2    | 2    | 2    | 2    |
| Ave | 2.4 | 2.4 | 2.2 | 2.2 | 2.8 | -   | -   | 2   | 2   | 2    | 2.2  | 2.6  | 2.6  |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24CS482                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | DESIGN AND ANALYSIS OF ALGORITHMS<br>LABORATORY<br>(Common to B.Tech. AI & DS)                                                                                                                                                                                                                                                                                                                                                                                                                                             | L | T | P | C |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0 | 0 | 4 | 2 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>• Apply algorithmic techniques to solve computational problems using recursion and non-recursive methods.</li><li>• Apply divide-and-conquer, decrease-and-conquer, and transform-and-conquer strategies to develop efficient solutions for standard algorithmic problems.</li><li>• Apply dynamic programming and greedy techniques to design solutions for optimization problems.</li><li>• Apply iterative improvement methods such as the Simplex Method to model and solve real-world optimization scenarios.</li><li>• Apply backtracking and branch-and-bound techniques to solve combinatorial and computationally hard problems.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |   |   |   |
| S. No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | List of Experiments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |   |   |   |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Develop a Python program that implements both recursive and non-recursive versions of factorial and Fibonacci algorithms. Compare their execution times and demonstrate how computational growth progresses from $O(\log n)$ to $O(n!)$ , helping analysts understand algorithmic efficiency and scalability in real-world data processing.                                                                                                                                                                                |   |   |   |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Create a Python program that multiplies two matrices using Strassen’s Algorithm (Divide and Conquer method). Compare its execution time with the standard matrix multiplication approach to determine which is more efficient for large image or data matrix                                                                                                                                                                                                                                                               |   |   |   |   |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Write a Python program that accepts a Directed Acyclic Graph (DAG) representing task dependencies and produces a topological ordering of tasks using the DFS algorithm. Demonstrate how this approach ensures proper task scheduling without violating dependencies.                                                                                                                                                                                                                                                       |   |   |   |   |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Develop a Python program that sorts a list of integers (e.g., product prices or student marks) using Heap Sort (Transform and Conquer method). Allow the user to visualize the heap construction process and the sorted output, illustrating how sorting algorithms enhance search efficiency in real-world applications.                                                                                                                                                                                                  |   |   |   |   |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Develop a Python program using Dynamic Programming to solve the following optimization problems:<br>(i) Coin Change Problem – Compute the minimum number of coins required to make a given amount (e.g., optimizing ATM withdrawal denominations).<br>(ii) Floyd’s Algorithm – Find shortest paths between all pairs of cities in a transportation network.<br>(iii) Knapsack Problem – Maximize total profit/value of selected items under a given budget or weight constraint (e.g., investment portfolio optimization). |   |   |   |   |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Develop a Python program using the Greedy Technique to solve the following problems:<br>(i) Dijkstra’s Algorithm – Determine the shortest route from a source city to all other cities in a transportation or logistics network.<br>(ii) Huffman Coding – Implement data compression for transmitting large files efficiently, displaying the generated Huffman Tree and encoded values.<br>The program should allow the user to input data and visualize the results.                                                     |   |   |   |   |



|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 | Develop a Python program using the Simplex Method to solve a real-world production optimization problem. For example, a factory producing two types of products wants to maximize profit while considering constraints on labor hours and raw materials. The program should allow the user to input the objective function and constraints, and display step-by-step tableau iterations leading to the optimal production plan.                                                                                                                                                                                                                                                                                                    |
| 8 | Develop a Python program using the Backtracking technique to solve the following problems that simulate real-world game and puzzle logic generation:<br>(i) N-Queen Problem – Display all possible safe arrangements of N queens on an N×N chessboard, ensuring that no two queens attack each other. (This mimics the decision-making process in chess AI for positioning pieces safely.)<br>(ii) Subset Sum Problem – Display all subsets of a given set that sum up to a target value. (This is useful for designing puzzle games or scenarios involving optimal subset selection, such as matching resources or scores.)<br>The program should allow user input for each problem and display all valid configurations clearly. |
| 9 | Develop a Python program using Branch and Bound to solve the following problems:<br>(i) Assignment Problem – Assign workers to tasks so that the total cost is minimized (applicable in workforce scheduling).<br>(ii) Traveling Salesman Problem (TSP) – Determine the optimal route for a delivery truck visiting multiple cities exactly once with minimum total distance.<br>The program should take user input for costs or distances and clearly display the optimal path and total cost.                                                                                                                                                                                                                                    |

### Course Outcomes

| CO  | Course Outcome Statement                                                                                                                             | Knowledge Level |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO1 | Develop Python programs implementing recursive and non-recursive algorithms and compare their efficiency in terms of execution time and space usage. | Applying        |
| CO2 | Apply brute-force, divide-and-conquer, decrease-and-conquer, and transform-and-conquer techniques to solve standard algorithmic problems.            | Applying        |
| CO3 | Apply dynamic programming and greedy techniques to solve optimization problems efficiently.                                                          | Applying        |
| CO4 | Apply iterative improvement methods to develop solutions for real-world optimization scenarios.                                                      | Applying        |
| CO5 | Implement backtracking and branch-and-bound to handle problems with computational limitations or intractability.                                     | Applying        |

### CO-PO/PSO Mapping

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 2   | 3   | 2    | 3    |      |      |
| CO2 | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 2   | 3   | 2    | 3    |      |      |
| CO3 | 3   | 3   | 3   | 3   | 2   | 2   | 2   | 2   | 3   | 2    | 3    |      |      |
| CO4 | 3   | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 3   | 2    | 3    |      |      |
| CO5 | 3   | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 3   | 2    | 3    |      |      |

For CO-PO/PSO Mapping: 3 – Substantial (High), 2– Moderate (Medium), 1– Slight (Low)



| U24EM422                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SOFT SKILLS AND PERSONALITY DEVELOPMENT – I | L | T | P | C |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                             | 0 | 0 | 2 | 1 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>• To understand and interpret human perception and behavior, enhancing interpersonal awareness.</li><li>• To enhance self-management, including habit formation, stress regulation, and personal productivity</li><li>• Develop conflict-resolution skills, aiming for win-win outcomes through structured strategies.</li><li>• Strengthen communication abilities—active listening, telephone etiquette, and overcoming listening barriers.</li></ul> |                                             |   |   |   |   |

**List of Exercises**

| Sl. No.                  | List of Exercises                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------------------------|
| 1                        | Introduction: A New Approach to Learning, Planning and Goal-Setting                                     |
| 2                        | Human Perceptions: Understanding People                                                                 |
| 3                        | Aiming for Excellence: Developing Potential and Self-Actualisation                                      |
| 4                        | Self-Management Skills- Time management & Self-motivation                                               |
| 5                        | Self-Management Skills- Stress management & Adaptability                                                |
| 6                        | Conflict Resolution Skills                                                                              |
| 7                        | Using The Zeigarnik Effect for Productivity and Personal Growth, Forming Habits of Success              |
| 8                        | Communication: Significance of Listening, Active Listening, Barriers to Active Listening                |
| 9                        | Telephone Communication: Basic Telephone Skills, Advanced Telephone Skills , Essential Telephone Skills |
| 10                       | Profile Building                                                                                        |
| <b>Total Periods: 30</b> |                                                                                                         |

**Text Books**

|   |                                                                                                                                                           |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.                                                                             |
| 2 | Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013. |

**Reference Books**

|   |                                                                                                                   |
|---|-------------------------------------------------------------------------------------------------------------------|
| 1 | Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007. |
| 2 | Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.    |



**Course Outcomes**

| At the end of the course, the students will be able to |                                                                                                     |                 |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                            | Knowledge Level |
| CO1                                                    | Develop an actionable growth plan aligning self-development with objectives.                        | Applying        |
| CO2                                                    | Analyze the habit loop; design personal interventions to break bad habits.                          | Analysing       |
| CO3                                                    | Analyze examples of interpersonal conflict, propose dual solutions using conflict-model frameworks. | Analysing       |
| CO4                                                    | Apply stress-management strategies: reframing, planning, relaxation exercises.                      | Applying        |
| CO5                                                    | Apply techniques to rectify the barriers in active listening                                        | Applying        |

**CO-PO/PSO Mapping**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO2  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO3  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO4  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO5  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| Avg. |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



**SYLLABUS SEMESTER V**

| U24CS511 | MOBILE COMPUTING | L | T | P | C |
|----------|------------------|---|---|---|---|
|          |                  | 3 | 0 | 0 | 3 |

**Course Objective:**

- To Understand the basics of mobile computing and evolution of wireless technologies.
- To Learn the architecture and services of LTE and 5G mobile communication systems.
- To Understand mobile network protocols and routing in ad hoc and IoT networks.
- To Learn transport and application layer concepts, including cloud and mobile application security.
- To Develop basic knowledge of mobile platforms, app development, and modern tools like Kotlin and Flutter.

**Detailed Syllabus**

|                                                                                                                                                                                                                                                                                                                                                                      |          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I: INTRODUCTION TO MOBILE COMPUTING</b>                                                                                                                                                                                                                                                                                                                      | <b>9</b> |
| Introduction to Mobile Computing – Applications of Mobile Computing – Evolution of Mobile Communication Technologies (1G to 6G) – Multiple Access Techniques: SDMA, TDMA, FDMA, CDMA, OFDMA – Spread Spectrum – MAC Protocols – 5G NR Overview and Emerging 6G Trends – Spectrum Bands (Sub-6 GHz, mmWave).                                                          |          |
| <b>UNIT II: MOBILE TELECOMMUNICATION SYSTEMS</b>                                                                                                                                                                                                                                                                                                                     | <b>9</b> |
| Introduction to Cellular Systems – LTE Architecture – 5G System Architecture – Services: eMBB, URLLC, mMTC – Protocol Stack – Handover and Roaming in Cellular Networks – Frequency Allocation – Routing – Mobility Management – Security in LTE and 5G – Network Slicing – Edge Computing.                                                                          |          |
| <b>UNIT III: MOBILE NETWORK LAYER</b>                                                                                                                                                                                                                                                                                                                                | <b>9</b> |
| Mobile IP – DHCP – Ad Hoc Networks – MANET, VANET, FANET – Proactive Routing Protocols: DSDV, OLSR – Reactive Routing Protocols: DSR, AODV – Hybrid Routing: ZRP – Multicast Routing: ODMRP – IoT Networking: NB-IoT, LoRaWAN – Security Issues                                                                                                                      |          |
| <b>UNIT IV: MOBILE TRANSPORT AND APPLICATION LAYER</b>                                                                                                                                                                                                                                                                                                               | <b>9</b> |
| Mobile TCP – QUIC – HTTP/2 and HTTP/3 – REST APIs – Cloud-based Mobile Applications – Content Delivery Networks – Edge Computing – Mobile Streaming – Application Layer Security: OAuth, JWT, HTTPS.                                                                                                                                                                 |          |
| <b>UNIT V: MOBILE PLATFORMS AND APPLICATIONS</b>                                                                                                                                                                                                                                                                                                                     | <b>9</b> |
| Mobile Device Operating Systems – Android and iOS Architecture – Mobile App Development Models: Native, Hybrid, Progressive Web Apps – Mobile Development Platforms: Kotlin for Android Development, Flutter for Cross – Platform Development – UI/UX Principles – M-Commerce – Digital Payment Systems: UPI, NFC – Mobile App Security – AI in Mobile Applications. |          |
| <b>Total Periods:45</b>                                                                                                                                                                                                                                                                                                                                              |          |



## Learning Resources

|   |                                                                                                                                                                                          |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Jochen Schiller, —Mobile communications, 2nd Edition, Pearson Education, 2013                                                                                                            |
| 2 | William Stallings, —Wireless Communications and Networks, 2nd Edition, Pearson.2020                                                                                                      |
| 3 | Rappaport, Wireless Communications – Principles and Practice, Pearson.2011                                                                                                               |
| 4 | Misra & Woungang, Guide to Wireless Ad Hoc Networks, Springer.2009                                                                                                                       |
| 5 | 3GPP (3rd Generation Partnership Project) – Official standards for LTE and 5G.<br><a href="https://www.3gpp.org">https://www.3gpp.org</a>                                                |
| 6 | Cisco Networking Academy – Wireless & Mobile Networks. <a href="https://www.netacad.com">https://www.netacad.com</a>                                                                     |
| 7 | Mobile Computing / Wireless Communication Courses, Prof. Ranjan Bose, IIT- Delhi , NPTEL.<br><a href="https://nptel.ac.in/courses/117102062">https://nptel.ac.in/courses/117102062</a> . |

## Course Outcomes

| At the end of the course, the students will be able to |                                                                                                                 |                 |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                                        | Knowledge Level |
| CO1                                                    | Understand the fundamentals of mobile computing, wireless technologies (1G–6G), and multiple access techniques. | Understand      |
| CO2                                                    | Apply LTE and 5G architectures, services, and mobility management techniques.                                   | Apply           |
| CO3                                                    | Apply mobile network layer protocols and routing techniques in ad hoc and IoT networks.                         | Apply           |
| CO4                                                    | Analyze transport and application layer protocols, cloud integration, and mobile security mechanisms.           | Analyze         |
| CO5                                                    | Apply mobile applications using modern platforms and frameworks like Android, Kotlin, and Flutter.              | Apply           |

## Course Articulation Matrix

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 2   | 2   | -   | 2   | -   | -   | -   | -   | -    | 2    | 3    | 3    |
| CO2  | 3   | 2   | 2   | -   | 2   | -   | -   | -   | -   | -    | 2    | 3    | 3    |
| CO3  | 3   | 3   | 2   | -   | 2   | -   | -   | -   | -   | -    | 2    | 3    | 3    |
| CO4  | 2   | 3   | 2   | -   | 3   | -   | -   | -   | -   | -    | 2    | 3    | 3    |
| CO5  | 2   | 2   | 3   | -   | 3   | -   | -   | -   | -   | -    | 2    | 3    | 3    |
| Avg. | 2.6 | 2.4 | 2.2 |     | 2.2 |     |     |     |     |      | 2    | 3    | 3    |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24CS521                                                                                                                                                                                                                                                                                                                                                                            | COMPILER DESIGN | L | T | P | C |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                     |                 | 3 | 0 | 0 | 3 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>• To learn the various phases of compiler.</li><li>• To impart knowledge on various parsing techniques.</li><li>• To understand intermediate code generation and run-time environment</li><li>• To make the students effectively generate machine code.</li><li>• To learn to implement code optimization.</li></ul> |                 |   |   |   |   |

### Detailed Syllabus

|                                                                                                                                                                                                                                                                                                                                           |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>UNIT I: INTRODUCTION TO COMPILERS &amp; LEXICAL ANALYSIS</b>                                                                                                                                                                                                                                                                           | <b>8</b>  |
| Introduction – Translators – Compilation and Interpretation – Language processors – The Phases of Compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Language for Specifying Lexical Analyzers – Lex tool.                                                      |           |
| <b>UNIT II: SYNTAX ANALYSIS</b>                                                                                                                                                                                                                                                                                                           | <b>11</b> |
| Role of Parser – Grammars – Context-free grammars – Writing a grammar – Top-Down Parsing – General Strategies – Recursive Descent Parser – LL(1) – Predictive Parser – Bottom up parsing – Shift Reduce Parser – LR Parsers – SLR Parser – Canonical LR Parser – LALR Parser - Error Handling and Recovery in Syntax Analyzer – YACC tool |           |
| <b>UNIT III: SYNTAX DIRECTED TRANSLATION &amp; INTERMEDIATE CODE GENERATION</b>                                                                                                                                                                                                                                                           | <b>9</b>  |
| Syntax directed Definitions- Evaluation order for syntax directed definitions-Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Back patching                                                                                                                   |           |
| <b>UNIT IV: RUN-TIME ENVIRONMENT AND CODE GENERATION</b>                                                                                                                                                                                                                                                                                  | <b>9</b>  |
| Runtime Environments – source language issues – Storage organization – Storage Allocation Strategies: Static, Stack and Heap allocation – Issues in the Design of a code generator – Basic Blocks and Flow graphs – Design of a simple Code Generator – Optimal Code Generation for Expressions.                                          |           |
| <b>UNIT V: CODE OPTIMIZATION</b>                                                                                                                                                                                                                                                                                                          | <b>8</b>  |
| Principal Sources of Optimization – Peep-hole optimization – DAG – Optimization of Basic Blocks – Global Data Flow Analysis – Efficient Data Flow Algorithm – Recent trends in Compiler Design.                                                                                                                                           |           |
| <b>Total Periods:45</b>                                                                                                                                                                                                                                                                                                                   |           |

### Learning Resources:

|   |                                                                                                                                                  |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Updated 2e, Pearson Education, 2023. |
| 2 | Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, Reprint 2004   |



|   |                                                                                                                                                               |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2007.                   |
| 4 | Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 3rd edition 2022.                                      |
| 5 | V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, Reprint 2017                                                               |
| 6 | Allen I. Holub, Compiler Design in C, Prentice-Hall Software Series, Reprint 1993                                                                             |
| 7 | "Compiler Design", Prof. Sanjeev K Aggarwal, IIT Kanpur, NPTEL<br><a href="https://nptel.ac.in/courses/106104072">"https://nptel.ac.in/courses/106104072"</a> |
| 8 | <a href="https://www.geeksforgeeks.org/compiler-design-tutorials/">https://www.geeksforgeeks.org/compiler-design-tutorials/</a>                               |
| 9 | <a href="https://www.coursera.org/courses?query=compilers">https://www.coursera.org/courses?query=compilers</a>                                               |

### Course Outcomes

| At the end of the course, the students will be able to |                                                                                              |                 |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                     | Knowledge Level |
| CO1                                                    | Explain the different phases of compiler and design a lexical analyzer for a simple language | Understand      |
| CO2                                                    | Apply different parsing algorithms to develop the parsers using given grammar.               | Apply           |
| CO3                                                    | Illustrate syntax-directed translation and generate simple intermediate code                 | Apply           |
| CO4                                                    | Apply the storage allocation strategies for generating simple code.                          | Apply           |
| CO5                                                    | Apply the code optimization techniques.                                                      | Apply           |

### Course Articulation Matrix

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 2   | 2   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 2    | -    |
| CO2  | 3   | 3   | 2   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 2    | -    |
| CO3  | 3   | 3   | 2   | 2   | 2   | -   | -   | -   | -   | -    | 2    | 2    | -    |
| CO4  | 3   | 3   | 2   | 2   | 2   | -   | -   | -   | -   | -    | 2    | 2    | -    |
| CO5  | 3   | 3   | 2   | 2   | 2   | -   | -   | -   | -   | -    | 2    | 2    | -    |
| Avg. | 3   | 3   | 2   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 2    | -    |

**For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)**



| U24CSFS02                                                                                                                                                                                                                                                                                                                                                                                                                                                          | UI AND UX DESIGN | L | T | P | C |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  | 1 | 0 | 4 | 3 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>● To provide a sound understanding of UI &amp; UX principles.</li><li>● To understand the design field and the role of UX in product development.</li><li>● To learn various research methods and ideation techniques used in UI/UX design.</li><li>● To explore the tools used in UI &amp; UX development.</li><li>● To apply wireframes, prototypes, and user-centered design concepts.</li></ul> |                  |   |   |   |   |

### Detailed Syllabus

|                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UNIT I: FOUNDATIONS OF DESIGN</b><br>Introduction – UI vs UX – Stages of Design Thinking – Divergent & Convergent Thinking – Brainstorming – Game-storming – Observational Empathy.                                                                                                                                 |
| <b>UNIT II: FOUNDATIONS OF UI DESIGN FOUNDATIONS OF DESIGN</b><br>Visual & UI Principles – UI Elements & Patterns – Interaction Behaviours – Branding – Style Guides – Visual Consistency & Hierarchy.                                                                                                                 |
| <b>UNIT III: FOUNDATIONS OF UX DESIGN</b><br>Introduction to User Experience – Importance of UX – Understanding UX – Introduction about UX Research Methods – UX Design Activities – Defining Product Goals – UX Workflow – Design Ideation & Prototyping – Task Flows – Card Sorting – Storyboards – UX Deliverables. |
| <b>UNIT IV: WIREFRAMING, PROTOTYPING &amp; TESTING</b><br>Low/Mid/High Fidelity Wireframes – Mockups – Efficient Designing – Interactive Prototypes – Usability Testing – UX Metrics – Synthesizing Test Findings – Prototype Iteration.                                                                               |
| <b>UNIT V: RESEARCH, IDEATION &amp; INFORMATION ARCHITECTURE</b><br>Problem Identification – Research Methods – Persona Creation – Scenario Building – Flow Diagrams – Task Flow Mapping – Information Architecture – User Needs & Requirements.                                                                       |
| <b>Total Periods: 15</b>                                                                                                                                                                                                                                                                                               |

### List of Experiments

| Sl. No | List of Experiments                                                                                                                                                                                                                                             |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Design a responsive website for a College Event Management System. Mini Project Idea: Students should design layouts for: <ul style="list-style-type: none"> <li>Desktop view</li> <li>Tablet view</li> <li>Mobile view</li> </ul>                              |
| 2      | Create interaction patterns for a Food Delivery App. Design interactions such as: <ul style="list-style-type: none"> <li>Add to cart button animation</li> <li>Swipe to delete item</li> <li>Loading indicators</li> <li>Checkout confirmation popup</li> </ul> |



|    |                                                                                                                                                                                                                                                                                      |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3  | Design a Library Management System Interface. Create a UI Style Guide including: <ul style="list-style-type: none"> <li>• Typography</li> <li>• Button styles</li> <li>• Color palette</li> <li>• Icons</li> <li>• Layout grids</li> </ul>                                           |
| 4  | Build a Mobile App Prototype for Bus Ticket Booking. Design screens for: <ul style="list-style-type: none"> <li>• Login</li> <li>• Search buses</li> <li>• Seat selection</li> <li>• Payment</li> <li>• Ticket confirmation</li> </ul>                                               |
| 5  | Design a Smart Study Planner App for Students. Follow the design thinking steps: <ol style="list-style-type: none"> <li>1. Empathize</li> <li>2. Define</li> <li>3. Ideate</li> <li>4. Prototype</li> <li>5. Test</li> </ol>                                                         |
| 6  | Improve the College Website Navigation System.                                                                                                                                                                                                                                       |
| 7  | Create ideas for a Campus Navigation App. Use brainstorming methods such as: <ul style="list-style-type: none"> <li>• Mind mapping</li> <li>• Crazy 8 technique</li> <li>• Affinity diagrams</li> </ul>                                                                              |
| 8  | Design a UI pattern library for an E-commerce Website. Include: <ul style="list-style-type: none"> <li>• Mood board</li> <li>• Color palette</li> <li>• Typography</li> <li>• Buttons</li> <li>• Form elements</li> <li>• Cards and navigation components</li> </ul>                 |
| 9  | Solve a sample application problem through UX workflow.- Design an Assignment Reminder Application. UX Workflow: <ol style="list-style-type: none"> <li>1. Problem definition</li> <li>2. User research</li> <li>3. Ideation</li> <li>4. Wireframes</li> <li>5. Prototype</li> </ol> |
| 10 | Conduct end-to-end UX research (user research → persona → scenarios → mapping).- Develop a College Bus Tracking Application.                                                                                                                                                         |
| 11 | Sketch wireframes and build a prototype.- Design a Simple Online Grocery Shopping App. Create wireframes for: <ul style="list-style-type: none"> <li>• Home page</li> <li>• Product listing</li> </ul>                                                                               |



|                                  |                                                                                                                                                                                                                                                                                                        |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>Product details</li> <li>Cart</li> <li>Checkout</li> </ul>                                                                                                                                                                                                      |
| 12                               | Conduct usability testing and refine prototype.- Test the Online Grocery Shopping App Prototype. Ask 5 users to perform tasks: <ul style="list-style-type: none"> <li>Search product</li> <li>Add item to cart</li> <li>Complete checkout</li> <li>Collect feedback</li> <li>Improve design</li> </ul> |
| <b>Total Periods: 60</b>         |                                                                                                                                                                                                                                                                                                        |
| <b>Total Periods: 15+60 = 75</b> |                                                                                                                                                                                                                                                                                                        |

### Learning Resources

|   |                                                                                                     |
|---|-----------------------------------------------------------------------------------------------------|
| 1 | Joel Marsh, "UX for Beginners", O'Reilly, 2022.                                                     |
| 2 | Jon Yablonski, "Laws of UX: Using Psychology to Design Better Products & Services", O'Reilly, 2021. |
| 3 | Jennifer Tidwell, Charles Brewer, A. Valencia, Designing Interfaces, 3rd Edition, 2020.             |
| 4 | Steve Krug, Don't Make Me Think, 2022.                                                              |
| 5 | <a href="https://www.interaction-design.org/">https://www.interaction-design.org/</a>               |
| 6 | <a href="https://www.smashingmagazine.com/articles">https://www.smashingmagazine.com/articles</a>   |

### Course Outcomes

| At the end of the course, the students will be able to |                                                                                                       |                 |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                              | Knowledge Level |
| CO1                                                    | Apply UI/UX fundamentals and design principles.                                                       | Apply           |
| CO2                                                    | Analyze UI/UX design of any product/application.                                                      | Analyze         |
| CO3                                                    | Apply UX skills in product development.                                                               | Apply           |
| CO4                                                    | Analyze sketching and prototyping principles to evaluate and improve user interface design solutions. | Analyze         |
| CO5                                                    | Apply wireframes and working prototypes concepts                                                      | Apply           |

### Course Articulation Matrix

| CO          | PO1      | PO2        | PO3      | PO4      | PO5      | PO6      | PO7      | PO8      | PO9      | PO 10    | PO 11    | PSO1     | PSO2     |
|-------------|----------|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| CO1         | 2        | 1          | 3        | 2        | 3        | 2        | 2        | 2        | -        | 2        | 3        | 2        | 3        |
| CO2         | 2        | 2          | 3        | 2        | 3        | 2        | 2        | 2        | 3        | 2        | 3        | 2        | 3        |
| CO3         | 2        | 2          | 3        | 2        | 3        | 2        | 2        | 2        | 3        | 2        | 3        | 2        | 3        |
| CO4         | 2        | 2          | 3        | 2        | 3        | 2        | 2        | 2        | -        | 2        | 3        | 2        | 3        |
| CO5         | 2        | 2          | 3        | 2        | 3        | 2        | 2        | 2        | 3        | 2        | 3        | 2        | 3        |
| <b>Avg.</b> | <b>2</b> | <b>1.8</b> | <b>3</b> | <b>2</b> | <b>3</b> | <b>2</b> | <b>2</b> | <b>2</b> | <b>3</b> | <b>2</b> | <b>3</b> | <b>2</b> | <b>3</b> |

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |   |   |   |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---|---|---|-------------------------|
| U24EM511                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Aptitude and Reasoning – II | L | T | P | C                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             | 2 | 0 | 0 | 2                       |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>Enhance analytical and logical reasoning skills to solve problems efficiently.</li><li>Strengthen understanding of basic arithmetic, algebra, geometry, and data interpretation.</li><li>Train students to approach problems systematically and apply suitable techniques.</li><li>Foster quick thinking and reduce error rates through practice and time-bound exercises.</li><li>Understand data interpretation using bar chart, pie chart and table chart</li></ul> |                             |   |   |   |                         |
| <b>Syllabus topics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |   |   |   |                         |
| <b>Topic titles</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |   |   |   | <b>No of periods</b>    |
| <b>Quantitative aptitude</b> <ul style="list-style-type: none"><li>Time and work</li><li>Pipes and Cistern</li><li>Chain Rule and wages</li><li>Time speed and distance</li><li>Train problems</li><li>Boats and streams</li><li>Races and games</li><li>Permutations and Combinations</li><li>Probability</li><li>Heights and distance</li><li>Logarithms</li><li>Surds and indices</li><li>Mensuration – 2D, 3D</li><li>Date interpretation – pie chart, bar chart, table chart. Data sufficiency in logical reasoning</li></ul>    |                             |   |   |   | 20                      |
| <b>Reasoning:</b> <ul style="list-style-type: none"><li>Symbols and notations</li><li>Mathematical operators and Venn diagrams</li><li>Puzzles</li><li>Cubes and Dice</li><li>Clocks and Calendars</li><li>Critical Reasoning</li><li>Non-verbal reasoning</li><li>Verbal Ability</li></ul>                                                                                                                                                                                                                                           |                             |   |   |   | 10                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |   |   |   | <b>Total Periods:30</b> |

### Learning Resources

|   |                                                                                                                           |
|---|---------------------------------------------------------------------------------------------------------------------------|
| 1 | R.V. Praveen, "Quantitative Aptitude and Reasoning", 3rd Edition , Eastern Economy Edition, PHI Learning, New Delhi, 2016 |
| 2 | Dr. R.S. Aggarwal, " Quantitative Aptitude", S Chand Publishing, New Delhi 2017                                           |
| 3 | Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand                                          |



|   |                                                                             |
|---|-----------------------------------------------------------------------------|
|   | Publishing, New Delhi 2017                                                  |
| 4 | <a href="https://www.indiabix.com/">https://www.indiabix.com/</a>           |
| 5 | <a href="https://www.geeksforgeeks.org/">https://www.geeksforgeeks.org/</a> |
| 6 | <a href="https://faceprep.in/">https://faceprep.in/</a>                     |
| 7 | <a href="https://prepinsta.com/">https://prepinsta.com/</a>                 |
| 8 | <a href="https://www.javatpoint.com/">https://www.javatpoint.com/</a>       |

### Course Outcomes

| At the end of the course, the students will be able to |                                                                                                                  |                 |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                                         | Knowledge Level |
| CO1                                                    | Solve quantitative aptitude problems involving time & work, chain rule and wages etc., using logical approaches. | Apply           |
| CO2                                                    | Analyze problems and apply reasoning strategies such as deduction, inference, and pattern recognition.           | Analyse         |
| CO3                                                    | Solve problems on data interpretation, including bar charts, pie charts, tables, and graphs.                     | Apply           |
| CO4                                                    | Solve problems in probability, height and distance and logarithms logically                                      | Apply           |
| CO5                                                    | Demonstrate improved performance in time-bound aptitude tests through consistent practice.                       | Apply           |

### Course Articulation Matrix

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO2  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO3  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO4  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| CO5  |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |
| Avg. |     |     |     |     |     |     |     | 2   | 1   |      | 2    |      |      |

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24MG511                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | LEADERSHIP AND TEAM MANAGEMENT | L | T | P | C |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                | 2 | 0 | 0 | 2 |
| <b>Course Objective:</b><br>After completing this course, the students will be able to: <ul style="list-style-type: none"><li>• To introduce students to fundamental leadership theories, models, and frameworks for understanding leadership effectiveness.</li><li>• To develop the ability to analyze leadership styles, personality traits, emotional intelligence, and ethical values in organizational contexts.</li><li>• To enhance students' competence in evaluating leadership behavior, decision-making, and crisis management in diverse environments.</li><li>• To equip students with skills to lead groups and teams through effective communication, delegation, conflict management, and motivation.</li><li>• To enable students to design and apply strategies for developing high-performance, multicultural, and virtual teams using contemporary leadership practices.</li></ul> |                                |   |   |   |   |

### Detailed Syllabus

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I INTRODUCTION TO LEADERSHIP &amp; TEAM MANAGEMENT</b><br>Leadership Myths; Interactional Framework for analyzing leadership; Leadership Development: The First 90 Days as a Leader; Leader Development- The Action-Observation-Reflection Model. LMX Theory and Normative Decision Model; Situational Leadership Model; Contingency Model and Path Goal Theory.                                                                                                                                                                       | <b>6</b> |
| <b>UNIT II LEADERSHIP TYPES AND ATTRIBUTES</b><br>Emotional Approach Charismatic and Transformational Leadership; Leadership for Tomorrow, Leadership Attributes; Personality Traits and Leadership; Personality Types and Leadership; Intelligence and Leadership; Emotional Intelligence and Leadership. Power and Leadership; The art of influence in leadership; Leadership and "Doing the Right Things; Character-Based Approach to Leadership; Role of Ethics and Values in Organisational Leadership                                    | <b>6</b> |
| <b>UNIT III LEADERSHIP BEHAVIOUR</b><br>Leadership Behaviour, Assessing Leadership Behaviour: Multi-rater feedback instruments, The Dark Side of Leadership -Destructive Leadership, Managerial Incompetence and Derailment, Negotiation and Leadership, Leadership in Crisis Situation, The Situation and The Environment, Culture and Leadership, Global Leadership, Motivation and Leadership                                                                                                                                               | <b>6</b> |
| <b>UNIT IV INTRODUCTION TO GROUPS AND TEAMS</b><br>Characteristics of Leaders, Followers and Situation, Group Dynamics, Team Formation, Delegation and Empowerment, Leading Teams: Enhancing Teamwork Within a Group, The Leader's Role in Team-Based Organizations, Leader Actions That Foster Team Effectiveness, Offsite Training and Team Development, Understanding Team Processes and Team Coaching, Team Decision Making and Conflict Management, Virtual Teams                                                                         | <b>6</b> |
| <b>UNIT V MANAGING MULTICULTURAL TEAMS</b><br>Building Great Teams, Experiential Learning, Action Learning, Developmental Planning: Gaps Analysis, Coaching and Mentoring, Women in Leadership Roles, Building Effective Relationship with Subordinates and Peers, Fostering Followers Satisfaction, The Art of Communication, Setting Goals and Providing Constructive Feedback, Enhancing Creativity Problem Solving Skill, Building High-Performance Teams: The Rocket Model, Building Credibility and Trust, Skills for Developing others. | <b>6</b> |
| <b>Total Periods:30</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |          |



**Learning Resources**

|   |                                                                                                                                                                                                  |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Peter G. Northouse, "Leadership: Theory and Practice", 8th Edition, Sage Publications, 2019.                                                                                                     |
| 2 | Stephen P. Robbins and Timothy A. Judge, "Organizational Behavior", 18th Edition, Pearson Education, 2019.                                                                                       |
| 3 | Robert N. Lussier and Christopher F. Achua, "Leadership: Theory, Application, and Skill Development", 6th Edition, Cengage Learning, 2016.                                                       |
| 4 | Jon R. Katzenbach and Douglas K. Smith, "The Wisdom of Teams", Harvard Business School Press, 2005.                                                                                              |
| 5 | Daniel Goleman, "Emotional Intelligence", Bantam Books, 2006.                                                                                                                                    |
| 6 | Leadership and Team Effectiveness, Dr. Santosh Rangnekar, IIT Roorkee<br><a href="https://onlinecourses.nptel.ac.in/noc22_mq39/preview">https://onlinecourses.nptel.ac.in/noc22_mq39/preview</a> |

**Course Outcomes**

| At the end of the course, the students will be able to |                                                                                                                     |                 |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                                            | Knowledge Level |
| CO1                                                    | Explain and compare major leadership theories, models, and frameworks.                                              | Understand      |
| CO2                                                    | Describe leadership styles, attributes, personality, and emotional intelligence in organizational situations.       | Understand      |
| CO3                                                    | Discuss leadership behavior, ethics, power, and decision-making in complex and crisis situations.                   | Understand      |
| CO4                                                    | illustrate leadership principles to manage groups, teams, conflicts, and motivation effectively.                    | Understand      |
| CO5                                                    | Explain leadership development and team-building strategies for high-performance, multicultural, and virtual teams. | Understand      |

**Course Articulation Matrix**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 1   |     |     |     |     |     |     | 2   | 2   | 2    | 2    |      |      |
| CO2  | 1   |     |     |     |     |     |     | 2   | 2   | 2    | 2    |      |      |
| CO3  | 1   |     |     |     |     |     |     | 2   | 2   | 2    | 2    |      |      |
| CO4  | 1   |     |     |     |     |     |     | 2   | 2   | 2    | 2    |      |      |
| CO5  | 1   |     |     |     |     |     |     | 2   | 2   | 2    | 2    |      |      |
| Avg. | 1   |     |     |     |     |     |     | 2   | 2   | 2    | 2    |      |      |

**For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)**



| U24CS533 | EMBEDDED SYSTEMS AND IOT SYSTEM DESIGN | L | T | P | C |
|----------|----------------------------------------|---|---|---|---|
|          |                                        | 1 | 0 | 4 | 3 |

**Course Objective:**

- To understand the architecture and operation of 8-bit microcontrollers for embedded applications.
- To develop programs using Embedded C for real-time operations and multitasking.
- To evaluate the operation and interfacing of various sensors used in IoT environments.
- To analyze and implement sensor integration using Arduino and Raspberry Pi with appropriate communication protocols.
- To analyze real-time IoT case studies and assess the potential of IoT solutions in various application domains

### Detailed Syllabus

|                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UNIT I: 8-BIT EMBEDDED PROCESSOR</b><br>8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.                                                                                                         |
| <b>UNIT II: EMBEDDED C PROGRAMMING</b><br>Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need for RTOS – Multiple Tasks and Processes – Context Switching – Priority-Based Scheduling Policies                                                                              |
| <b>UNIT III: SENSORS</b><br>Introduction and need for sensors in IoT - Classification of sensors – active and passive - Analog and digital sensors – working principles - Ultrasonic sensor: operation and interfacing - Temperature and humidity sensor: operation and interfacing.                  |
| <b>UNIT IV: SENSOR INTEGRATION AND CLOUD PLATFORM</b><br>Sensor data acquisition using Arduino & Raspberry Pi - Data communication protocols – MQTT & HTTP - IoT cloud platforms Overview: ThingSpeak, Blynk, AWS IoT - Uploading sensor data to cloud - Real-time monitoring and data visualization. |
| <b>UNIT V: CASE STUDIES</b><br>Smart home automation using IoT - Smart city applications and traffic monitoring - IoT-based environmental monitoring system - Smart agriculture and irrigation system - Industrial IoT applications - Future trends and challenges in IoT.                            |
| <b>Total Periods: 15</b>                                                                                                                                                                                                                                                                              |



**List of Experiments**

| S. No                            | List of Experiments                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                | Write 8051 Assembly Language experiments using simulator.                                                                                                                                                                                                                                                                                                                                        |
| 2                                | Test data transfer between registers and memory.                                                                                                                                                                                                                                                                                                                                                 |
| 3                                | Perform ALU operations.                                                                                                                                                                                                                                                                                                                                                                          |
| 4                                | Write Basic and arithmetic Programs Using Embedded C.                                                                                                                                                                                                                                                                                                                                            |
| 5                                | Introduction to Arduino platform and programming                                                                                                                                                                                                                                                                                                                                                 |
| 6                                | Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)                                                                                                                                                                                                                                                                                                                |
| 7                                | Introduction to Raspberry PI platform and python programming                                                                                                                                                                                                                                                                                                                                     |
| 8                                | Interfacing sensors with Raspberry PI                                                                                                                                                                                                                                                                                                                                                            |
| 9                                | Communicate between Arduino and Raspberry PI using any wireless medium                                                                                                                                                                                                                                                                                                                           |
| 10                               | Setup a cloud platform to log the data                                                                                                                                                                                                                                                                                                                                                           |
| 11                               | Log Data using Raspberry PI and upload to the cloud platform Design an IOT based system                                                                                                                                                                                                                                                                                                          |
| 12                               | Mini Projects: Design an IOT based system. <ul style="list-style-type: none"> <li>• Smart Home Automation using IoT</li> <li>• IoT-based Smart Agriculture System</li> <li>• IoT-based Environmental Monitoring System</li> <li>• IoT-based Smart Parking System</li> <li>• IoT-based Industrial Application System</li> <li>• 6. IoT-based EV Charging &amp; Fleet Monitoring System</li> </ul> |
| <b>Total Periods: 60</b>         |                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Total Periods: 15+60 = 75</b> |                                                                                                                                                                                                                                                                                                                                                                                                  |

**Learning Resources**

|   |                                                                                                                                                                                                                                |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Peter Waher, "Mastering the Internet of Things: Design and Deploy Solutions Using IoT Platforms", Packt Publishing, 2nd Edition, 2023                                                                                          |
| 2 | David Hanes et al., "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, First Edition 2022.                                                                          |
| 3 | "Introduction to Internet of Things", Prof. Sudip Misra, IIT Kharagpur, NPTEL. <a href="https://nptel.ac.in/courses/106105166">https://nptel.ac.in/courses/106105166</a>                                                       |
| 4 | "Components and Applications of Internet of Things", Prof. Sanjoy Kumar Parida, IIT Patna, Swayam. <a href="https://onlinecourses.swayam2.ac.in/arp19_ap52/preview">https://onlinecourses.swayam2.ac.in/arp19_ap52/preview</a> |



### Course Outcomes

| At the end of the course, the students will be able to |                                                                                                                                         |                 |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course outcome Statement                                                                                                                | Knowledge Level |
| CO1                                                    | Describe the architecture, instruction set, and programming of 8-bit embedded processors.                                               | Analyze         |
| CO2                                                    | Develop embedded C programs for interfacing peripherals and managing multiple tasks using RTOS concepts.                                | Apply           |
| CO3                                                    | Integrate multiple sensors with Arduino and Raspberry Pi using appropriate communication protocols to create functional IoT prototypes. | Evaluate        |
| CO4                                                    | Develop cloud-enabled IoT systems for real-time data monitoring and visualization.                                                      | Create          |
| CO5                                                    | Design IoT-based solutions for domains such as smart homes, agriculture, industries, and environment monitoring.                        | Create          |

### Course Articulation Matrix

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 3   | 3   |     |     | 2   | 3   | 3   |      | 2    | 3    | 3    |
| CO2  | 3   | 3   | 3   | 3   |     | 3   | 2   | 3   | 3   | 3    | 2    | 3    | 3    |
| CO3  | 3   | 3   | 3   | 3   |     | 3   | 2   | 3   | 3   | 3    | 2    | 3    | 3    |
| CO4  | 3   | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3    | 2    | 3    | 3    |
| CO5  | 3   | 3   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3    | 2    | 3    | 3    |
| Avg. | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | 3.0  | 2.0  | 3.0  | 3.0  |

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24CS543 | ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING | L | T | P | C |
|----------|----------------------------------------------|---|---|---|---|
|          |                                              | 3 | 0 | 2 | 4 |

**Course Objective:**

- To introduce the fundamental concepts of Artificial Intelligence, intelligent agents, and problem-solving techniques.
- To provide knowledge of search strategies, reasoning methods, and decision-making approaches used in AI systems.
- To develop understanding of supervised machine learning models for regression and classification tasks.
- To equip with knowledge of unsupervised learning techniques and ensemble methods for data analysis and model improvement.
- To introduce the basic concepts of reinforcement learning for solving sequential decision-making problems.

### Detailed Syllabus

|                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>UNIT I: FOUNDATIONS OF ARTIFICIAL INTELLIGENCE</b>                                                                                                                                                                                                                                                                                                                                                                         | <b>9</b> |
| Introduction to Artificial Intelligence — AI definition, history, types and applications; Intelligent agents — types of agents, agent architecture, environment types; Problem-solving — problem formulation, state space, goals, operator; Uninformed (Blind) search strategies — BFS, DFS, Depth-Limited Search, Iterative Deepening; Informed search strategies — Best-First Search, Greedy Search, A* Search.             |          |
| <b>UNIT II: AI REASONING AND DECISION MAKING</b>                                                                                                                                                                                                                                                                                                                                                                              | <b>9</b> |
| Heuristic search — Hill climbing, Simulated Annealing, and Local Search. Adversarial search — Minimax, Alpha-Beta pruning. Constraint Satisfaction Problems — CSP formulation, backtracking. Basic probabilistic reasoning — conditional probability, Bayes rule, Naïve Bayes classifier (conceptual). Simple Bayesian network examples (basic structure & inference).                                                        |          |
| <b>Unit III: SUPERVISED MACHINE LEARNING</b>                                                                                                                                                                                                                                                                                                                                                                                  | <b>9</b> |
| Machine Learning basics — Types of ML, dataset types, Preprocessing, train-test split, model evaluation (accuracy, confusion matrix). Regression models — Linear regression, Gradient Descent, error metrics (MSE/MAE). Classification models — Logistic regression, K-Nearest Neighbour (KNN), Decision Trees. Support Vector Machines (concepts only). Overfitting, underfitting, regularization (L1/L2), cross-validation. |          |
| <b>Unit IV: UNSUPERVISED LEARNING &amp; ENSEMBLE METHODS</b>                                                                                                                                                                                                                                                                                                                                                                  | <b>9</b> |
| Clustering — K-Means clustering, Hierarchical clustering. Dimensionality reduction — PCA (basic concept). Ensemble Learning — Bagging, Random Forests, Boosting, Gaussian Mixture Model, Model selection — Bias-variance tradeoff, accuracy, confusion matrix.                                                                                                                                                                |          |
| <b>Unit V: BASICS OF REINFORCEMENT LEARNING</b>                                                                                                                                                                                                                                                                                                                                                                               | <b>9</b> |
| Introduction to Reinforcement Learning - Key elements, History; Understanding Rewards & Policies; Markov Decision Process (MDP) – Property, Building an MDP; Q-Learning — Algorithm, Implementation; Building Policy and value iteration, playing with Policy vs value. Real time application.                                                                                                                                |          |
| <b>Total Periods: 45</b>                                                                                                                                                                                                                                                                                                                                                                                                      |          |



**List of Experiments:**

| S. No                              | Experiments                                                                                                                                                                                           |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                 | Design and implement BFS, DFS, and Uniform Cost Search (UCS) to find a path between two locations in a city map. Compare the performance of each algorithm in terms of path cost and time complexity. |
| 2.                                 | Develop a grid-based pathfinding system for a warehouse robot using the A* search algorithm. The robot must navigate from a start position to a goal while avoiding obstacles.                        |
| 3.                                 | Design an AI agent for a two-player game (e.g., Tic-Tac-Toe) using the Minimax algorithm. Enhance performance using Alpha-Beta pruning.                                                               |
| 4.                                 | Develop a Naïve Bayes classifier to classify emails or messages as spam or not spam using a real-world dataset.                                                                                       |
| 5.                                 | Build a regression model (Linear/Multiple Regression) to predict house prices based on features such as area, location, and number of rooms.                                                          |
| 6.                                 | Implement Decision Tree and KNN classification on an educational or medical dataset or Irish dataset.                                                                                                 |
| 7.                                 | Apply K-Means clustering on customer data to segment users based on purchasing behaviour.                                                                                                             |
| 8.                                 | Implement Bagging, Random Forest, and Boosting techniques to detect fraudulent transactions in a financial dataset.                                                                                   |
| 9.                                 | Design a Q-Learning agent to control traffic signals at an intersection to minimize waiting time and congestion.                                                                                      |
| 10.                                | Develop a Q-Learning-based agent to play a simple game (Gridworld or Snake) and maximize cumulative reward.                                                                                           |
| <b>Total Periods: 30</b>           |                                                                                                                                                                                                       |
| <b>Total Periods: 45 + 30 = 75</b> |                                                                                                                                                                                                       |

**Learning Recourses**

|    |                                                                                                                                                                  |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.                                         |
| 2. | Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020                                                                              |
| 3. | Micheal Lanham, "Hands-on Reinforcement Learning for Games" Packt, First Edition, 2020. <a href="#">Hands-On Reinforcement Learning for Games - Google Books</a> |
| 4. | Aurelien Geron, "Hands – on Machine Learning with Scikit – Learn, Keras & TensorFlow" 2 <sup>nd</sup> Edition, O'Reilly, 2019                                    |
| 5. | Bernd Klein, "Machine learning with Python Tutorial" bodenseo, 2021, <a href="#">Machine Learning with Python Tutorial   InfoBooks.org</a>                       |
| 6. | Reinforcement Learning Algorithms with Python by Andrea Lonza, 2019, Packt. <a href="#">Reinforcement Learning Algorithms with Python - Google Books</a>         |
| 7. | "Introduction to Machine Learning", Prof. Balaraman Ravindran, IIT Madras, NPTEL, <a href="#">Introduction to Machine Learning - Course</a>                      |



### Course Outcomes

| At the end of the course, the students will be able to |                                                                                                                                                        |                 |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                                                                               | Knowledge Level |
| CO1                                                    | Apply fundamental concepts of Artificial Intelligence, intelligent agents, and search techniques to solve real-world problems.                         | Apply           |
| CO2                                                    | Analyze AI reasoning and decision-making techniques including heuristic search, adversarial search, constraint satisfaction, and probabilistic models. | Analyze         |
| CO3                                                    | Apply supervised machine learning algorithms for regression and classification tasks on real-world datasets.                                           | Apply           |
| CO4                                                    | Analyze unsupervised learning techniques and ensemble methods for clustering and model improvement.                                                    | Analyze         |
| CO5                                                    | Apply basic Reinforcement Learning techniques for sequential decision-making problems.                                                                 | Apply           |

### Course Articulation Matrix

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 3   | 2   | 1   | 2   | 2   |     | 2   |     |      | 3    | 3    | 3    |
| CO2  | 3   | 3   |     | 2   | 3   | 2   |     |     |     |      | 2    | 3    | 2    |
| CO3  | 3   | 3   | 2   | 2   | 3   | 2   |     | 2   | 2   |      | 3    | 3    | 3    |
| CO4  | 2   | 3   | 2   | 3   | 3   | 2   |     | 2   |     | 2    | 3    | 3    | 3    |
| CO5  | 3   | 2   | 2   | 3   | 3   | 2   |     | 2   | 2   |      | 3    | 3    | 3    |
| Avg. | 2.8 | 2.8 | 2   | 2.2 | 2.8 | 2   |     | 2   | 2   | 2    | 3    | 3    | 3    |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24CS552 | MOBILE APPLICATION DEVELOPMENT LABORATORY | L | T | P | C |
|----------|-------------------------------------------|---|---|---|---|
|          |                                           | 0 | 0 | 4 | 2 |

**Course Objective:**

- To understand the components and structure of mobile application development frameworks for Android and windows OS-based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.

### List of Experiments

| SI No | List of Experiments                                                                                                                                                                                                                                                                                                                           |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | <b>Student Workshop Registration App (GUI Components)</b><br>Develop a mobile application to register students for a workshop. The application should collect Student Name, Email ID, and Mobile Number using GUI components and display the submitted details when the Submit button is clicked. Implement labels, text fields, and buttons. |
| 2     | <b>Course Feedback Collection System (Layouts &amp; Event Handling)</b><br>Design an application to collect feedback from students about a course. The application should include Student Name, Course Name, Rating (1–5), Comments. Use appropriate layout managers and implement Submit and Reset buttons with event handling.              |
| 3     | <b>Mini Graphics Editor (Drawing Primitives)</b><br>Develop a graphical application that draws a simple house scene using basic primitives such as line, rectangle, circle, and ellipse. The program should demonstrate coordinate positioning and graphical drawing methods.                                                                 |
| 4     | <b>Employee Management System (Database Connectivity)</b><br>Develop a database-driven mobile application to manage employee records including Employee ID, Name, Department, and Salary. Implement CRUD operations (Insert, View, Update, and Delete) with a user-friendly interface.                                                        |
| 5     | <b>Assignment Reminder Application (Notification Manager)</b><br>Develop a reminder application that allows students to set task reminders for assignments. The app should generate system notifications with title, message, and icon.                                                                                                       |
| 6     | <b>Parallel Processing Demonstration (Multithreading)</b><br>Implement an application that demonstrates multithreading by creating multiple threads to perform tasks such as printing numbers, displaying system time, or performing simple calculations simultaneously.                                                                      |



|                          |                                                                                                                                                                                                                                                      |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7                        | <b>Location Tracking App (GPS)</b><br>Develop a location-based mobile application that retrieves the user's current location. The application should display latitude and longitude after obtaining location permissions.                            |
| 8                        | <b>Quick Alert Messaging App (Alert Dialog)</b><br>Design an application that allows users to enter a message and display it in an alert dialog box when the Send Alert button is pressed.                                                           |
| 9                        | <b>Simple Email Sender Application</b><br>Develop a mobile application that allows the user to compose and send an email. Inputs include recipient email address, subject, and message body. Display a confirmation message after sending the email. |
| 10                       | <b>Personal Daily Activity Manager</b><br>Design a mobile application to manage daily activities such as user registration, adding tasks, and displaying saved information. Use appropriate GUI components and event handling.                       |
| <b>Total Periods: 60</b> |                                                                                                                                                                                                                                                      |

### Learning Resources

|   |                                                                                                                                                                                       |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Jochen Schiller, —Mobile communications, 2nd Edition, Pearson Education, 2013                                                                                                         |
| 2 | William Stallings, —Wireless Communications and Networks, 2nd Edition, Pearson.2020                                                                                                   |
| 3 | Rappaport, Wireless Communications – Principles and Practice, Pearson.2011                                                                                                            |
| 4 | Misra & Woungang, Guide to Wireless Ad Hoc Networks, Springer.2009                                                                                                                    |
| 5 | 3GPP (3rd Generation Partnership Project) – Official standards for LTE and 5G.<br><a href="https://www.3gpp.org">https://www.3gpp.org</a>                                             |
| 6 | Cisco Networking Academy – Wireless & Mobile Networks. <a href="https://www.netacad.com">https://www.netacad.com</a>                                                                  |
| 7 | Mobile Computing / Wireless Communication Courses - IIT- Delhi, Prof. Ranjan Bose, NPTEL, <a href="https://nptel.ac.in/courses/117102062">https://nptel.ac.in/courses/117102062</a> . |

### Course Outcomes

| At the end of the course, the students will be able to |                                                                                                       |                 |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                              | Knowledge Level |
| CO1                                                    | Develop mobile applications using GUI components and layout managers for user interaction.            | Apply           |
| CO2                                                    | Implement event handling and alert mechanisms in mobile applications.                                 | Apply           |
| CO3                                                    | Design database-driven mobile applications to perform CRUD operations for data management.            | Create          |
| CO4                                                    | Develop mobile applications using device features such as notifications, GPS, and multithreading.     | Apply           |
| CO5                                                    | Design and build real-world mobile applications integrating different components and functionalities. | Create          |



**Course Articulation Matrix**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  | 3   | 2   | 2   | 1   | 3   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 1    |
| CO2  | 2   | 2   | 2   | 2   | 3   | 2   | 2   | 2   | 2   | 2    | 2    | 3    | 3    |
| CO3  | 2   | 3   | 3   | 2   | 3   | 3   | 3   | 3   | 1   | 2    | 2    | 3    | 3    |
| CO4  | 2   | 2   | 3   | 3   | 3   | 3   | 3   | 3   | 2   | 2    | 2    | 3    | 3    |
| CO5  | 2   | 3   | 3   | 2   | 3   | 3   | 3   | 3   | 2   | 2    | 2    | 3    | 2    |
| Avg. | 2.2 | 2.4 | 2.6 | 2   | 3   | 2.6 | 2.6 | 2.6 | 1.8 | 2    | 2    | 2.8  | 2.8  |

**For CO-PO/PSO Mapping:** 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                              |   |   |   |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---|---|---|---|
| U24EM522                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Soft Skills and Personality Development – II | L | T | P | C |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                              | 0 | 0 | 2 | 1 |
| Course Objective:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                              |   |   |   |   |
| <ul style="list-style-type: none"><li>To improve written communication etiquette, covering email principles, netiquette, and proper messaging practices.</li><li>To communicate effectively with clarity, active listening, and overcoming sender–receiver barriers.</li><li>To develop non-verbal awareness, interpreting body language and cues, especially in high-stakes contexts (interviews, presentations).</li><li>To enhance public speaking and presentation skills using visuals, confidence building, and anxiety management.</li><li>To cultivate integrity-driven human relations, emphasizing listening, trust, and ethical communication</li></ul> |                                              |   |   |   |   |

### List of Exercises

| Sl. No.                  | List of Exercises                                                                                                     |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1                        | Technology and Communication: Technological Personality, Mobile Personality?                                          |
| 2                        | Communication Skills: Effective Communication                                                                         |
| 3                        | Barriers to Communication: Arising out of Sender/Receiver's Personality, Interpersonal Transactions, Miscommunication |
| 4                        | Nonverbal Communication: Introduction And Importance, Issues and Types, Basics and Universals                         |
| 5                        | Body Language: For Interviews, For Group Discussions                                                                  |
| 6                        | Presentation Skills: Overcoming Fear, Becoming A Professional, The Role of Body Language                              |
| 7                        | Presentation Skills: Using Visuals                                                                                    |
| 8                        | Reading Skills: Effective Reading                                                                                     |
| 9                        | Human Relations: Developing Trust and Integrity                                                                       |
| 10                       | Visume                                                                                                                |
| <b>Total Periods: 30</b> |                                                                                                                       |

### Learning Resources

|   |                                                                                                                                                                     |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.                                                                                       |
| 2 | Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.           |
| 3 | Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.                                                   |
| 4 | Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.                                                      |
| 5 | Developing Soft Skills and Personality, Prof. T Ravichandran, IIT Kanpur, <a href="https://nptel.ac.in/courses/109104107">https://nptel.ac.in/courses/109104107</a> |
| 6 | Enhancing Soft Skills and Personality, Prof. T. Ravichandran, IIT Kanpur, <a href="https://nptel.ac.in/courses/109104115">https://nptel.ac.in/courses/109104115</a> |



**Course Outcomes**

| At the end of the course, the students will be able to |                                                                                                 |                 |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                        | Knowledge Level |
| CO1                                                    | Write effective emails using email principles and etiquette                                     | Apply           |
| CO2                                                    | Design visuals using principles of clarity, readability, and relevance (graphs, slides, props). | Apply           |
| CO3                                                    | Apply the communication model to real-world situations, accounting for tone, style, barriers    | Apply           |
| CO4                                                    | Compare self-assessed nonverbal behaviors to standardized benchmarks.                           | Understand      |
| CO5                                                    | Apply confident body language techniques in interviews and group discussion simulations.        | Apply           |

**Course Articulation Matrix**

| CO   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO2  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO3  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO4  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| CO5  |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |
| Avg. |     |     |     |     |     |     |     | 1   | 2   |      | 2    |      |      |

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



| U24MC21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ENVIRONMENTAL SCIENCE | L | T | P | C |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---|---|---|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       | 3 | 0 | 0 | 0 |
| <b>Course Objective:</b> <ul style="list-style-type: none"><li>• To introduce the basic concepts and importance of Environmental Science and natural resources.</li><li>• To understand ecosystem structure, energy flow, and the importance of biodiversity.</li><li>• To study different types of environmental pollution and their control measures.</li><li>• To understand major environmental issues and the concept of sustainable development.</li><li>• To understand environmental laws, policies, and the role of public participation in environmental protection.</li></ul> |                       |   |   |   |   |

### Detailed Syllabus

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>UNIT I: INTRODUCTION TO ENVIRONMENT AND NATURAL RESOURCES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>8</b>  |
| Definition, scope, and importance of Environmental Science. Components of the environment: lithosphere, hydrosphere, atmosphere, and biosphere. Structure and functions of the environment. Natural resources: renewable and non-renewable resources. Resource distribution and utilization. Resource depletion and conservation strategies. Sustainable use of natural resources and the concept of equitable resource sharing. Importance of environmental awareness and responsibility.                                                                                                |           |
| <b>UNIT II: ECOSYSTEMS AND BIODIVERSITY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>10</b> |
| Concept, structure, and functions of ecosystems. Types of ecosystems: terrestrial and aquatic ecosystems. Food chains, food webs, and ecological pyramids. Energy flow in ecosystems. Biogeochemical cycles: water cycle, carbon cycle, and nitrogen cycle. Biodiversity: definition, types (genetic, species, and ecosystem diversity), values of biodiversity. Threats to biodiversity such as habitat destruction, overexploitation, pollution, and climate change. Biodiversity conservation methods: in-situ and ex-situ conservation strategies.                                    |           |
| <b>UNIT III: ENVIRONMENTAL POLLUTION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>10</b> |
| Definition and types of environmental pollution: air pollution, water pollution, soil pollution, noise pollution, thermal pollution, and radioactive pollution. Sources, causes, effects, and control measures for different types of pollution. Solid waste management: types of waste, waste segregation, recycling, and disposal methods. Management of e-waste and plastic waste. Importance of pollution prevention and environmental protection practices.                                                                                                                          |           |
| <b>UNIT IV: ENVIRONMENTAL ISSUES AND SUSTAINABLE DEVELOPMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>9</b>  |
| Major environmental issues: climate change, global warming, ozone layer depletion, acid rain, deforestation, land degradation, urbanization, and population growth. Impact of environmental issues on ecosystems and human health. Concept of sustainable development and sustainable lifestyles. Sustainable Development Goals (SDGs). Sustainable agriculture, renewable energy sources, and green buildings. Carbon footprint, life cycle assessment (LCA), environmental ethics, and green campus initiatives.                                                                        |           |
| <b>UNIT V: ENVIRONMENTAL POLICIES, LEGISLATION AND FIELDWORK</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>8</b>  |
| Environmental policies and legislation in India: Environmental (Protection) Act, 1986; Air (Prevention and Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Forest Conservation Act; Biological Diversity Act. Role of National Green Tribunal (NGT). Environmental Impact Assessment (EIA). Role of government agencies, NGOs, and public participation in environmental protection. Fieldwork/Project component: campus environmental audit, biodiversity survey, waste segregation activity, case study analysis, or visit to a pollution control facility. |           |
| <b>Total Periods: 45</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |



## Learning Recourses

|   |                                                                                                                                              |
|---|----------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.             |
| 2 | Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.                                                    |
| 3 | R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. Edition 2010. |
| 4 | Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.                           |
| 5 | Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005                                                                |
| 6 | <a href="https://moef.gov.in">https://moef.gov.in</a> — Ministry of Environment, Forest and Climate Change, India                            |
| 7 | <a href="https://sdgs.un.org/goals">https://sdgs.un.org/goals</a> — UN Sustainable Development Goals                                         |
| 8 | <a href="https://niti.gov.in">https://niti.gov.in</a> — NITI Aayog's SDG India Index                                                         |

## Course Outcomes

| At the end of the course, the students will be able to |                                                                                                          |                 |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------|
| CO                                                     | Course Outcome Statement                                                                                 | Knowledge Level |
| CO1                                                    | Explain the basic concepts of environment and natural resources.                                         | Understand      |
| CO2                                                    | Describe ecosystem structure, functions, and biodiversity conservation.                                  | Understand      |
| CO3                                                    | Identify different types of environmental pollution and their control methods.                           | Understand      |
| CO4                                                    | Discuss major environmental issues and principles of sustainable development.                            | Understand      |
| CO5                                                    | Explain environmental policies, legislation, and apply environmental practices through field activities. | Understand      |

