

**B. TECH. FOUR YEAR DEGREE**

**PROGRAM CURRICULUM**

(Applicable for the batches admitted from A.Y. 2025-26)

**COMPUTER SCIENCE AND  
ENGINEERING**

**in association with SAP**



**A D I T Y A**  
**U N I V E R S I T Y**

Aditya Nagar, ADB Road, Surampalem - 533 437



# ADITYA UNIVERSITY

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## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

### **Vision**

To be a globally recognized center of excellence in Computer Science through quality education, innovative practices, Sustainable technologies.

### **Mission**

M1: Provide transformative and inclusive education through robust curriculum, modern pedagogy, and state-of-art infrastructure.

M2: Foster innovation and research by developing sustainable technological solutions that address real-world challenges.

M3: Strengthen collaborations with industry, academia, and global partners to promote knowledge sharing and entrepreneurial growth.

### **Program Educational Objectives (PEOs)**

#### **Graduates of the Program will:**

#### **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

PEO1: Apply emerging tools and technologies to solve interdisciplinary problems.

PEO2: Advance in education and research by applying innovative ideas and project-based learning.

PEO3: Work collaboratively and establish leadership with ethical, social, and financial accountability.

### **Program Specific Outcomes (PSOs)**

#### **After successful completion of the program, the graduates will be able to:**

PSO1: Apply advanced computing tools and technologies for effective software design, development, and deployment.

PSO2: Design, configure, and secure computing infrastructure services by applying emerging technologies

## PROGRAM OUTCOMES (PO's)

The 11 Program Outcomes are described as below.

After successful completion of the program, the graduates will be able to

- PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- PO3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
- PO4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- PO5 **Engineering tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- PO6 **The Engineer and the world :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- PO7 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- PO8 **Individual and collaborative teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- PO9 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO10 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO11 **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Department of Computer Science and Engineering**  
**B. Tech (CSE) in association with SAP**  
(Applicable for the batches admitted from the A.Y. 2025-26)

**UG Programs Offered**

- B.Tech in (Computer Science and Engineering)
- B. Tech in (Computer Science and Engineering in collaboration with SAP)
- B. Tech in (Computer Science and Engineering in collaboration with Google Cloud)

**Minor Stream offered in B.Tech (Computer Science and Engineering)**

- Cloud ERP in collaboration with SAP

**B.Tech in (Computer Science and Engineering) with Minor Degree in:**

- Minor degree in Civil Engineering
- Minor degree in Electrical and Electronics Engineering
- Minor degree in Mechanical Engineering
- Minor degree in Electronics and Communication Engineering
- Minor degree in Petroleum Technology
- Minor degree in Mining Engineering
- Minor degree in Agricultural Engineering
- Minor degree in Entrepreneurship Development and Incubation
- Minor degree in Quantum Technologies

### Credit Division Category-wise

| S.No                                                 | Broad Category of Course          | UGC        | Credits    |
|------------------------------------------------------|-----------------------------------|------------|------------|
| 1                                                    | Major Core Courses (MCC)          | 80         | 84         |
| 2                                                    | Minor Stream Courses (MSC)        | 33         | 33         |
| 3                                                    | Multidisciplinary Courses (MDC)   | 9          | 9          |
| 4                                                    | Ability Enhancement Courses (AEC) | 8          | 8          |
| 5                                                    | Skill Enhancement Courses (SEC)   | 9          | 6          |
| 6                                                    | Value Added Courses (VAC)         | 6-8        | 4          |
| 7                                                    | Summer Internships (SI)           | 2-4        | 4          |
| 8                                                    | Full Semester Internship (PROJ)   | 12         | 12         |
| 9                                                    | Mandatory Courses (MC)            | 0          | 0          |
| <b>Total Credits to be earned for B. Tech Degree</b> |                                   | <b>160</b> | <b>160</b> |

**Foundation Courses – FC**

**Intermediate-level Courses – IC**

**Advanced Courses – AC**

### Major Core Courses (MCC)

| Course Code | Course Name                                   | Level | L         | T        | P         | C         | CIE | SEE | Total | Pre-requisite |
|-------------|-----------------------------------------------|-------|-----------|----------|-----------|-----------|-----|-----|-------|---------------|
| 2501MA01    | Linear algebra & Calculus                     | FC    | 2         | 1        |           | 3         | 50  | 50  | 100   | -             |
| 2501PH02    | Modern Physics                                | FC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501CS01    | Programming for Problem Solving Using C       | FC    | 2         |          | 2         | 4         | 50  | 50  | 100   | -             |
| 2501IT01    | Business Intelligence Lab                     | FC    |           |          | 2         | 2         | 50  | 50  | 100   | -             |
| 2501ME01    | Engineering Graphics                          | FC    | 1         |          | 2         | 3         | 50  | 50  | 100   | -             |
| 2501MA02    | Differential equations & Vector Calculus      | FC    | 2         | 1        |           | 3         | 50  | 50  | 100   | -             |
| 2501CS03    | Data Structures                               | FC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501IT42    | Programming with Python                       | FC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501CS71    | Computer Organization & Architecture          | FC    | 2         | 1        |           | 3         | 50  | 50  | 100   | DLD           |
| 2501MA08    | Discrete Mathematics                          | IC    | 2         | 1        |           | 3         | 50  | 50  | 100   | LAC           |
| 2501CS08    | Object Oriented Programming through C++       | IC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501CS11    | Theory of Computation                         | IC    | 2         | 1        |           | 3         | 50  | 50  | 100   | DMS           |
| 2501IT05    | Database Management Systems                   | IC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501IT07    | Agile Software Engineering                    | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | PPSC          |
| 2501MA09    | Probability & Statistics                      | IC    | 2         | 1        |           | 3         | 50  | 50  | 100   | LAC           |
| 2501IT06    | Java Programming                              | IC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501CS13    | Operating Systems                             | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501AI02    | Artificial Intelligence                       | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501CS07    | Computer Networks                             | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501AI03    | Data Mining                                   | IC    | 1         |          | 2         | 3         | 50  | 50  | 100   | -             |
| 2501CS10    | Advanced Data Structures & Algorithm Analysis | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | DS            |
| 2501IT04    | Compiler Design                               | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | TOC           |
| 2501AI05    | Machine Learning                              | AC    | 2         |          | 2         | 4         | 50  | 50  | 100   | DAE           |
| 2501AI04    | Big Data Analytics                            | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | DM            |
| 2501IT03    | Cryptography & Network Security               | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | CN            |
| 2501CS15    | Software Architecture                         | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | ASE           |
|             | <b>Total</b>                                  |       | <b>48</b> | <b>6</b> | <b>30</b> | <b>84</b> |     |     |       |               |



### Multidisciplinary Courses (MDC)

| Course Code  | Course Name                                | Level | L        | T        | P        | C        | CIE | SEE | Total | Pre-requisite |
|--------------|--------------------------------------------|-------|----------|----------|----------|----------|-----|-----|-------|---------------|
| 2501EC95     | Digital Logic Design                       | FC    | 2        | 1        |          | 3        | 50  | 50  | 100   | -             |
| 2501EE01     | Basic Electrical & Electronics Engineering | FC    | 2        |          | 2        | 4        | 50  | 50  | 100   | -             |
| 2501MB01     | Engineering Economics & Management         | FC    | 2        |          |          | 2        | 50  | 50  | 100   | -             |
| <b>Total</b> |                                            |       | <b>6</b> | <b>1</b> | <b>2</b> | <b>9</b> |     |     |       |               |

### Ability Enhancement Courses (AEC)

| Course Code  | Course Name                                                                                                     | Level | L        | T | P        | C        | CIE | SEE | Total | Pre-requisite |
|--------------|-----------------------------------------------------------------------------------------------------------------|-------|----------|---|----------|----------|-----|-----|-------|---------------|
| 2501EN01     | Essential Cognitive Skills for Engineers                                                                        | FC    |          |   | 1        | 1        | 100 | -   | 100   | -             |
| 2501UC07     | Design Thinking using AI                                                                                        | FC    |          |   | 1        | 1        | 100 | -   | 100   | -             |
| 2501EN02     | Advanced Cognitive Skills for Engineers (or) Proficiency in Foreign Language (Japanese/German/ Spanish/ French) | FC    |          |   | 1        | 1        | 100 | -   | 100   | ECSE          |
| 2501UC05     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC04     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC03     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC06     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC08     | Universal Human Values                                                                                          | FC    | 2        |   |          | 2        | 100 | -   | 100   | -             |
| 2501UC09     | Technical Paper Publication                                                                                     | AC    |          |   | 2        | 2        | 100 | -   | 100   | -             |
| 2501CS72     | Student Activity Based Learning                                                                                 | AC    |          |   |          | 2        | 100 | -   | 100   | -             |
| <b>Total</b> |                                                                                                                 |       | <b>2</b> |   | <b>5</b> | <b>9</b> |     |     |       |               |

### Skill Enhancement Courses (SEC)

| Course Code  | Course Name                                  | Level | L | T | P        | C        | CIE | SEE | Total | Pre-requisite |
|--------------|----------------------------------------------|-------|---|---|----------|----------|-----|-----|-------|---------------|
| 2501AI34     | Web Application Development using MERN Stack | AC    |   |   | 2        | 2        | 50  | 50  | 100   | -             |
| 2501CS17     | Object Oriented Analysis & Design using UML  | IC    |   |   | 2        | 2        | 50  | 50  | 100   | ASE           |
| 2501IT08     | Bigdata Spark                                | AC    |   |   | 2        | 2        | 50  | 50  | 100   | -             |
| <b>Total</b> |                                              |       |   |   | <b>6</b> | <b>6</b> |     |     |       |               |

### Value Added Courses (VAC)

| Course Code  | Course Name              | Level | L | T | P         | C        | CIE | SEE | Total | Pre-requisite |
|--------------|--------------------------|-------|---|---|-----------|----------|-----|-----|-------|---------------|
| 2501UC11     | Employability Skills-I   | FC    |   |   | 3         | 0        | 100 | -   | 100   | -             |
| 2501UC13     | Employability Skills-II  | FC    |   |   | 3         | 0        | 100 |     | 100   | ES-I          |
| 2501AI06     | Data Analysis Essentials | IC    |   |   | 2         | 2        | 50  | 50  | 100   | PP            |
| 2501UC14     | Employability Skills-III | IC    |   |   | 3         | 0        | 100 |     | 100   | ES-II         |
| 2501UC15     | Employability Skills-IV  | IC    |   |   | 3         | 0        | 100 |     | 100   | ES-III        |
| 2501CS04     | Internet of Things       | FC    |   |   | 1         | 1        | 50  | 50  | -     | -             |
| 2501UC16     | Employability Skills-V   | AC    |   |   | 3         | 1        | 100 |     | 100   | ES-IV         |
| <b>Total</b> |                          |       |   |   | <b>18</b> | <b>4</b> |     |     |       |               |

### Summer Internships (SI)

| Course Code  | Course Name          | Level | L | T | P        | C        | CIE | SEE | Total | Pre-requisite |
|--------------|----------------------|-------|---|---|----------|----------|-----|-----|-------|---------------|
| 2501CS20     | Summer Internship-I  | IC    |   |   | 2        | 2        | 100 | -   | 100   | -             |
| 2501CS21     | Summer Internship-II | AC    |   |   | 2        | 2        | 100 | -   | 100   | -             |
| <b>Total</b> |                      |       |   |   | <b>4</b> | <b>4</b> |     |     |       |               |

### Full Semester Internship (PROJ)

| Course Code  | Course Name              | Level | L | T | P         | C         | CIE | SEE | Total | Pre-requisite |
|--------------|--------------------------|-------|---|---|-----------|-----------|-----|-----|-------|---------------|
| 2501CS22     | Full Semester Internship | AC    |   |   | 12        | 12        | 50  | 50  | 100   | -             |
| <b>Total</b> |                          |       |   |   | <b>12</b> | <b>12</b> |     |     |       |               |

### Mandatory Courses (MC)

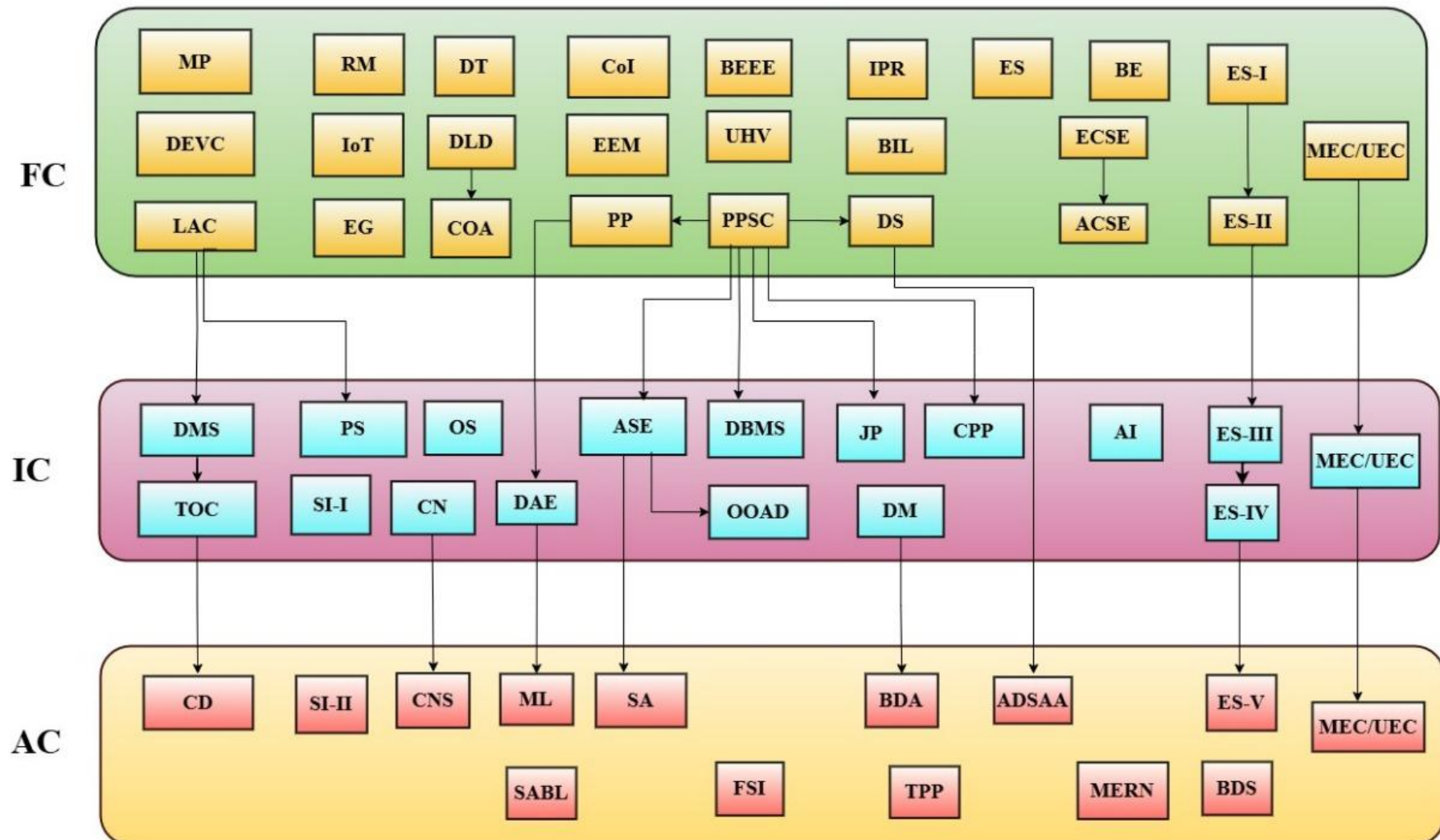
| Course Code  | Course Name                            | Level | L         | T | P | C        | CIE | SEE | Total | Pre-requisite |
|--------------|----------------------------------------|-------|-----------|---|---|----------|-----|-----|-------|---------------|
| 2501AC01     | Environmental Science                  | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC02     | Constitution of India                  | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC03     | Research Methodology                   | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC04     | Intellectual Property Rights & Patents | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC05     | Indian Knowledge Systems (IKS)         | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| <b>Total</b> |                                        |       | <b>10</b> |   |   | <b>0</b> |     |     |       |               |

### Minor Stream: Cloud ERP in Collaboration with SAP

| Course Code | Course Name                                   | Level | L         | T | P         | C         | CIE | SEE | Total | Pre-requisite |
|-------------|-----------------------------------------------|-------|-----------|---|-----------|-----------|-----|-----|-------|---------------|
| 2501CS81    | Integrated Business Processes in Cloud ERP I  | FC    | 2         |   | 1         | 3         | 50  | 50  | 100   | -             |
| 2501CS73    | Design Thinking using AI                      | FC    |           |   | 1         | 1         | 50  | 50  | 100   | -             |
| 2501CS74    | Basic ABAP Programming                        | FC    | 2         |   | 2         | 4         | 50  | 50  | 100   | -             |
| 2501CS77    | Fiori Programming-Basic                       | FC    | 2         |   | 2         | 4         | 50  | 50  | 100   | -             |
| 2501CS82    | Integrated Business Processes in Cloud ERP II | IC    | 2         |   | 1         | 3         | 50  | 50  | 100   | IBP1          |
| 2501CS75    | Intermediate ABAP Programming                 | IC    | 3         |   | 0         | 3         | 50  | 50  | 100   | BABAP         |
| 2501CS78    | Fiori Programming-Intermediate                | IC    | 2         |   | 2         | 4         | 50  | 50  | 100   | FPB           |
| 2501CS76    | Advanced ABAP Programming                     | AC    | 2         |   | 2         | 4         | 50  | 50  | 100   | IABAP         |
| 2501CS79    | Fiori Programming-Advanced                    | AC    | 2         |   | 2         | 4         | 50  | 50  | 100   | FBI           |
| 2501CS80    | Cloud ERP Implementation Methodology          | AC    | 2         |   | 1         | 3         | 50  | 50  | 100   | -             |
|             |                                               |       | <b>19</b> |   | <b>14</b> | <b>33</b> |     |     |       |               |



## B.Tech(CSE) Program Curriculum Pre-requisite Flow Chart



| Foundation Level Courses:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Intermediate Level Courses:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Advanced Level Courses:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LAC</b> - Linear algebra & Calculus<br><b>MP</b> – Modern Physics<br><b>PPSC</b> - Programming for Problem Solving Using C<br><b>BIL</b> – Business Intelligence Lab<br><b>EG</b> – Engineering Graphics<br><b>DLD</b> - Digital Logic Design<br><b>ECSE</b> – Essential Cognitive Skills for Engineers<br><b>DT</b> - Design Thinking using AI<br><b>ES</b> – Environmental Science<br><b>DEVC</b> - Differential equations & vector calculus<br><b>DS</b> - Data Structures<br><b>PP</b> - Programming with Python<br><b>COA</b> - Computer Organization & Architectures<br><b>EEM</b> - Engineering Economics & Management<br><b>BEEE</b> - Basic Electrical & Electronics Engineering<br><b>ACSE</b> - Advanced Cognitive Skills for Engineers (or) Proficiency in Foreign Language (Japanese/German/Spanish/French)<br><b>UHV</b> - Universal Human Values<br><b>ES-I</b> - Employability Skills-I<br><b>ES-II</b> - Employability Skills-II<br><b>CoI</b> - Constitution of India<br><b>RM</b> - Research Methodology<br><b>IPR</b> - Intellectual Property Rights & Patents<br><b>IoT</b> - Internet of Things<br><b>BE</b> - Biology for Engineers<br><b>IBP1</b> -Integrated Business Process in Cloud ERP I<br><b>BABAP</b> -Basic ABAP Programming<br><b>FPB</b> -Fiori Programming-Basic<br><b>CERP</b> -Cloud ERP Implementation Methodology | <b>DMS</b> - Discrete Mathematics<br><b>CPP</b> - Object Oriented Programming through C++<br><b>TOC</b> - Theory of Computation<br><b>DBMS</b> - Database Management Systems<br><b>ASE</b> – Agile Software Engineering<br><b>DAE</b> - Data Analysis Essentials<br><b>PS</b> - Probability & Statistics<br><b>JP</b> - Java Programming<br><b>OS</b> - Operating Systems<br><b>AI</b> - Artificial Intelligence<br><b>ES-III</b> - Employability Skills-III<br><b>CN</b> - Computer Networks<br><b>ES-IV</b> - Employability Skills-IV<br><b>OOAD</b> – Object Oriented Analysis & Design using UML<br><b>SI-I</b> - Summer Internship - I<br><b>DM</b> – Data Mining<br><b>IBP2</b> -Integrated Business Process in Cloud ERP II<br><b>IABAP</b> -Intermediate ABAP Programming<br><b>FPBI</b> -Fiori Programming-Intermediate | <b>ADSAA</b> – Advanced Data Structures and Algorithm Analysis<br><b>MERN</b> - Web Application Development using MERN Stack<br><b>CD</b> - Compiler Design<br><b>ML</b> - Machine Learning<br><b>BDA</b> - Big Data Analytics<br><b>CNS</b> - Cryptography & Network Security<br><b>SA</b> - Software Architecture<br><b>BDS</b> - Bigdata Spark<br><b>SI-II</b> - Summer Internship – II<br><b>TPP</b> - Technical Paper Publication<br><b>ABL</b> - Student Activity Based Learning<br><b>ES-V</b> - Employability Skills-V<br><b>FSI</b> – Full Semester Internship<br><br><b>AABAP</b> -Advanced ABAP Programming<br><br><b>FBA</b> -Fiori Programming-Advanced |

## Suggestive Semester-wise Curriculum

### I SEMESTER

| Course code     | Course Title                                                                 | Course     |           | Credits   |          |           |           | Total Hours |
|-----------------|------------------------------------------------------------------------------|------------|-----------|-----------|----------|-----------|-----------|-------------|
|                 |                                                                              | Category   | Level     | L         | T        | P         | Total     |             |
| 2501MA01        | Linear Algebra & Calculus                                                    | MCC        | FC        | 2         | 1        |           | 3         | 3           |
| 2501PH02        | Modern Physics                                                               | MCC        | FC        | 2         |          | 1         | 3         | 4           |
| 2501CS01        | Programming for Problem Solving Using C                                      | MCC        | FC        | 2         |          | 2         | 4         | 6           |
| 2501IT01        | Business Intelligence Lab                                                    | MCC        | FC        |           |          | 2         | 2         | 4           |
| 2501ME01        | Engineering Graphics                                                         | MCC        | FC        | 1         |          | 2         | 3         | 5           |
| <b>2501CS81</b> | Minor Stream Course-1<br><b>Integrated Business Processes in Cloud ERP I</b> | <b>MSC</b> | <b>FC</b> | <b>1</b>  |          | <b>2</b>  | <b>3</b>  | <b>5</b>    |
| 2501EC95        | Digital Logic Design                                                         | MDC        | FC        | 2         | 1        |           | 3         | 3           |
| 2501EN01        | Essential Cognitive Skills for Engineers                                     | AEC        | FC        |           |          | 1         | 1         | 2           |
| <b>Total</b>    |                                                                              |            |           | <b>10</b> | <b>2</b> | <b>10</b> | <b>22</b> | <b>32</b>   |

### II SEMESTER

| Course code  | Course Title                                                | Course   |       | Credits   |          |           |           | Total Hours |
|--------------|-------------------------------------------------------------|----------|-------|-----------|----------|-----------|-----------|-------------|
|              |                                                             | Category | Level | L         | T        | P         | Total     |             |
| 2501MA02     | Differential Equations & Vector Calculus                    | MCC      | FC    | 2         | 1        |           | 3         | 3           |
| 2501CS03     | Data Structures                                             | MCC      | FC    | 2         |          | 2         | 4         | 6           |
| 2501IT42     | Programming with Python                                     | MCC      | FC    | 2         |          | 2         | 4         | 6           |
| 2501CS71     | Computer Organization & Architecture                        | MCC      | FC    | 2         | 1        |           | 3         | 3           |
| 2501CS82     | Minor Stream Course-2<br>Business Processes in Cloud ERP II | MSC      | FC    | 2         |          | 1         | 3         | 4           |
| 2501EE01     | Basic Electrical & Electronics Engineering                  | MDC      | FC    | 2         |          | 2         | 4         | 6           |
| 2501EN02     | Advanced Cognitive Skills for Engineers                     | AEC      | FC    |           |          | 1         | 1         | 2           |
| 2501UC08     | Universal Human Values                                      | AEC      | FC    | 2         |          |           | 2         | 2           |
| 2501UC11     | Employability Skills-I                                      | VAC      | FC    |           |          | 3         | 0         | 0           |
| 2501AC01     | Environmental Science                                       | MC       | FC    | 2         |          |           | 0         | 2           |
| <b>Total</b> |                                                             |          |       | <b>16</b> | <b>2</b> | <b>11</b> | <b>24</b> | <b>36</b>   |

### III SEMESTER

| Course code     | Course Title                                            | Course     |           | Credits   |          |           |           | Total Hours |
|-----------------|---------------------------------------------------------|------------|-----------|-----------|----------|-----------|-----------|-------------|
|                 |                                                         | Category   | Level     | L         | T        | P         | Total     |             |
| 2501MA08        | Discrete Mathematics                                    | MCC        | IC        | 2         | 1        |           | 3         | 3           |
| 2501CS08        | Object Oriented Programming through C++                 | MCC        | IC        | 2         |          | 2         | 4         | 6           |
| 2501IT05        | Database Management Systems                             | MCC        | IC        | 2         |          | 2         | 4         | 6           |
| 2501IT07        | Agile Software Engineering                              | MCC        | IC        | 2         |          | 1         | 3         | 4           |
| 2501CS10        | Advanced Data Structures & Algorithm Analysis           | MCC        | AC        | 2         |          | 1         | 3         | 4           |
| <b>2501CS74</b> | <b>Minor Stream Course-3<br/>Basic ABAP Programming</b> | <b>MSC</b> | <b>FC</b> | <b>2</b>  |          | <b>2</b>  | <b>4</b>  | <b>6</b>    |
| 2501CS73        | Design Thinking                                         | AEC        | FC        |           |          | 1         | 1         | 2           |
| 2501UC13        | Employability Skills-II                                 | VAC        | FC        |           |          | 3         | 0         | 0           |
| 2501AI06        | Data Analysis Essentials                                | VAC        | IC        |           |          | 2         | 2         | 4           |
| 2501AC02        | Constitution of India                                   | MC         | FC        | 2         |          |           | 0         | 2           |
|                 | <b>Total</b>                                            |            |           | <b>14</b> | <b>1</b> | <b>14</b> | <b>24</b> | <b>37</b>   |

### IV SEMESTER

| Course code     | Course Title                                                   | Course     |           | Credits   |          |           |           | Total Hours |
|-----------------|----------------------------------------------------------------|------------|-----------|-----------|----------|-----------|-----------|-------------|
|                 |                                                                | Category   | Level     | L         | T        | P         | Total     |             |
| 2501MA09        | Probability & Statistics                                       | MCC        | IC        | 2         | 1        |           | 3         | 3           |
| 2501IT06        | Java Programming                                               | MCC        | IC        | 2         |          | 2         | 4         | 6           |
| 2501CS13        | Operating Systems                                              | MCC        | IC        | 2         |          | 1         | 3         | 4           |
| 2501AI02        | Artificial Intelligence                                        | MCC        | IC        | 2         |          | 1         | 3         | 4           |
| <b>2501CS75</b> | <b>Minor Stream Course-4<br/>Intermediate ABAP Programming</b> | <b>MSC</b> | <b>IC</b> | <b>3</b>  |          | <b>0</b>  | <b>3</b>  | <b>3</b>    |
| 2501CS77        | Minor Stream Course-5<br>Fiori Programming - Basic             | MSC        | FC        | 2         |          | 2         | 4         | 6           |
| 2501AI34        | Web Application Development using MERN Stack                   | SEC        | AC        |           |          | 2         | 2         | 4           |
| 2501UC14        | Employability Skills-III                                       | VAC        | IC        |           |          | 3         | 0         | 0           |
| 2501AC03        | Research Methodology                                           | MC         | FC        | 2         |          |           | 0         | 2           |
|                 | <b>Total</b>                                                   |            |           | <b>15</b> | <b>1</b> | <b>11</b> | <b>22</b> | <b>32</b>   |

### V SEMESTER

| Course code     | Course Title                                                   | Course     |           | Credits   |          |           |           | Total Hours |
|-----------------|----------------------------------------------------------------|------------|-----------|-----------|----------|-----------|-----------|-------------|
|                 |                                                                | Category   | Level     | L         | T        | P         | Total     |             |
| 2501CS07        | Computer Networks                                              | MCC        | IC        | 2         |          | 1         | 3         | 4           |
| <b>2501CS11</b> | <b>Theory of Computation</b>                                   | <b>MCC</b> | <b>IC</b> | <b>2</b>  | <b>1</b> |           | <b>3</b>  | <b>3</b>    |
| 2501AI05        | Machine Learning                                               | MCC        | AC        | 2         |          | 2         | 4         | 6           |
| <b>2501CS76</b> | <b>Minor Stream Course-6<br/>Advanced ABAP<br/>Programming</b> | <b>MSC</b> | <b>AC</b> | <b>2</b>  |          | <b>2</b>  | <b>4</b>  | <b>6</b>    |
| 2501CS78        | Minor Stream Course-7<br>Fiori Programming –<br>Intermediate   | MSC        | IC        | 2         |          | 2         | 4         | 6           |
| 2501CS17        | Object Oriented Analysis &<br>Design using UML                 | SEC        | IC        |           |          | 2         | 2         | 4           |
| 2501UC15        | Employability Skills-IV                                        | VAC        | IC        |           |          | 3         | 0         | 3           |
| 2501CS20        | Summer Internship-I                                            | SI         | IC        |           |          | 2         | 2         | 4           |
| 2501AC04        | Intellectual Property Rights &<br>Patents                      | MC         | FC        | 2         |          |           | 0         | 2           |
| <b>Total</b>    |                                                                |            |           | <b>12</b> | <b>1</b> | <b>14</b> | <b>22</b> | <b>38</b>   |

### VI SEMESTER

| Course code     | Course Title                                                     | Course     |           | Credits   |   |          |           | Total Hours |
|-----------------|------------------------------------------------------------------|------------|-----------|-----------|---|----------|-----------|-------------|
|                 |                                                                  | Category   | Level     | L         | T | P        | Total     |             |
| <b>2501IT04</b> | <b>Compiler Design</b>                                           | <b>MCC</b> | <b>AC</b> | <b>2</b>  |   | <b>1</b> | <b>3</b>  | <b>4</b>    |
| 2501AI03        | Data Mining                                                      | MCC        | IC        | 1         |   | 2        | 3         | 5           |
| 2501AI04        | Big Data Analytics                                               | MCC        | AC        | 2         |   | 1        | 3         | 4           |
| 2501CS10        | Engineering Economics &<br>Management                            | MDC        | FC        | 2         |   |          | 2         | 2           |
| 2501CS79        | Minor Stream Course-8<br>Fiori Programming - Advanced            | MSC        | AC        | 2         |   | 2        | 4         | 6           |
| 2501CS80        | Minor Stream Course-9<br>Cloud ERP Implementation<br>Methodology | MSC        | AC        | 2         |   | 1        | 3         | 4           |
| 2501CS04        | Internet of Things                                               | VAC        | FC        |           |   | 1        | 1         | 2           |
| 2501AC05        | Indian Knowledge Systems (IKS)                                   | MC         | FC        | 2         |   |          | 0         | 2           |
| <b>Total</b>    |                                                                  |            |           | <b>13</b> |   | <b>8</b> | <b>19</b> | <b>29</b>   |

### VII SEMESTER

| Course code  | Course Title                            | Course   |       | Credits  |   |          |           | Total Hours |
|--------------|-----------------------------------------|----------|-------|----------|---|----------|-----------|-------------|
|              |                                         | Category | Level | L        | T | P        | Total     |             |
| 2501IT03     | Cryptography & Network Security (MOOCS) | MCC      | AC    | 2        |   | 1        | 3         | 4           |
| 2501CS15     | Software Architecture (MOOCS)           | MCC      | AC    | 2        |   | 1        | 3         | 4           |
| 2501IT08     | Bigdata Spark (MOOCS)                   | SEC      | AC    |          |   | 2        | 2         | 4           |
| 2501CS21     | Summer Internship-II                    | SI       | AC    |          |   | 2        | 2         | 4           |
| <b>Total</b> |                                         |          |       | <b>4</b> |   | <b>6</b> | <b>10</b> | <b>16</b>   |

### VIII SEMESTER

| Course code  | Course Title                    | Course   |       | Credits |   |           |           | Total Hours |
|--------------|---------------------------------|----------|-------|---------|---|-----------|-----------|-------------|
|              |                                 | Category | Level | L       | T | P         | Total     |             |
| 2501UC09     | Technical Paper Publication     | AEC      | AC    |         |   | 2         | 2         | 4           |
| 2501CS72     | Student Activity Based Learning | AEC      | AC    |         |   |           | 2         | 0           |
| 2501UC16     | Employability Skills-V          | VAC      | AC    |         |   | 3         | 1         | 3           |
| 2501CS22     | Full Semester Internship        | PROJ     | AC    |         |   | 12        | 12        | 24          |
| <b>Total</b> |                                 |          |       |         |   | <b>17</b> | <b>17</b> | <b>31</b>   |

**\* To acquire a minor degree, a student has to earn 20 credits in addition to the 160 credits.**  
**Minor Degree in Computer Science and Engineering (offered to other branches students):**

| Course Code | Course Name                                                   | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite |
|-------------|---------------------------------------------------------------|-------|----|---|---|----|-----|-----|-------|---------------|
| 2501CS13    | Operating Systems                                             | IC    | 2  |   | 1 | 3  | 50  | 50  | 100   | -             |
| 2501CS07    | Computer Networks                                             | IC    | 2  |   | 1 | 3  | 50  | 50  | 100   | -             |
| 2501IT07    | Agile Software Engineering                                    | IC    | 2  |   | 1 | 3  | 50  | 50  | 100   | PPSC          |
| 2501AI03    | Data Mining                                                   | IC    | 1  |   | 2 | 3  | 50  | 50  | 100   | -             |
| 2501CS08    | Object Oriented Programming through C++ (or) Java Programming | IC    | 2  |   | 2 | 4  | 50  | 50  | 100   | PPSC          |
| 2501IT06    |                                                               |       |    |   |   |    |     |     |       |               |
| 2501CS16    | Introduction to MERN Stack Development(or)                    | IC    |    |   | 2 | 2  | 50  | 50  | 100   | JP            |
| 2501CS30    | Information Security Analysis & Audit                         |       | 2  |   |   | 2  | 50  | 50  | 100   | -             |
| 2501CS18    | Advanced MERN Stack Development (or)                          | AC    |    |   | 2 | 2  | 50  | 50  | 100   | IMSD          |
| 2501IT12    | Flutter Fundamentals                                          |       |    |   | 2 | 2  | 50  | 50  | 100   | -             |
|             | Total                                                         |       | 11 |   | 9 | 20 |     |     |       |               |

### Minor Degree in Civil Engineering

| Course Code | Course Name                                                           | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite |
|-------------|-----------------------------------------------------------------------|-------|----|---|---|----|-----|-----|-------|---------------|
| 2501CE25    | Repair & Rehabilitation of Structures                                 | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501CE43    | Building Planning & Computer-Aided Drawing                            | FC    |    |   | 2 | 2  | 50  | 50  | 100   | -             |
| 2501CE27    | Green Buildings                                                       | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501CE40    | Fundamentals of Soil Behaviour                                        | FC    | 2  | 1 |   | 3  | 50  | 50  | 100   | -             |
| 2501CE54    | Railway Engineering (or)Docks & Harbour Engineering                   | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501CE47    |                                                                       |       |    |   |   |    |     |     |       |               |
| 2501CE36    | Environmental Impact & Risk Management(or) Environmental Management   | IC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501CE37    |                                                                       |       |    |   |   |    |     |     |       |               |
| 2501CE56    | Urban Transportation Planning (or) Intelligent Transportation Systems | IC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501CE49    |                                                                       |       |    |   |   |    |     |     |       |               |
| Total       |                                                                       |       | 17 | 1 | 2 | 20 |     |     |       |               |

### Minor Degree in Electrical and Electronics Engineering

| Course Code | Course Name                                                      | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite     |
|-------------|------------------------------------------------------------------|-------|----|---|---|----|-----|-----|-------|-------------------|
| 2501EE55    | Operation &Control of Electric machines                          | FC    | 2  |   |   | 2  | 50  | 50  | 100   | BEEE              |
| 2501EE56    | Fundamentals of Power Electronics                                | FC    | 2  |   |   | 2  | 50  | 50  | 100   | BEEE              |
| 2501EE13    | Electrical Measurements & Instrumentation                        | FC    | 2  | 1 | 1 | 4  | 50  | 50  | 100   | ENA-1/BEEE        |
| 2501EE53    | Electric Power Generation, Transmission and Distribution Systems | IC    | 3  |   |   | 3  | 50  | 50  | 100   | ENA-1/BEEE        |
| 2501EE34    | Alternative Energy Sources (or) Utilization of Electrical Energy | IC    | 3  |   |   | 3  | 50  | 50  | 100   | EPGDS / BEEE/ ISM |
| 2501EE27    |                                                                  |       |    |   |   |    |     |     |       |                   |
| 2501EE37    | Hybrid Electric Vehicles (or) Special Electric machines          | AC    | 3  |   |   | 3  | 50  | 50  | 100   | FPE/ OCEM         |
| 2501EE35    |                                                                  |       |    |   |   |    |     |     |       |                   |
| 2501EE43    | Electrical Safety (or)                                           | AC    | 3  |   |   | 3  | 50  | 50  | 100   | EPGDS/PSA         |
| 2501EE30    | Methods & Algorithms for Intelligent Control                     |       |    |   |   |    |     |     |       |                   |
|             | Total                                                            |       | 18 | 1 | 1 | 20 |     |     |       |                   |

### Minor Degree in Mechanical Engineering

| Course Code | Course Name                             | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite |
|-------------|-----------------------------------------|-------|----|---|---|----|-----|-----|-------|---------------|
| 2501ME74    | Basic Mechanical Engineering            | FC    | 2  |   |   | 2  | 50  | 50  | 100   | -             |
| 2501ME04    | Engineering Thermodynamics              | IC    | 2  | 1 |   | 3  | 50  | 50  | 100   | SSP/MP        |
| 2501ME77    | Introduction to Automobile              | IC    | 3  |   |   | 3  | 50  | 50  | 100   | SSP/MP        |
| 2501ME78    | Engineering (or)<br>Mechanics of Solids |       |    |   |   |    |     |     |       |               |
| 2501ME12    | Heat Power Engineering (or)             | IC    | 2  | 1 |   | 3  | 50  | 50  | 100   | ETD           |
| 2501ME40    | Refrigeration & Air<br>Conditioning     |       |    |   |   |    |     |     |       |               |
| 2501ME75    | Production Technology                   | IC    | 3  |   |   | 3  | 50  | 50  | 100   | EW            |
| 2501ME76    | Metallurgy & Material<br>Science        | IC    | 3  |   |   | 3  | 50  | 50  | 100   | SSP/MP        |
| 2501ME79    | Theory of Machines (or)                 | AC    | 3  |   |   | 3  | 50  | 50  | 100   | SSP/MP        |
| 2501ME80    | Advanced Engineering<br>Metrology       |       |    |   |   |    |     |     |       |               |
|             | Total                                   |       | 18 | 2 |   | 20 |     |     |       |               |

### Minor Degree in Electronics & Communication Engineering

| Course Code | Course Name                                                            | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite      |
|-------------|------------------------------------------------------------------------|-------|----|---|---|----|-----|-----|-------|--------------------|
| 2501EC87    | Fundamentals of Communications                                         | FC    | 2  |   | 1 | 3  | 50  | 50  | 100   | -                  |
| 2501EC88    | Fundamentals of Signal Processing                                      | FC    | 2  |   | 1 | 3  | 50  | 50  | 100   | -                  |
| 2501EC89    | Analog & Digital Circuits                                              | IC    | 2  |   |   | 2  | 50  | 50  | 100   | BEEE               |
| 2501EC42    | Wireless LAN's & PAN's                                                 | IC    | 2  | 1 |   | 3  | 50  | 50  | 100   | -                  |
| 2501EC90    | Linear & Digital IC Applications (or) Sensors & Actuators              | IC    | 3  |   |   | 3  | 50  | 50  | 100   | ADC                |
| 2501EC91    |                                                                        |       |    |   |   |    |     |     |       |                    |
| 2501EC92    | Embedded Microcontrollers (or) Digital System Design                   | IC    | 2  |   | 1 | 3  | 50  | 50  | 100   | ADC, PPSC          |
| 2501EC93    |                                                                        |       |    |   |   |    |     |     |       |                    |
| 2501EC67    | Introduction to Internet of things (or) Modern Wireless Communications | AC    | 2  |   | 1 | 3  | 50  | 50  | 100   | EM, WLAN's & PAN's |
| 2501EC74    |                                                                        |       | 3  |   |   | 3  | 50  | 50  | 100   | FC                 |
| Total       |                                                                        |       | 15 | 1 | 4 | 20 |     |     |       |                    |

### Minor Degree in Petroleum Technology

| Course Code  | Course Name                                                                                 | Level | L         | T | P | C         | CIE | SEE | Total | Pre-requisite |
|--------------|---------------------------------------------------------------------------------------------|-------|-----------|---|---|-----------|-----|-----|-------|---------------|
| 2501PT27     | Introduction to Petroleum Engineering                                                       | FC    | 2         |   |   | 2         | 50  | 50  | 100   | -             |
| 2501PT35     | Unit Operations in Petroleum Industry                                                       | FC    | 3         |   |   | 3         | 50  | 50  | 100   | -             |
| 2501PT47     | Fundamentals of Geology & Reservoir Engineering                                             | IC    | 3         |   |   | 3         | 50  | 50  | 100   | -             |
| 2501PT48     | Fundamentals of Drilling & Production Engineering (or) Unconventional Hydrocarbon Resources | IC    | 3         |   |   | 3         | 50  | 50  | 100   | -             |
| 2501PT16     |                                                                                             |       |           |   |   |           |     |     |       |               |
| 2501PT49     | Natural Gas Hydrates (or) Fundamentals of Liquefied Natural Gas                             | AC    | 3         |   |   | 3         | 50  | 50  | 100   | -             |
| 2501PT05     |                                                                                             |       |           |   |   |           |     |     |       |               |
| 2501PT50     | Artificial Lift Techniques (or) Enhanced Oil Recovery                                       | AC    | 3         |   |   | 3         | 50  | 50  | 100   | -             |
| 2501PT03     |                                                                                             |       |           |   |   |           |     |     |       |               |
| 2501PT12     | Petroleum Refinery Engineering                                                              | AC    | 3         |   |   | 3         | 50  | 50  | 100   | -             |
| <b>Total</b> |                                                                                             |       | <b>20</b> |   |   | <b>20</b> |     |     |       |               |

### Minor Degree in Mining Engineering

| Course Code | Course Name                                               | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite |
|-------------|-----------------------------------------------------------|-------|----|---|---|----|-----|-----|-------|---------------|
| 2501MN03    | Development of Mineral Deposits                           | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MN41    | Green Mining                                              | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MN06    | Surface Mining                                            | IC    | 3  |   |   | 3  | 50  | 50  | 100   | DMD           |
| 2501MN24    | Drilling & Blasting                                       | IC    | 3  |   |   | 3  |     |     | 100   | DMD           |
| 2501MN07    | Underground Coal Mining                                   | IC    | 3  |   |   | 3  | 50  | 50  | 100   | DMD           |
| 2501MN08    | Technology (or)<br>Underground Metal Mining<br>Technology |       |    |   |   |    |     |     |       |               |
| 2501MN14    | Mine Legislation & General Safety                         | AC    | 3  |   |   | 3  | 50  | 50  | 100   | UCMT/<br>UMMT |
| 2501MN28    | (or)<br>Environmental Pollution & Control                 |       |    |   |   |    |     |     |       |               |
| 2501MN45    | Industrial Safety Practices(or)                           | AC    | 2  |   |   | 2  | 50  | 50  | 100   | -             |
| 2501MN46    | Ground Control                                            |       |    |   |   |    |     |     |       |               |
| Total       |                                                           |       | 20 |   |   | 20 |     |     |       |               |

### Minor Degree in Agricultural Engineering

| Course Code | Course Name                                          | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite |
|-------------|------------------------------------------------------|-------|----|---|---|----|-----|-----|-------|---------------|
| 2501AE82    | Fundamentals of Renewable Energy Sources             | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501AE83    | Post-harvest Engineering of Cereal Crops             | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501AE84    | Ground Water Hydrology                               | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501AE85    | Micro Irrigation Systems                             | IC    | 2  |   |   | 2  | 50  | 50  | 100   | -             |
| 2501AE86    | Surface Water Hydrology (or)                         | IC    | 3  |   |   | 3  | 50  | 50  | 100   | GWH           |
| 2501AE87    | Land & Water Management Engineering                  |       |    |   |   |    |     |     |       |               |
| 2501AE88    | Agricultural Process Engineering & Food Quality (or) | AC    | 3  |   |   | 3  | 50  | 50  | 100   | PHECC         |
| 2501AE89    | Post-harvest Engineering for Horticultural Produce   |       |    |   |   |    |     |     |       |               |
| 2501AE90    | Agricultural Machinery & Equipment (or)              | AC    | 3  |   |   | 3  | 50  | 50  | 100   | FRES          |
| 2501AE91    | Design of Bio-energy systems                         |       |    |   |   |    |     |     |       |               |
| TOTAL       |                                                      |       | 20 |   |   | 20 |     |     |       |               |

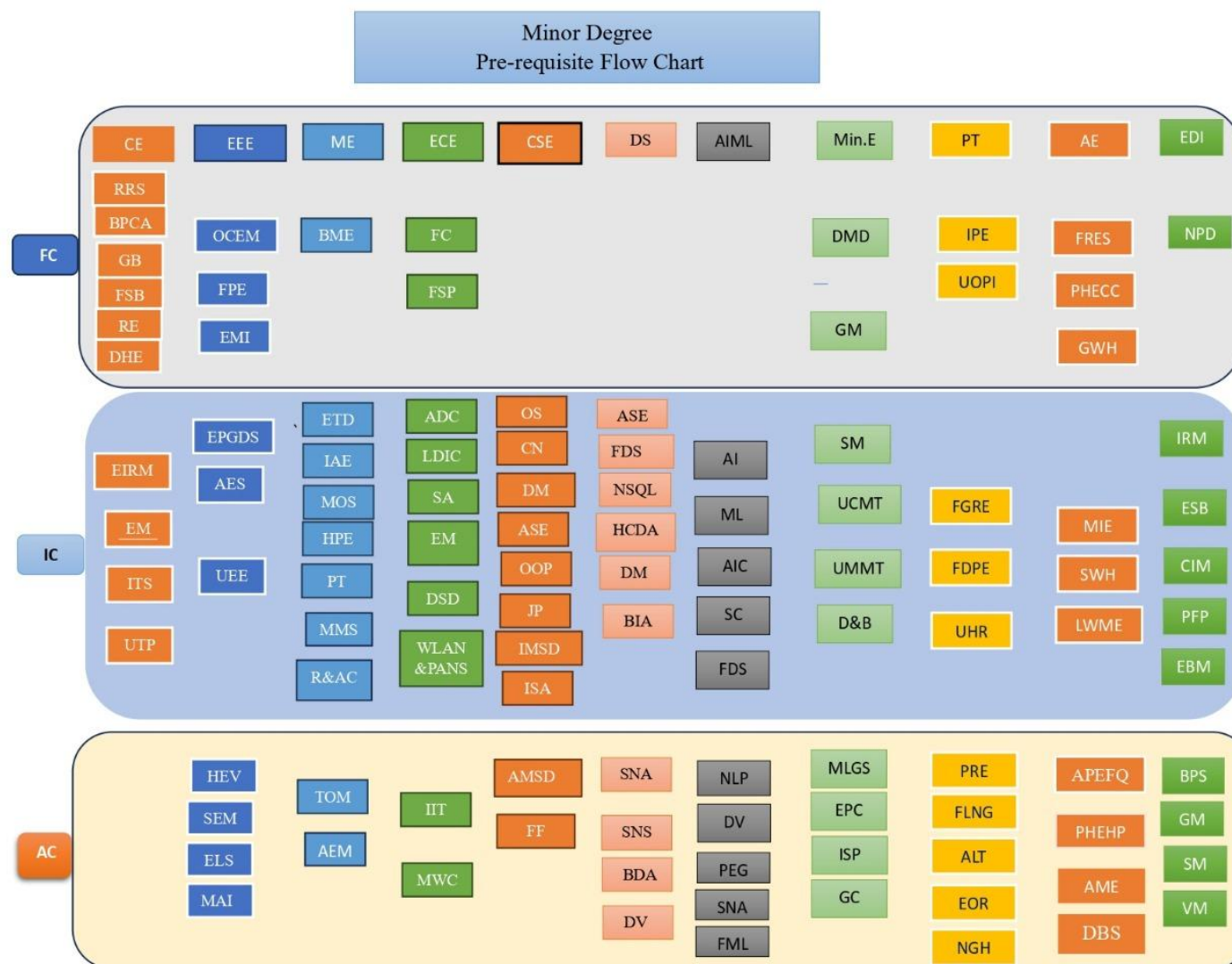
### Minor Degree in Entrepreneurship Development & Incubation

| Course Code | Course Name                                  | Level | L  | T | P | C  | CIE | SEE | Total | Pre-requisite |
|-------------|----------------------------------------------|-------|----|---|---|----|-----|-----|-------|---------------|
| 2501MB07    | New Product Development                      | FC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MB08    | Entrepreneurship & Small Business Management | IC    | 2  |   |   | 2  | 50  | 50  | 100   | -             |
| 2501MB09    | Insurance & Risk Management                  | IC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MB10    | Change & Innovations Management              | IC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MB11    | Personal Financial Planning (or)             | IC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MB12    | E-Business management                        |       |    |   |   |    |     |     |       |               |
| 2501MB13    | Business Policy & Strategic Management       | AC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MB14    | (or)Green Marketing                          |       |    |   |   |    |     |     |       |               |
| 2501MB15    | Startup Management                           | AC    | 3  |   |   | 3  | 50  | 50  | 100   | -             |
| 2501MB16    | (or) Venture Management                      |       |    |   |   |    |     |     |       |               |
| Total       |                                              |       | 20 |   |   | 20 |     |     |       |               |

### Minor Degree in Quantum Technologies

| S.No.                         | Course Code | Course Name                                      | L                             | T | P | C | Semester |
|-------------------------------|-------------|--------------------------------------------------|-------------------------------|---|---|---|----------|
| Mandatory Courses             |             |                                                  |                               |   |   |   |          |
| 1                             | 251EC097    | Survey of Quantum technologies and Application   | 3                             | 0 | 0 | 3 | IV       |
| 2                             | 251EC098    | Foundations of Quantum Technologies              | 3                             | 0 | 0 | 3 | V        |
| 3                             | 251EC099    | Basic Programming Lab (or)                       | 1                             | 0 | 2 | 3 | V        |
|                               | 251EC100    | Basic Laboratory Course for Quantum Technologies |                               |   |   |   |          |
| 4                             | 251EC101    | Quantum Algorithms and Cryptography              | 12 week 3 Credit - NPTEL MOOC |   |   | 3 | VII/VIII |
| Any One course from the below |             |                                                  |                               |   |   |   |          |
| 5                             | 251EC102    | Introduction to Quantum Computation              | 3                             | 0 | 0 | 3 | VI       |
| 6                             | 251EC103    | Introduction to Quantum Communication            | 3                             | 0 | 0 | 3 | VI       |

|                                      |          |                                                 |           |          |          |           |     |
|--------------------------------------|----------|-------------------------------------------------|-----------|----------|----------|-----------|-----|
| 7                                    | 251EC104 | Introduction to Quantum Sensing                 | 3         | 0        | 0        | 3         | VI  |
| 8                                    | 251EC105 | Introduction to Quantum Materials               | 3         | 0        | 0        | 3         | VI  |
| <b>Any One course from the below</b> |          |                                                 |           |          |          |           |     |
| 9                                    | 251EC106 | Engineering Foundations of Quantum Technologies | 3         | 0        | 0        | 3         | VII |
| 10                                   | 251EC107 | Solid State Physics for Quantum Technologies    | 3         | 0        | 0        | 3         | VII |
| 11                                   | 251EC108 | Quantum Optics                                  | 3         | 0        | 0        | 3         | VII |
| 12                                   | 251EC109 | Quantum Cybersecurity                           | 3         | 0        | 0        | 3         | VII |
| 13                                   | 251EC110 | Quantum Machine Learning                        | 3         | 0        | 0        | 3         | VII |
| <b>Total</b>                         |          |                                                 | <b>18</b> | <b>0</b> | <b>0</b> | <b>18</b> |     |



| Dept. | FOUNDATION COURSE |                                            | INTERMEDIATE- LEVEL COURSE |                                                  | ADVANCED COURSE |                                              |
|-------|-------------------|--------------------------------------------|----------------------------|--------------------------------------------------|-----------------|----------------------------------------------|
| CE    | RRS               | Repair & Rehabilitation of Structures      | EIRM                       | Environmental Impact & Risk Management           |                 |                                              |
|       | BPCA              | Building Planning & Computer-Aided Drawing | EM                         | Environmental Management                         |                 |                                              |
|       | GB                | Green Building                             | UTP                        | Urban Transportation Planning                    |                 |                                              |
|       | FSB               | Fundamental of Soil Behaviour              | ITS                        | Intelligent Transportation Systems               |                 |                                              |
|       | RE                | Railway Engineering                        |                            |                                                  |                 |                                              |
|       | DHE               | Docks & Harbour Engineering                |                            |                                                  |                 |                                              |
| EEE   | OCEM              | Operation control of Electric Machines     | AES                        | Alternative Energy Sources                       | MAI             | Methods & Algorithms for Intelligent Control |
|       | FPE               | Fundamentals of Power Electronics          | EPGDS                      | Electric Power Generation & Distribution Systems | HEV             | Hybrid Electric Vehicles                     |
|       | EMI               | Electrical Measurements & Instrumentation  | UEE                        | Utilization of Electrical Energy                 | SEM             | Special Electric Machines                    |
|       |                   |                                            |                            |                                                  | ES              | Electrical Safety                            |
|       |                   |                                            |                            |                                                  |                 |                                              |
| ME    | BME               | Basic Mechanical Engineering               | ETD                        | Engineering Thermodynamics                       | TOM             | Theory of Machines                           |
|       |                   |                                            | IAE                        | Introduction to Automobile Engineering           | AEM             | Advanced Engineering Metrology               |
|       |                   |                                            | MOS                        | Mechanics of Solids                              |                 |                                              |
|       |                   |                                            | HPE                        | Heat Power Engineering                           |                 |                                              |
|       |                   |                                            | PT                         | Production Technology                            |                 |                                              |
|       |                   |                                            | MMS                        | Metallurgy & Material Science                    |                 |                                              |
|       |                   |                                            | R&AC                       | Refrigeration & Air Conditioning                 |                 |                                              |
| ECE   | FC                | Fundamentals of Communications             | ADC                        | Analog & Digital Circuits                        | IIT             | Introduction to Internet of things           |
|       |                   |                                            | LDIC                       | Linear & Digital IC Applications                 |                 |                                              |
|       |                   |                                            | SA                         | Sensors & Actuators                              |                 |                                              |
|       | FSP               | Fundamentals of Signal Processing          | EM                         | Embedded Microcontrollers                        | MWC             | Modern Wireless Communications               |
|       |                   |                                            | DSD                        | Digital System Design                            |                 |                                              |
|       |                   |                                            | WLAN&PAN                   | Wireless LANS & PANS                             |                 |                                              |
| CSE   |                   |                                            | ASE                        | Agile Software Engineering                       | AMSD            | Advanced MERN Stack Development              |
|       |                   |                                            | OOP                        | Object Oriented Programming through C++          |                 |                                              |
|       |                   |                                            | OS                         | Operating Systems                                | FF              | Flutter Fundamentals                         |
|       |                   |                                            | CN                         | Computer Networks                                |                 |                                              |
|       |                   |                                            | JP                         | Java Programming                                 |                 |                                              |
|       |                   |                                            | IMSD                       | Introduction to MERN                             |                 |                                              |

|               |        |                                          |      |                                                     |       |                                                    |
|---------------|--------|------------------------------------------|------|-----------------------------------------------------|-------|----------------------------------------------------|
|               |        |                                          |      | Stack Development                                   |       |                                                    |
|               |        |                                          | ISA  | Information Security Analysis and Audit             |       |                                                    |
|               |        |                                          | DM   | Data Mining                                         |       |                                                    |
| <b>DS</b>     |        |                                          | DM   | Data Mining                                         | SNA   | Social Network Analysis                            |
|               |        |                                          | FDS  | Fundamentals of Data Science                        | DV    | Data Visualization                                 |
|               |        |                                          | ASE  | Agile Software Engineering                          | BDA   | Big Data Analytics                                 |
|               |        |                                          | NSQL | NoSQL Databases                                     | SNSW  | Social Networks and Semantic Web                   |
|               |        |                                          | BIA  | Business Intelligence & Analytics                   |       |                                                    |
|               |        |                                          | HCDA | Health Care Data Analysis                           |       |                                                    |
|               |        |                                          |      |                                                     |       |                                                    |
| <b>AIML</b>   |        |                                          | ML   | Machine Learning                                    | DV    | Data Visualization                                 |
|               |        |                                          | AI   | Artificial Intelligence                             | PEG   | Prompt Engineering and GenAI                       |
|               |        |                                          | AI C | AI Chatbot                                          | SNA   | Social Network Analysis                            |
|               |        |                                          | FDS  | Fundamentals of Data Science                        | FML   | Federated Machine Learning                         |
|               |        |                                          | SC   | Soft Computing                                      | NLP   | Natural Language Processing                        |
| <b>Min. E</b> | DMD    | Development of Mineral Deposits          | SM   | Surface Mining                                      | MLGS  | Mine Legislation and General Safety                |
|               | GM     | Green Mining                             | UCMT | Underground Coal Mining Technology                  | EPC   | Environmental Pollution & Control                  |
|               |        |                                          | UMMT | Underground Metal Mining Technology                 | ISP   | Industrial Safety Practices                        |
|               |        |                                          | DB   | Drilling & Blasting                                 | GC    | Ground Control                                     |
| <b>PT</b>     | IPE    | Introduction to Petroleum Engineering    | FGRE | Fundamentals of Geology and Reservoir Engineering   | PRE   | Petroleum Refinery Engineering                     |
|               | UOPI   | Unit operations in Petroleum Industry    | FDPE | Fundamentals of Drilling and Production Engineering | FLNG  | Fundamentals of Liquefied Natural Gas              |
|               |        |                                          |      |                                                     | NGH   | Natural Gas Hydrates                               |
|               |        |                                          | UHR  | Unconventional Hydrocarbon Resources                | ALT   | Artificial Lift Techniques                         |
|               |        |                                          |      |                                                     | EOR   | Enhanced Oil Recovery                              |
| <b>Ag.E</b>   | GWH    | Ground Water Hydrology                   | LWME | Land and Water Management                           | DBS   | Design of Bio-Energy Systems                       |
|               | PHEC C | Post-harvest Engineering of Cereal Crops | SWH  | Surface Water Hydrology                             | PHEHP | Post-Harvest Engineering for Horticultural Produce |
|               |        |                                          | MIE  | Micro Irrigation Systems                            |       |                                                    |
|               | FRES   | Fundamentals of Renewable Energy Sources |      |                                                     | AME   | Agricultural Machinery and Equipment               |



### Major Core Courses (MCC)

| Course Code  | Course Name                                   | Level | L         | T        | P         | C         | CIE | SEE | Total | Pre-requisite |
|--------------|-----------------------------------------------|-------|-----------|----------|-----------|-----------|-----|-----|-------|---------------|
| 2501MA01     | Linear algebra & Calculus                     | FC    | 2         | 1        |           | 3         | 50  | 50  | 100   | -             |
| 2501PH02     | Modern Physics                                | FC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501CS01     | Programming for Problem Solving Using C       | FC    | 2         |          | 2         | 4         | 50  | 50  | 100   | -             |
| 2501IT01     | Business Intelligence Lab                     | FC    |           |          | 2         | 2         | 50  | 50  | 100   | -             |
| 2501ME01     | Engineering Graphics                          | FC    | 1         |          | 2         | 3         | 50  | 50  | 100   | -             |
| 2501MA02     | Differential Equations & Vector Calculus      | FC    | 2         | 1        |           | 3         | 50  | 50  | 100   | -             |
| 2501CS03     | Data Structures                               | FC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501IT42     | Programming with Python                       | FC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501CS71     | Computer Organization & Architecture          | FC    | 2         | 1        |           | 3         | 50  | 50  | 100   | DLD           |
| 2501MA08     | Discrete Mathematics                          | IC    | 2         | 1        |           | 3         | 50  | 50  | 100   | LAC           |
| 2501CS08     | Object Oriented Programming through C++       | IC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501CS11     | Theory of Computation                         | IC    | 2         | 1        |           | 3         | 50  | 50  | 100   | DMS           |
| 2501IT05     | Database Management Systems                   | IC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501IT07     | Agile Software Engineering                    | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | PPSC          |
| 2501MA09     | Probability & Statistics                      | IC    | 2         | 1        |           | 3         | 50  | 50  | 100   | LAC           |
| 2501IT06     | Java Programming                              | IC    | 2         |          | 2         | 4         | 50  | 50  | 100   | PPSC          |
| 2501CS13     | Operating Systems                             | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501AI02     | Artificial Intelligence                       | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501CS07     | Computer Networks                             | IC    | 2         |          | 1         | 3         | 50  | 50  | 100   | -             |
| 2501AI03     | Data Mining                                   | IC    | 1         |          | 2         | 3         | 50  | 50  | 100   | -             |
| 2501CS10     | Advanced Data Structures & Algorithm Analysis | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | DS            |
| 2501IT04     | Compiler Design                               | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | TOC           |
| 2501AI05     | Machine Learning                              | AC    | 2         |          | 2         | 4         | 50  | 50  | 100   | DAE           |
| 2501AI04     | Big Data Analytics                            | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | DM            |
| 2501IT03     | Cryptography & Network Security               | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | CN            |
| 2501CS15     | Software Architecture                         | AC    | 2         |          | 1         | 3         | 50  | 50  | 100   | ASE           |
| <b>Total</b> |                                               |       | <b>47</b> | <b>6</b> | <b>30</b> | <b>84</b> |     |     |       |               |

## Linear Algebra & Calculus

(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E)

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
|                              | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Code: 2501MA01</b> | <b>2</b> | <b>1</b> | <b>0</b> | <b>3</b> |

### Course Outcomes:

**At the end of the Course, Student will be able to:**

- CO1:** Solve the system of Linear equations
- CO2:** Calculate Eigen values and Eigen vectors
- CO3:** Apply differential calculus for one and several variable functions
- CO4:** Calculate the Maximum value and Minimum value of a function of several variables
- CO5:** Compute areas and volumes using multiple integrals

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |
| <b>CO2</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |
| <b>CO3</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |
| <b>CO4</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |
| <b>CO5</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |

### UNIT – I

**System of linear equations:** Vector Space, Linear Independence, Rank of a matrix by echelon form, normal form, Inverse of Non-singular matrices by Gauss-Jordan method, Solutions of Linear Systems: Existence, Uniqueness, Solving the system by Gauss elimination method.

#### Practice(Using any computational tool)

- Variables, arithmetic operations, elementary mathematical functions.
- Defining row vector, column vector, Arithmetic operations on matrices
- finding transpose of a matrix, inverse of a matrix, determinant of a matrix
- rank of a matrix, solving system of linear equations.

### UNIT – II

**Eigenvalues, Eigenvectors :** Eigenvalues and properties(without proof), Eigenvectors, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), Quadratic forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation, Nature of Quadratic forms.

#### Practice(Using any computational tool):

- Computing eigen values and eigen vectors, matrix diagonalization.

### UNIT-III

**One Variable Calculus:** Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

**Several Variable Calculus:** Limit, Continuity, partial derivatives and their geometrical interpretation.

**Practice(Using any computational tool):**Basics of plotting,Plot graphs of single variable functions

#### **UNIT – IV**

**Functions of several variables:**Total differential and differentiability,derivatives of composite and implicit functions,derivatives of higher order and their commutativity,Euler's theorem on homogeneous functions , Taylor's and Maclaurin's expansion of functions of two variables. Jacobians, maxima and minima, constrained maxima/minima problems using Lagrange's method of multipliers.

**Practice(Using any computational tool):** Plot graphs of various multi variable functions

#### **UNIT – V**

**Multiple Integrals:** Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**Practice(Using any computational tool):**Plotting the region of Integration

Students are advised to use any computational / AI Tool like Wolfram Alpha, Symbolab, Mathway, Desmos, Geogebra etc., for the practice

#### **Text Books:**

- 1 Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 5th Edition (9th reprint), 2021· ISBN 978-8184875607
- 2 Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 5th Edition, 2018. ISBN-13. 978-1292174341

#### **Reference Books:**

- 1 Advanced Engineering Mathematics, Michael Greenberg, Pearson publishers, 9th edition. ISBN-13. 9788177585469
- 2 Higher Engineering Mathematics, H. K. Dass, Er. R. Verma, S-Chand publishers, 3rd edition 2023.ISBN 9788121938907

#### **Web Links:**

- 1 <https://archive.nptel.ac.in/courses/111/104/111104137/>
- 2 <https://archive.nptel.ac.in/courses/111/107/111107108/>
- 3 <https://www.khanacademy.org/math/linear-algebra/>
- 4 <https://www.khanacademy.org/math/multivariable-calculus>

## Modern Physics

(Common to EEE, ECE, CSE, IT, AIML & CSE (DS))

|                             |          |          |          |          |
|-----------------------------|----------|----------|----------|----------|
|                             | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Code:2501PH02</b> | <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

At the end of the Course, Student will be able to:

- CO1** Apply the principles of interference and diffraction to design and enhance the resolving power of grating
- CO2** Familiarize the concepts of LASER's and Optical fibres with applications.
- CO3** Explain the fundamental concepts of Quantum behavior of matter
- CO4** Differentiate various electron theories to understand the properties of solids.
- CO5** Explain the basic concepts of Semiconductors and identify the type of semiconductors using Hall effect.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 2   | 1   | -   | -   | -   | -   | -   | 1   | 1   | -    | -    |
| <b>CO2</b> | 2   | 1   | -   | -   | -   | -   | -   | 1   | 1   | -    | -    |
| <b>CO3</b> | 2   | 1   | -   | -   | -   | -   | -   | 1   | 1   | -    | -    |
| <b>CO4</b> | 2   | 1   | -   | -   | -   | -   | -   | 1   | 1   | -    | -    |
| <b>CO5</b> | 2   | 1   | -   | -   | -   | -   | -   | 1   | 1   | -    | -    |

## UNIT-I

### Wave Optics

**Interference:** Introduction - Principle of Superposition - Interference of light- Conditions for sustained Interference- Interference in thin films (reflected geometry) – Colours in thin films – Newton's Rings (reflected geometry) – Determination of wavelength and refractive index – Applications.

**Diffraction:** Introduction – Fresnel and Fraunhofer Diffraction - Diffraction due to Single slit (quantitative), Double slit (qualitative) - N-Slits Intensity distribution curves (qualitative) – Grating spectrum–Rayleigh's criterion - Resolving powers of grating (qualitative) - Applications.

### Practice:

- Determination of Radius of curvature of a plano-convex lens using Newton's Rings.
- Measurement of Width or thickness of a thin wire by forming interference fringes.
- Determination of Wavelength of light source using Diffraction grating by normal incidence method.

4. Resolving power of grating.
5. Determination of wavelength of light by using prism.

## UNIT-II

### **Lasers & Optical Fibers**

**Lasers:** Introduction - Characteristics of Lasers – Spontaneous and Stimulated emission of radiation – population inversion- Einstein's coefficients – Relation - significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser - Applications.

**Optical Fibers:** Introduction – Principle of propagation in Optical Fiber – Angle of acceptance – Expression for Numerical Aperture and condition for propagation – Classification of Optical fibers - Applications.

#### **Practice:**

1. Determination of Wavelength of He-Ne laser source by using diffraction grating.

## UNIT-III

### **Quantum Mechanics**

Introduction – Matter waves – de Broglie's hypothesis – Davisson and Germer Experiment - Heisenberg's Uncertainty Principle – interpretation of wave function – Schrödinger Time dependent and Time Independent wave equations– Particle in a potential box.

## Unit-IV

### **Free electron Theory**

**Free Electron Theory:** Introduction–Classical free electron theory (merits and demerits only) -Quantum Free electron theory – Electrical conductivity- Fermi energy state–Fermi Dirac distribution function - Temperature dependence – Density of states.

**Band theory of solids:** Bloch Theorem – Origin of energy bands in crystalline solids – classification of crystalline solids.

#### **Practice:**

1. Study the variation of magnetic field along the axis of a circular coil carrying current by using Stewart and Gee's apparatus.
2. Determination of Frequency of electrically maintained tuning fork by Melde's apparatus.

## UNIT-V

### **Semiconductor Physics**

**Semiconductors** Introduction – Intrinsic semiconductors – density of charge carriers (Qualitative only) – Electrical conductivity –Fermi level - extrinsic semiconductors - P-type & N-type semiconductors-Density of charge carriers (Qualitative only) - Dependence of Fermi energy on carrier concentration and temperature–Hall effect-Hall coefficient - Applications of Hall effect–Drift and Diffusion currents - Einstein's equation

**Semiconductor Devices** Working of PN junction diode – Forward and reverse bias Zener diode -Metal-Oxide-Semiconductor (MOS) structure- Capacitance-voltage characteristics- MOSFET structure - I-V characteristics.

**Practice:**

1. Determination of V-I characteristics and Breakdown voltage of a Zener diode.
2. Determination of Energy band gap of a semiconductor by using P-N junction diode.
3. Study the relation between Temperature and resistance and finding the constants A & B of a thermistor.
4. Determine the resistivity of a semiconductor by four probe method.

**Textbooks:**

1. Engineering Physics, M N Avadhanulu & T.V.S. Arun Murthy, S Chand &Company Ltd, 1st edition 2024. ISBN: 978-93-5870-932-3
2. Engineering Physics, Satyendra Sharma and Jyotshna Sharma, Pearson publications. ISBN: 978-81-3151-178-7

**Reference Books:**

1. Concepts of Modern Physics, Authur Beiser, Shobhit Mahajan and S Rai Choudhary, McGraw Hill (2017). ISBN: 9789351341857
2. Engineering Physics, M.R. Srinivasan, New Age international publishers (2009). ISBN: 978-1848290501
3. Optics, Ajoy Ghatak, 6th Edition McGraw Hill Education, 2017. ISBN: 978-9390113590

**Web Links:**

1. <http://nptel.ac.in/courses/122107035/11>
2. <http://nptel.ac.in/courses/115102023/->
3. <https://phet.colorado.edu/en/simulations/category/physics>
4. <http://physicsgecg.blogspot.in/p/reading-materials.html>

## Programming for Problem Solving using C

(Common to all)

**Course Code: 241CS001**

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

**Course Outcomes: At the end of the Course, Student will be able to:**

- CO1:** Demonstrate basics of computer, algorithm and flow chart for problem solving.
- CO2:** Make use of an appropriate control structures to solve given problems.
- CO3:** Solve complex problems using arrays and strings.
- CO4:** Develop modular programming using functions.
- CO5:** Demonstrate dynamic memory allocations and file handling using file operations.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 3    | 2    | 1    | 3    | -    | -    | 2    | -    | -     | 1     |
| <b>CO2</b> | 2    | 3    | 2    | 1    | 3    | -    | -    | 2    | -    | -     | 1     |
| <b>CO3</b> | 2    | 3    | 2    | 1    | 3    | -    | 1    | 2    | -    | -     | 1     |
| <b>CO4</b> | 2    | 3    | 2    | 1    | 3    | -    | 1    | 2    | -    | -     | 1     |
| <b>CO5</b> | 2    | 3    | 2    | 1    | 3    | -    | 1    | 2    | -    | -     | 1     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 2    | 2    |
| <b>CO2</b> | 2    | 2    |
| <b>CO3</b> | 2    | 2    |
| <b>CO4</b> | 2    | 2    |
| <b>CO5</b> | 2    | 2    |

### UNIT – I

#### Introduction to Programming and Problem Solving

Introduction to Programming Languages, Basics of a Computer Program- Algorithms, Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms, flowcharts (Using Dia Tool), pseudo code. Structure of C Program, Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, operators, keywords, identifiers, Type Conversion, and Casting.

#### Practice 1:

1. Explore different platforms
  - a. Basic linux environment and its editors like Vi, Vim & Emacs etc.
  - b. Exposure to turbo C, gcc.
  - c. Explore to hacker rank or any other Online coding platform and compiler environment.
  - d. “Hello world” in C.
  - e. Objective: Learn about the syntax of reading from stdin and writing to stdout.  
<https://www.hackerrank.com/challenges/hello-world-c/problem?isFullScreen=true>

- f. Write a simple program to read int, float, char and string using scanf() and display using printf() in all the above given platforms.
2. Basics and Operators
  - a. Sum and Difference of 2 numbers.  
Objective: Learn int and float data types.  
<https://www.hackerrank.com/challenges/sum-numbers-c/problem?isFullScreen=true>
  - b. Playing with Characters.  
Objective: Learn how to take a character, a string and a sentence as input in C.  
<https://www.hackerrank.com/challenges/playing-with-characters/problem?isFullScreen=true>
  - c. Bitwise Operators  
Objective: Learn how to work with bits (0,1) and bitwise operators.  
<https://www.hackerrank.com/challenges/bitwise-operators-in-c/problem?isFullScreen=true>
  - d. Conversion of Fahrenheit to Celsius and vice versa.
  - e. Distance travelled by an object.
  - f. Calculate Simple interest and compound interest.
3. Operators and Expressions, Variables and Type conversions.
  - a. Evaluate the following expressions
    - i.  $a/b*c-b+a*d/3$
    - ii.  $j = (i++) + (++i)$
  - b. Square root of a given number.
  - c. Find the area of circle, square, rectangle and triangle.
  - d. Find the maximum of three numbers using conditional operator.
  - e. Take marks of 5 subjects in integers, find the total in integer and average in float.

## UNIT – II

### Control Structures

Simple sequential programs, Conditional Statements (if, if-else, else if ladder, switch), Loops (for, nested for loop, while, do-while), break and continue, goto statement.

#### Practice:

1. Conditional Statements
  - a. Objective: Understand if and else Conditional statements in C.  
<https://www.hackerrank.com/challenges/conditional-statements-in-c/problem?isFullScreen=true>
  - b. Roots of a Quadratic Equation.
  - c. Generate electricity bill.
  - d. Simulate a calculator using switch case.
  - e. Find the given year is a leap year or not.
2. Loops
  - a. Objective: Learn the usage of the for loop in C.  
<https://www.hackerrank.com/challenges/for-loop-in-c/problem?isFullScreen=true>
  - b. Sum of the digits of a 5-digit number.  
Objective: Learn the usage of while loop and usage of operators - % and /.  
<https://www.hackerrank.com/challenges/sum-of-digits-of-a-five-digit-number/problem?isFullScreen=true>

- c. Given number is a prime or not. (Also Prime numbers between a given range.)
- d. Armstrong Number or not.
- e. Palindrome or not.
- f. Objective: Print a pattern of numbers using Loops.  
<https://www.hackerrank.com/challenges/printing-pattern-2/problem?isFullScreen=true>
- g. Construct a Pyramid pattern.

### UNIT – III

**Arrays:** Arrays indexing, Accessing programs with array of integers, two dimensional arrays, Introduction to Strings, string handling functions.

**Sorting Techniques:** bubble sort, selection sort.

**Searching Techniques:** linear, Binary search.

#### Practice:

1. 1-Dimensional Arrays
  - a. Objective: Print the sum and free the memory where the array is stored.  
<https://www.hackerrank.com/challenges/1d-arrays-in-c/problem?isFullScreen=true>
  - b. Objective: Working with indices in array.  
<https://www.hackerrank.com/challenges/reverse-array-c/problem?isFullScreen=true>
  - c. Search an element in array (Linear Search).
  - d. Find min and max elements in array.
  - e. Insert an element into array.
  - f. Eliminate duplicate elements from array.
  - g. Sorting of elements in an array using Bubble sort.
2. 2-Dimensional Arrays
  - a. Sum of two 2-D arrays.
  - b. Multiplication of two 2-D arrays.
  - c. Transpose of a Matrix.
  - d. Trace of a Matrix.
  - e. Lower Triangular Matrix.
3. Hacker Rank
  - a. Objective: print each word of the sentence in a new line.  
<https://www.hackerrank.com/challenges/printing-tokens-/problem?isFullScreen=true>
  - b. Count number of alphabets (lowercase, uppercase, consonants, vowels) and digits  
Lowercase to Uppercase, Uppercase to Lowercase, Toggle case, Sentential case
  - c. Objective: Digit Frequency find the frequency of each digit in the given string.  
<https://www.hackerrank.com/challenges/frequency-of-digits-1/problem?isFullScreen=true>
  - d. Find string length, concatenate 2 strings, reverse a string using built-in and without built-in string functions.

### UNIT – IV

**Functions:** Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, arrays as parameters, Scope and Lifetime of Variables, **storage classes**, **recursion**, functions and arrays.

#### Practice: Functions in C

1. Objective: Learn simple usage of functions.  
<https://www.hackerrank.com/challenges/functions-in-c/problem?isFullScreen=true>

2. Objective: Fibonacci Numbers using recursive function.  
<https://www.hackerrank.com/challenges/ctci-fibonacci-numbers/problem>
3. Objective: N<sup>th</sup> factorial using recursion.  
<https://www.hackerrank.com/contests/ccc-veltech-practice-set-ende/challenges/factorial-using-recursion-1>
4. Objective: Find the super digit of the integer.  
<https://www.hackerrank.com/challenges/recursive-digit-sum/problem>
5. Implement LCM
6. Objective: Calculate the Nth term of series.  
<https://www.hackerrank.com/challenges/recursion-in-c/problem?isFullScreen=true>

## UNIT – V

**Pointer:** Introduction to Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, **functions & pointers** modifying parameters inside functions using pointers, Command line Arguments, Dynamic memory allocation, Null Pointer, generic pointer, dangling pointer.

**File Handling:-** Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

### Practice:

1. Pointers
  - a. Objective: learn to implement the basic functionalities of pointers in C.  
<https://www.hackerrank.com/challenges/pointer-in-c/problem?isFullScreen=true>
  - b. Objective: Learn using Pointers with Arrays and Functions.  
<https://www.hackerrank.com/challenges/students-marks-sum/problem?isFullScreen=true>
  - c. Objective: sort a given array of strings into lexicographically increasing order or into an order in which the string with the lowest length appears first.  
<https://www.hackerrank.com/challenges/sorting-array-of-strings/problem?isFullScreen=true>
  - d. Find the sum of a 1D array using malloc().
  - e. Swap two numbers using functions and pointers - call by value and reference.
  - f. Objective: Dynamic Handling requests by a Librarian to place the books in the shelves.  
<https://www.hackerrank.com/challenges/dynamic-array-in-c/problem?isFullScreen=true>
2. File handling concepts
  - a) Write text into and read text from a file.
  - b) Write text into and read text from a binary file using fread() and fwrite().
  - c) Copy the contents of one file to another file.
  - d) Merge two files into the third file using command-line arguments
  - e) Find no. of lines, words and characters in a file.

### Additional Practice:

1. Variadic functions in C  
Objective: Understanding variable number of arguments  
<https://www.hackerrank.com/challenges/variadic-functions-in-c/problem?isFullScreen=true>
2. Small Triangles, Large Triangles  
Objective: Print sorted by their areas

<https://www.hackerrank.com/challenges/small-triangles-large-triangles/problem?isFullScreen=true>

3. Permutations of Strings

Objective: print all strings permutations in strict lexicographical order

<https://www.hackerrank.com/challenges/permutations-of-strings/problem?isFullScreen=true>

**Text Books:**

- 1 Programming in C, Rema Tharaja, Oxford, 2nd edition. ISBN 93-5497-9
- 2 "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall. ISBN 13: 9780131103627

**Reference Books:**

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education. ISBN.No: 9352604172
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill. ISBN No. 0071367993
3. Let Us C Yashwanth, Kanetkar, Eighth edition, BPB Publications. ISBN No. 1934015253
4. Programming in C A-Practical Approach, Ajay Mittal. Pearson Education. ISBN No. 9788131729342
5. R G Dromey How to Solve It by Computer (Prentice-Hall International Series in Computer Science. ISBN-13 : 978-0134340012

**Web Links:**

- 1 <https://www.hackerrank.com/>
- 2 [https://onlinecourses.nptel.ac.in/noc22\\_cs40/preview](https://onlinecourses.nptel.ac.in/noc22_cs40/preview)
- 3 <https://archive.nptel.ac.in/courses/106/104/106104128/>

**Business Intelligence Lab**  
(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E)

**Course Code: 2501IT01**

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

**Course Outcomes:**

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

- CO1:** Utilize Excel and Power BI for data analysis, visualization, and reporting.
- CO2:** Apply various data analysis techniques in Excel and Power BI to extract meaningful insights from datasets.
- CO3:** Create clear and compelling visualizations using Excel and Power BI to communicate data-driven insights.
- CO4:** Develop data models in Power BI to organize and analyze data efficiently.
- CO5:** Design interactive dashboards in Power BI to facilitate data exploration and decision-making.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 2    |      |      | 2    |      |      |      | 1    | 1     | 1     |
| <b>CO2</b> | 2    | 3    |      |      | 2    |      |      |      | 1    | 1     | 2     |
| <b>CO3</b> | 2    | 2    |      |      | 2    |      |      |      | 1    | 1     | 2     |
| <b>CO4</b> | 1    | 2    | 1    |      | 2    |      |      |      | 1    | 1     | 2     |
| <b>CO5</b> | 1    | 2    | 1    |      | 2    |      |      |      | 1    | 1     | 2     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    | 2    |
| <b>CO2</b> | 2    | 1    |
| <b>CO3</b> | 2    | 2    |
| <b>CO4</b> | 1    | 2    |
| <b>CO5</b> | 2    | 2    |

**Practice:**

**1. Introduction to Excel**

- a. Overview of Excel and its capabilities for data analysis.
- b. Basics of Excel: Navigating the interface, entering data, formatting cells.
- c. Introduction to functions and formulas: SUM, AVERAGE, IF, VLOOKUP, etc.
- d. Importing data into Excel from different sources: CSV, text files.

## **2. Data Analysis with Excel**

- a. Data manipulation techniques: Sorting, filtering, and grouping data.
- b. Advanced functions and formulas: INDEX/MATCH, SUMIFS, COUNTIFS, etc.
- c. Data visualization with Excel: Creating charts and graphs.
- d. Using PivotTables for data summarization and analysis.

## **3. Advanced Excel Features**

- a. Introduction to Excel tables and structured references.
- b. Working with named ranges and dynamic ranges.
- c. Excel data validation techniques.

## **4. Introduction to Power BI**

- a. Overview of Power BI and its advantages over Excel for large datasets.
- b. Installing Power BI Desktop.
- c. Understanding the Power BI interface: Navigation, ribbons, and panes.
- d. Importing data into Power BI Desktop from various sources.

## **5. Data Preparation in Power BI**

- a. Introduction to Power Query for data transformation.
- b. Cleaning, shaping, and filtering data in Power Query Editor.

## **6. Data Preparation in Power BI**

- a. Combining data from different sources.
- b. Loading data into Power BI model.

## **7. Data Modeling in Power BI**

- a. Understanding relationships between tables.
- b. Creating calculated columns and measures using DAX.

## **8. Data Modeling in Power BI**

- a. Introduction to DAX functions: CALCULATE, FILTER, RELATED, etc.
- b. Working with date and time functions in DAX.

## **9. Visualization Basics in Power BI**

- a. Creating basic visualizations: Bar charts, line charts, pie charts, etc.
- b. Customizing visualizations: Formatting, titles, legends, etc.

## **10. Visualization Basics in Power BI**

- a. Using slicers and filters to interact with visualizations.
- b. Adding drill-down capabilities to visualizations.

## **11. Advanced Visualizations and Dashboards in Power BI**

- a. Exploring advanced visualizations: TreeMap, Waterfall chart, KPIs, etc.
- b. Creating custom visuals from the marketplace.

## **12. Advanced Visualizations and Dashboards in Power BI**

- a. Designing effective dashboards: Layout, arrangement, and organization.
- b. Adding interactivity with bookmarks and drill-through.

### **Additional Practice:**

1. **Basic Data Analysis:** Import a dataset into Excel and perform basic data analysis tasks such as sorting, filtering, and creating simple charts to visualize the data.
2. **Expense Tracker:** Create a spreadsheet to track your expenses. You can have columns for date, item description, category, and amount. Use formulas to calculate totals and analyze your spending habits.
3. **Data modeling and extracting statistics from dataset:** Connecting Power BI to local data files and cloud servers (COVID19 dataset will be imported into the Power BI for visualization).

### **Text Books:**

- 1 Learn Power BI - Second Edition: A comprehensive, step-by-step guide for beginners to learn real-world business intelligence 2<sup>nd</sup> Edition, ISBN: 9781801811958.
- 2 Power BI Beginner: Zero to Hero in Power BI Desktop by Philip Seamark, ISBN 1691641227.

### **Reference Books:**

- 1 Power BI Quick Start Guide: Build dashboards and visualizations to make your data come to life" by Devin Knight and Siddharth Mehta.
- 2 Learn Power BI: A Beginner's Guide to Analyzing Data and Creating Reports with Power BI" by Murilo Miranda.

### **Web Links:**

- 1 <https://learn.microsoft.com/en-us/power-bi/>
- 2 <https://support.microsoft.com/en-us/excel>
- 3 <https://cce.sydney.edu.au/course/MSE1>
- 4 <https://cce.sydney.edu.au/course/PBBA>

**Engineering Graphics**  
(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E)

**Course Code: 2501ME01**

**L      T      P      C**  
**1      0      2      3**

**Course Outcomes:**

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

- CO1:** Apply the principles of engineering drawing to construct Engineering curves
- CO2:** Construct projections of points and lines.
- CO3:** Demonstrate visualization skills of projections of planes.
- CO4:** Demonstrate visualization skills of projections of solids and development of surfaces
- CO5:** Construct isometric and orthographic views of simple solids.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    | 2    | 1    |      | 2    |      |      |      | 1    | 1     |       |
| <b>CO2</b> | 3    | 2    | 1    |      | 2    |      |      |      | 1    | 1     |       |
| <b>CO3</b> | 3    | 2    | 1    |      | 2    |      |      |      | 1    | 1     |       |
| <b>CO4</b> | 3    | 2    | 1    |      | 2    |      |      |      | 1    | 1     |       |
| <b>CO5</b> | 3    | 2    | 1    |      | 2    |      |      |      | 1    | 1     |       |

**Practice:**

- a) Introduction to Engineering Graphics**  
Introduction to AutoCAD, Dimensioning, elements of dimensioning, system of dimensioning, and Conventions in Drawing.
- b) Construction of Cycloids and Involute**
  - a) Construction of Cycloid, Epicycloid and Hypocycloid
  - b) Involute of a pentagon and circle
- c) Introduction to Orthographic Projection**
  - a) Principles of Projection
  - b) Orthographic Projection – Four Quadrants.
  - c) First angle & Third angle Projection with examples, reference plane, importance of reference lines or Plane.
  - d) Projections of a point situated in any one of the four quadrants.
- d) Projection of straight lines-I:**
  - a) Projections of straight lines parallel to both reference planes.
  - b) Projections of straight lines perpendicular to one reference plane and parallel to other reference plane
  - c) Projections of straight line parallel to one plane & inclined to another plane

- e) **Projection of straight lines-II:**
  - a) Projections of straight line inclined to both reference planes
- f) **Projection of planes:**
  - a) Regular planes perpendicular to both reference planes, Parallel to one reference plane and inclined to the other reference plane  
Ex: Rectangle, Pentagon, Hexagon and Rhombus
- g) **Projection of planes**
  - a) Projections of Planes inclined to both reference planes Ex: Rectangle, Pentagon, Hexagon and Rhombus.
- h) **Projection of solids**
  - a) Axis Perpendicular to H.P and Axis Perpendicular to V.P, Ex: Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone
  - b) Axis Parallel to H.P and V.P, Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone
- i) **Projection of solids**
  - a) Projection of Solids with axis inclined to one reference plane and parallel to another plane. Ex: Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone
- j) **Development of Surfaces**
  - a) Development of Prisms and Cylinder simple cases
- k) **Development of Surfaces**
  - a) Development of Pyramids and Cone simple cases
- l) **Conversion of Isometric views to Orthographic views**
  - a) Practice figure - 1
  - b) Practice figure – 2

**Additional Practice:**

1. **Conversion of Isometric views to Orthographic views**
  - a) Practice figure - 3
  - b) Practice figure - 4
2. **Conversion of Orthographic views to Isometric views**
  - a) Practice figure - 1
  - b) Practice figure - 2

**Text Books:**

1. Engineering Drawing, N. D. Bhatt, Charotar Publishing House, 54<sup>th</sup> edition, 2024, ISBN : 9789385039706.
2. Engineering Drawing and Graphics , Venugopal, New Age Publications, 2<sup>nd</sup> edition, 2019, ISBN: 9788122415452.

**Reference Books:**

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2021, ISBN: 978-9385983177.
2. Computer Aided Engineering Graphics, T. Jeyapoovan, Vikas Publishing house, New Delhi, 1<sup>st</sup> Edition, 2023, ISBN : 9789356743199.

**Web Links:**

1. <https://nptel.ac.in/courses/112103019/>
2. <https://academy.autodesk.com/authenticated-home-user>
3. <https://www.sciencedirect.com/book/9780080108391/engineering-drawing-from-thebeginning>

**Differential Equations & Vector Calculus**  
(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E)

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code:</b> 2501MA02 | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                              | <b>2</b> | <b>1</b> | <b>0</b> | <b>3</b> |

**Course Outcomes:**

**At the end of the Course, Student will be able to:**

- CO1:** Solve the linear differential equations of first order and apply in various engineering problems.
- CO2:** Solve the linear differential equations of higher order and and apply in various engineering problems.
- CO3:** Solve the linear partial differential equations
- CO4:** Calculate the gradient, divergence and curl.
- CO5:** Compute work done, flux using vector integration

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 3    | 2    |      |      |      |      |      |      |      |       |       |
| CO2   | 3    | 2    |      |      |      |      |      |      |      |       |       |
| CO3   | 3    | 2    |      |      |      |      |      |      |      |       |       |
| CO4   | 3    | 2    |      |      |      |      |      |      |      |       |       |
| CO5   | 3    | 2    |      |      |      |      |      |      |      |       |       |

**UNIT – I**

**Ordinary Differential Equations of First Order and First Degree:**

Solution of first order linear differential equations, exact differential equations and equations reducible to exact differential equations, Orthogonal Trajectories, Modelling of RL- circuit.

**Practice(Using any computational tool):** Solving the first order initial value problems using **odesolver** and plot the solution curves.

**UNIT – II**

**Linear Differential Equations of Higher Order:**

Solution of linear differential equations with constant coefficients, method of variation of parameters, solution of simultaneous linear differential equations.

Equations reducible to Linear differential equations with constant coefficients: Cauchy's homogeneous Linear Equations, Legendere's Linear Equations. Study of oscillations arising in LCR circuit (free oscillations and forced oscillations).

**Practice(Using any computational tool):** Solving the second order initial value problems using **odesolver** and plot the solution curves

**UNIT – III**

**Partial Differential Equations:**

Solution of linear PDE of first order by Lagrange's method, solution of homogeneous linear PDE of higher order with constant coefficients.

**UNIT – IV****Vector Differentiation:**

Gradient of a scalar field, finding angle between two surfaces, directional derivative. Divergence and solenoidal fields. Curl and irrotational fields, Finding Scalar Potential.

**Practice(Using any computational tool):** Plotting of surfaces, 3D-plots, plotting vector fields.

**UNIT – V****Vector Integration:**

Line integrals, work done by a force, conservative force field, surface integral, flux, volume integral. Green's theorem, Stoke's theorem and Gauss divergence theorem.

Students are advised to use any computational / AI Tool like Wolfram Alpha, Symbolab, Mathway, Desmos, Geogebra etc., for the practice

**Text Books:**

- 1 Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, 10th Ed., 2018. ISBN 978-0470458365
- 2 Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 44<sup>th</sup> Edition (2021). ISBN 978-9383214204

**Reference Books:**

- 1 Advanced Engineering Mathematics, Dennis G. Zill, Jones & Bartlett Learning, 2018, 6th Edition. ISBN 978-1284105902.
- 2 Higher Engineering Mathematics, B.V. Ramana, McGraw-Hill Education, 11<sup>th</sup> Ed., 2017. ISBN 978-9339216016.

**Web Links:**

- 1 <https://www.classcentral.com/course/differential-equations-engineers-13258>
- 2 <https://archive.nptel.ac.in/courses/111/106/111106100/>
- 3 <https://www.khanacademy.org/math/differential-equations>
- 4 <https://archive.nptel.ac.in/courses/111/101/111101153/>
- 5 <https://archive.nptel.ac.in/courses/111/105/111105122/>

**Data Structures**  
(Common to EEE, ECE, CSE, IT, AIML & CSE (DS))

|                              | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501CS03</b> | <b>2</b> | <b>0</b> | <b>2</b> | <b>4</b> |

**Course Outcomes:**

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

- CO1:** Utilize structure, union to handle heterogeneous data.
- CO2:** Illustrate Time and Space complexities for different sorting Algorithms
- CO3:** Demonstrate various operations on Linked Lists
- CO4:** Explain different operations on Stack and Queue with applications.
- CO5:** Demonstrate the importance and various operation on non-linear data structures

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 1    | 1    | 2    |      |      |      |      | 1    | 1    |       |       |
| <b>CO2</b> | 1    | 1    | 2    | 2    |      |      |      | 1    | 1    |       |       |
| <b>CO3</b> | 1    | 2    | 2    | 1    |      |      |      | 1    | 1    |       |       |
| <b>CO4</b> | 1    | 1    | 2    | 1    |      |      |      | 1    | 1    |       |       |
| <b>CO5</b> | 1    | 1    | 2    | 2    |      |      |      | 1    | 1    |       |       |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 3    | -    |
| <b>CO2</b> | 2    | -    |
| <b>CO3</b> | 2    | -    |
| <b>CO4</b> | 2    | -    |
| <b>CO5</b> | 2    | -    |

**UNIT – I**

**Structures and Unions:** Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type - enum variables, Using Typedef keyword, Bit Fields.

**Data Structures:** Introduction to Data Structures, Types of Data Structures.

**Practice:**

- Write a C program to find the total, average of n students using structures
- Copy one structure variable to another structure of the same type.
- Read student name and marks from the command line and display the student details along with the total.

## UNIT – II

**Introduction to Linear Data Structures:** Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures.

Sorting Techniques: Quick sort, Merge sort, Radix sort

**Practice:**

1. Implement Merge sort using arrays.
2. Implement Quick sort using arrays
3. Implement Radix Sort using arrays

## UNIT – III

**Linked Lists:** Singly linked lists: representation and operations, doubly linked lists and its operations and circular linked lists and its operations, Comparing arrays and linked lists, Applications of linked lists.

**Practice:**

1. Single Linked List: Perform different operations in single linked list.
2. Reversing a single linked list
3. Perform different operations in double linked list
4. Circular Linked List

## UNIT – IV

**Stacks:** Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, applications of stacks.

**Queues:** Introduction to queues: properties and operations, Types of Queues, implementing queues using arrays and linked lists, applications of queues.

**Practice:**

1. Stack and its operations using arrays and Linked List
2. Implement a program to evaluate a postfix expression.
3. Queue and its operations using arrays and Linked List
4. Implement Circular Queue using Arrays

## UNIT – V

**Non-linear Data Structures:**

Trees: Definition of tree, Tree Terminology, types of trees, Binary tree traversals, Binary Search Tree – Insertion, Deletion.

Graphs: Definition and Terminology – Representation of Graphs-Adjacency Matrix and Linked list, Graph Traversals (BFT & DFT)

**Practice:**

1. Implement Binary search tree (BST).
2. Implement Binary search Tree (BST) Traversals.
3. Graph Traversal using Breadth First Search (BFS)
4. Graph Traversal using Depth First Search (DFS)

**Additional Practice:**

1. Using a structure for transporting some boxes through a tunnel
2. Delete duplicate-value nodes from a sorted linked list
3. Convert an infix expression into postfix expression
4. De Queue Implementation

**Text Books:**

1. Data Structures using C, Rema Theraja, Oxford University Press, 3<sup>rd</sup> Edition. ISBN: 978-9354979453
2. Data Structures, KV Sambasivarao, S Rama Sree, S.Chand. ISBN: 978-9358704730

**Reference Books:**

1. The Algorithm Design Manual, Steven S. Skiena, Springer Publication, Second Edition. ISBN: 978-1849967204.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, ISBN: 978-0716782506.
3. Data Structures and Algorithms by Maganti Venkatesh, Naresh. ISBN: 9780929306407.
4. Data Structures Using C, Reema Thareja, Oxford University Press, 2<sup>nd</sup> Edition. ISBN: 978-0198099307.

**Web Links:**

1. <https://nptel.ac.in/courses/106102064>
2. <https://archive.nptel.ac.in/courses/106/105/106105225/>
3. <https://www.udemy.com/topic/data-structures/>
4. <https://www.coursera.org/specializations/data-structures-algorithms>
5. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>

**Programming with Python**  
(Common to CSE, IT, AI&ML and DS)

**Course Code: 2501IT42**

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

**Course Outcomes: At the end of the Course, Student will be able to:**

- CO1:** Develop programs using fundamental concepts in python.
- CO2:** Solve problems using control statements and string methods.
- CO3:** Develop real time applications using data structures and functions.
- CO4:** Apply Object Oriented Programming concepts and files.
- CO5:** Build various applications using GUI and exceptions.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 2    | 2    | 3    | -    | -    | -    | -    | -    | -    | -     | 1     |
| CO2   | 2    | 2    | 3    | -    | -    | -    | -    | -    | -    | -     | 1     |
| CO3   | 3    | -    | 2    | -    | -    | -    | -    | -    | -    | -     | 1     |
| CO4   | 2    | 1    | 2    | -    | -    | -    | -    | -    | -    | -     | 1     |
| CO5   | 1    | 1    | 2    | -    | -    | -    | -    | -    | -    | -     | 1     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    | 2    | -    |
| CO2    | 3    | -    |
| CO3    | 2    | -    |
| CO4    | 2    | -    |
| CO5    | 1    | -    |

## UNIT – I

### Programming:

Programming: Introduction to Programming Concepts with Scratch Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Data Types Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

### Practice:

1. Basic Programs.
  - a. Convert weight from kilograms to pounds.
  - b. Input three numbers; compute total and average.
  - c. Use a for loop to print 8, 11, 14, ..., 89.

- d. Accept user name and repeat it n times.
- e. Print a triangle of height n using \*.

## 2. Decision Structures and Loops.

- a. Generate a random number (1-10), and ask the user to guess it.
- b. Accept two float values; print “Close” if difference  $\leq 0.001$ , else “Not Close”.
- c. Check if a string contains any vowels.
- d. Input a large number and insert commas (e.g., 1000000  $\rightarrow$  1,000,000).
- e. Insert \* in expressions like  $3x+4y$  to get  $3*x+4*y$ .

## UNIT – II

### Control Statements:

Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration the While Loop Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

### Practice:

- 1. Conditional and Looping Constructs
  - a. Check if the year is a leap year or not.
  - b. Simulate a basic calculator using conditionals.
  - c. Display electricity bill based on consumption slabs.
  - d. Check if a number is prime and print all primes in a range.
  - e. Check for Armstrong number, Palindrome.
- 2. Loop-based Patterns and String Logic
  - a. Print a number pyramid.
  - b. Accept two strings of same length and interleave their characters.
  - c. Count vowels, consonants, digits in a string.
  - d. Convert strings: lowercase  $\leftrightarrow$  uppercase, toggle case.

## UNIT – III

**List and Dictionaries:** List and Dictionaries: Lists, Defining Simple Functions, Dictionaries Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top-Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program’s Namespace, Higher Order Function. Modules: Modules, Standard Modules, Packages.

### Practice:

- 1. Working with Lists and Strings
  - a. Generate 20 random numbers; print min, max, avg, even count.
  - b. Generate a list of factors for a given integer.
  - c. Generate 100 random 0s and 1s; find longest run of 0s.
  - d. Remove duplicates from a list.
  - e. Menu-based unit converter (feet  $\leftrightarrow$  inches, yards, etc.)
- 2. Matrix and String Processing
  - a. Create and print matrices; add, multiply two matrices.
  - b. Reverse, concatenate, and find length of strings.
  - c. Count digit frequency in a string.
  - d. Print each word in a sentence on a new line.
  - e. Lower Triangular Matrix.

## UNIT – IV

**Object Oriented Programming:** Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using OOPS support Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations.

### Practice:

1. OOP – Classes and Methods
  - a. Create a Product class with dynamic pricing and stock update.
  - b. Create a Time class to convert seconds → minutes, hours.
  - c. Define Converter class for unit conversions (e.g., inches → feet).
2. File Handling
  - a. Read email addresses from file and print as semicolon-separated list.
  - b. Read temperatures from a file and convert them to Fahrenheit.
  - c. Count character frequencies in a file.
  - d. Count how many times each word appears in a file.
3. Additional OOP
  - a. Implement a class for pow(x, n).
  - b. Define a class to reverse a string word-by-word.

## UNIT – V

**Errors and Exceptions:** Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User- defined Exceptions, Defining Clean-up Actions, Redefined Clean up Actions. Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI - Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.

### Practice:

1. GUI and Exceptions
  - a. Build a file-open dialog and display content in a text box.
  - b. Demonstrate try/except/else blocks.
  - c. Show file handling using try/finally and with statements.
2. Integrated Problem Solving
  - a. Implement the Hangman game using string logic and loops.
  - b. Recursively reduce a number to a single-digit sum (e.g., 4683 → 4+6+8+3=21 → 2+1=3).
  - c. Validate recursively whether an input is a well-formatted list.

### Additional Practice:

1. Hangman **The Goal:** Despite the name, the actual “hangman” part isn’t necessary. The main goal here is to create a sort of “guess the word” game. The user needs to be able to input letter guesses. A limit should also be set on how many guesses they can use. This means you’ll need a way to grab a word to use for guessing. (This can be grabbed from a pre-made list. No need to get too fancy.) You will also need functions to check if the user has actually inputted a single letter, to

check if the inputted letter is in the hidden word (and if it is, how many times it appears), to print letters, and a counter variable to limit guesses.

2. Write a program to find the greatest number that can be formed by using given set of numbers.
3. Write a program to find sum of digits of a number till you get single digit sum.

Example:

Input : 142 (Hint:  $1+4+2=7$ )

Output : 7

Input : 4683 (Hint:  $4+6+8+3=21 \Rightarrow 2+1=3$ )

Output : 3

### **Text Books:**

- 1 Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage, 2018
- 2 Beginning Python: from Novice to Professional, Lie Hetland, Magnus, 2nd Edition, 2005

### **Reference Books:**

1. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson, 2017.
3. Think Python, Allen Downey, Green Tea Press, 2012.
4. Python for Everybody Exploring Data in Python 3, Charles Russell Severance, Sue Blumenberg.

### **Web Links:**

- 1 <https://www.python.org/>
- 2 <https://www.coursera.org/courses?query=Python%20programming>
- 3 <https://www.learnpython.org/>
- 4 [https://onlinecourses.nptel.ac.in/noc21\\_cs32/preview/](https://onlinecourses.nptel.ac.in/noc21_cs32/preview/)

## Computer Organization & Architecture

(Common to CSE, IT, AIML & CSE (DS))

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
| <b>Semester:</b>             | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Code: 2501CS71</b> | <b>2</b> | <b>1</b> | <b>0</b> | <b>3</b> |

### Course Outcomes:

At the end of the course, student will be able to:

- CO1:** Describe the basic structure of a computer system, various number systems and arithmetic operations.
- CO2:** Explain the Operation of CPUs including RTL, ALU, Instruction Cycle and Buses
- CO3:** Demonstrate the architecture and functionality of central processing unit
- CO4:** Illustrate the I/O and memory organization in an efficient way.
- CO5:** Make use of multi processors and pipelining to improve the efficiency of computer system.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 1    | -    | -    | 2    | -    | -    | -    | -    | -     | -     |
| <b>CO2</b> | 2    | 1    | -    | -    | 2    | -    | -    | -    | -    | -     | -     |
| <b>CO3</b> | 3    | 1    | -    | -    | 2    | -    | -    | -    | -    | -     | -     |
| <b>CO4</b> | 2    | 1    | -    | -    | 2    | -    | -    | -    | -    | -     | -     |
| <b>CO5</b> | 3    | 2    | -    | -    | 3    | -    | -    | -    | -    | -     | -     |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO / PSO   | PSO | PSO 2 |
|------------|-----|-------|
| <b>CO1</b> | 2   |       |
| <b>CO2</b> | 2   |       |
| <b>CO3</b> | 2   |       |
| <b>CO4</b> | 2   |       |
| <b>CO5</b> | 3   |       |

## UNIT – I

**Basic Structure of Computers:** Basic Organization of Computers, Historical Perspective, Bus Structures. Data Representation: Data types, Complements, Fixed Point Representation. Floating – Point Representation. Other Binary Codes, Error Detection Codes. Computer **Arithmetic:** Addition and Subtraction, Multiplication Algorithms, Division Algorithms.

## UNIT – II

**Register Transfer Language and Microoperations:** Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit

**Basic Computer Organization and Design:** Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input – Output and Interrupt, Complete Computer Description.

### UNIT – III

**Central Processing Unit:** General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.  
**Microprogrammed Control:** Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

### UNIT – IV

**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.  
**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

### UNIT – V

**Multi Processors:** Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.  
**Pipeline:** Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

#### Text Books:

- 1 Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008.
- 2 Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5/e, McGraw Hill, 2002.

#### Reference Books:

- 1 Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
- 2 Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
- 3 Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer, 2006

#### Web Links:

- 1 <https://nptel.ac.in/courses/106/105/106105163/>
- 2 <https://nptel.ac.in/courses/106/106/106106092/>
- 3 <https://www.udemy.com/course/computer-architecture-computer-organization-course/>
- 4 <http://www.cuc.ucc.ie/CS1101/David%20Tarnoff.pdf>

**Discrete Mathematics**  
(Common to CSE, IT, AIML & CSE (DS))

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501MA08</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                              | <b>2</b> | <b>1</b> | <b>0</b> | <b>3</b> |

**Course Outcomes:**

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

- CO1:** Apply the principles of mathematical logic to statement calculus and predicate calculus.
- CO2:** Compute transitive closure, equivalence classes of binary relations.
- CO3:** Apply basic counting techniques to solve the combinatorial problems.
- CO4:** Solve recurrence relations by various methods.
- CO5:** Apply the concepts of Graph theory to find Euler paths, Hamiltonian paths and demonstrate different traversal methods for trees.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 3    | 2    |      |      |      |      |      |      |      |       |       |
| CO2   | 3    | 2    |      |      |      |      |      |      |      |       |       |
| CO3   | 2    | 3    |      |      |      |      |      |      |      |       |       |
| CO4   | 3    | 2    |      |      |      |      |      |      |      |       |       |
| CO5   | 3    | 2    |      |      |      |      |      |      |      |       |       |

**UNIT – I**

**Logic:** Propositional Logic: Statements and logical connectives, Well-Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus. Predicate Logic: Statement Functions, Variables, and Quantifiers; Inference Theory for Predicate Calculus.

**Practice(Using any computational tool):** Construct the truth table calculator taking two inputs, P and Q, and calculate AND, OR and NOT.

**UNIT – II**

**Relations:** Properties of Binary Relations, Relation Matrix, Digraph, Operations on Relations, Partition and Covering, Transitive, Closure, Warshall Algorithm, Equivalence Relation, R-Equivalence Class, partially ordered sets, Hasse Diagrams.

**UNIT – III**

**Combinatorics:** Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.

## UNIT – IV

**Recurrence Relations:** Formation of Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots.

**Practice(Using any computational tool:** Compute the nth Fibonacci number.

## UNIT – V

**Graph Theory:** Basic Concepts of Graphs, Matrix Representation of Graphs: Adjacency Matrix, Incidence Matrix, Isomorphic Graphs, Paths and Circuits, Euler and Hamilton Graphs, Planar Graphs, and Euler's Formula. **Trees:** Tree Properties, Spanning Trees, BFS Algorithm, DFS Algorithm, Minimal Spanning Trees, and Kruskal's Algorithm, Graph coloring, chromatic number.

**Practice(Using any computational tool):** BFS and DFS algorithms.

### Text Books:

- Discrete Mathematics and its Applications with Combinatorics and Graph Theory,  
1 Kenneth H. Rosen, McGraw Hill Education (India) Private Limited, ISBN : 9780070681880.
- 2 Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and R. Manohar, Tata Mc Graw Hill, ISBN 978-0074631133

### Reference Books:

- 1 Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI. ISBN 978-9332549593.
- 2 Mathematical Foundations of Computer Science, S. Santha, E. V. Prasad, Cengage Publishers, ISBN 978-8131515938.

### Web Links:

- 1 <http://nptel.ac.in/courses/106106094/>
- 2 <http://mathworld.wolfram.com/classroom/classes/DiscreteMathematics.html>
- 3 <http://mathworld.wolfram.com/topics/GeneralLogic.html>
- 4 <https://ggc-discrete-math.github.io/>

## Object Oriented Programming through C++ (Common to CSE, IT, AIML & CSE(DS))

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
|                              | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Course Code: 2501CS08</b> | <b>2</b> | <b>0</b> | <b>2</b> | <b>4</b> |

### Course Outcomes:

At the end of the course, student will be able to:

- CO1:** Make use of C and C++ programming constructs to demonstrate OOP concepts.
- CO2:** Develop applications using constructor and destructor.
- CO3:** Apply C++ features for problem solving.
- CO4:** Apply inheritance concepts and file I/O to solve a given problem.
- CO5:** Design C++ classes using templates and STL.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 1    | 2    |      |      |      |      | 1    | 1    |       |       |
| <b>CO2</b> | 1    | 2    | 2    |      |      |      |      | 1    | 1    |       |       |
| <b>CO3</b> | 1    | 1    | 1    |      |      |      |      | 1    | 1    |       |       |
| <b>CO4</b> | 1    | 1    | 2    |      |      |      |      | 1    | 1    |       |       |
| <b>CO5</b> | 2    | 1    | 2    |      |      |      |      | 1    | 1    |       |       |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 2    |      |
| <b>CO2</b> | 2    |      |
| <b>CO3</b> | 2    |      |
| <b>CO4</b> | 2    |      |
| <b>CO5</b> | 2    |      |

## UNIT – I

**Introduction to C++:** Differences between C and C++, Disadvantages of Conventional Programming, Evolution of C++, Key Concepts of Object Oriented Programming, Structure of C++ program , Advantages of OOP, scope resolution Operator, Namespace.

### Practice:

- Find the roots of a quadratic equation.
- Find factorial of a given number using recursion
- Implement scope resolution and namespaces.
- Illustrate the use of default arguments and access specifiers

## UNIT – II

**Classes and Objects:** Declaring Objects- Access Specifiers and their Scope, Defining Member Function, Rules for Inline Functions, static Member Variable, static Member Function, Friend functions, overloading Member Function, Array of Objects, Object as Parameter, Object as return type, Nested class, Introduction to Constructors and Destructor, Characteristics of Constructor and Destructor, Application with Constructor, Constructor with Arguments, Copy Constructor, Anonymous Objects.

### Practice:

1. Program to illustrate inline functions and function overloading.
2. Program to illustrate friend function
3. Program to illustrate the use of Constructors and Destructors.
4. Program illustrating Constructor overloading.
5. Program illustrating Copy Constructor.

## UNIT – III

**Operator Overloading:** Introduction, The Keyword Operator, Rules for Overloading Operators, Overloading Unary Operator, Overloading Binary Operator, Overloading using friend function.

**Inheritance:** Introduction, Reusability, Types of Inheritance, Virtual Base Classes, Object as a Class Member, Abstract Classes, Advantages and Disadvantages of Inheritance. Pointer to Class- Pointer Object, this Pointer, Pointer to Derived Classes and Base Class.

**Binding Polymorphisms and Virtual Functions:** Introduction, Binding in C++, Virtual Functions, Rules for Virtual Function, Abstract classes, Virtual Destructor

### Practice:

1. Overload Unary, and Binary Operators using member function.
2. Overload Unary, and Binary Operators using friend function.
3. Incorporate various forms of Inheritance i. Single Inheritance ii. Multiple Inheritances  
iii. Multi-level inheritance iv. Hierarchical Inheritance v. Hybrid inheritance
4. Order of execution of constructors and destructors in inheritance.
5. Illustrate the use of object as a class member, pointer to a class, this pointer and Virtual Base Class.
6. Illustrate virtual functions.
7. Implement pure virtual function and calculate the area of different shapes by using abstract class.

## UNIT – IV

**Generic Programming with Templates:** Introduction, Need for Templates, Definition of class Templates, Normal Function Templates, Overloading of Template Function, Bubble Sort Using Function Templates, Difference between Templates and Macros, Linked list with templates

### Practice:

1. Illustrate the use of function template.
2. Implement template class.

3. Implement class templates with multiple parameters.

## UNIT – V

**Exception Handling:** Introduction, Principles of Exception Handling, The Keywords try throw and catch, Multiple Catch Statements.

**Files:** Stream I/O ,Reading and writing to Files.

**Overview of Standard Template Library:** Introduction, STL Programming Model, Containers, Sequence Containers, Associative Containers, Algorithms, Iterators, Vectors, Lists, Maps

### Practice:

1. Implement Exceptions handling.
2. Illustrate the use of multiple catch statements.
3. Implement List, Vector and its Operations.
4. Implement Deque and its Operations.
5. Implement Map and its Operations.

### Additional Practice:

1. Develop a C++ program for flight booking system
2. Develop Qt application containing slider and spin box in which a slider responds to changes in the spin box.
3. Develop a Qt application for creating a text pad.
4. Develop a C++ program with maximum of 20 characters, that your user will be guessed and will show only asterisks (\*) on the screen. The user will input or enter one character at a time. And for every correct character, the asterisk will be replaced by that character until all the characters or the mystery word/s will reveal. Your program will accept a maximum three (3) errors or mistakes in entering/inputting character otherwise the mystery word/s will be viewed. Sample Output:

Output: \*\*\*\*\* Enter your character: e

Output: \*\*\*e\*\*e

Enter your character: a Output: sorry! the character is not existing. you still have 2 chances

Enter your character: s Output: s\*\*e\*\*e

Enter your character: c Output: sc\*e\*ce

Enter your character: i Output: scie\*ce

Enter your character: n Output: science

### Text Books:

- 1 The Complete Reference C++, Herbert Schildt, Fourth Edition, TMH ISBN-13:978-0070532465, and the ISBN-10 is 007053246X.
- 2 The C++ Programming Language, Bjarne Stroustrup, Fourth Edition, Pearson ISBN 978-0321563842

### Reference Books:

- 1 A First Book Of C++, Gary Bronson, Fourth Edition, Cengage Learning ISBN-10. 8131532712 and ISBN-13. 978-8131532713
- 2 C++ Primer Plus By Stephen Prata, Sixth Edition, Pearson ISBN: 978-0321776402

- 3 C++ Programming: From Problem Analysis To Program Design, Ds Malik, Eighth Edition, Cengage Learning ISBN: 9781337102087

**Web Links:**

- 1 <http://nptel.ac.in/courses/106105151/>
- 2 <http://www.geeksforgeeks.org/c-plus-plus/>
- 3 [https://infyspringboard.onwingspan.com/web/en/viewer/html/lex\\_auth\\_01350157284861542410101](https://infyspringboard.onwingspan.com/web/en/viewer/html/lex_auth_01350157284861542410101)
- 4 <https://www.udemy.com/course/beginning-c-plus-plus-programming/>

## Theory of Computation (Common to CSE&IT)

**Course Code: 2501CS11**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>1</b> | <b>0</b> | <b>3</b> |

### Course Outcomes:

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

- CO1:** Apply the properties of languages and automata to solve a given problem.
- CO2:** Construct an automata for a given language.
- CO3:** Design grammars for a given language.
- CO4:** Apply interconversion on automata, grammar and regular expressions.
- CO5:** Analyze decidability and undecidability problems.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    |      | 1    |      |      |      |      |      |      |       |       |
| <b>CO2</b> | 1    | 2    | 1    |      |      |      |      |      |      |       |       |
| <b>CO3</b> | 1    | 2    | 1    |      |      |      |      |      |      |       |       |
| <b>CO4</b> | 3    |      |      |      |      |      |      |      |      |       |       |
| <b>CO5</b> | 2    | 2    |      | 2    |      |      |      |      |      |       |       |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 2    |      |
| <b>CO2</b> | 2    |      |
| <b>CO3</b> | 2    |      |
| <b>CO4</b> | 2    |      |
| <b>CO5</b> | 2    |      |

### UNIT – I

**Finite Automata:** Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automata, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with  $\epsilon$ -Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

### UNIT – II

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars,

Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

### UNIT – III

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols,  $\epsilon$ -Productions and Unit Productions, Normal Forms-Chomsky Normal form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

### UNIT – IV

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

### UNIT – V

**Turing Machine:** Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

#### Text Books:

- 1 Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008 ISBN: 978-8131720479
- 2 Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007 ISBN: 978-8120329683

#### Reference Books:

- 1 Elements of Theory of Computation, Lewis H.P. & Papadimitriou C.H., Pearson /PHI ISBN: 978-0132624787
- 2 Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014 ISBN: 978-0070702042

#### Web Links:

- 1 <http://nptel.ac.in/courses/111103016>
- 2 <https://archive.nptel.ac.in/courses/106/104/106104148/>
- 3 <https://www.iitg.ac.in/dgoswami/Flat-Notes.pdf>
- 4 <https://www.ics.uci.edu/~goodrich/teach/cs162/notes/>
- 5 <https://www.geeksforgeeks.org/introduction-of-finite-automata/>

**Database Management Systems**  
(Common to CSE, IT, AIML & CSE (DS))

**Course Code:** 2501IT05

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

**Course Outcomes:**

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

- CO1:** Describe the Fundamental concepts of DBMS.
- CO2:** Interpret relational database using SQL.
- CO3:** Make use of normalization techniques for database design.
- CO4:** Illustrate the mechanisms of transaction management.
- CO5:** Optimize database performance with advanced indexing, query optimization, and robust backup and recovery strategies.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 3    | 3    | 3    |      | 1    |      |      | 1    |      |       |       |
| CO2   | 3    | 3    | 3    | 2    | 2    | 1    |      | 1    |      |       |       |
| CO3   | 3    | 3    | 3    | 3    | 3    | 2    |      |      |      |       | 1     |
| CO4   | 3    | 3    | 3    | 1    | 2    | 1    |      |      |      |       |       |
| CO5   | 3    | 3    | 3    | 3    | 3    | 2    |      |      |      |       | 2     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    | 3    | 3    |
| CO2    | 3    | 2    |
| CO3    | 3    | 2    |
| CO4    | 3    | 1    |
| CO5    | 3    | 2    |

**UNIT – I**

**Introduction to DBMS:** History and Architecture, Data Independence, Data Models, Levels of abstraction, structure of DBMS.

**Data Models :** Concepts of Schema, Instance and data independence, Three tier schema architecture for data independence, Database system structure, environment, Centralized and Client Server architecture for the database.

**Practice**

1. Familiarization with installation of any DBMS.
2. Implementing a University Database System.

## UNIT – II

**Relational Model:** Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance

**BASIC SQL:** Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

### Practice

1. Querying and modifying the database using Data Manipulation Language commands - select, insert, update, delete.
2. Implementation of Aggregate Functions – sum, avg, min, max, count. Use group-by and having clause.

## UNIT – III

**Entity Relationship Model:** Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

**SQL:** Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and nonupdatable), relational set operations.

### Practice

1. Perform join operations – natural join, equi-join, outer join, left outer join, right outer join, inner join and assess the impact of query plans on the performance of join heavy queries.
2. Perform set operations - union, intersection, set difference.
3. Implementation of correlated sub-queries and nested queries
4. Creating and querying views and materialized views.

## UNIT – IV

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

**Transaction Concept:** Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Storage, Recovery and Atomicity, Recovery algorithm.

### Practice

1. Implement SQL queries on a normalized database schema based on the provided schema. For this example: use the schema for a university database, which includes:

- Students (StudentID, StudentName, Major)
- Courses (CourseID, CourseName, Credits)
- Enrollments (StudentID, CourseID, EnrollmentDate)

- Instructors (InstructorID, InstructorName, Phone)
  - Course\_Instructors (CourseID, InstructorID)
2. (A) Implementation of Data Control Language commands – grant and revoke.  
(B) Implementation of Transaction Control Language commands - commit, save point, and rollback.

## UNIT – V

**Indexing Techniques:** Introduction, B+ Trees: Search, Insert, delete algorithms, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing: Tree base Indexing, Comparison of File Organizations.

**Database Tuning:** Introduction, Database Performance Tuning, Query Optimization: Introduction, Query Optimization algorithms, Backup and Recovery.

### Practice

1. Create a Primary, Secondary Index on a Column?
2. Retrieve Data Using an Index?
3. Insert Data and Update Indexes?
4. Delete Data and Impact on Indexes?

**Note:** The student must Complete & Submit a Database Fundamentals Certificate Course offered by Oracle Academy at the end of the Practice Session.

### Text Books:

- 1 Database System Concepts ,Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGraw-Hill , 8<sup>th</sup> Edition., ISBN-13: 978-1260230508.
- 2 Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Mc Graw-Hill, 4<sup>th</sup> Edition, ISBN: 978-1260091195.

### Reference Books:

- 1 Fundamentals of Database Systems ,R Elmasri, S Navathe, Addison-Wesley.6<sup>th</sup> edition, ISBN: 978-0136086208..
- 2 Database Management Systems ,Ramakrishna Gehrke,Mcgraw Hill Publication,3<sup>rd</sup> Edition, ISBN: 978-0072465631 .
- 3 Introduction to Database Systems, C J Date, Pearson, 9<sup>th</sup> Edition, ISBN: 978-0133970777.

### Web Links:

- 1 <https://academy.oracle.com/pages/coursedescription/Oracle%20Academy%20Database%20Foundations%20Course%20Description.pdf>
- 2 <https://www.w3schools.com/sql/>
- 3 [https://onlinecourses.nptel.ac.in/noc22\\_cs91/](https://onlinecourses.nptel.ac.in/noc22_cs91/)

**Engineering Workshop**  
(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E)

**Course Code:** 2501ME03

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>0</b> | <b>0</b> | <b>1</b> | <b>1</b> |

**Course Outcomes:**

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

- CO1:** Prepare various wooden joints.
- CO2:** Demonstrate various sheet metal models.
- CO3:** Develop the basic knowledge of house wiring.
- CO4:** Develop the basic knowledge of plumbing.
- CO5:** Practice various welded joints.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 1    | 1    |      |      |      | 1    | 1    | 2    | 1    |       | 1     |
| CO2   | 1    | 1    |      |      |      | 1    | 1    | 2    | 1    |       | 1     |
| CO3   | 2    | 2    |      |      |      | 1    | 1    | 2    | 1    |       | 1     |
| CO4   | 1    | 2    |      |      |      | 1    | 1    | 2    | 1    |       | 1     |
| CO5   | 2    | 2    |      |      |      | 1    | 1    | 2    | 1    |       | 1     |

**Practice:**

- To make a T-Lap joint from the given wooden workpieces.
- To make a dovetail lap joint from the given wooden workpieces.
- To make a taper tray using the given sheet metal.
- To make a funnel using the given sheet metal.
- To make a square tin using the given sheet metal.
- To connect three bulbs by using series and parallel connections.
- To give connection to a bulb by using staircase wiring.
- To prepare wiring for a tube light with switch control.
- To prepare a PVC pipe joint by using the given circuit1.
- To prepare a PVC pipe joint by using the given circuit2.
- To make a butt joint using the given M.S pieces by arc welding.
- To make a lap joint using given M.S pieces by arc welding

**Additional Practice:**

- To make a cross-lap joint from the given wooden workpieces.
- To make an open scoop using the given sheet metal.
- To make a T-joint using given M.S pieces by arc welding.

**Text Books:**

1. Work shop Manual , P.Kannaiah & K.L.Narayana/ SciTech Publishers, 2<sup>nd</sup> edition, ISBN: 978-8183711302.
2. Elements of Workshop Technology, Vol I by S.K. Hajra Choudhury, S.K. Hajra Choudhury & Nirjhar Roy, Media Promoters and Publishers Pvt. Limited, 14<sup>th</sup> edition, ISBN: 8185099146.

**Reference Books:**

1. Workshop Technology, Part 1, W.A.J. Chapman, 5<sup>th</sup> edition, ISBN 9780415503020.
2. Engineering Practices Lab Manual, T. Jeyapoovan & M. Saravanapandian, Vikas Publishing House Pvt. Limited, 4<sup>th</sup> edition, ISBN: .8125929037
3. Engineering Practices Laboratory Manual, Ramesh Babu.V., VRB Publishers Private Limited, Chennai, Revised edition, 2019-20, ISBN: 978-81-935993-8.

**Web Links:**

1. <https://bharatskills.gov.in>
2. <https://www.gopracticals.com/basic-engineering/workshop/>

**Agile Software Engineering**  
(Common to CSE, IT, AIML & CSE (DS))

**Course Code: 2501IT07**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> |          | <b>1</b> | <b>3</b> |

**Course Outcomes:**

**At the end of the Course, Student will be able to:**

- CO1:** Apply software engineering practices and evaluate different software development models to design and manage the life cycle of a Student Management System (SMS).
- CO2:** Analyze the principles of Agile methodologies and compare them with traditional models by transitioning a retail software company from Waterfall to Agile.
- CO3:** Evaluate the impact of Agile processes on requirements engineering and manage unstable requirements for a social media platform project.
- CO4:** Design and implement a comprehensive testing strategy using TDD and test automation tools in an Agile project.
- CO5:** Apply Agile design principles and execute refactoring techniques to develop maintainable and scalable software systems.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 1    |      |      | 2    |      |      |      |      |       |       |
| <b>CO2</b> | 3    | 2    | 1    | 1    |      |      |      | 2    | 2    | 2     | 1     |
| <b>CO3</b> | 2    | 1    | 1    |      |      |      |      |      |      | 2     | 1     |
| <b>CO4</b> | 3    | 2    | 2    | 1    |      |      |      | 2    | 2    | 2     | 1     |
| <b>CO5</b> | 1    | 2    |      |      |      |      |      |      |      |       |       |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 2    |      |
| <b>CO3</b> | 1    | 1    |
| <b>CO4</b> | 2    | 2    |
| <b>CO5</b> | 1    | 1    |

**UNIT – I**

**Introduction to Software Engineering:** Define Software Engineering, The Software Process, Software Engineering Practice, Software Myths

**Software Life Cycle models and Processes:** Software Process, Process Classification, Phased Development Life Cycle, Software Development Process Models – The Waterfall, Spiral and Evolutionary Models, Software Project Management Process, Project Planning and Estimation, Gathering Requirements, Software Design, Software Testing, Software Quality and Reliability.

**Case Study:** Developing a Student Management System (SMS)

**UNIT – II**

**Fundamentals of Agile Methodology:** Theories for Agile Management, Agile Software Development, Traditional Model Vs. Agile Model, Classification of Agile Methods, Agile Manifesto and Principles, Agile Project Management, Agile Team Interactions, Ethics in Agile Teams, Agility in Design, Testing, Agile Documentations, Agile Drivers, Capabilities and Values.

**Case Study:** Implementing Agile Methodology in a Software Development Project

### UNIT – III

**Agile Processes:** Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, and Extreme Programming: Method overview – lifecycle – work products, roles and practices.

**Agility And Requirements Engineering:** Impact of Agile Processes in RE, Current Agile Practices, Overview of RE Using Agile, Managing Unstable Requirements, Requirements Elicitation

**Case Study:** Agile Processes and Requirements Engineering in a Healthcare Software Project

### UNIT – IV

**Agile Testing:** The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

**Case Study:** Implementing Test-Driven Development (TDD) for a Healthcare Application

### UNIT – V

**Agile Software Design and Development:** Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

**Case Study:** Refactoring an E-Commerce Backend Using Agile Design Principles.

#### **Capstone Project:**

Students shall choose a real-time software application (e.g., e-commerce backend, SMS, food delivery app) and apply Agile design principles, perform refactoring, implement TDD, and use version control and CI tools. This project should be implemented as a mini project and submitted at the end of the course.

#### **Text Books:**

- 1 Software Engineering – Concepts and Practices: Ugrasen Suman, Cengage Learning, ISBN: 9789390555475.
- 2 Agile Software Development, Current Research and Future Directions, Springer-Verlag Berlin Heidelberg, Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), ISBN-10. 3642125743.

**Reference Books:**

- 1 Software Engineering, Ian Sommerville, Ninth Edition, Pearson
- 2 Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, David J. Anderson; Eli Schragenheim,

**Web Links:**

- 1 [https://www.tutorialspoint.com/software\\_engineering/](https://www.tutorialspoint.com/software_engineering/)
- 2 <https://www.sciencedirect.com/science/article/pii/S0950584916303329>

**Probability & Statistics**  
(Common to CSE, IT AIML & CSE (DS))

**Course Code: 2501MA09**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>1</b> | <b>0</b> | <b>3</b> |

**Course Outcomes:**

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

- CO1:** Apply Baye's theorem
- CO2:** Apply various Probability distributions for both discrete and continuous random variables
- CO3:** Compute mean and variance of sample means with replacement and without replacement and maximum errors.
- CO4:** Apply various tests to test the hypothesis concerning mean, Proportion, variance and attributes.
- CO5:** Apply the concepts of correlation and regression to the given statistical data.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 3    |      |      |      |      |      |      |      |       |       |
| <b>CO2</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |
| <b>CO3</b> | 2    | 3    |      |      |      |      |      |      |      |       |       |
| <b>CO4</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |
| <b>CO5</b> | 3    | 2    |      |      |      |      |      |      |      |       |       |

**UNIT – I**

**Probability and Random Variables:**

Probability – Conditional probability and Baye's Theorem-Random variables – Discrete and Continuous random variables-Mathematical Expectation, Variance and Moment generating function.

**Practice(Using any computational tool):**

Calculation of Mean and Variance.

**UNIT – II**

**Probability Distributions:**

Distribution function –Binomial, Poisson, Normal and Exponential distributions.

**Practice(Using any computational tool):**

Discrete and continuous probability distributions (Binomial, Poisson, normal and exponential distributions)

**UNIT – III**

**Data Analytics and Sampling Theory:**

Data science –Collection of data – primary and secondary data – Types of variables: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency(Mean,mode and median) – Measures of Variability (spread or variance).

**Sampling Theory:**Introduction – Population and samples – Sampling distribution of Means and Variance – Central limit theorem (without proof)-Point and Interval estimations – Maximum error of estimate.

**Practice(Using any computational tool):**

1. Finding measures of variability and central tendency (mean, median, mode, arithmetic mean, geometric mean, Variance)
2. Data visualization (Construction of bar charts, pie charts).
3. Construction of confidence intervals

## **UNIT – IV**

**Tests of Hypothesis:**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions, Chi-Square and F test.

**Practice(Using any computational tool):**

1. Z-test, t-test and Chi-square test

## **UNIT – V**

**Correlation and Regression:**

Method of least squares – Straight line - nonlinear curves– parabola -Exponential – Power curves-Correlation – Karl Pearson’s correlation coefficient – rank correlation – regression— regression coefficients and properties (without proof) –regression lines

**Practice(Using any computational tool):**

1. Finding correlation coefficient and regression lines

\*Students are advised to use any Programming language/computational tool/AI tool like Python,Excel, PowerBI ,Wolfrum Alpha, Symbolab, Mathway, etc., for the practice

**Text Books:**

- 1 Miller and Freund’s, Probability and Statistics for Engineers, 9/e, Pearson, 2020. ISBN 978-9353945237
- 2 Fundamentals of Mathematical Statistics, S.C. Gupta and V.K.Kapoor, 12th edition, Sultan Chand & Sons Publications, 2020, ISBN: 978-9351611738

**Reference Books:**

- 1 Probability, Statistics and Random processes, T.Veerarajan, Tata McGraw-Hill, ISBN: 978-0070669253
- 2 Probability and statistics by T.K.V. Iyengar, S. Chand publishers, 2022, ISBN: 9789355010643
- 3 Modern Statistics: Intuition, Math, Python, R by Mike X Cohen, ISBN: 9798867723736

**Web Links:**

- 1 [https://onlinecourses.nptel.ac.in/noc21\\_ma74/preview](https://onlinecourses.nptel.ac.in/noc21_ma74/preview)
- 2 <http://mathworld.wolfram.com/topics/ProbabilityandStatistics.html>
- 3 <https://www.khanacademy.org/math/statistics-probability>
- 4 <https://www.geeksforgeeks.org/statistics-with-python/>
- 5 <https://www.coursera.org/learn/inferential-statistical-analysis-python?specialization=statistics-with-python>

## Java Programming

(Common to CSE, IT, AIML & CSE (DS))

|                       | L | T | P | C |
|-----------------------|---|---|---|---|
| Course Code: 2501IT06 | 2 | 0 | 2 | 4 |

### Course Outcomes:

At the end of the course, student will be able to:

- CO1** Apply Java features for problem solving.
- CO2** Build applications using principles of OOPs, interfaces and Packages.
- CO3** Develop programs using Exception Handling to handle run-time errors.
- CO4** Develop applications using multithreading for inter thread communication.
- CO5** Build JDBC applications for performing CRUD operations using MySQL.

### Mapping of Course Outcomes with Program Outcomes:

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

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 1    |      |
| <b>CO3</b> | 1    |      |
| <b>CO4</b> | 2    |      |
| <b>CO5</b> | 3    |      |

## UNIT – I

**Introduction to Java:** History of Java, Features of Java Language, JVM Architecture, Java source file structure. Building Blocks of Java, Control Statements, Operators, Type Conversion, Command Line Arguments, Arrays.

### Practice:

#### 1. Control Statements

- a. Select all the prime numbers within the range of 1 to 100.
- b. Find the sum of all even terms in the Fibonacci sequence up to the given range N.
- c. Check whether a given number is Armstrong or not.

#### 2. Arrays

- a. Sort an array of integers in ascending order.
- b. Find the maximum and minimum element in an array.

- c. Remove duplicate elements from an array.

## UNIT – II

**Concepts of Class:** Class, Object, Method, Constructor, Overloading- Method and Constructor Keywords: this, static and final, String Class and its Methods, StringTokenizer, StringBuffer and StringBuilder.

### Practice:

#### 1. Class Mechanism

- a. Display the details of a person. Personal details should be given in one method and the qualification details in another method.
- b. Implement constructor and constructor overloading.
- c. Implement method overloading.

#### 2. Strings

- a. Check if a given string is a pangram (contains every letter of the alphabet at least once).
- b. Find the most frequently occurring character in a string.
- c. Find all permutations of a given string.
- d. Check if a given string is a anagram (Ex: CAT and ACT).

## UNIT – III

**Inheritance:** Inheritance, Types of Inheritance, super and super( ), Method Overriding, Using final with inheritance, abstract with Class and Method, Dynamic Method Dispatch. Interfaces: Introduction to interface, Multiple inheritance.

### Practice:

#### 1. Inheritance & interface

- a. Implement multi level Inheritance.
- b. Implement multiple Inheritance.
- c. Find the areas of different shapes using abstract classes.

## UNIT – IV

**Packages:** Introduction, Importing Packages and Classes, path and classpath, Access Specifiers, java.util: Collection Framework (related interfaces and classes), java.io: FileReader, FileWriter, FileInputStream, FileOutputStream, BufferedReader and BufferedWriter, Wrapper Classes.

### Practice:

#### 1. Packages & java.io

- a. Import and use user defined package.
- b. Illustrate the use of protected members in a package.
- c. Copy Even numbers into Even.txt file and Odd Numbers into Odd.txt file.

#### 2. Collection Framework

- a. ArrayList and LinkedList
- b. Iterator and Iterable
- c. Comparator and Comparable
- d. HashMap and TreeMap
- e. HashSet and TreeSet
- f. HashTable

## UNIT – V

**Exception Handling:** Introduction, Keywords: try, catch, throw, throws and finally, Multiple Catch Clauses, Checked and Unchecked Exceptions, User Defined Exceptions.

**Multithreading:** Introduction, Thread Life Cycle, Creation, Priorities, Synchronization, ITC.

**Java Database Connectivity:** Introduction, JDBC Architecture, Types of Drivers, JDBC Environment Setup, JDBC Steps, CRUD Operations.

### Practice:

#### 1. Exception Handling

- a. Illustrate exception handling mechanism using multiple catch clauses.
- b. Make use of Built-in and user-defined Exceptions in handling a run time exception.

#### 2. Multithreading

- a. Creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable).
- b. Solve Producer-Consumer problem using synchronization.

#### 3. JDBC

- a. CRUD operations.

### Additional Practice:

1. Student Management
2. Inventory Management
3. Phone book Management

### Capstone Project:

Develop a console-based quiz application in Java where questions are fetched from a database. The app should handle user login, score calculation, timer using threads, exception handling, and store results in both files and database.

**\* Note: The student must Complete & Submit a Java Programming Certificate Course offered by Oracle Academy at the end of the Practice Session.**

### Text Books:

- 1 The Complete Reference Java, Herbert Schildt, TMH ,8<sup>th</sup> Edition, ISBN 978-1260440232.
- 2 Java one step ahead, Anita seth, B.L.Juneja, Oxford, First Edition. ISBN: 9780199459643.

### Reference Books:

- 1 Introduction to java programming, by Y Daniel Liang, Seventh Edition, Pearson, ISBN: 978-8131729588
- 2 Core Java: An Integrated Approach, R.Nageswara Rao, Dream tech press, ISBN: 978-9351199250

**Web Links:**

- 1 <https://nptel.ac.in/courses/106/105/106105191/>
- 2 <http://java.sun.com/docs/books/tutorial/>

## Operating Systems

(Common to CSE, IT, AIML & CSE (DS))

**Course Code: 2501CS13**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

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

- CO1:** Describe basic concepts of Operating Systems and its structure.
- CO2:** Analyse various issues related to inter process communication like process scheduling, resource management and deadlocks.
- CO3:** Interpret the issues and challenges of memory management.
- CO4:** Illustrate concepts of Disk management and file system implementation.
- CO5:** Explain issues related to protection and security mechanisms.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    |      |      |      |      |      |      |      | 1    |       |       |
| <b>CO2</b> | 1    | 3    |      | 1    |      |      |      |      | 2    |       | 1     |
| <b>CO3</b> | 1    | 3    |      | 1    |      |      |      |      | 2    |       | 1     |
| <b>CO4</b> | 1    | 3    |      | 1    |      |      |      |      | 1    |       | 1     |
| <b>CO5</b> | 2    | 2    |      |      |      |      |      |      | 1    |       |       |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1     | PSO2 |
|------------|----------|------|
| <b>CO1</b> | <b>1</b> |      |
| <b>CO2</b> | <b>2</b> |      |
| <b>CO3</b> | <b>2</b> |      |
| <b>CO4</b> | <b>2</b> |      |
| <b>CO5</b> | <b>2</b> |      |

## UNIT – I

**Operating Systems Overview:** Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, System Boot.

**Case Study:** The above topics are discussed as case study in Windows/ Unix OS

### Practice:

1. Basic Linux commands

2. Implementation of System calls
3. Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit (), System calls

## UNIT – II

**Process Concept:** Process scheduling, Operations on processes, Inter-process communication.

**Process Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling.

**Multithreaded Programming:** Multithreading models, Thread libraries, Threading issues

**Case Study:** The above topics are discussed as case study in Windows/ Unix OS

### Practice:

1. Simulate the following CPU scheduling algorithms:FCFS and SJF
2. Simulate the following CPU scheduling algorithms: Priority and Round Robin

## UNIT – III

**Inter-process Communication:** Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

**Deadlocks:** Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.

**Case Study:** The above topics are discussed as case study in Windows/ Unix OS

### Practice:

1. Simulate Bankers Algorithm for Dead Lock Avoidance
2. Write a C program that illustrates two processes communicating using shared memory.
3. Write C program to create a thread using pthreads library and let it run its function.
4. Write a C program to illustrate concurrent execution of threads using pthreads library

## UNIT – IV

**Memory-Management Strategies:** Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation.

**Virtual Memory Management:** Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation.

**File Systems:** Files, Directories, File system implementation, management and optimization.

**Case Study:** The above topics are discussed as case study in Windows/ Unix OS

### Practice:

1. Simulate the Multiprogramming with a fixed number of tasks (MFT)
2. Simulate the Multiprogramming with a variable number of tasks (MVT)
3. Simulate the FIFO page replacement algorithm
4. Simulate the LRU page replacement algorithm

5. Simulate the following File allocation strategies: Sequenced, Indexed and Linked

## UNIT – V

**Secondary-Storage Structure:** Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

**System Protection:** Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.

**System Security:** Introduction, Program threats, System and network threats.

### Practice:

1. The above topics are discussed as case study in Windows/ Unix OS

### Text Books:

- 1 Operating System Concepts, Abraham Silberschatz, Peter B Galvin and Greg Gagne, John Wiley and Sons Inc., 12<sup>th</sup> Edition. ISBN: 978-0470128725
- 2 William Stallings, Operating Systems: Internals and Design Principles. Prentice-Hall, 7<sup>th</sup> Edition. ISBN: 978-9332518803

### Reference Books:

- 1 Modern Operating Systems, Tanenbaum A S, Pearson Education, 3<sup>rd</sup> Edition. ISBN: 978-0136006633
- 2 Operating Systems A Concept Based Approach, Dhamdhere D M, Tata McGraw-Hill, 3<sup>rd</sup> Edition. ISBN: 978-1259005589
- 3 Operating Systems, Nutt G, Pearson Education, 3<sup>rd</sup> Edition, . ISBN: 978-8131723593

### Web Links:

- 1 <https://archive.nptel.ac.in/courses/106/106/106106144/>
- 2 <https://archive.nptel.ac.in/courses/106/105/106105214/>
- 3 <https://www.coursera.org/learn/iot/lecture/MrgxS/lecture-3-1-operating-systems>
- 4 <https://in.udacity.com/auth?next=/course/introduction-to-operating-systems--ud923>

**Artificial Intelligence**  
(Common to CSE, IT, AIML & CSE (DS))

**Course Code: 2501AI02**

**L      T      P      C**  
**2      0      1      3**

**Course Outcomes:**

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

- CO1:** Illustrate the historical development of AI, key milestones and contributors.
- CO2:** Apply the basic principles of AI in problem solving
- CO3:** Apply Local Search Algorithms and Optimization Techniques.
- CO4:** Choose the appropriate representation of Knowledge.
- CO5:** Summarise the expert systems and real time applications

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    |      |      | 1    |      |      |      | 1    | 1    |       | 1     |
| <b>CO2</b> | 3    | 2    |      | 2    |      |      |      | 1    | 1    |       | 1     |
| <b>CO3</b> | 3    | 2    | 1    | 2    | 1    |      |      | 1    | 1    |       | 1     |
| <b>CO4</b> | 2    |      | 1    |      |      |      |      | 1    | 1    |       |       |
| <b>CO5</b> | 2    | 2    | 1    | 1    | 1    |      |      | 1    | 1    |       | 1     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 2    | 1    |
| <b>CO3</b> | 1    | 1    |
| <b>CO4</b> | 1    |      |
| <b>CO5</b> | 1    | 1    |

**UNIT – I**

**Introduction:**

What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

**Practice :**

1. Introduction to LISP : To demonstrate simple recursive functions and list manipulation in LISP
2. Introduction to Prolog : Provide a brief introduction to Prolog syntax, including facts, rules, and queries.

## UNIT – II

### **Problem formulation:**

Problem Definition Production systems, Control strategies, Search strategies. Problem characteristics, Problem Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies

### **Practice :**

1. Implementation of DFS for water jug problem using LISP/PROLOG
2. Implementation of BFS for tic-tac-toe problem using LISP/PROLOG

## UNIT – III

### **Problem solving methods**

Problem graphs, Matching, Indexing and Heuristic functions Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions, Constraints satisfaction – Measure of performance and analysis of search algorithms. Game playing.

### **Practice :**

1. Implementation of TSP using heuristic approach using LISP/Prolog
2. Implementation of Hillclimbing to solve 8 Puzzle Problem

## UNIT – IV

### **Knowledge representation**

Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic Structured representation of knowledge Basic plan generation systems – Strips Advanced plan generation systems – K strips Strategic explanations Why, why not and how explanations.

### **Practice :**

1. Design a semantic network to represent knowledge about a specific domain, such as animals or transportation systems. Experiment with different node types, relationships, and attributes to encode information effectively. Implement a Python / LISP code for this program.
2. Create a frame-based representation for a simple domain like a restaurant. Define frame templates for entities like menu items, customers, and orders, along with slots for attributes such as price, ingredients, and customer preferences.

## UNIT – V

### **Expert Learning**

Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.

### **Practice :**

1. Using PYTHON / LISP, develop an expert system to help users plan travel itineraries, including transportation, accommodation, and activities. Utilize knowledge about travel destinations, transportation options, and user preferences to generate personalized travel plans.

2. Using PYTHON / LISP , create an expert system to assist students in selecting courses, majors, or career paths based on their interests, skills, and academic performance. Use knowledge about educational programs, career prospects, and academic requirements to make personalized recommendations.

**Text Books:**

- 1 Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig , Pearson, 3rd Edition, ISBN: 978-9332543515
- 2 Artificial Intelligence: Structures and Strategies for Complex Problem Solving by George F. Luger, 2<sup>nd</sup> Edition, ISBN: 978-0805347807

**Reference Books:**

- 1 Artificial Intelligence, Saroj Kaushik, Cengage Learning India, ISBN: 978-8131510995
- 2 Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw Hill, ISBN: 978-0-07-052263-3
- 3 Artificial Intelligence: Foundations for Computational Agents, David Poole and Alan Mackworth, Cambridge University Press, ISBN: 978-1107195394

**Web Links:**

- 1 <https://nptel.ac.in/courses/106105077>
- 2 <https://nptel.ac.in/courses/106106126>
- 3 <https://aima.cs.berkeley.edu>

**Computer Networks**  
(Common to CSE, IT, AIML & CSE (DS))

**Course Code:** 2501CS07

**L      T      P      C**  
**2      0      1      3**

**Course Outcomes:**

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

- CO1:** Describe network topologies, reference models and media for data transmission
- CO2:** Analyze error and flow control issues in data link layer
- CO3:** Classify MAC protocols and channelization techniques
- CO4:** Apply routing algorithms and congestion control techniques for effective data transmission
- CO5:** Analyze protocols Transport and Application Layers

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 3    | 1    |      |      |      |      |      |      |      |       |       |
| CO2   |      | 2    |      |      |      |      |      |      |      |       |       |
| CO3   |      | 2    |      |      |      |      |      |      | 1    | 1     |       |
| CO4   | 1    | 2    | 2    |      |      |      |      |      | 2    |       | 1     |
| CO5   |      | 1    |      |      | 1    |      |      |      |      |       | 1     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PO | PSO1 | PSO2 |
|-------|------|------|
| CO1   | 1    |      |
| CO2   | 2    |      |
| CO3   | 2    |      |
| CO4   | 2    |      |
| CO5   | 2    |      |

**UNIT – I**

**Network Overview:** interfaces, protocols and services, connection-oriented and connectionless services, OSI & TCP/IP Reference Models. Local Area Networks: Topologies - star, bus, ring, media access control - deterministic and probabilistic, IEEE 802.x. wireless networking.

**Practice:**

1. Study of Network devices in detail and connect the computers in Local Area Network

**UNIT – II**

**Data Link Protocols:** Framing and Data Transparency, Error Detection & Correction, Flow control.

**Practice:**

1. Write a Program to implement the data link layer framing methods such as i) Character stuffing ii) bit stuffing.

**UNIT – III**

**Media Access Control:** Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, Controlled Access: Reservation, Polling, Token Passing, Channelization: frequency division multiple Access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA).

**Practice:**

1. Write a Program to implement Sliding window protocols

**UNIT – IV**

**Routing Algorithms:** The Optimality principle, Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms: General principles of congestion control, Congestion prevention policies, Approaches to Congestion Control, Traffic Aware Routing, Admission Control, Traffic Throttling, Load Shedding, Traffic Control Algorithm: Leaky bucket & Token bucket.

**Practice:**

1. Programs to implement routing protocols like shortest path.

**UNIT – V**

**IP Protocols:** IP Addressing, IP & ICMP.

Transmission Control Protocol: UDP & TCP.

Application Layer: World Wide Web, HTTP, Electronic mail, Architecture, web based mail, email security, TELENET, local versus remote Logging, Domain Name System: Name Space, DNS, SNMP.

**Practice:**

1. NS2 Simulator i. NS2 Simulator-Introduction ii. Simulate to Find the Number of Packets Dropped iii. Simulate to Find the Number of Packets Dropped by TCP/UDP

**Capstone Project:**

Simulate and implement data link layer protocols and network routing strategies using NS2 (Network Simulator 2). It includes configuring network topologies, setting up routing protocols like AODV, DSDV, and OLSR, and analyzing their performance through metrics such as throughput, delay, and packet delivery ratio. Additionally, explore the simulation of data link layer functionalities, including MAC addressing and error detection. You may use NS2's capabilities, that insights into the behaviour of network protocols, aiding in the design and optimization of efficient communication systems.

**Text Books:**

- 1 Computer Networks — Andrew S Tanenbaum and David J Wetherall, Pearson Education, 5th Edition. ISBN: 978-0132126953
- 2 Data Communications and Networking – Behrouz A.Forouzan, McGraw Hill Education, 5th Edition ISBN: 978-1259064753

**Reference Books:**

- 1 Data Communications and Networks- Achut S Godbole, AtulKahate, McGraw-Hill Education (India) Pvt Limited, 2<sup>nd</sup> Edition. ISBN: 978-0-07-123110-7
- 2 Computer Networks, Mayank Dave, CENGAGE India, 6<sup>th</sup> Edition ISBN: 978-8131509869

**Web Links:**

- 1 <https://nptel.ac.in/courses/106105081>
- 2 <https://www.coursera.org/learn/fundamentals-network-communications>

**Data Mining**  
(Common to CSE, IT, AIML & CSE (DS))

**Course Code: 2501AI03**

**L      T      P      C**  
**1      0      2      3**

**Course Outcomes:**

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

- CO1:** Illustrate data warehousing architectures and mining concepts for knowledge discovery.
- CO2:** Apply preprocessing techniques to prepare data for mining algorithms.
- CO3:** Build classification model using Decision tree induction.
- CO4:** Analyze association rule generation using Apriori and FP growth algorithms.
- CO5:** Apply Clustering algorithms on given data to find similarity between classes.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 2    | 2    | 2    |      | 1    |      |      | 1    | 1    |       | 2     |
| CO2   | 2    | 2    | 2    |      | 2    |      |      | 1    | 1    |       | 2     |
| CO3   | 2    | 2    | 3    |      | 1    |      |      | 1    | 1    |       | 2     |
| CO4   | 2    | 2    | 3    |      | 1    |      |      | 1    | 1    |       | 2     |
| CO5   | 2    | 2    | 3    |      | 1    |      |      | 1    | 1    |       | 2     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    |      | 1    |
| CO2    |      | 2    |
| CO3    |      | 2    |
| CO4    |      | 2    |
| CO5    |      | 2    |

**UNIT – I**

**Data Warehousing and Online Analytical Processing:**

**Data Warehouse:** Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

**Data Mining:** What Is Data Mining, Why Data Mining, Data Mining Functionalities, Technologies Are Used, Major Issues in Data Mining, Architecture of Data Mining Systems Classification of Data Mining Systems.

**UNIT – II**

**Know Your Data :** Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.

**Data Preprocessing :** An Overview, Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization

**Practice:**

1. Apply Statistical Descriptions and Measures of Similarity and Dissimilarity on given data
2. Apply PreProcessing for training data set related to Weather data

**UNIT – III**

**Classification and Prediction:** Classification: Basic Concepts, General Approach to Solving a Classification Problem, Decision Tree Induction, Model Overfitting, Evaluating the Performance of a Classifier, Issues Regarding Classification and Prediction

**Practice:**

1. Demonstrate classification rule process on given data set using id3 algorithm.
2. Demonstrate classification rule process on Student's Academic Performance Data using j48 algorithm.

**UNIT – IV**

**Mining Frequent Patterns, Associations and Correlations:** Basic Concepts and Methods, Frequent Itemset Mining Methods, Which Patterns Are Interesting?—Pattern Evaluation Methods, Association Mining to Correlation Analysis.

**Practice:**

1. Demonstrate Association rule generation on credit card data using apriori algorithm.
2. Demonstrate Association rule process on ontactlenses.arff using FPGrowth Algorithm

**UNIT – V**

**Cluster Analysis:** Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Evaluation of Clustering, Mining Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

**Practice:**

1. Demonstrate clustering process on given dataset using simple k-means
2. Apply Hierarchical clustering process on dataset

**Additional Practice:**

1. Write a program of cluster analysis using DB SCAN algorithm Python programming language
2. Demonstrate Web/Text Mining using WEKA/KNIME Tool

**Capstone Project:** Implement a data mining application involving data preprocessing and various data mining tasks can be achieved by focusing on a specific domain, such as retail, sales and customers, and then applying different techniques to analyse the data. This project would involve data cleaning, transformation, and various data mining tasks like clustering and association rule mining of your own data set, potentially leading to valuable insights into various area of data mining Applications.

**Text Books:**

- 1 Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei  
Third Edition, Elsevier, ISBN: 978-9380931913
- 2 Introduction to Data Mining, PangNing Tan, Michael Steinbach and Vipin Kumar  
Pearson Education, ISBN: 978-1-292-02615-2

**Reference Books:**

- 1 Data Mining: Introductory and Advanced Topics, Margaret H. Dunham, 1st Edition  
Pearson Edn, ISBN: 978-8177587852
- 2 Data Mining Techniques and Applications An Introduction, Hongbo Du, 1st Edition,  
Cengage India, ISBN: 978-8131519554
- 3 Data Warehousing, Data Mining and OLAP, Alex Berson,.Stephen J. Smith,  
McGrawHill series, ISBN: 978-0070062726

**Web Links:**

- 1 <https://nptel.ac.in/courses/106105174/>
- 2 <https://www.kdnuggets.com/>
- 3 <https://www.import.io/post/datascientistsvsdataanalystswhythedistinctionmatters/>

## Advanced Data Structures & Algorithm Analysis (Common to AIML, CSE, CSE-DS & IT)

|                              | L        | T        | P        | C        |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501CS10</b> | <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

At the end of the Course, Student will be able to:

**CO1:** Analyze the algorithms efficiency and hashing techniques for searching.

**CO2:** Illustrate the concepts of search trees and operations of Priority Queues.

**CO3:** Analyze the algorithms of Divide & Conquer and Greedy paradigms.

**CO4:** Analyze the algorithms of Dynamic Programming paradigm.

**CO5:** Design the algorithms of Backtracking and Brach & Bound paradigms.

### Mapping of Course Outcomes with Program Outcomes:

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

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 2    | -    |
| <b>CO2</b> | 2    | -    |
| <b>CO3</b> | 2    | -    |
| <b>CO4</b> | 2    | -    |
| <b>CO5</b> | 2    | -    |

### UNIT – I

**Introduction to Algorithm Analysis,** Space and Time Complexity analysis, Asymptotic Notations.

**Hashing:** Introduction to Static Hashing, Hash Tables, Hash Functions, Different Hash Functions, Collision Resolution Techniques, Dynamic Hashing.

#### Practice:

1. Write a program to implement collision resolution techniques of Hash data structure.

### UNIT – II

**AVL Trees** – Creation, Insertion, Deletion operations and Applications.

**B-Trees** – Creation, Insertion, Deletion operations and Applications

**Priority Queues (Heaps):** Introduction, Binary Heaps-Model and Simple Implementation, Basic Heap Operations, Other Heap Operations, Applications of Priority Queues

**Practice:**

1. Write a program to implement AVL tree operations
2. Write a program to implement Max heap and min heap operations

**UNIT – III**

**Divide and Conquer:** The General Method, Binary Search, Merge Sort, Quick Sort.

**Greedy Method:** The General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths.

**Practice:**

1. Write a program to sort the given list of elements using Merge sort technique using divide and conquer approach.
2. Write a program to implement Single Source Shortest Paths using greedy approach.

**UNIT – IV**

**Dynamic Programming:** The General Method, Single Source Shortest Paths– General Weights (Bellman Ford Algorithm), All-pairs shortest paths, Optimal Binary Search Trees, 0/1 Knapsack, Travelling Salesperson problem

**Practice:**

1. Write a program to implement 0/1 Knapsack problem using Dynamic Programming approach.
2. Write a program to implement all pairs shortest path problem using Dynamic Programming approach.

**UNIT – V**

**Backtracking:** The General Method, N-Queens Problem, Sum of Subsets problem, Graph Coloring, Hamiltonian cycles.

**Branch and Bound:** The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem.

**Practice:**

1. Write a program to implement N-Queens problem using backtracking algorithm.
2. Write a program to implement Travelling Salesperson problem using branch and bound approach.

**Text Books:**

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

**Reference Books:**

1. Data Structures and program design in C, Robert Kruse, 2nd Edition Pearson Education Asia.
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison - Wesley.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson

**Web Links:**

1. <https://archive.nptel.ac.in/courses/106/102/106102064/>
2. <https://archive.nptel.ac.in/courses/106/106/106106131/>
3. <http://peterindia.net/Algorithms.html>

## Compiler Design

(Common to CSE&IT)

**Course Code: 2501IT04**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

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

- CO1:** Analyze the phases in compilation process.
- CO2:** Apply different parsing algorithms to develop parsers for a given grammar
- CO3:** Construct various forms of intermediate code.
- CO4:** Compare the storage allocation strategies.
- CO5:** Apply techniques to generate optimized and target code.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 3    |      |      |      |      |      |      | 1    | 1     |       |
| <b>CO2</b> | 2    | 3    | 1    |      | 1    |      |      |      | 1    | 1     |       |
| <b>CO3</b> | 3    | 2    |      |      |      |      |      |      | 1    | 1     |       |
| <b>CO4</b> | 2    | 2    |      |      |      |      |      |      | 1    | 1     |       |
| <b>CO5</b> | 2    | 2    | 1    |      |      |      |      |      | 1    | 1     |       |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 2    |      |
| <b>CO2</b> | 1    |      |
| <b>CO3</b> | 1    |      |
| <b>CO4</b> | 1    |      |
| <b>CO5</b> | 1    |      |

## UNIT – I

**Overview of Language Processing:** Language Processors, Structure of a Compiler.

Lexical Analysis: The Role of the Lexical Analyzer - Lexical Analysis Vs. Parsing, Tokens, Patterns and Lexemes, Lexical Errors, Regular Expressions, Regular Definitions, Recognition of Tokens, The Lexical-Analyzer Generator Lex.

### Practice:

- 1 a) Write a lex program which removes white spaces from its input file.
- b) Write a program to implement the lexical analyzer using JLex, flex, lex or other lexical analyzer generating tools.

## UNIT – II

**Syntax Analysis:**

The Role of the Parser, Context Free Grammars- Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring, Classification of Parsing Techniques.

**Top-Down Parsing:**

Brute-Force Parsing, Recursive-Descent Parsing, First and Follow, LL(1) Grammars, Nonrecursive Predictive Parsing, Error Recovery in Predictive Parsing.

**Practice:**

1. Write a C program to implement Recursive Descent Parser for an expression.

**UNIT – III****Bottom-Up Parsing:**

Reductions, Handle Pruning, Shift-Reduce Parsing, Why LR Parsers, The LR-Parsing Algorithm, Constructing SLR-Parsing Tables, More Powerful LR Parsers - Construction of CLR(1), LALR Parsing Tables, Using Ambiguous Grammars.

**Practice:**

1. Write a C program to implement LALR bottom up parser for the given language.

**UNIT – IV****Semantic Analysis:**

Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax Directed Translation.

**Intermediate Code Generation:** Three Address Code, Quadruples, Triples, Abstract Syntax Trees, Type Checker - Type Expressions, Type Conversion.

**Runtime Environments:**

Activation Record, Storage Organization, Storage Allocation Strategies – Static Allocation, Stack Allocation and Heap Allocation.

**Practice:**

1. Write a C program to implement intermediate code generation for simple expression.

**UNIT – V**

**Code Optimization:** Basic Blocks & Flow Graphs, Machine-Independent Optimizations – The Principal Sources of Optimization: Common Subexpression Elimination, Copy Propagation, Dead Code Elimination, Code Motion, Induction Variables and Reduction in Strength, DAG Representation, Machine-dependent Optimization: Peephole Optimization.

**Code Generation:** Issues in the Design of a Code Generator, Object Code Forms, A Simple Code Generator, Register Allocation and Assignment.

**Practice:**

- 1 a) Write a C program to perform Loop Unrolling.
- b) Write a C program for constant propagation

**TextBooks:**

- 1 Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Second Edition, Pearson, 2007. ISBN: 978-1-29202-434-9
- 2 Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press ISBN: 978-0521607650

**Reference Books:**

- 1 Compiler Construction-Principles and Practice, Kenneth C Loudon, Cengage Learning. ISBN: 978-0534939724
- 2 The Compiler Design Handbook, Y.N. Srikant and Priti Shankar, 2<sup>nd</sup> ed., CRC Press ISBN: 978-1420043822.

**Web Links:**

- 1 <https://nptel.ac.in/courses/106/108/106108113/>
- 2 <https://nptel.ac.in/courses/106/104/106104123/>

## Machine Learning

(Common to CSE, IT, AIML & CSE(DS))

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501AI05</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                              | <b>2</b> | <b>0</b> | <b>2</b> | <b>4</b> |

### Course Outcomes:

At the end of the course, student will be able to:

- CO1:** Outline the Concepts of Machine Learning and Statistical Learning
- CO2:** Build Regression and Classification models for given data.
- CO3:** Apply Instance based Learning techniques and SVM techniques linear and nonlinear data.
- CO4:** Apply clustering techniques on high dimensional data to group the similar entities.
- CO5:** Make use of ensemble learning techniques to improve the performance of a model.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|-----|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 2    |     |      | 2    | 2    |      | 1    | 1    |       |       |
| <b>CO2</b> | 2    | 2    | 3   |      | 2    | 2    |      | 1    | 1    |       |       |
| <b>CO3</b> | 3    | 2    | 3   |      | 2    |      |      | 1    | 1    |       | 2     |
| <b>CO4</b> | 3    | 2    | 3   |      | 2    |      |      | 1    | 1    |       |       |
| <b>CO5</b> | 2    | 2    | 2   |      | 2    |      |      | 1    | 1    |       | 2     |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 1    |
| <b>CO2</b> |      | 2    |
| <b>CO3</b> |      | 2    |
| <b>CO4</b> |      | 2    |
| <b>CO5</b> |      | 2    |

## UNIT – I

### Introduction:

Machine Learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. Statistical Learning: Introduction, Supervised and Unsupervised Learning, Learning Problem, Feasibility of Learning.

### Practice :

1. Installation of Jupiter/Spider notebook and working on basic commands.
2. Loading and apply key preprocessing techniques on the dataset and also analyse the dataset.

## UNIT – II

### **Supervised Learning(Regression/Classification):Basic Methods:**

**Concept Learning:** General-to-Specific Hypotheses Ordering, Find-S and Candidate Elimination Algorithm, Version Space, and Inductive Bias.

**Bayesian Learning:** Probability Overview, MLE and MAP Estimates, Gaussian Naive Bayes Classifier, Bayesian Networks.

**Instance-based Learning:** k-Nearest Neighbour (kNN) Classifier, Voronoi Diagram and Distance-Weighted kNN, Distance Metrics and Curse of Dimensionality.

#### **Practice :**

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Exercises to solve the real-world problems using Binary Classifier
4. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

## UNIT – III

**Linear Models and Regression:** Linear Classification, Linear Regression, Non-linear Transformation, Logistic Regression.

**Support Vector Machines:** Decision Boundary and Support Vector: Optimization and Primal-Dual Problem, Soft Margin and Non-linear Decision Boundary, Kernel Functions and Radial Basis Functions introduction.

#### **Practice :**

1. Exercises to solve the real-world problems using Linear Regression
2. Exercises to solve the real-world problems using Logistic Regression
3. Consider Patient Dataset. Apply linear classification technique(SVM) to identify the rate of heart patients.

## UNIT – IV

**Classifier / Hypothesis Evaluation:** Accuracy, Precision, Recall and F-Measures, Scores, Sampling, Bootstrapping and ROC, Hypotheses Testing and Cross-validation.

### **Unsupervised Learning:**

**Clustering :** Partitional Clustering and Hierarchical Clustering, Cluster Types, Attributes and Salient Features, Hierarchical and Density-based Clustering Algorithms, Inter and Intra Clustering Similarity, Cohesion and Separation. MST and DBSCAN Clustering Algorithms.

#### **Practice :**

1. Develop a program for Bias, Variance, Remove duplicates , Cross Validation
2. Write a program to implement One-hot Encoding.
3. Write a program to implement Categorical Encoding.

## UNIT – V

### **Ensemble Learning :**

Bagging and Boosting, Adaboost and Random Forest ,

**Computational Learning Theory :** Error and Noise Formalisms, Training vs. Testing, Theory of Generalization, PAC Learnability and VC Dimensions , Overfitting, Regularization and Validation.

### **Practice :**

1. Write a program to demonstrate the working of Random Forest classifier. Use appropriate dataset for Random Forest Classifier.
2. Use a sentiment analysis dataset from Twitter or other social media platforms, available on platforms like Kaggle and apply bagging and boosting techniques for prediction.

### **Additional Practice:**

1. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
2. Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using kMeans algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

### **Capstone Project:**

#### **Student Performance Prediction System**

**Objective:** Predict a student's performance (pass/fail or score range) based on input features like study time, attendance, past grades, family background, etc.

**Domain:** Education

#### **Techniques & Concepts Used:**

- Supervised learning (Classification – Logistic Regression, SVM)
- Data preprocessing (handling nulls, encoding categorical variables)
- Evaluation metrics (accuracy, precision, recall)

### **Text Books:**

- 1 Hands On Machine Learning with ScikitLearn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019, ISBN: 978-1492032649
- 2 Data Science and Machine Learning Mathematical and Statistical Methods, Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman, 2019, ISBN: 978-1118492530

### **Reference Books:**

- 1 Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, ISBN: 9780262018029
- 2 Machine Learning Tools, Dr Muddafa Maruli Krishna, Dr A Vanathi, Final Thawaksr, Dr Lokesh P. Gangani, publisher: Book Rivers, ISBN: 978-93-5515-730-0

**Web Links:**

- 1 <https://www.deeplearning.ai/machinelearningyearning/>
- 2 <https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html>

**Big Data Analytics**  
(Common to CSE, IT, AIML & CSE(DS))

**Course Code:** 2501AI04

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

**Course Outcomes:**

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

- CO1:** Illustrate big data challenges in different domains
- CO2:** Use various techniques for mining data stream.
- CO3:** Demonstrate building blocks of Hadoop
- CO4:** Make use of Pig and Hive to structure big Data
- CO5:** Apply Spark tool to analyze big data.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    | 2    |      | 1    | 2    |      |      | 1    | 2    |       | 1     |
| <b>CO2</b> | 2    | 3    |      | 1    | 2    |      |      | 1    | 2    |       | 1     |
| <b>CO3</b> | 2    | 1    |      | 3    | 2    |      |      | 1    | 2    |       | 2     |
| <b>CO4</b> | 2    | 3    |      | 2    | 2    |      |      | 1    | 2    |       | 2     |
| <b>CO5</b> | 2    | 2    |      | 1    | 3    |      |      | 1    | 2    |       | 2     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 2    |
| <b>CO2</b> |      | 2    |
| <b>CO3</b> |      | 2    |
| <b>CO4</b> |      | 2    |
| <b>CO5</b> |      | 2    |

**UNIT – I**

**Introduction to big data:** Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

**Practice:**

1. Hadoop File System Operations: Implement the following file management tasks in Hadoop: a.) Adding files and directories b.) Retrieving files c.) Deleting files

**UNIT – II**

**Stream Processing:**

**Mining data streams:** Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting

Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications.

**Practice:**

1. Loading DataSet in to HDFS for Spark Analysis.

### UNIT – III

**Introduction to Hadoop:** History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

**Practice:**

1. Map Reduce Word Count Hadoop Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

### UNIT – IV

**Pig: Hadoop Programming Made Easier:** Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Checking out the Pig Script Interfaces, Scripting with Pig Latin. Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works with examples, Querying and Analyzing Data.

**Practice:**

1. Hive Queries a) Install Hive Framework b) Implement Hive to create, alter, and drop databases, tables
2. Hive Queries Implement hive queries and joins to perform display and retrieve the data

### UNIT – V

**Spark:** Installing Spark, Spark applications, Jobs, stages and Tasks, Resilient Distributed data sets, Shared Variables, Anatomy of a Spark job run.

**Practice:**

1. Demonstrate Spark SQL on Hive
  - a) Create a SQLContext object and load the Parquet file into DataFrame
  - b) Load the Dataframe into Hive table.
  - c) Verify the created Hive table in Hive environment
  - d) Execute Spark SQL query

**Text Books:**

1. Hadoop: The Definitive Guide, Tom White, O'reilly, 4<sup>th</sup> Edition, ISBN: 978-1491901632
2. Hadoop for Dummies, Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss, John Wiley & Sons, ISBN: 978-1118727128

**Reference Books:**

- 1 Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley & sons, ISBN: 978-1118224912
- 2 Harness the Power of Big Data: The IBM Big Data Platform, Paul Zikopoulos, Dirk de Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, Tata McGraw Hill Publications, ISBN: 9780071808187
- 3 Big Data Science & Analytics: A Hands On Approach, Arshdeep Bahga and Vijay Madisetti, VPT, ISBN: 978-0996025577
- 4 Learning Spark: Lightning Fast Big Data Analysis Paperback, Holden Karau, ISBN: 978-1449358624

**Web Links:**

- 1 Hadoop: <http://hadoop.apache.org/>
- 2 Hive: <https://cwiki.apache.org/confluence/display/Hive/Home>
- 3 <https://nptel.ac.in/courses/106106142>
- 4 <https://www.cloudera.com/servicesandsupport/tutorials.html>
- 5 <https://www.databricks.com/spark/gettingstartedwithapachespark>

## Cryptography & Network Security

(Common to CSE, IT, AIML & CSE (DS))

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501IT03</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                              | <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

At the end of the course, student will be able to:

- CO1:** Explain Security Threats and Mathematical Foundations of Cryptography
- CO2:** Classify the basic principles of symmetric key algorithms.
- CO3:** Revise the basic principles of public key algorithms and Asymmetric key algorithms
- CO4:** Design applications of hash algorithms, digital signatures, and key management techniques
- CO5:** Determine the knowledge of Network layer security Protocols.

### Mapping of Course Outcomes with Program Outcomes:

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

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 2    |      |
| <b>CO2</b> | 2    |      |
| <b>CO3</b> | 2    |      |
| <b>CO4</b> | 2    |      |
| <b>CO5</b> | 1    |      |

## UNIT – I

**Basic Principles:** Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography (Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence).

### Practice:

1. Write a program to obtain GCD of two numbers using Euclidean Algorithm

2. Write a c program to implement elliptical curve cryptography algorithm

## UNIT – II

**Symmetric Encryption:** Traditional Symmetric Key Ciphers (Introduction, Substitution ciphers, Transposition ciphers, Stream and block ciphers), Data Encryption Standard, Advanced Encryption Standard.

**Practice:**

1. Write a C program to implement Mono alphabetic substitution cipher
2. Write a C program to implement Vernam Cipher

## UNIT – III

**Asymmetric Encryption:** Mathematics of Asymmetric Key Cryptography ( Euler's Phi Function, Fermat's Little Theorem, Euler's Theorem, Chinese Remainder Theorem), Asymmetric Key Cryptography( Introduction, RSA Cryptography, Diffie Hellman key exchange, Rabin Cryptosystem, Elgamal Cryptosystem)

**Practice:**

1. Write a C program to implement Rabin Cryptosystem

## UNIT – IV

**Digital Signature Schemes & Key Management:** Message Integrity and Message Authentication, Cryptographic Hash Functions (SHA-512), Digital Signatures(Process, Services, Attacks), Key Management (Kerberos, X.509).

**Practice:**

1. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

## UNIT – V

**Network Security:** PGP and S/MIME, SSL and TLS, IPsec ( Modes, Security Protocols),IPC.

**Practice:**

1. Implement the following forms of IPC
  - a. Pipes
  - b. FIFO

### Capstone Project:

1. Design and implement a Secure Messaging Application that ensures confidentiality and integrity of messages using Hybrid Cryptography (combination of symmetric and asymmetric encryption).Use RSA or ElGamal for secure key exchange and AES for encrypting the actual message content.Implement SHA-512 to generate message digests for integrity verification.The application should support basic message exchange between two users with proper key management.Demonstrate the working of encryption, decryption, key generation, and integrity verification through a user-friendly interface or command-line tool.

### Text Books:

- 1 Cryptography and Network Security: Principles and Practice, William Stallings, Pearson, 9<sup>th</sup> Edition , ISBN-13: 9781292742366, 2023.
- 2 Introduction to Modern Cryptography: Principles and Protocols, Jonathan Katz, Yehuda Lindell, CRC Press, 4<sup>th</sup> Edition , ISBN 13: 9781584885511, 2023.

**Reference Books:**

- 1 Understanding Cryptography: A Textbook for Students and Practitioners, Christof Paar, Jan Pelzl, Springer, 2nd Edition, 2020, ISBN: 978-3642041006.
- 2 Network Security Essentials: Applications and Standards, William Stallings, Pearson, 7th Edition, 2023, ISBN: 978-8131761755

**Web Links:**

- 1 <https://nptel.ac.in/courses/106105031>
- 2 <https://users.cs.northwestern.edu/~ychen/classes/cs395-w05/lectures.html>

## Software Architecture (Common to CSE&IT)

**Course Code: 2501CS15**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

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

- CO1:** Explain architectural styles of software
- CO2:** Illustrate software architectural models
- CO3:** Analyze quality attributes of software architecture
- CO4:** Explain architectural and design process.
- CO5:** Explain user interface architecture design for real time applications

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 1    |      | 3    | 2    |      |      |      |      |       | 2     |
| <b>CO2</b> | 2    | 2    | 3    | 2    | 2    |      |      |      |      |       | 1     |
| <b>CO3</b> | 2    | 1    | 1    | 1    | 3    |      |      |      |      |       | 1     |
| <b>CO4</b> | 2    | 3    |      | 2    | 2    |      |      |      |      |       | 2     |
| <b>CO5</b> | 2    | 3    | 1    | 1    | 2    |      |      |      |      |       | 2     |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 1    |      |
| <b>CO3</b> | 1    |      |
| <b>CO4</b> | 1    |      |
| <b>CO5</b> | 1    |      |

### UNIT – I

Introduction- Software Architecture- Definition Prospects- State of Art-Architectural Styles- Pipes and Filters-Layered Systems-Repositories-Process Control, Other familiar Architecture-Heterogeneous Architectures

#### Practice:

- Study case tools such as rational rose or equivalent tools

### UNIT – II

The Architecture Business Cycle, what is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

**Practice:**

1. Requirements implementation of requirements engineering activities such as elicitation, validation management using case tools

**UNIT – III**

Creating and Architecture Quality Attributes, achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

**Practice:**

1. Study and usage of software project management tools such cost estimates and scheduling

**UNIT – IV**

Architecture Evaluation, Architecture design decision making, Building systems from off the shelf components, Software architecture in future.

**Practice:**

1. Exposure towards test plan generators, test case generators, test coverage and software metrics

**UNIT – V**

Architecture design- Introduction Shared Information System, Architecture Structures for Shared Information Systems. Architecture design guidance-User Interface Architecture. Case study: Design of User Interface Design.

**Practice:**

1. Case study: Design of User Interface Design

**Text Books:**

- 1 Software Architecture in **Practice**, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education. ISBN :9788177589962
- 2 Designing Software Architectures: A Practical Approach" by Humberto Cervantes and Rick Kazman ISBN: 978-0134390789

**Reference Books:**

- 1 Beyond Software architecture, Luke Hohmann, Addison wesley. ISBN:9780201775945
- 2 Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR. ISBN: 9780130290328

**Web Links:**

- 1 <https://nptel.ac.in/courses/106105224>
- 2 <https://www.geeksforgeeks.org/fundamentals-of-software-architecture/>
- 3 <https://core.ac.uk/download/pdf/36753454.pdf>

### Multidisciplinary Courses (MDC)

| Course Code  | Course Name                                | Level | L        | T        | P        | C        | CIE | SEE | Total | Pre-requisite |
|--------------|--------------------------------------------|-------|----------|----------|----------|----------|-----|-----|-------|---------------|
| 2501EC95     | Digital Logic Design                       | FC    | 2        | 1        |          | 3        | 50  | 50  | 100   | -             |
| 2501EE1      | Basic Electrical & Electronics Engineering | FC    | 2        |          | 2        | 4        | 50  | 50  | 100   | -             |
| 2501MB01     | Engineering Economics & Management         | FC    | 2        |          |          | 2        | 50  | 50  | 100   | -             |
| <b>Total</b> |                                            |       | <b>6</b> | <b>1</b> | <b>2</b> | <b>9</b> |     |     |       |               |

## Digital Logic Design

(Common for CSE, AIML, DS and IT)

**Course Code: 2501EC95**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>1</b> | <b>0</b> | <b>3</b> |

### Course Outcomes:

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

- CO 1:** Understand various number systems, perform conversions between them, and apply binary codes in digital representations. (BTL: 2)
- CO 2:** Understand basic Boolean algebra rules and simplify Boolean expressions using Karnaugh maps. (BTL:
- CO 3:** Design and implement basic combinational logic circuits such as adders, decoders, and multiplexers.
- CO 4:** Apply the concepts of flip-flops to implement basic sequential circuits like registers, and counters.
- CO 5:** Develop logic circuits using PLDs such as PROM, PAL, and PLA by utilizing programming tables.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    | 2    |      |      |      |      |      | 2    | 1    |       | 1     |
| <b>CO2</b> | 2    | 2    |      |      |      |      |      | 2    | 1    |       | 1     |
| <b>CO3</b> | 2    | 2    | 3    | 1    |      |      |      | 2    | 1    |       | 1     |
| <b>CO4</b> | 2    | 2    | 3    | 1    |      |      |      | 2    | 1    |       | 1     |
| <b>CO5</b> | 2    | 2    | 3    | 1    |      |      |      | 2    | 1    |       | 1     |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 2    |
| <b>CO2</b> |      | 2    |
| <b>CO3</b> |      | 3    |
| <b>CO4</b> |      | 3    |
| <b>CO5</b> |      | 3    |

### UNIT-I:

#### Digital Systems and Binary Numbers

Digital Systems, Binary Numbers, Number based Conversions, Octal & Hexadecimal Numbers, Complements – r's complement, (r-1)'s complement, Signed binary Numbers, Arithmetic addition and subtraction, Binary Codes: BCD, 2421, 8421, Excess-3, Gray codes.

### UNIT-II:

#### Concept of Boolean algebra and Gate Level Minimization

Basic Definitions, Axioms and laws, Basic Theorems & Properties of Boolean algebra, Boolean Functions, Canonical and Standard Forms, Digital logic gates, The Map Method –

Two-Variable, Three-Variable, Four-Variable K-Maps. Product of Sums Simplification, Sum of Products Simplification, Don't Care Conditions.

### **UNIT–III:**

#### **Combinational Logic**

Review of adders, half subtractor, full subtractor, ripple carry adder, 4-bit binary adder/subtractor circuit, BCD adder, Decoders, encoders, priority encoder, multiplexers, demultiplexers, one bit comparator, realization of Boolean functions using decoders & multiplexers.

### **UNIT–IV:**

#### **Sequential Circuits**

Introduction to Sequential Circuits, Latches, RS- Latch Using NAND and NOR Gates, Flipflops, Truth Tables. RS, JK, D and T Flip Flops, Truth and Excitation Table.

#### **Registers and Counters**

Registers, Shift Registers, Universal Shift register, Ripple Counters – Binary Ripple counter, BCD ripple counter, Synchronous Counters – Binary counter, Up-down Counter, BCD counter, Ring Counter, Johnson Counter

### **Unit-V:**

**Programmable Logic Devices:** Introduction to PLDs: PROM, PAL, PLA-Basics structures, realization of Boolean function with PLDs, comparison, merits & demerits of PROM, PAL, PLA.

#### **Text Books:**

1. Switching and Finite Automata Theory, ZviKohavi& Niraj K.Jha, 3rdEdition, ISBN: 978-0521857482.
2. Digital Design, Morris Mano, Pearson, 3rd Edition, ISBN: 978-8178085555.

#### **Reference Books:**

1. Modern Digital Electronics, RP Jain, Tata Mc Graw Hill, 5thEdition, 2022, ISBN: 978-9355321770.
2. Fundamentals of Logic Design, Charles H. Roth Jr., Jaico Publishers, ISBN: 978-0534378042.

#### **Web Links:**

1. <http://nptel.ac.in/courses/117/106/117106086/> (By Prof. Goutam Saha, Electronics & Electrical Communication Engineering Dept, IIT Kharagpur)
2. [www.nptelvideos.in/2012/12/digital-circuits-and-systems.html](http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html)(By Prof. Santanu Chattopadhyay, Electronics & Electrical Communication Engineering Dept, IIT Kharagpur).
3. <https://www.smartzworld.com/notes/switching-theory-and-logic-design-stld/>.

**Basics of Electrical & Electronics Engineering**  
(Common to CE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E)

**Course Code: 2501EE01**

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

**Course Outcomes:**

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

- CO 1:** Analyze the concepts associated to AC and DC circuits.
- CO 2:** Explain the operating principles of motors, generators and measuring instruments.
- CO 3:** Analyze the Different Energy Resources and Equipment Safety Measures.
- CO 4:** Explain the concept and the applications of semiconductor Diodes.
- CO 5:** Analyze the Basic Electronic Circuits and interpret numeric information in different code formats.

**Mapping of course outcomes with program outcomes:**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1   | 2   | 3   | 1   |     | 1   |     |     |     | 2   | 2    |      |
| CO2   | 2   | 3   | 1   |     |     |     |     |     | 2   | 2    |      |
| CO3   | 3   | 2   | 1   |     |     |     |     |     | 2   | 2    |      |
| CO4   | 3   | 2   | 1   |     |     |     |     |     | 2   | 2    |      |
| CO5   | 3   | 2   | 1   |     |     |     |     |     | 2   | 2    |      |

**UNIT-I:**

**DC & AC Circuits:**

**DC circuits:** Ohm's and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits excited by independent voltage sources for R, L, C parameters, current division, voltage division

**AC circuits:** Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form, and peak factors. Real power, reactive power, apparent power, and Power factor.

**Practice:**

1. Verification of Ohm's Law.
2. Verification of KCL and KVL.
3. Verification of KCL, KVL and ohm's law using simulation.

**UNIT-II:**

**Machines and Measuring Instruments:**

Principles and operation of DC machines, Transformers – Synchronous Machines - three Phase and single phase induction motors - Moving coil and moving iron instruments, Wheatstone bridge and Megger.

**Practice:**

1. To study Magnetisation Characteristics of DC shunt generator
2. Measurement of Power and Power factor using Single-phase wattmeter

3. Measurement of Resistance using Wheat stone bridge
4. Measurement of Earth Resistance using Megger.

### **UNIT-III:**

#### **Energy Resources, Electricity Bill & Safety Measures**

Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Thermal, Solar & Wind power generation. Calculation of electricity bill for domestic appliances. Working principle of Fuse and Miniature circuit breaker (MCB). Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

#### **Practice:**

1. Calculation of Electrical Energy for Domestic Premises

### **UNIT-IV:**

#### **Semiconductor Devices**

Intrinsic semiconductors – Extrinsic semiconductors - P type and N type - P-N junction characteristics of P N Junction Diode — Zener Effect — Zener Diode and its Characteristics. working of simple zener voltage regulator and amplifier- Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics.

#### **Practice:**

1. Sketch the V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Sketch the V-I characteristics of Zener Diode and its application as voltage Regulator
3. Plot Input & Output characteristics of BJT in CE and CB configurations.
4. Obtain Frequency response of CE amplifier.

### **UNIT-V:**

#### **Basic Electronic Circuits**

Block diagram description of a dc power supply, working of a half and full wave, bridge rectifier, filters.

#### **Digital Electronics**

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders

#### **Practice:**

1. Implementation of half wave and full wave rectifiers.
2. Design Half Adder and Full Adder circuits.
3. Verification of truth table for Logic gates using ICs.

#### **Text Books:**

1. Basic Electrical and Electronics Engineering, Salivahanan S, Tata McGraw Hill Education (India) Private Limited, New Delhi, ISBN: 9789389691801.
2. Principles of Electrical Engineering, V. K. Mehta, R. Mehta, S. Chand & Company Ltd., New Delhi, ISBN-13: 9788121930888
3. Digital Fundamentals, Thomas Floyd, Prentice Hall, 10th Edition, ISBN: 9780132737968).

**Reference Books:**

1. Electronic Devices & Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson, 11/e, ISBN: 9780135026496.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co., ISBN: 9788177000207.

**Web Links:**

1. <https://nptel.ac.in/courses/108/101/108101091/> (NPTEL Video by Dr.Mahesh B. Patil from IIT Bombay)
2. <https://nptel.ac.in/courses/117/106/117106108/> ( NPTEL Video by Prof. Krishnapura from IIT Madras)

**Engineering Economics & Management**  
(Common to CE, EEE, ME, CSE, IT, AIML & CSE (DS))

**Course Code: 2501MB01**

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

**Course Outcomes:**

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

- CO1:** Explain the Business Economic concepts, law of demand and forecasting methods.
- CO2:** Identify the production, cost behavior for managerial decision making with Break-Even Point (BEP).
- CO3:** Make use of financial accounting and capital budgeting techniques for decision making.
- CO4:** Summarize management and motivational theories to renovate the practice of Management.
- CO5:** Illustrate the functional management and project management using PERT and CPM.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   |      |      |      |      |      |      |      |      | 2    | 2     |       |
| CO2   | 1    |      |      |      |      |      |      |      |      |       | 2     |
| CO3   |      |      |      |      |      |      |      |      |      |       | 3     |
| CO4   | 1    |      |      |      |      |      |      |      | 1    | 1     | 2     |
| CO5   |      |      |      |      |      |      |      |      |      |       | 3     |

**UNIT – I**

**Introduction to Managerial Economics and demand Analysis:**

Definition of Managerial Economics –Scope of Managerial Economics- Concept of Demand, Types of Demand, Determinants of Demand- Law of Demand and its limitations- Elasticity of Demand, Types- Demand forecasting and its Methods.

**UNIT – II**

**Production and Cost Analyses:**

Concept of Production function Law of Variable Proportions-Isoquants and Isocosts - Producer Equilibrium-, cost concepts: opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs – Cost –Volume-Profit Analysis-Determination of Breakeven point (simple problems).

**UNIT – III**

Introduction to Markets and Financial Accounting: Market Structures-Classification of markets, Introduction to Financial Accounting , Concepts and conventions, Accounting

cycle, Journal entries and Ledger (Simple Problems), Methods of capital budgeting (Simple Problems).

#### **UNIT – IV**

##### **Operations Management :**

Concept nature and importance of Management, Generic Functions of Management, Theories of Motivation, Plant location and layout, Principles of organization, SWOT analysis.

Material Management: Need for Inventory control, EOQ, ABC analysis

#### **UNIT – V**

##### **Functional Management And Project Management**

Concept of HRM , HRD and PMIR, Functions of HR Manager , Job Evaluation and Merit Rating , Marketing Management, Functions of Marketing , Channels of distributions - Development of Network , Difference between PERT and CPM, Finding Critical Path (Simple Problems)

##### **Text Books:**

- 1 Managerial Economics and Financial Analysis, A. R. Aryasri , McGraw Hill Education, ISBN: 978-0070078031
- 2 Managerial Economics and Financial Analysis', N. Appa Rao, P. Vijay Kumar, Cengage Publications, New Delhi, ISBN: 978-8131515952
- 3 Management Science by Aryasri; Publisher: Tata McGraw Hill, 2009, ISBN: 978-0070090279
- 4 Management by James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R. Gilbert 6th Ed; Publisher: Pearson Education/Prentice Hall, ISBN: 978-0131087477

##### **Reference Books:**

- 1 Principles of Marketing: A South Asian Perspective by Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshanul Haque, 13th Edition, Publisher: Pearson Education/ Prentice Hall of India, ISBN: 9788131731017
- 2 A Handbook of Human Resource Management Practice by Michael Armstrong, 2010; Publisher: Kogan Page Publishers, ISBN: 978-1789661033

##### **Web Links:**

- 1 [www.managementstudyguide.com](http://www.managementstudyguide.com)
- 2 [www.citehr.com](http://www.citehr.com)
- 3 [www.nptel.ac.in/courses/122106032](http://www.nptel.ac.in/courses/122106032)
- 4 [www.btechguru.com/courses--nptel--basic-course](http://www.btechguru.com/courses--nptel--basic-course)

### Ability Enhancement Courses (AEC)

| Course Code  | Course Name                                                                                                     | Level | L        | T | P        | C        | CIE | SEE | Total | Pre-requisite |
|--------------|-----------------------------------------------------------------------------------------------------------------|-------|----------|---|----------|----------|-----|-----|-------|---------------|
| 2501EN01     | Essential Cognitive Skills for Engineers                                                                        | FC    |          |   | 1        | 1        | 100 | -   | 100   | -             |
| 2501UC07     | Design Thinking using AI                                                                                        | FC    |          |   | 1        | 1        | 100 | -   | 100   | -             |
| 2501EN02     | Advanced Cognitive Skills for Engineers (or) Proficiency in Foreign Language (Japanese/German/ Spanish/ French) | FC    |          |   | 1        | 1        | 100 | -   | 100   | ECSE-I        |
| 2501UC05     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC04     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC03     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC06     |                                                                                                                 |       |          |   |          |          |     |     |       |               |
| 2501UC08     | Universal Human Values                                                                                          | FC    | 2        |   |          | 2        | 100 | -   | 100   | -             |
| 2501UC09     | Technical Paper Publication                                                                                     | AC    |          |   | 2        | 2        | 100 | -   | 100   | -             |
| 2501CS72     | Student Activity Based Learning                                                                                 | AC    |          |   |          | 2        | 100 | -   | 100   | -             |
| <b>Total</b> |                                                                                                                 |       | <b>2</b> |   | <b>7</b> | <b>9</b> |     |     |       |               |

## Essential Cognitive Skills for Engineers

(Common to all branches)

**Course Code: 2501EN01**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>0</b> | <b>0</b> | <b>1</b> | <b>1</b> |

### Course Outcomes:

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

- CO1:** Recognize the different aspects of the English language proficiency with emphasis on LSRW skills.
- CO2:** Apply communication skills through various language learning activities.
- CO3:** Analyze the English speech sounds, stress, intonation and syllable division for better listening and speaking comprehension.
- CO4:** Enable them to learn and apply fundamentals of English grammar concepts for improved language
- CO5:** Make use of various types of vocabulary in different academic and professional careers

### Mapping of Course Outcomes with Program Outcomes:

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

Practice:

### Unit – 1 Outstanding people A/B/C/D

|               |                                                                                                                                                            |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Listening     | Conversation about Jocelyn Bell- Burnell, Podcast: The 30-day challenge, Starting a new job, Conversation about technology                                 |
| Speaking      | Discussing inspiring people, Asking and answering questions about challenges, Explaining a process; Checking understanding, Discussing technology.         |
| Reading       | Articles: <i>Protector of the sea</i> and <i>The woman who reinvented children's TV</i> , Interviews: <i>30-day challenge</i> , Article: <i>Tech free!</i> |
| Writing       | Article Organizing an article                                                                                                                              |
| Grammar       | Review of Tenses, Questions                                                                                                                                |
| Vocabulary    | Character adjectives, trying and succeeding                                                                                                                |
| Pronunciation | The letter e; Word stress, Rapid speech                                                                                                                    |

### Unit – 2 Survival A/B/C/D

|           |                                                                                                                                  |
|-----------|----------------------------------------------------------------------------------------------------------------------------------|
| Listening | Conversation about a survival situation, Interview: The Tiger, Cooking for a friend, Talking about getting lost                  |
| Speaking  | Telling a survival story, Giving advice; Asking questions, Giving compliments and responding, Discussing the natural environment |

|               |                                                                                                                  |
|---------------|------------------------------------------------------------------------------------------------------------------|
| Reading       | Article: Lost at sea, Leaflet: <i>How to survive...an animal attack</i> ,<br>Leaflet: <i>Be wise and survive</i> |
| Writing       | Guidelines, organizing guidelines in a leaflet                                                                   |
| Grammar       | Narrative tenses, Future time clauses and conditionals                                                           |
| Vocabulary    | Expressions with <i>get</i> , Animals and the environment                                                        |
| Pronunciation | Sound and Spelling: g, Intonation in question tags                                                               |

### **Unit – 3 Talent A/B/C/D**

|               |                                                                                                                                                                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Listening     | Conversation: learning experiences, Radio Programme: The sports<br>gene, Making wedding plans, Interviews about sport                                             |
| Speaking      | Talking about something you have put a lot of effort into,<br>Discussing sport and ways to improve performance, planning a<br>party, Talking about popular sports |
| Reading       | Text about learning; <i>Learning to learn</i> , Article: <i>Born to be the best</i> ;<br>Three articles about athletes, Article: <i>Fitness: Seattle snapshot</i> |
| Writing       | Article describing data                                                                                                                                           |
| Grammar       | Multi-word verbs, Present perfect and present perfect continuous                                                                                                  |
| Vocabulary    | Ability and achievement, word connected with sport                                                                                                                |
| Pronunciation | Word stress, sound and spelling consonant sounds                                                                                                                  |

### **Unit – 4 Life Lessons A/B/C/D**

|               |                                                                                                                                                                                        |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Listening     | Interview: Psychology of money; Two monologues: Life-changing<br>events, Two monologues; training for a job, Presenting photos,<br>Three monologues; living in different places        |
| Speaking      | Talking about how your life has changes, Discuss experiences of<br>training and rules, Describing photos: Expressing careful<br>disagreement, Discussing living in a different country |
| Reading       | Two texts about life-changing events that helped people become<br>rich, Article: <i>Training for the emergency frontline</i> , Advert for<br>being an international student ‘buddy’    |
| Writing       | Job application, Giving a positive impression                                                                                                                                          |
| Grammar       | <i>Used to</i> and <i>would</i>                                                                                                                                                        |
| Vocabulary    | Cause and result, Talking about difficulty                                                                                                                                             |
| Pronunciation | Sound and spelling: u                                                                                                                                                                  |

### **Unit – 5 Chance A/B/C/D**

|           |                                                                                                                                                                                                                                                            |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Listening | Monologue: What are your chances?, Conversation: Talking about<br>work, Money problems, News reports: environmental problems                                                                                                                               |
| Speaking  | Discussing possible future events, Role Play: job interview,<br>Explaining and responding to an idea for a café, Giving opinions<br>on environmental problems                                                                                              |
| Reading   | Quiz: <i>Are you an optimist or a pessimist?</i> ; Article: <i>Why we think<br/>we’re going to have a long and happy life</i> , Quiz: <i>The unknown<br/>continent</i> ; Article: <i>Cooking in Antarctica</i> , Essay about protecting<br>the environment |
| Writing   | For and against essay, Arguing for and against an idea                                                                                                                                                                                                     |
| Grammar   | Future probability, Future perfect and future continuous                                                                                                                                                                                                   |

Vocabulary                      Adjectives describing attitude, The natural world  
Pronunciation                Sound and spelling : *th*, Intonation groups

**Text Book:**

- 1      Cambridge Empower – Second Edition B2 Level - Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis – Jones, ISBN: 978-1107468726

**Suggested Software:**

- 1      Cambridge Empower
- 2      Soft X (K-Van Solutions)

**Reference Books:**

- 1      M Ashraf Rizvi: Effective Technical Communication, ISBN: 9352605780
- 2      Raymond Murphy: English Grammar in Use, Cambridge University Press. Fifth Edition, ISBN: 978-3125354241
- 3      J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, ISBN: 9788120314955

**Web Links:**

- 1      [www.cambridgeone.org](http://www.cambridgeone.org)
- 2      <https://www.britishcouncil.in/english/online>
- 3      [www.englishmedialab.com](http://www.englishmedialab.com)

**Design Thinking using AI**  
(Common to CE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E)

**Course Code: 2501UC07**

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

**Course Outcomes:**

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

- CO1:** Appreciate various design process procedure
- CO2:** Generate and develop design ideas through different technique
- CO3:** Identify the significance of reverse Engineering to Understand products
- CO4:** Draw technical drawing for design ideas
- CO5:** Illustrate design teams to create feasible and user-focused solutions to complex problems in design.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   |      |      |      |      |      |      |      | 2    | 2    |       |       |
| CO2   |      |      |      |      |      |      |      |      |      | 2     |       |
| CO3   |      |      |      |      |      |      |      |      |      | 3     |       |
| CO4   |      |      |      |      |      |      |      | 1    | 1    | 2     |       |
| CO5   |      |      |      |      |      |      |      |      |      | 3     |       |

**UNIT – I**

**Process of Design Understanding Design thinking:** Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping.

**UNIT – II**

**Tools for Design Thinking:** Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

**Practice using any AI tool:**

Students are advised to use any AI tool like Otter AI etc for Transcribe interviews automatically and summarize user insights.

**UNIT – III**

**Design Thinking in IT:** Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping

**Practice using any AI tool:**

Students are advised to use any AI tool like ChatGPT, Claude, Perplexity etc to define, synthesize, ideate and prototype.

## **UNIT – IV**

**DT For strategic innovations:** Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design.

**Practice using any AI tool:**

Students are advised to use any AI tool like looka, logomkr, canva and figma etc for logo, prototyping and sketching.

## **UNIT – V**

**Design thinking workshop:** Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test.

### **Text Books:**

- 1        Engineering Design by John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, Cengage learning (International edition) Second Edition. ISBN: 9781133708766
- 2        The Design of Business: Why Design Thinking is the Next Competitive Advantage Roger Martin by Harvard Business Press. ISBN: 9781422177808

### **Reference Books:**

- 1        Engineering Design Process by Yousef Haik and Tamer M. Shahin, Cengage Learning, Second Edition. ISBN: 978-8131529041
- 2        Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author). ISBN: 978-0231163569

### **Web Links:**

- 1        [www.tutor2u.net/business/presentations/. /Product lifecycle/default.html](http://www.tutor2u.net/business/presentations/. /Product lifecycle/default.html)
- 2        [https://docs.oracle.com/cd/E11108\\_02/otn/pdf/. /E11087\\_01.pdf](https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf)

## Universal Human Values

(Common to CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT & Min.E)

|                              | L        | T        | P        | C        |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501UC08</b> | <b>1</b> | <b>1</b> | <b>0</b> | <b>2</b> |

**Pre Requisites:** Universal Human Values (UHV-I) (desirable).

### Course Objectives:

This course input is intended

1. To help the students appreciate the complementarity between 'VALUES' and 'SKILLS' and understand how ethical foundations enhance technical competence to achieve sustainable happiness, prosperity, and responsible professional growth.
2. To develop a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a right understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values (UHV) and movement towards value-based living in a natural way.
3. To highlight real-world implications of Holistic understanding of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. To encourage the students to realise their full potential and act accordingly.
5. To assist the students to live with a feeling of relationship, harmony and co-existence.

Thus, this course is intended to provide a much-needed input in value education to the young enquiring minds.

## UNIT I INTRODUCTION TO VALUE EDUCATION

Lecture 1: Holistic Development and the Role of Education (Right Understanding, Relationship and Physical Facility)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 - Sharing about Oneself

Lecture 3: Self-Exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 - Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 - Exploring Natural Acceptance.

## UNIT II HARMONY IN THE HUMAN BEING

Lecture 7: Understanding Human being as the Co-existence of the self and the body

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 - Exploring the difference of Needs of self and body

Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 - Exploring Sources of Imagination in the self

Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 - Exploring Harmony of self with the body.

### **UNIT III HARMONY IN THE FAMILY AND SOCIETY**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction  
Lecture 14: 'Trust' – the Foundational Value in Relationship  
Tutorial 7: Practice Session PS7 - Exploring the Feeling of Trust  
Lecture 15: 'Respect' – as the Right Evaluation  
Tutorial 8: Practice Session PS8 - Exploring the Feeling of Respect  
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship  
Lecture 17: Understanding Harmony in the Society  
Lecture 18: Vision for the Universal Human Order  
Tutorial 9: Practice Session PS9 - Exploring Systems to fulfil Human Goal

### **UNIT IV HARMONY IN THE NATURE/EXISTENCE**

Lecture 19: Understanding Harmony in Nature  
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature  
Tutorial 10: Practice Session PS10 - Exploring the Four Orders of Nature  
Lecture 21: Realizing Existence as Co-existence at All Levels  
Lecture 22: The Holistic Perception of Harmony in Existence  
Tutorial 11: Practice Session PS11 - Exploring Co-existence in Existence.

### **UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING A LOOK AT PROFESSIONAL ETHICS**

Lecture 23: Natural Acceptance of Human Values  
Lecture 24: Definitiveness of (Ethical) Human Conduct  
Tutorial 12: Practice Session PS12 - Exploring Ethical Human Conduct  
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order  
Lecture 26: Competence in Professional Ethics  
Tutorial 13: Practice Session PS13 - Exploring Humanistic Models in Education  
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies  
Lecture 28: Strategies for Transition towards Value-based Life and Profession  
Tutorial 14: Practice Session PS14 - Exploring Steps of Transition towards Universal Human Order

#### **Course Outcomes:**

Upon successful completion of the course, students will be able to

- CO1:** Demonstrate an understanding of basic human aspiration and the concept of Natural Acceptance and apply them in personal and professional decision-making.
- CO2:** Develop self-awareness and practice self-regulation.
- CO3:** Recognize human-human relationship (Justice) and identify human goals in society.
- CO4:** Appreciate the harmony in nature and existence.
- CO5:** Develop as socially and ecologically responsible engineers in handling problems with sustainable solutions (user-friendly and eco-friendly).

#### **Text Books:**

1. R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 3<sup>rd</sup> Revised Edition, UHV Publications, Sarva Shubha Nyas, Kanpur, 2023. ISBN: 978- 81-957703-7-3 (Printed Copy) ISBN: 978-81-957703-6-6 (e-book)
2. R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for a Foundation Course in Human Values and Professional Ethics*, 3<sup>rd</sup> Revised Edition, UHV Publications, Sarva Shubha Nyas, Kanpur, 2023.

**Reference Books:**

1. *Jeevan Vidya: Ek Parichaya*, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book), Annie Leonard, Free Press, 2010.
4. *The Story of My Experiments with Truth*, Mohandas Karamchand Gandhi, Fingerprint! Publishing
5. *Small is Beautiful* - E. F Schumacher, Random House, 2011.
6. *Slow is Beautiful* - Cecile Andrews, New Society Publishers, 2006
7. *Economy of Permanence* - J C Kumarappa
8. *Vivekananda* - Romain Rolland

**Online Resources**

1. <https://fdp-si.aicte-india.org/index.php>
2. [https://onlinecourses.swayam2.ac.in/aic22\\_ge23/preview](https://onlinecourses.swayam2.ac.in/aic22_ge23/preview)
3. <https://uhv.org.in/>
4. <https://www.youtube.com/@UniversalHumanValues/playlists>

## Advanced Cognitive Skills for Engineers (Common to all branches)

**Course Code: 2501EN02**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

### Course Outcomes:

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

- CO1:** Recognize the basics of communication and summarize formal and informal language expressions in all aspects.
- CO2:** Establish and maintain interpersonal relationships and transmit the message through different language activities.
- CO3:** Use language effectively to prepare and demonstrate proficiency in facing various types of interviews.
- CO4:** Demonstrate and exhibit professionalism in participating in various public speaking activities like debates, group discussions and presentation skills.
- CO5:** Identify the basic elements of writing and apply the fundamentals to compose e-mails catering to different professional needs.

### Mapping of Course Outcomes with Program Outcomes:

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

### List of the Topics

#### Unit – 1                      Around the globe A/B/C/D

|               |                                                                                                                                          |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Listening     | Two monologues about sightseeing tours, Interview: disappearing languages, Asking for a favour, conversation: a trip to the Grand Canyon |
| Speaking      | Comparing different tourist destinations, Agreeing and disagreeing, Asking for a favour, Discussing local tourist destinations.          |
| Reading       | Website about four tourist destinations; Website: <i>Where to go?</i>                                                                    |
| Writing       | Travel blog, Using descriptive language                                                                                                  |
| Grammar       | Infinitives and <i>-ing</i> forms                                                                                                        |
| Vocabulary    | Travel and tourism, Describing changes                                                                                                   |
| Pronunciation | Consonant clusters, Consonant sounds                                                                                                     |

#### Unit – 2                      City living A/B/C/D

|           |                                                                                                                 |
|-----------|-----------------------------------------------------------------------------------------------------------------|
| Listening | Interview: 'Smart' cities: Two monologues talking about 'smart' cities, Two monologues: house renovations, Flat |
|-----------|-----------------------------------------------------------------------------------------------------------------|

|                 |                                                                                                                                                                                   |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Speaking        | hunting, Interviews about a new shopping centre                                                                                                                                   |
| Reading         | Discussing good and bad points about a city<br>Article: <i>Quick-slow down!</i> , Article: <i>Who puts the 'real' in reality TV?</i> Email: Complaining about an important issue. |
| Writing         | Email of complaint, Using formal language                                                                                                                                         |
| Grammar         | <i>Too/enough; so/such</i> , Causative <i>have/get</i>                                                                                                                            |
| Vocabulary      | Describing life in cities, Film and TV; Houses                                                                                                                                    |
| Pronunciation   | Sound and spelling: o, Stress in compound nouns                                                                                                                                   |
| <b>Unit – 3</b> | <b>Dilemmas A/B/C/D</b>                                                                                                                                                           |
| Listening       | Radio programme: person finance, Three monologues about honesty, Going to the bank, Conversation about a TV programme                                                             |
| Speaking        | Giving opinions on financial matters, Discussing moral dilemmas, Talking about hopes and worries Discussing programmes about crime                                                |
| Reading         | Article: <i>Is it time to give up on cash?</i> , Newspaper article: <i>The honesty experiment</i> , Review: <i>Crime with a smile</i>                                             |
| Writing         | Review, Organising a review                                                                                                                                                       |
| Grammar         | First and second conditionals, Third conditional; <i>should have+past participle</i>                                                                                              |
| Vocabulary      | Money and finance, Crime                                                                                                                                                          |
| Pronunciation   | Stressed and unstressed words; Sound and spelling: l, Word groups                                                                                                                 |
| <b>Unit – 4</b> | <b>Discoveries A/B/C/D</b>                                                                                                                                                        |
| Listening       | Conversation about inventions, Conversation about an email hoax, Finding the perfect flat, Four monologues about alternative medicine                                             |
| Speaking        | Talking about inventions, Describing a hoax or a scam or a case of fraud, Giving and receiving surprises                                                                          |
| Reading         | Article: <i>Too good to be true?</i> , Article: <i>The rise and fall of Barry Minkow</i> , Essay: <i>The Value of alternative medicine</i>                                        |
| Writing         | Opinion essay, Presenting a series of arguments                                                                                                                                   |
| Grammar         | Relative clauses, Reported speech; Reporting verbs                                                                                                                                |
| Vocabulary      | Health, Verbs describing thought and knowledge                                                                                                                                    |
| Pronunciation   | Sound and spelling : ui, Linking and intrusion                                                                                                                                    |
| <b>Unit – 5</b> | <b>Possibilities A/B/C/D</b>                                                                                                                                                      |
| Listening       | Interview about Dan Cooper, Two monologues: pursuing a dream, Celebrating good news, conversation about goals                                                                     |
| Speaking        | Telling stories about coincidences, Describing and comparing brave or amazing people, Telling an important piece of news,                                                         |

|               |                                                                                                                                                        |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | Talking about performing                                                                                                                               |
| Reading       | Story: The man who disappeared; Blog: <i>The Wreck of the Titan</i> ,<br>Article: <i>Dream to help</i> , Story: Rosa's diary: <i>The ultimate goal</i> |
| Writing       | Story, Making a story interesting                                                                                                                      |
| Grammar       | Past modals of deduction, Wishes and regrets                                                                                                           |
| Vocabulary    | Adjectives with prefixes, Verbs of effort                                                                                                              |
| Pronunciation | Word stress, Linking, Consonant clusters                                                                                                               |

**Text Book:**

1. Cambridge Empower – Second Edition B2 Level - Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis – Jones. ISBN: 978-1107468726

**Suggested Software:**

- Cambridge Empower
- Soft X (K-Van Solutions)

**Reference Books:**

- 1 Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford University Press.2018. ISBN: 9789354972256
- 2 Michael Swan- Practical English Usage ISBN: 9780194202466
- 3 Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India,2016 ISBN: 978-0070996038

**Web Links:**

- 1 <https://www.cambridgeone.org/login>
- 2 <https://www.coursera.org/>
- 3 <https://www.skillshare.com/>
- 4 <https://www.mindtools.com/cawh8bu/communication-tools>

### Skill Enhancement Courses (SEC)

| Course Code  | Course Name                                  | Level | L | T | P        | C        | CIE | SEE | Total | Pre-requisite |
|--------------|----------------------------------------------|-------|---|---|----------|----------|-----|-----|-------|---------------|
| 2501AI34     | Web Application Development using MERN Stack | AC    |   |   | 2        | 2        | 50  | 50  | 100   | -             |
| 2501CS17     | Object Oriented Analysis & Design using UML  | IC    |   |   | 2        | 2        | 50  | 50  | 100   | ASE           |
| 2501IT08     | Bigdata Spark                                | AC    |   |   | 2        | 2        | 50  | 50  | 100   | -             |
| <b>Total</b> |                                              |       |   |   | <b>6</b> | <b>6</b> |     |     |       |               |

## WEB Application Development using MERN Stack (Common to CSE, IT AIML & CSE (DS))

**Course Code: 2501AI34**

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

### Course Outcomes:

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

- CO1:** Make use of HTML elements, CSS styles and their attributes for designing static web pages.
- CO2:** Apply JavaScript to develop dynamic web pages and validate forms.
- CO3:** Build a basic web server using Node.js and also working with Node Package Manager (NPM) & Make use of Typescript to optimize JavaScript code using strict type checking
- CO4:** Make use of router, template engine and authentication using sessions to develop application in ExpressJS & components, props, stats and render data in ReactJS
- CO5:** Build a single page application using RESTful APIs in ExpressJS. & Make use of MongoDB queries

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 2    | 2    | 3    |      | 2    |      |      | 1    | 2    |       | 2     |
| CO2   | 2    | 3    | 2    |      | 2    |      |      | 1    | 2    |       | 2     |
| CO3   | 2    | 2    | 3    | 1    | 2    |      |      | 1    | 2    |       | 2     |
| CO4   | 2    | 3    | 2    | 2    | 2    |      |      | 1    | 2    |       | 2     |
| CO5   | 2    | 2    | 3    | 1    | 2    |      |      | 1    | 2    |       | 2     |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    | 2    |      |
| CO2    | 2    |      |
| CO3    | 2    |      |
| CO4    | 2    |      |
| CO5    | 2    |      |

### Practice:

1. Lists, Links, Images, Tables, Forms.
  - a. Write a HTML program, to explain the working of lists.  
Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
  - b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.  
Note: Use text to link ☐ <https://www.aec.edu.in/>  
Use image to link ☐ <https://www.aec.edu.in/?p=Gallery>

- c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
  - d. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
  - e. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field.
2. HTML 5 and Cascading Style Sheets, Types of CSS & CSS Box Model
  - a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.
  - b. Write a HTML program, to embed audio and video into HTML web page.
  - c. Write a program to demonstrate the various ways you can reference a color in CSS.
  - d. Write a program, to explain the importance of CSS Box model using
    - i. Content
    - ii. Border
    - iii. Margin
    - iv. padding
3. Selector forms & JavaScript-internal and & I/o
  - a. Write a program to apply different types of selector forms
    - i. Simple selector (element, id, class, group, universal)
    - ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
    - iii. Write a program to embed internal and external JavaScript in a web page.
    - iv. Write a program to explain the different ways for displaying output.
4. Javascript Pre-defined and User-defined Objects, Conditional & Loop Statements
  - a. Write a program using document, window, math & string object properties and methods.
  - b. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
  - c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
5. Javascript Functions and Events & Node.js
  - a. Design a appropriate function should be called to display
    - i. Factorial of that number
    - ii. Fibonacci series up to that number
    - iii. Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
    - iv. Write a program to transfer data over http protocol using http module.
    - v. Create a text file src.txt and add the following content to it. (HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js)
6. Typescript
  - a. Write a program to understand simple and special types.
  - b. Write a program to understand function parameter and return types.

7. ExpressJS – Routing, HTTP Methods, Templating
  - a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
  - b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
  - c. Write a program using templating engine.
8. ExpressJS – Cookies, Sessions, Authentication, Database.
  - a. Write a program for session management using cookies and sessions.
  - b. Write a program for user authentication.
  - c. Write a program to connect MongoDB database using Mongoose and perform CRUD operations
9. ExpressJS – Templating, Form Data, Cookies, Sessions
  - a. Write a program using templating engine.
  - b. Write a program to work with form data.
  - c. Write a program for session management using cookies and sessions.
10. ReactJS – Render HTML, JSX, Props and States
  - a. Write a program to render HTML to a web page.
  - b. Write a program for writing markup with JSX.
  - c. Write a program to work with props and states.
11. ReactJS – Conditional Rendering, Rendering Lists, React Router
  - a. Write a program for conditional rendering.
  - b. Write a program for rendering lists.
  - c. Write a program for routing to different pages using react router.
12. ReactJS – Hooks, Sharing data between Components, To-do list and Quiz & MongoDB – Installation, Configuration
  - a. Write a program to understand the importance of using hooks.
  - b. Write a program for sharing data between components.
  - c. Design to-do list application.
  - d. Install MongoDB and configure ATLAS

**Additional Practice:**

1. Design a to-do list application using Javascript
2. Design a to-do list application using NodeJS and ExpressJS.

**Note:** The student must Complete & Submit a HTML5, JavaScript, TypeScript ,NodeJs & MongoDB Certificate Courses offered by Infosys Spring board at the end of the Practice Session.

**Reference Books:**

- 1 Programming the World Wide Web, Robert W Sebesta, Pearson, 7th Edition. ISBN 139789332518827
- 2 Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, APress, O'Reilly, 2nd edition. ISBN 9781484226520

**Web Links:**

- 1 [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_17739732834840810000\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview) (HTML5)
- 2 [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_18109698366332810000\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview) (Javascript)
- 3 [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01384329019595161635073\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384329019595161635073_shared/overview) (Express Js)
- 4 [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_auth\\_013177169294712832113\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/overview) (MongoDB)

## Object Oriented Analysis & Design using UML

(Common to CSE, IT AIML & CSE (DS))

**Course Code: 2501CS17**

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

### Course Outcomes:

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

- CO1:** Explain the importance of system analysis and design in solving complex problems.
- CO2:** Compare object-oriented approach with traditional approach in system analysis and design.
- CO3:** Analyze the importance of modeling and design of various applications.
- CO4:** Compare various object relationships.
- CO5:** Show the role and function of each UML model in developing object- oriented software.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 2    | 2    | 3    | 1    |      |      |      |      |      |       |       |
| CO2   | 2    | 3    | 2    |      |      |      |      |      |      |       |       |
| CO3   | 3    | 2    | 2    | 1    | 3    |      |      |      |      |       |       |
| CO4   | 1    | 2    |      |      |      |      |      |      |      |       |       |
| CO5   | 2    | 1    | 1    | 3    | 1    |      |      |      |      |       |       |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    | 2    |      |
| CO2    | 2    |      |
| CO3    | 3    |      |
| CO4    | 3    |      |
| CO5    | 3    |      |

### Practice:

#### List of Case Studies:

- ATMApplication.
- Library ManagementSystem.
- Online Book Shop.
- Customer SupportSystem.
- Point ofSale.
- Familiarization with RationalRose

1. For each case study:
  - 1.1) Identify and analyze events

- 1.2) Identify Usecases
2. For each case study:
  - 2.1) Develop event table
  - 2.2) Identify & analyze domain classes
3. For each case study:
  - 3.1) Represent use cases and a domain class diagram using Rational Rose
  - 3.2) Develop CRUD matrix to represent relationships between use cases and problem domain classes
4. For each case study:
  - 4.1) Develop Use case diagrams
  - 4.2) Develop elaborate Use case descriptions & scenarios
5. For each case study
  - 5.1) develop system sequence diagrams
6. For each case study:
  - 6.1) Develop highlevel sequence diagrams for each usecase
  - 6.2) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three layer objects
7. For each case study:
  - 7.1) Develop highlevel sequence diagrams for each usecase 1
  - 7.2) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three layer objects
8. For each case study:
  - 8.1) Develop highlevel sequence diagrams for each usecase
  - 8.2) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three layer objects
9. For each case study:
  - 9.1) Develop highlevel Collaboration diagrams for each usecase
  - 9.2) Develop detailed collaboration diagrams for each use case showing interactions among all the three layer objects
10. For each case study:
  - 10.1) Develop Use case Packages.
  - 10.2) Develop component diagrams.
  - 10.3) Develop sample diagrams for other UML diagrams state chart diagrams, activity diagrams and deployment diagrams.
11. Design UML models for the following application. Restaurant System.

**Additional practice:**

Design UML models for the following Case studies.

1. Banking Application System.
2. Railway Reservation System
3. Online Movie Ticket Booking System.

**Text Books:**

- 1 Object-oriented analysis and design using UML, Mahesh P. Matha, PHI. ISBN: 9788120333222
- 2 Head first object-oriented analysis and design, Brett D. McLaughlin, Gary Pollice, Dave West, O'Reilly. ISBN: 9780596008673

**Reference Books:**

- 1 Object-oriented analysis and design with the Unified process, John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning. ISBN: 978-0619216436
- 2 The Unified modeling language Reference manual, James Rumbaugh, Ivar Jacobson, Grady Booch, Addison Wesley. ISBN: 9780321245625
- 3 Object Oriented Analysis & Design, Atul Kahate, The McGraw-Hills Companies. ISBN: 9780070583764

**Web Links:**

- 1 [https://onlinecourses.nptel.ac.in/noc24\\_cs40/preview](https://onlinecourses.nptel.ac.in/noc24_cs40/preview)
- 2 <https://www.quora.com/in/What-are-the-best-website-to-study-UML-for-beginners>
- 3 <https://creatly.com/lp/uml-diagram-tool/>

**Bigdata Spark**  
(Common to CSE, IT, AIML & CSE (DS))

|                              | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501IT08</b> | <b>0</b> | <b>0</b> | <b>2</b> | <b>2</b> |

**Course Outcomes:**

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

- CO1:** Demonstrate Hadoop Installation process.
- CO2:** Illustrate Hadoop architecture
- CO3:** Compare Bigdata models
- CO4:** Implement various Scalable Algorithms
- CO5:** Illustrate Applications of Bigdata

**Mapping of Course Outcomes with Program Outcomes:**

| <b>CO/PO</b> | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|
| <b>CO1</b>   | 3           | 2           | 2           | 1           | 2           | 1           |             |             |             |              |              |
| <b>CO2</b>   | 2           | 2           | 2           | 1           | 2           |             |             |             |             |              |              |
| <b>CO3</b>   | 2           | 2           | 3           | 1           | 2           | 1           |             |             |             |              |              |
| <b>CO4</b>   | 2           |             | 2           | 1           | 3           |             |             |             |             |              |              |
| <b>CO5</b>   | 2           |             | 2           | 1           | 3           | 1           |             |             |             |              |              |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| <b>CO/PSO</b> | <b>PSO1</b> | <b>PSO2</b> |
|---------------|-------------|-------------|
| <b>CO1</b>    | 2           |             |
| <b>CO2</b>    | 2           |             |
| <b>CO3</b>    | 2           |             |
| <b>CO4</b>    | 2           |             |
| <b>CO5</b>    | 2           |             |

**Practice:**

1. Set up and Configuration Hadoop Using Cloudera Creating a HDFS System with minimum 1 Name Node and 1 Data Nodes HDFS Commands Self-Learning Topics: Set up Hadoop in Linux Environment.
2. Map Reduce Programming Examples Word Count. Union, Intersection and Difference. Matrix Multiplication. Self-Learning Topics: Natural Join Programming Example.
3. Implement an iterative PageRank graph algorithm in MapReduce.
4. Perform an efficient semi-join in MapReduce. Hint: Perform a semi-join by having the mappers load a Bloom filter from the Distributed Cache, and then filter results from the actual MapReduce data source by performing membership queries against the Bloom filter to determine which data source records should be emitted to the reducers.

5. Hive: Introduction Creation of Database and Table, Hive Partition, Hive Built in Function and Operators, Hive View and Index. Self-Learning Topics: Configure Hive Metastore to MySQL
6. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes
7. Pig: Pig Latin Basic Pig Shell, Pig Data Types, Creating a Pig Data Model, Reading and Storing Data, Pig Operations Self-Learning Topics:
8. Analytics at Large Scale: Libraries of algorithms include SparkMLlib, H2O; integrations with TensorFlow and PyTorch;
9. Visualization: Connect to data, Build Charts and Analyze Data, Create Dashboard, Create Stories using Tableau Self-Learning Topics: Tableau using web.
10. Mongo DB: Installation and Creation of database and Collection CRUD Document: Insert, Query, Update and Delete Document. Self-Learning Topics: HBASE Commands

### **Additional Practice:**

1. Spark: RDD, Actions and Transformation on RDD , Ways to Create -file, data in memory, other RDD. Lazy Execution, Persist RDD Self-Learning Topics: Machine Learning Algorithms like K-Means using Spark
2. Spark joins: Consider a scenario where 2 datasets of a leading retail client to be joined with one another using Spark joins. Customer dataset: Sales dataset: Schema Details: 101 ravi 1 102 keerth 2 101 Syam 1 101 Geetha 1 103 Dawn 3 101 ravi 1 102 keerth 2 101 Syam 1 101 Geetha 1 103 Dawn 3 ) 66 Customer schema (customer id,customer name,product id) Sales Schema (product id,product name and price) Join both datasets with common key Product id and print customer id, customer name, product name and price.
3. Matrix-Vector Multiplication by Map Reduce
4. Implement an iterative PageRank graph algorithm in MapReduce

**Note:** The student must Complete & Submit a Big Data 101 & Big Data - 201

Certificate Courses offered by Infosys Spring board at the end of the Practice Session.

### **Text Books:**

- 1 Understanding Big data, Chris Eaton, Dirk Deroos et al., McGraw Hill, ISBN : 9789339221270.
- 2 Professional Hadoop Solutions, Boris Lublin sky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071.

### **Reference Books:**

- 1 Spark in Action, Marko Bonaci and Petar Zecevic,Manning, ISBN: 978-1617292606
- 2 PySpark SQL Recipes: With HiveQL, Dataframe and Graphframes, Raju Kumar Mishra and Sundar Rajan Raman, Apress Media, ISBN: 978-1484243343

### **Web Links:**

- 1 [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_auth\\_01256841991858585686\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01256841991858585686_shared/overview)
- 2 [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_auth\\_01258388119638835242\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01258388119638835242_shared/overview)
- 3 [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_auth\\_0126052684230082561692\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0126052684230082561692_shared/overview)

### Value Added Courses (VAC)

| Course Code  | Course Name              | Level | L | T | P         | C        | CIE | SEE | Total | Pre-requisite |
|--------------|--------------------------|-------|---|---|-----------|----------|-----|-----|-------|---------------|
| 2501UC11     | Employability Skills-I   | FC    |   |   | 3         | 0        | 100 | -   | 100   | -             |
| 2501UC13     | Employability Skills-II  | FC    |   |   | 3         | 0        | 100 |     | 100   | ES-I          |
| 2501AI06     | Data Analysis Essentials | IC    |   |   | 2         | 2        | 50  | 50  | 100   | PP            |
| 2501UC14     | Employability Skills-III | IC    |   |   | 3         | 0        | 100 |     | 100   | ES-II         |
| 2501UC15     | Employability Skills-IV  | IC    |   |   | 3         | 0        | 100 |     | 100   | ES-III        |
| 2501CS04     | Internet of Things       | FC    |   |   | 1         | 1        | 100 | -   | 100   | -             |
| 2501UC16     | Employability Skills-V   | AC    |   |   | 3         | 1        | 100 |     | 100   | ES-IV         |
| <b>Total</b> |                          |       |   |   | <b>18</b> | <b>4</b> |     |     |       |               |

### Employability Skills- I

(Common to CE,EEE,ME,ECE,CSE,IT,AI ML,CSE(DS),PT&Min.E,Agri.E)

**Course Code:** 2501UC11

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

#### Course Outcomes:

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

- CO1** Apply fundamental arithmetic concepts such as number systems, LCM & HCF, ratio & proportion, and averages to solve quantitative problems efficiently.
- CO2** Analyze number and letter series to identify logical patterns and predict subsequent elements.
- CO3** Select the option by evaluating relationships in analogy-based problems and detecting inconsistencies in logical sequences
- CO4** Demonstrate effective verbal communication skills by using appropriate parts of speech and tone in various interpersonal and professional contexts.

#### Mapping with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 2   | 3   |     |     | 1   |     |     |     |     |      |      |
| <b>CO2</b> | 1   | 3   |     | 2   | 2   |     |     |     |     |      |      |
| <b>CO3</b> |     | 3   |     | 2   | 1   |     |     |     |     |      |      |
| <b>CO4</b> |     |     |     |     |     |     |     | 2   | 3   |      | 1    |

#### Aptitude:

Number System, LCM & HCF, Ratio and Proportion, Averages

#### Reasoning:

Number Series, Letter Series, Number Analogy, Letter Analogy, Odd Man Out, Logical Sequence of Words.

#### Verbal:

Introduction to soft skills, how to improve communication? Parts of Speech, Mind your language towards better English, Vocabulary Expansion

#### Text Books

- 1 Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, ISBN: 9789355012326.
- 2 A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, ISBN-13. 978-9352832163.

- 3 Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, , ISBN-13. 978-8121922111.

**Reference Books:**

- 1 Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, ISBN-13 9789389957426.
- 2 How To Crack Test of Reasoning Verbal, Non-Verbal & Analytical – Jaikishan and Premkishan, Arihant Publications, New Edition 2024, ASIN : B0CRQ9BVBC.
- 3 A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: 978-8186651032

**Web Links:**

- 1 [www.indiabix.com](http://www.indiabix.com)
- 2 [www.bankersadda.com](http://www.bankersadda.com)

## Employability Skills- II

(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E,Agri.E)

**Course Code: 2501UC13**

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

### Course Outcomes:

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

- CO1** Apply percentage, profit & loss, and partnership concepts to solve real-world quantitative problems.
- CO2** Analyze age-related problems to develop logical problem-solving strategies.
- CO3** Evaluate logical reasoning questions including ranking, directions, and alphabet tests for accurate decision-making.
- CO4** Solve pattern-based problems in coding and decoding to enhance analytical skills.
- CO5** Demonstrate effective written communication using correct grammar and structured presentation techniques

### Mapping with Program Outcomes:

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

### Aptitude:

Problems on Ages, Partnership, Percentages, Profit and Loss

### Reasoning:

Coding and Decoding, Ranking Test, Alphabet Test, Direction Test

### Verbal:

Written communication skill practice, Grammatical use, Concept of 4 step method for presentation, Present Tense

### Text Books

- 1 Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, ISBN: 9789355012326.
- 2 A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, ISBN-13. 978-9352832163.

- 3 Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, , ISBN-13. 978-8121922111.

**Reference Books:**

- 1 Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, ISBN-13 9789389957426.
- 2 How To Crack Test of Reasoning Verbal, Non-Verbal & Analytical – Jaikishan and Premkishan, Arihant Publications, New Edition 2024, ASIN : B0CRQ9BVBC.
- 3 A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: 978-8186651032

**Web Links:**

- 1 [www.indiabix.com](http://www.indiabix.com)
- 2 [www.bankersadda.com](http://www.bankersadda.com)

**Data Analysis Essentials**  
(Common to CSE,IT,AI ML,CSE(DS))

**Course Code: 2501AI06**

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

**Course Outcomes:**

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

- CO1:** Perform various operations on NumPy arrays.
- CO2:** Importing data from different file formats using pandas
- CO3:** Draw different types of charts using matplotlib.
- CO4:** Demonstrate web scraping using python.
- CO5:** Design preprocessing techniques on loan prediction dataset.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 2    | 2    | -    | -    | 2    | -    | -    | 1    | 2    | -     | -     |
| CO2   | 3    | 2    | -    | -    | 3    | -    | -    | 1    | 2    | -     | -     |
| CO3   | 2    | 2    | -    | -    | 3    | -    | -    | 2    | 1    | -     | -     |
| CO4   | 2    | 2    | -    | -    | 1    | -    | -    | 1    | 1    | -     | -     |
| CO5   | 2    | 2    | -    | -    | 2    | -    | -    | 1    | 1    | -     | -     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    | 1    | 2    |
| CO2    | 2    | -    |
| CO3    | 2    | -    |
| CO4    | 1    | 2    |
| CO5    | 2    | -    |

**Practice:**

**Week 1: Creating a NumPy Array**

- a. Basic ndarray
- b. Array of zeros
- c. Array of ones
- d. Random numbers in ndarray
- e. An array of your choice
- f. Imatrix in NumPy
- g. Evenly spaced ndarray

**Week 2: The Shape and Reshaping of NumPy Array**

- a. Dimensions of NumPy array
- b. Shape of NumPy array
- c. Size of NumPy array
- d. Reshaping a NumPy array
- e. Flattening a NumPy array
- f. Transpose of a NumPy array

**Week 3: Expanding and Squeezing a NumPy Array**

- a. Expanding a NumPy array
- b. Squeezing a NumPy array
- c. Sorting in NumPy Arrays

**Week 4: Indexing and Slicing of NumPy Array**

- a. Slicing 1-D NumPy arrays
- b. Slicing 2-D NumPy arrays
- c. Slicing 3-D NumPy arrays
- d. Negative slicing of NumPy arrays

**Week 5: Stacking and Concatenating Numpy Arrays**

- a. Stacking ndarrays
- b. Concatenating ndarrays
- c. Broadcasting in Numpy Arrays

**Week 6: Perform following operations using pandas**

- a. Creating dataframe
- b. concat()
- c. Setting conditions
- d. Adding a new column

**Week 7: Perform following operations using pandas**

- a. Filling NaN with string
- b. Sorting based on column values
- c. groupby()

**Week 8: Read the following file formats using pandas**

- a. Text files
- b. CSV files
- c. Excel files
- d. JSON files

**Week 9: Read the following file formats**

- a. Pickle files
- b. Image files using PIL
- c. Multiple files using Glob
- d. Importing data from database

**Week 10: Demonstrate web scraping using python****Week 11: Perform following preprocessing techniques on loan prediction dataset**

- a. Feature Scaling
- b. Feature Standardization
- c. Label Encoding
- d. One Hot Encoding

**Week 12: Perform following visualizations using matplotlib**

- a. Bar Graph
- b. Pie Chart
- c. Box Plot
- d. Histogram
- e. Line Chart and Subplots
- f. Scatter Plot.

**Additional Practice:**

1. Write a program that reads a list of temperatures from a file called temps.txt, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt
2. Write a program to find the greatest number that can be formed by using given set of numbers.
3. Write a program to find sum of digits of a number till you get single digit sum.

Example:

Input: 142 (Hint:  $1+4+2=7$ )

Output: 7

Input: 4683 (Hint:  $4+6+8+3=21 \Rightarrow 2+1=3$ )

Output: 3

4. Write a program to count how many times each word present in a file.

**Text Books:**

1. Python Data Science Handbook, Jake VanderPlas, 2nd Edition, 2022, ISBN: 978-1098121228
2. Data Analysis from Scratch with Python: Step By Step Guide, Peters Morgan, 2018, ISBN: 978-1725678095

**Reference Books:**

1. Python for Data Analysis, Wes McKinney, 3rd Edition 2022, ISBN: 978-1098104030
2. An Introduction to Statistical Learning: With Applications in Python, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Jonathan Taylor, 1st Edition, 2023, ISBN: 978-3031387463

**Web Links:**

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

### Employability Skills- III

(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E,Agri.E)

**Course Code: 2501UC14**

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

#### Course Outcomes:

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

- CO1** Solve financial and quantitative aptitude problems using concepts of simple and compound interest.
- CO2** Apply logical time-work frameworks to solve real-time problems related to work efficiency and pipe systems.
- CO3** Analyze and interpret problems related to blood relations, clocks, calendars, and coded inequalities.
- CO4** Evaluate spatial and logical reasoning through cubes, dice, and symbolic interpretation problems.
- CO5** Demonstrate effective communication using correct grammar, and participate actively in discussions and comprehension activities.

#### Mapping with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 2    | 3    |      |      | 1    |      |      |      |      |       |       |
| <b>CO2</b> | 3    | 3    |      |      | 1    |      |      |      |      |       |       |
| <b>CO3</b> |      | 3    |      | 2    | 1    |      |      |      |      |       |       |
| <b>CO4</b> |      | 3    |      | 2    | 2    |      |      |      |      |       |       |
| <b>CO5</b> |      |      |      |      |      |      |      | 2    | 3    |       | 2     |

#### Aptitude:

Simple Interest, Compound Interest, Time and Work, Pipes and Cisterns

#### Reasoning:

Blood Relations, Calendar, Clocks, Cubes and Dice, Coded Inequalities

#### Verbal:

Grammar in use, Group discussion, Reading Comprehension, Past Tense, Future Tense

#### Text Books

- 1 Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, ISBN: 9789355012326.
- 2 A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, ISBN-13. 978-9352832163.
- 3 Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, , ISBN-13. 978-8121922111.

**Reference Books:**

- 1 Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, ISBN-13 9789389957426.
- 2 How To Crack Test of Reasoning Verbal, Non-Verbal & Analytical – Jaikishan and Premkishan, Arihant Publications, New Edition 2024, ASIN : B0CRQ9BVBC.
- 3 A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: 978-8186651032

**Web Links:**

- 1 [www.indiabix.com](http://www.indiabix.com)
- 2 [www.bankersadda.com](http://www.bankersadda.com)

### Employability Skills- IV

(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT&Min.E,Agri.E)

**Course Code: 2501UC15**

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

#### Course Outcomes:

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

- CO1** Apply concepts of time, speed, distance, trains, boats and streams to solve motion-related aptitude problems.
- CO2** Solve mensuration problems involving surface area and volume in real-world contexts.
- CO3** Analyze logical reasoning questions involving Venn diagrams and syllogisms to make valid conclusions.
- CO4** Interpret seating arrangements and solve non-verbal reasoning questions involving patterns and spatial reasoning.
- CO5** Demonstrate effective communication through structured self-introduction, emails, letters, reports, and grammar usage.

#### Mapping with Program Outcomes:

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 3    | 3    |      |      | 2    |      |      |      |      |       |       |
| <b>CO2</b> | 3    | 3    |      |      | 2    |      |      |      |      |       |       |
| <b>CO3</b> |      | 3    |      | 2    | 2    |      |      |      |      |       |       |
| <b>CO4</b> |      | 3    |      | 2    | 2    |      |      |      |      |       |       |
| <b>CO5</b> |      |      |      |      |      |      |      | 2    | 2    |       | 2     |

#### Aptitude:

Time, Speed and Distance, Problems on Trains, Boats and Streams, Mensuration - I, Mensuration – II

#### Reasoning:

Venn Diagrams, Syllogisms, Non - Verbal Reasoning, Seating Arrangement

#### Verbal:

Grammatical use, Self-introduction, Letters, E-Mail & Report writing, Error correction, Effective Communication

**Text Books**

- 1 Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, ISBN: 9789355012326.
- 2 A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, ISBN-13. 978-9352832163.
- 3 Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, , ISBN-13. 978-8121922111.

**Reference Books:**

- 1 Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, ISBN-13 9789389957426.
- 2 How To Crack Test of Reasoning Verbal, Non-Verbal & Analytical – Jaikishan and Premkishan, Arihant Publications, New Edition 2024, ASIN : B0CRQ9BVBC.
- 3 A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: 978-8186651032

**Web Links:**

- 1 [www.indiabix.com](http://www.indiabix.com)
- 2 [www.bankersadda.com](http://www.bankersadda.com)

**Internet of Things**  
(Common to EEE,ME,ECE,CSE,IT,AI ML,CSE(DS),PT&Min.E)

**Course Code: 2501CS04**

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

**Course Outcomes:**

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

- CO1:** Identify and select appropriate sensors, actuators, and boards (Arduino/Pi) for specific tasks.
- CO2:** Execute digital and analog interfacing of peripherals with embedded platforms.
- CO3:** Develop control algorithms and decision-making logic for real-time automation.
- CO4:** Configure cloud platforms and APIs for data transmission and visualization.
- CO5:** Design and build functional end-to-end IoT prototypes for real-world applications.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 2    | 1    |      |      | 1    |      |      |      |      |       |       |
| CO2   | 2    | 2    | 1    |      | 2    |      |      |      |      |       |       |
| CO3   | 1    | 2    | 2    | 1    |      |      |      |      |      |       |       |
| CO4   | 1    | 1    |      | 1    | 2    |      |      |      |      |       | 1     |
| CO5   | 1    | 2    | 2    | 2    | 2    | 1    | 1    | 1    | 2    | 2     | 2     |

**Mapping of Course Outcomes with Program Specific Outcomes:**

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    |      |      |
| CO2    |      |      |
| CO3    |      |      |
| CO4    |      |      |
| CO5    |      |      |

**Practice:**

- Study of Arduino UNO and Raspberry Pi boards including architecture, pin configuration, power supply, communication interfaces and development environments.
- Study of commonly used sensors and actuators such as temperature sensor, moisture sensor, LDR, ultrasonic sensor, IR sensor, PIR sensor, LED and motor. Identify their working principles and applications.
- Design and implement basic digital input–output operations using Arduino by controlling LED/buzzer.
- Interface an analog sensor (LDR) with Arduino and display sensor values on Serial Monitor.

5. Interface a digital sensor (Ultrasonic sensor) with Arduino and display measured values on Serial Monitor.
6. Develop conditional logic using Arduino to control LED or buzzer based on sensor threshold values.
7. Interface a servo motor with Arduino and control its angular position based on sensor input to demonstrate automatic gate or smart irrigation model.
8. Design and implement a multi-sensor monitoring system using Arduino to read analog and digital sensors simultaneously and display results on Serial Monitor.
9. Create a cloud platform account, explore available IoT services and register a device (Thing) on the platform.
10. Demonstration of IoT based system to upload sensor data to cloud platform and visualize the received data in graphical form.

#### **Additional Practice (Any 2 from the following)**

1. **Smart Lighting System:** Design a lighting system that automatically turns ON/OFF or dims lights based on human movement or surrounding light conditions to demonstrate energy saving.
2. **Intelligent Traffic Control System:** Develop an automated traffic signal system for busy roads with priority control for emergency vehicles (such as ambulances).
3. **Smart Parking System:** Create a sensor-based parking system to detect available slots and provide parking guidance or remote monitoring.
4. **Air Pollution Monitoring System:** Build an IoT-based setup using gas or environmental sensors to measure air quality and indicate whether pollution levels are safe or dangerous.
5. **Bluetooth-Based Actuator Control:** Control motors or other actuators connected to a development board using Bluetooth communication.

#### **Reference Books:**

- 1 An Introduction to Internet of Things, Connecting devices, Edge Gateway and Cloud with Applications, Rahul Dubey, Cengage, 2019. ISBN: 9789353501020
- 2 Adrian McEwen, Designing the Internet of Things, Wiley Publishers. ISBN:978-1118430620
- 3 IoT Fundamentals, Networking Technologies, Protocols and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetette, rob Barton, Jerome Henry, CISCO, Pearson, 2018. ISBN:9789386873743
- 4 Internet of Things, by Vengalapudi Appala Konda and Prof. Sangareddy B. Krutakoti, Scientific International Publishing House, First Edition, 2024. ISBN: 978-93-6132-958-6.

#### **Web Links:**

- 1 <https://iotvirtuallab.github.io/vlab/Experiments/index.html>
- 2 [https://onlinecourses.nptel.ac.in/noc21\\_cs17/preview](https://onlinecourses.nptel.ac.in/noc21_cs17/preview)
- 3 <https://www.electronicsforu.com/electronics-projects/internet-of-things-iot>
- 4 <https://www.coursera.org/specializations/iot>
- 5 <https://projecthub.arduino.cc/>
- 6 <https://www.edureka.co/iot-certification-training>

**Employability Skills- V**  
(Common to CE,EEE,ME,ECE,CSE,IT,AI ML,CSE(DS),PT&Min.E)

**Course Code: 2501UC16**

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

**Course Outcomes:**

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

- CO1** Apply principles of permutations, combinations, probability, and logarithms to solve quantitative aptitude problems.
- CO2** Interpret and analyze data from charts, graphs, and statistical tables for decision-making and accuracy.
- CO3** Evaluate logical reasoning statements involving arguments, assumptions, conclusions, and data sufficiency.
- CO4** Solve puzzle and eligibility test problems using analytical and critical thinking skills.
- CO5** Demonstrate effective interpersonal, communication, and time management skills for successful personal and professional interactions.

**Mapping with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | 3    | 3    |      |      | 2    |      |      |      |      |       |       |
| CO2   | 3    | 3    |      |      | 2    |      |      |      |      |       |       |
| CO3   |      | 3    |      | 2    | 2    |      |      |      |      |       |       |
| CO4   |      | 3    |      | 2    | 2    |      |      |      |      |       |       |
| CO5   |      |      |      |      |      |      |      | 2    | 3    |       | 2     |

**Aptitude:**

Permutations and Combinations, Probability, Data Interpretation, Logarithms, Statistics

**Reasoning:**

Puzzle Tests, Eligibility Test, Data Sufficiency, Statements – Arguments, Statements – Assumptions, Statements - Course of Action, Statements – Conclusions

**Verbal:**

Interview skills, Grammar in use, Interpersonal Skills, Negotiation Skills, Social Skills, Problem-Solving Skills, Time Management Skills

**Text Books**

- 1 Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, ISBN: 9789355012326.
- 2 A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, ISBN-13. 978-9352832163.

- 3 Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, , ISBN-13. 978-8121922111.

**Reference Books:**

- 1 Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, ISBN-13 9789389957426.
- 2 How To Crack Test of Reasoning Verbal, Non-Verbal & Analytical – Jaikishan and Premkishan, Arihant Publications, New Edition 2024, ASIN : B0CRQ9BVBC.
- 3 A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: 978-8186651032

**Web Links:**

- 1 [www.indiabix.com](http://www.indiabix.com)
- 2 [www.bankersadda.com](http://www.bankersadda.com)

### Mandatory Courses (MC)

| Course Code  | Course Name                            | Level | L         | T | P | C        | CIE | SEE | Total | Pre-requisite |
|--------------|----------------------------------------|-------|-----------|---|---|----------|-----|-----|-------|---------------|
| 2501AC01     | Environmental Science                  | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC02     | Constitution of India                  | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC03     | Research Methodology                   | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC04     | Intellectual Property Rights & Patents | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| 2501AC05     | Indian Knowledge Systems (IKS)         | FC    | 2         |   |   | 0        | 100 | -   | 100   | -             |
| <b>Total</b> |                                        |       | <b>10</b> |   |   | <b>0</b> |     |     |       |               |

**Environmental Science**  
(Common to CE,EEE,ME,ECE,CSE,IT,AIIML,CSE(DS),PT,Min.E)

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501AC01</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                              | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b> |

**Course Outcomes:**

**At the end of the Course, Student will be able to:**

- CO1:** Outline the natural resources and their importance for the sustenance of the life  
**CO2:** Explain about the biodiversity of India, threats and its conservation methods  
**CO3:** Illustrate various attributes of the pollution, impacts and measures to control the pollution along with waste management practices  
**CO4:** Describe social issues of both rural and urban environment to combat the challenges and the legislations of India in environmental protection  
**CO5:** Explain the population growth and its implications

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 1    | -    | -    | -    | 1    | -    | 2    | -    | -    | -     | -     |
| <b>CO2</b> | 1    | -    | -    | -    | -    | -    | 3    | -    | -    | -     | -     |
| <b>CO3</b> | -    | -    | -    | -    | 2    | -    | 3    | -    | -    | -     | 1     |
| <b>CO4</b> | -    | -    | -    | -    | 1    | -    | 3    | 1    | -    | -     | 1     |
| <b>CO5</b> | -    | -    | -    | -    | -    | -    | 3    | -    | -    | -     | -     |

**UNIT – I**

**Multidisciplinary Nature of Environmental Studies:**

Definition, Scope and Importance, Need for Public Awareness.

**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems.

**UNIT – II**

**Ecosystem, Biodiversity and Its Conservation:**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers,

consumers, and decomposers. Food chains, food webs and ecological pyramids.

Biodiversity And Its Conservation: Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Values of biodiversity. Hot-spots of biodiversity – Threats to biodiversity. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT – III**

**Environmental Pollution and Solid Waste Management:**

Environmental Pollution: Definition, Cause, effects, and control measures of:

- Air Pollution.
- Water Pollution

c. Soil Pollution

d. Marine Pollution

e. Noise Pollution

Solid Waste Management:

Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution

## **UNIT – IV**

### **Social Issues and The Environment:**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to Energy & Water. Resettlement and rehabilitation of people, Environmental ethics, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, and holocaust. Environment Protection Act – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act-Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

## **UNIT – V**

### **Human Population and The Environment:**

Population growth, variation among nations.

Environment and human health, Human Rights, Value Education. Role of Information Technology in Environment and human health.

### **Text Books:**

1. Textbook of Environmental Studies for Undergraduate Courses, Erach Bharucha for University Grants Commission, Universities Press. ISBN: 9788173718625.
2. Environmental Studies, Palaniswamy – Pearson education. ISBN: 978-9332528277.

### **Reference Books:**

1. Textbook of Environmental Science, Deeksha Dave and E.Sai Baba Reddy, Cengage Publications. ISBN: 978-8131517604.
2. Textbook of Environmental Sciences and Technology by M.Anji Reddy, B.S Publication. ISBN: 9385433385.
3. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications. ISBN: 978-8170087380.

### **Web Links:**

1. <https://archive.nptel.ac.in/courses/127/105/127105018/>
2. [https://onlinecourses.swayam2.ac.in/cec24\\_ge05/preview](https://onlinecourses.swayam2.ac.in/cec24_ge05/preview)

**Constitution of India**  
(Common to CE,EEE,ME,ECE,CSE,IT,AI ML,CSE(DS),PT,Min.E)

**Course Code: 2501AC02**

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

**Course Outcomes:**

**At the end of the Course, Student will be able to:**

- CO1:** Explain historical background of the constitution making and its importance for building a democratic India
- CO2:** Compare the functioning of three wings of the government i.e., executive, legislative and judiciary
- CO3:** Interpret the value of the fundamental rights and duties for becoming good citizen of India
- CO4:** Compare the decentralization of power between central, state and local self-government
- CO5:** Extend the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | -    | -    | -    | -    | 3    | -    | -    | 1    | 2    | -     | -     |
| CO2   | -    | -    | -    | -    | 2    | -    | -    | 1    | 3    | -     | -     |
| CO3   | -    | -    | -    | -    | 3    | -    | -    | 2    | 3    | -     | -     |
| CO4   | -    | -    | -    | -    | 3    | -    | -    | 2    | 1    | -     | -     |
| CO5   | -    | -    | -    | -    | 2    | -    | -    | 1    | 3    | -     | -     |

**UNIT – I**

**Introduction to Indian Constitution:**

Constitution’ meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

**UNIT – II**

**Union Government and its Administration Structure of the Indian Union:**

Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions.

**UNIT – III**

**State Government and its Administration Governor:**

Role and Position - CM and Council of ministers, State Secretariat: Organization, Structure and Functions

## **UNIT – IV**

### **Local Administration:**

District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PanchayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

## **UNIT – V**

### **Election Commission:**

Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women.

### **Text Books:**

1. Introduction to the Constitution of India, Durga Das Basu, Prentice – Hall of India Pvt. Ltd. New Delhi. ISBN: 978-9388548861.
2. Indian Constitution, Subash Kashyap, National Book Trust. ISBN: 9788123707341.

### **Reference Books:**

1. Dynamics of Indian Government & Politics, J.A. Siwach. ISBN: 9788120709768.
2. Indian Government and Politics, D.C. Gupta. ISBN: 9780706987782.
3. Constitutional Law of India , H.M.Sreevai, 4<sup>th</sup> edition in 3 volumes (Universal Law Publication). ISBN: 9788194776529.

### **Web Links:**

1. [nptel.ac.in/courses/109104045/](https://nptel.ac.in/courses/109104045/)
2. [nptel.ac.in/courses/101104065/](https://nptel.ac.in/courses/101104065/)

**Research Methodology**  
(Common to CE,EEE,ME,ECE,CSE,IT,AI ML,CSE(DS),PT,Min.E)

|                              |          |          |          |          |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501AC03</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                              | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b> |

**Course Outcomes:**

**At the end of the Course, Student will be able to:**

- CO1:** Explain the characteristics and process of research.
- CO2:** Select the research problem by applying problem identification techniques.
- CO3:** Formulate and execute research design process.
- CO4:** Report the results of research process adhering to professional ethics.
- CO5:** Analyze the results of research using statistical measures of central tendency

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 1    | -    | -    | 2    | -    | -    | -    | -    | -    | 2     | 1     |
| <b>CO2</b> | 1    | -    | -    | 2    | -    | -    | -    | -    | -    | 2     | 1     |
| <b>CO3</b> | 1    | -    | -    | 2    | -    | -    | -    | -    | -    | 2     | 1     |
| <b>CO4</b> | 1    | -    | -    | 2    | -    | -    | -    | 3    | -    | 2     | 1     |
| <b>CO5</b> | 1    | -    | -    | 2    | 2    | -    | -    | -    | -    | 2     | 1     |

**UNIT – I**

**Meaning of Research:**

Function of Research - Characteristics of Research – Steps involved in Research – Research in Pure and Applied Sciences - Inter Disciplinary Research. Factors which hinder Research – Significance of Research - Research and scientific methods – Research Process– Criteria of good Research – Problems encountered by Researchers – Literature review.

**UNIT – II**

**Identification of Research Problem :**

Selecting the Research problem – Necessity of defining the problem – Goals and Criteria for identifying problems for research. Perception of Research problem – Techniques involved in defining the problem.

**UNIT – III**

**Research Design :**

Formulation of Research design – Need for Research design – Features of a good design – Important concepts related to Research design.

**UNIT – IV**

**Interpretation and Report Writing:**

Meaning and Technique of interpretation – Precautions in interpretation – Significance of report writing – Different steps in writing a report – Layout of a Research report.

## **UNIT – V**

### **Statistical Techniques and Tools :**

Introduction of statistics – Functions – Limitations – Measures of central tendency - Arithmetic mean – Median – Mode – Standard deviation – Co-efficient of variation (Discrete series and continuous series) – Correlation – Regression.

### **Text Books:**

1. Research Methodology Methods & Techniques, C.R. Kothari – New Age international Publishers, Reprint. ISBN: 9788122415223.
2. A Hand Book of Methodology of Research, Rajammall, P. Devadoss and K. Kulandaivel, RMM Vidyalaya press. ISBN: 9780367135720.

### **Reference Books:**

1. Thesis and Assignment Writing, J. Anderson, Wiley Eastern Ltd. ISBN: 978-8126530755.
2. Research Methodology, Mukul Gupta, Deepa Gupta – PHI Learning Private Ltd., New Delhi. ISBN: 9788120349469.
3. Fundamentals of Mathematical statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons, New Delhi. ISBN: 978-8180545283.

### **Web Links:**

1. <https://nptel.ac.in/courses/127106227>
2. <https://archive.nptel.ac.in/courses/121/106/121106007/>

**Intellectual Property Rights & Patents**  
(Common to CE,EEE,ME,ECE,CSE,IT,AI ML,CSE(DS),PT,Min.E)

|                              | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501AC04</b> | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b> |

**Course Outcomes:**

**At the end of the Course, Student will be able to:**

- CO1:** Compare various types of Intellectual Property rights.
- CO2:** Discuss Intellectual Property and infer rights on such Intellectual Property owners
- CO3:** Explain the process of patenting
- CO4:** Apply for Trade marks and Copyrights.
- CO5:** Explain the methods to protect Trade secrets

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1</b> | 1    | -    | -    | -    | 1    | -    | -    | 3    | -    | -     | 2     |
| <b>CO2</b> | 1    | -    | -    | -    | 1    | -    | -    | 3    | -    | -     | 2     |
| <b>CO3</b> | 1    | -    | -    | -    | 1    | -    | -    | 3    | -    | -     | 2     |
| <b>CO4</b> | 1    | -    | -    | -    | 1    | -    | -    | 3    | -    | -     | 2     |
| <b>CO5</b> | 1    | -    | -    | -    | 1    | -    | -    | 3    | -    | -     | 2     |

**UNIT – I**

Introduction to Intellectual Property Rights (IPR): Concept of Property - Introduction to IPR – International Instruments and IPR - WIPO - TRIPS – WTO –Laws Relating to IPR - IPR Tool Kit - Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents - Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR – Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

**UNIT – II**

Copyrights and Neighboring Rights: Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law - Semiconductor Chip Protection Act.

**UNIT – III**

Patents: Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Patent Registration and Granting of Patent - Exclusive Rights – Limitations - Ownership and Transfer – Revocation of Patent – Patent Appellate Board - Infringement of Patent – Double Patenting – Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations.

## **UNIT – IV**

Trademarks and Trade secrets: Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Deceptive Similarities - Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies – Passing off Action - Introduction to Trade Secrets – General Principles - Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreements.

## **UNIT – V**

Cyber Law and Cyber Crime : Introduction to Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions - E-commerce - Data Security – Authentication and Confidentiality - Privacy - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention and Punishment – Liability of Network Providers. Relevant Cases Shall be dealt where ever necessary.

### **Text Books:**

1. Fundamentals of IPR for Engineers- Kompal Bansal & Parishit Bansal, B. S. Publications (Press). ISBN: 9788178002774.
2. Intellectual Property -Deborah E.Bouchoux, Third Edition, Cengage Learning, New Delhi. ISBN: 0 340 67786 4.

### **Reference Books:**

1. Intellectual property rights- Prabuddha Ganuli, Tata Mcgraw hill. ISBN: 978-0070077171.
2. Intellectual property rights M.Ashok kumar and Mohd.Iqbal Ali:, Serials Publications. ISBN: 9788183871648.
3. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi. ISBN: 979-8886848229.
4. Intellectual Property- Richard Stim, Cengage Learning, New Delhi. ISBN: 978-0766826656.

### **Web Links:**

1. <http://www.wipo.int/portal/en/index.html>
2. <https://indiankanoon.org/>
3. <http://www.ipindia.nic.in/patents.htm>
4. <http://www.ipindia.nic.in/trade-marks.htm>
5. <http://copyright.gov.in>

**Indian Knowledge Systems (IKS)**  
(CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT, Min. E)

**Course Code: 2501AC05**

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

**Course Outcomes:**

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

- CO1:** Describe the foundations and scope of Indian Knowledge Systems.
- CO2:** Recognize major Indian contributions to knowledge, science, and culture.
- CO3:** Appreciate ethical values and sustainability rooted in Indian traditions.
- CO4:** Relate traditional knowledge to contemporary societal and technological needs.

**Mapping of Course Outcomes with Program Outcomes:**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|-------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1   | -    | -    | -    | -    | -    | 3    | 1    | 1    | -    | -     | -     |
| CO2   | -    | -    | -    | -    | -    | 3    | 1    | 1    | -    | -     | -     |
| CO3   | -    | -    | -    | -    | -    | 3    | 1    | 1    | -    | -     | -     |
| CO4   | -    | -    | -    | -    | -    | 3    | 1    | 1    | -    | -     | -     |
| CO5   | -    | -    | -    | -    | -    | 3    | 1    | 1    | -    | -     | -     |

**UNIT – I**

**Foundations of Indian Knowledge Systems**

Meaning, scope, and importance of IKS. Sources of IKS: Vedas, Upanishads, Itihasas, Puranas, Shastras. Traditional Knowledge, Indigenous Knowledge, and Western Knowledge – comparison. Gurukula system and knowledge transmission traditions

**UNIT – II**

**Indian Civilization and Philosophical Traditions**

Overview of ancient Indian civilization (Indus Valley, Maurya, Gupta). Indian philosophical schools and ethical values. Epics: Ramayana and Mahabharata – cultural and moral significance. Religious traditions: Hinduism, Buddhism, Jainism, Sikhism

**UNIT – III**

**Arts, Architecture and Cultural Expressions**

Temple architecture: Nagara, Dravidian, Vesara. Mughal architecture and monuments. Indian classical dance forms and music traditions. Handicrafts, sculpture, painting, and iconography

**UNIT – IV**

**Traditional Knowledge in Health, Environment and Sustainability**

Ayurveda and Yoga – holistic health systems. Traditional agriculture and food practices. Water conservation methods and environmental ethics. Biodiversity conservation and sustainable living

## **UNIT – V**

### **Traditional Knowledge and Contemporary Relevance**

Protection of Traditional Knowledge.Traditional Knowledge (TK) and Intellectual Property Rights (overview). Role of government and national initiatives. Relevance of IKS to engineering, innovation, and entrepreneurship

#### **Text Books:**

1. **Indian Knowledge Systems**, Kapil Kapoor & Avadhesh Kumar Singh, D.K. Printworld (India) Pvt. Ltd., New Delhi. ISBN: 9788124608177.
2. **Indian Philosophy – Volume I & II**, S. Radhakrishnan, Oxford University Press, New Delhi. ISBN: 9780195698418.
3. **Science and Technology in Ancient India**, O.P. Jaggi, Atma Ram & Sons, Delhi. ISBN: 9788185694085.
4. **Indian Heritage and Culture**, Madhukar K. Bhagat, McGraw Hill Education (India). ISBN: 9789332901476.
5. **Traditional Knowledge System in India**, Yogendra K. Malik, Pearson Education India. ISBN: 9788131762219.

#### **Reference Books:**

1. **Ancient Indian Science and Technology**, Debiprasad Chattopadhyaya, History of Science, Philosophy and Culture in Indian Civilization Series. ISBN: 9788187586098.
2. **Indian Culture and Heritage**, Nitin Singhania, McGraw Hill Education. ISBN: 9789353161132.
3. **Knowledge Traditions of India**, Bhu Dev Sharma, Indian Council of Philosophical Research (ICPR). ISBN: 9788185636306.

#### **Web Links:**

1. <https://iks.aicte-india.org/>
2. <https://www.education.gov.in/iks>

### Minor Stream: Cloud ERP in Collaboration with SAP

| Course Code  | Course Name                                   | Level | L         | T | P         | C         | CIE | SEE | Total | Pre-requisite |
|--------------|-----------------------------------------------|-------|-----------|---|-----------|-----------|-----|-----|-------|---------------|
| 2501CS81     | Integrated Business Processes in Cloud ERP I  | FC    | 2         |   | 1         | 3         | 50  | 50  | 100   | -             |
| 2501CS82     | Integrated Business Processes in Cloud ERP II | IC    | 2         |   | 1         | 3         | 50  | 50  | 100   | IBP I         |
| 2501CS73     | Design Thinking                               | FC    |           |   | 1         | 1         | 50  | 50  | 100   | -             |
| 2501CS74     | Basic ABAP Programming                        | FC    | 2         |   | 2         | 4         | 50  | 50  | 100   | -             |
| 2501CS75     | Intermediate ABAP Programming                 | IC    | 3         |   | 0         | 3         | 50  | 50  | 100   | BABAP         |
| 2501CS76     | Advanced ABAP Programming                     | AC    | 2         |   | 2         | 4         | 50  | 50  | 100   | IABAP         |
| 2501CS77     | Fiori Programming-Basic                       | FC    | 2         |   | 2         | 4         | 50  | 50  | 100   | -             |
| 2501CS78     | Fiori Programming-Intermediate                | IC    | 2         |   | 2         | 4         | 50  | 50  | 100   | FPB           |
| 2501CS79     | Fiori Programming-Advanced                    | AC    | 2         |   | 2         | 4         | 50  | 50  | 100   | FBI           |
| 2501CS80     | Cloud ERP Implementation Methodology          | AC    | 2         |   | 1         | 3         | 50  | 50  | 100   | -             |
| <b>Total</b> |                                               |       | <b>19</b> |   | <b>14</b> | <b>33</b> |     |     |       |               |

## Integrated Business Processes in Cloud ERP I

**Course Code: 2501CS81**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

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

- CO1:** Define concepts of ERP including Organization Structures and Master Data.
- CO2:** Define basics of Financial Accounting and Management Accounting.
- CO3:** Explain financial accounting processes including G/L accounting, accounts payable, accounts receivable, asset accounting.
- CO4:** Explain management accounting processes including planning / budgeting, capture of actuals, plan vs actuals comparison.
- CO5:** Explain human resource management concepts (including organization structure, employee master record), and HR processes of talent acquisition, talent management, talent development.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 2   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO2</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO3</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO4</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO5</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 1    |      |
| <b>CO3</b> | 1    |      |
| <b>CO4</b> | 1    |      |
| <b>CO5</b> | 1    |      |

## UNIT – I

### SAP S/4HANA Enterprise Management: Overview

SAP S/4HANA, SAP ERP to SAP S/4HANA, new user experience, Organizational structures, Master Data.

### Practice:

1. Adjust the SAP Fiori Launchpad in SAP S/4HANA
2. Display the Organizational Structures
3. Display a Material Master Record

## **UNIT – II**

### **SAP Record-to-Report Processing Overview:**

Financial Accounting (FI), Management Accounting (CO), Integration between Finance and Controlling.

#### **Practice:**

1. Create a Primary Cost Account
2. Create and Display Cost Centers
3. Display a Profit Center

## **UNIT – III**

### **Financial Accounting**

Organizational levels in SAP Financials, G/L Accounts, Cost Centers, Profit Centres, G/L Accounts Posting, Financial Statements, Supplier Master Records, Vendor Invoice posting, asset master record.

#### **Practice:**

1. Create a Posting from Financial Accounting
2. Create a Business Partner and an FI Vendor
3. Enter a Vendor Invoice with Document Splitting
4. Post a Manual Outgoing Payment with Check Printing
5. Display a Vendor Account Balance
6. Create an Asset Master Record

## **UNIT – IV**

### **Management Accounting**

Cost centre and activity types, activity allocation, internal orders.

#### **Practice:**

1. Create a Secondary Cost Account, an Activity Type and Set Activity Prices
2. Maintain Internal Order Master Data

## **UNIT – V**

### **SAP Recruit-to-Retire Processing**

Organizational management, employee master data record, SAP HCM and SAP SuccessFactors.

#### **Practice:**

1. Create an Organizational Unit and a Position in Organizational Management
2. Create an Employee Master Data Record

#### **Text Books:**

- 1 TS410\_Integrated Business Processes in SAP S/4HANA course available in SAP learning Hub.

**Reference Books:**

- 1 SAP S/4HANA, An introduction, written by Devraj Bardhan, Axel Baumgartl, Madalina.
- 2 Dascalescu, Mark Dudgeon, Piotr Górecki, Asidhara Lahiri, Richard Maund, Bert Meijerink, Andrew Worsley-Tonks. Published by Rheinwerk and available at SAP PRESS: [https://www.sap-press.com/sap-s4hana\\_5973/](https://www.sap-press.com/sap-s4hana_5973/).

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## Integrated Business Processes in Cloud ERP II

**Course Code: 2501CS82**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| 2        | 0        | 1        | 3        |

### Course Outcomes:

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

- CO1:** Explain organization structure, master data, and process flow in Purchase and Inventory functions.
- CO2:** Explain organization structure, master data, and process flow in Manufacturing function.
- CO3:** Explain organization structure, master data, and process flow in Sales function.
- CO4:** Explain organization structure, master data, and process flow in Projects function.
- CO5:** Explain organization structure, master data, and process flow in Maintenance function.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO2</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO3</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO4</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO5</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 1    |      |
| <b>CO3</b> | 1    |      |
| <b>CO4</b> | 1    |      |
| <b>CO5</b> | 1    |      |

## UNIT – I

### SAP Source-to-Pay Processing

Source-to-pay business process, organizational levels in SAP source to pay business process, material/product master record, supplier master record, additional suppliers specific master data records, purchase requisition for stock item and consumable material, purchase order, SAP Ariba functionality with procurement in SAP S/4HANA, goods receipt for a purchase order, supplier invoices, automatic payment run, warehouse management, warehouse structures and usage, types of stock changes.

### Practice:

1. Create a Material Master Record
2. Extend a Vendor Master Record
3. Create a Purchasing Info Record
4. Create a Purchase Requisition for a Stock Item and a Consumable Material

5. Create a Purchase Order with Reference to a Purchase Requisition
6. Post a Goods Receipt for a Purchase Order
7. Post the Supplier Invoice
8. Create an Automatic Payment Run
9. Extend a Material Master Record

## **UNIT – II**

### **SAP Design-to-Operate Processing**

Organizational levels, master data, product cost estimate, product demand planning, MRP process, advanced planning, planned order to production order conversion, production order release, material withdrawal for a production order, order confirmation and materials goods receipt, period end closing activities for production order.

#### **Practice:**

1. Create a Standard Cost Estimate
2. Manage Planned Independent Requirements
3. Display the Material Master Record
4. Explore PP/DS in SAP S/4HANA
5. Convert a Planned Order to a Production Order
6. Perform Goods Issue for a Production Order
7. Confirm a Production Order
8. Calculate Variances in a Production Order

## **UNIT – III**

### **SAP Lead-to-Cash Processing**

Organizational levels, master data, customer master record, condition record, sales order, delivery document, customer invoice, CO-PA, Transportation Management.

#### **Practice:**

1. Check Material Master Record for Sales
2. Create a Customer Invoice

## **UNIT – IV**

### **SAP Project Systems (PS)**

Project structure, resource plan, cost plan, project budget, project execution, labour and materials recording, period-end closing activities.

#### **Practice:**

1. Create a Project Structure
2. Release a Project

## **UNIT – V**

### **SAP Enterprise Asset Management (EAM)**

Business steps in SAP EAM, organizational levels, functional locations, master data, equipment, asset accounting integration, notifications, maintenance orders processing, period-end closing activities.

**Practice:**

1. Display and Create a Functional Location Structure
2. Create a Maintenance Request Notification
3. Confirm Time for Maintenance Order and Goods Issue Posting
4. Perform Period-End Closing Activities

**Text Books:**

- 1 TS410 Integrated Business Processes in SAP S/4HANA course available in SAP learning Hub.

**Reference Books:**

- 1 SAP S/4HANA Business Process Integration Certification Guide, written by Murat Adivar. Published by Rheinwerk and available at SAP PRESS: [https://www.sap-press.com/sap-s4hana-business-process-integration-certification-guide\\_5238/](https://www.sap-press.com/sap-s4hana-business-process-integration-certification-guide_5238/)

## Design Thinking

**Course Code: 2501CS73**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| 0        | 0        | 1        | 1        |

### Course Outcomes:

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

- CO1:** Define Design Thinking process.
- CO2:** Name the stages involved in the process.
- CO3:** Demonstrate Design Thinking process in refining the problem through stages of scoping, research, synthesis.
- CO4:** Demonstrate Design Thinking process in solving the problem through stages of ideation, prototyping, validation.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1   | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| CO2   | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| CO3   | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| CO4   | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO | PSO1 | PSO2 |
|--------|------|------|
| CO1    | 1    |      |
| CO2    | 1    |      |
| CO3    | 1    | 1    |
| CO4    | 1    | 1    |

## UNIT – I

### Introduction to Design Thinking

Overview and theoretical Introduction of the Design Thinking topic. Working in groups on simulated challenge and going through the whole Design Thinking cycle. During the process many typical Design Thinking technics and methods will be used.

## UNIT - II

### Scoping

Brain dump of the knowledge of the team members to get a common understanding of the challenge.

## UNIT – III

### Research and Synthesis

Preparation and execution of interviews to gather relevant user data and generating empathic understanding of the user.

Communicate the collected data in the team (storytelling), compression of the data with the help of Persona Definitions and Point of View techniques.

## **UNIT – IV**

### **Ideation**

Generating solution ideas using various creativity- enhancing techniques (e.g. brainstorming, Remember the Future, etc.).

## **UNIT -V**

### **Prototyping and Validation**

Building a "low-fidelity" prototype which addresses the challenge. Presentation of the prototype; learning from the feedback.

#### **Text Books:**

- 1 THINK1-Design Thinking for Business Innovation course available in SAP learning Hub.

#### **Reference Books:**

- 1 Design Thinking with SAP by Anne Johnson and available at SAP PRESS:  
[https://www.sap-press.com/design-thinking-with-sap\\_4643/?srsId=AfmBOoqwMjZhvJHFQd-ZWUMwboj7DbB6GtRIEeAmTDKk64J7gc7XR9mm](https://www.sap-press.com/design-thinking-with-sap_4643/?srsId=AfmBOoqwMjZhvJHFQd-ZWUMwboj7DbB6GtRIEeAmTDKk64J7gc7XR9mm).

## Basic ABAP Programming

**Course Code: 2501CS74**

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

### Course Outcomes:

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

- CO1:** Develop using ABAP development environment.
- CO2:** Make use of basic techniques in ABAP language.
- CO3:** Utilize ABAP SQL.
- CO4:** Model using Object Orientation in ABAP.
- CO5:** Develop interfaced.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 1   |     | 1   |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO2</b> | 1   |     | 1   | 1   | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO3</b> | 1   |     | 1   |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO4</b> | 1   |     | 1   |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO5</b> | 1   |     | 1   |     | 1   | 1   |     | 1   | 1   |      | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 1    |      |
| <b>CO3</b> | 1    |      |
| <b>CO4</b> | 1    |      |
| <b>CO5</b> | 1    |      |

## UNIT – I

### Working with ABAP Development Environment

Development model in SAP S/4HANA, ABAP development environment.

#### Practice:

1. Creating ABAP development objects
2. Writing ABAP development objects

## UNIT – II

### Basic techniques in ABAP language

Working with variables, debugging, re-usable procedures, structures, internal tables.

**Practice:**

1. Using and working with variables
2. Handling errors
3. Debugging
4. Using classes and function modules
5. Creating and declaring structures
6. Creating and working with internal tables

**UNIT – III****Using ABAP SQL to access the database**

Understanding open SQL, creating and reading database tables, core data services in SAP S/4HANA.

**Practice:**

1. Creating database tables
2. Reading single row
3. Reading multiple rows

**UNIT – IV****Object Orientation in ABAP**

Modelling classes, creating classes, creating objects, call methods, using constructors, factory methods, inheritance

**Practice:**

1. Creating a class
2. Creating objects
3. Calling methods
4. Creating constructors
5. Using factory methods

**UNIT – V****Interfaces**

Using interfaces

**Practice:**

1. Implementing interfaces

**Text Books:**

- 1 S4D400\_Basic ABAP Programming course available in SAP learning Hub.

**Reference Books:**

- 1 ABAP An Introduction by Brian O'Neill & Jelena Perfiljeva, and available at SAP PRESS: [https://www.sap-press.com/abap\\_4955/](https://www.sap-press.com/abap_4955/).

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## Intermediate ABAP Programming

(Common to CSE, IT, AIML & CSE (DS))

**Course Code: 2501CS75**

|          |          |          |          |
|----------|----------|----------|----------|
| <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 Outcomes:

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

- CO1:** Analyze and test ABAP code.
- CO2:** Use data types, type conversions, ABAP SQL code pushdown, process character fields.
- CO3:** Solve internal table performance issues.
- CO4:** Build authorization checks.
- CO5:** Design object oriented code, define exception classes, document ABAP code.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 2   |     | 2   |     | 2   | 1   |     | 1   | 1   |      | 1    |
| <b>CO2</b> | 2   |     | 2   |     | 2   | 1   |     | 1   | 1   |      | 1    |
| <b>CO3</b> | 2   |     |     | 2   | 2   | 1   |     | 1   | 1   |      | 1    |
| <b>CO4</b> | 2   |     | 2   |     | 2   | 1   |     | 1   | 1   |      | 1    |
| <b>CO5</b> | 2   |     | 2   |     | 2   | 1   |     | 1   | 1   |      | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 2    |
| <b>CO2</b> |      | 2    |
| <b>CO3</b> |      | 2    |
| <b>CO4</b> |      | 2    |
| <b>CO5</b> |      | 2    |

## UNIT – I

### Analyzing and Testing Code:

1. Improving code quality using ABAP Test Cockpit
2. Implementing code tests with ABAP Unit
3. Measuring run time consumption with ABAP Profiling
4. Analyzing database access with SQL Trace

## UNIT – II

### Using Data Types and Type Conversions, Processing Character Fields, Using Code Pushdown in ABAP SQL:

1. Classifying technical data types in ABAP

2. Avoiding pitfalls of type conversions
3. Calculating with dates, times, and timestamps
4. Using translatable text in ABAP
5. Processing strings using functions and regular expressions
6. Implementing Joins
7. Working with expressions in ABAP SQL
8. Performing calculations and string processing in ABAP SQL
9. Using special built in functions in ABAP SQL
10. Sorting and Condensing data sets in ABAP SQL

## **UNIT – III**

### **Improving Internal Table Performance:**

1. Processing the contents of internal tables
2. Using field symbols to process internal tables
3. Working with sorted and hashed tables
4. Improving internal table performance using secondary keys

## **UNIT – IV**

### **Implementing Authorization Checks:**

1. Describing authorization concept in ABAP
2. Using CDS access controls
3. Using Authority-Check statement.

## **UNIT – V**

### **Designing Effective Object-Oriented Code, Defining and Working with Exception Classes, Adding Documentation to ABAP Code:**

1. Implementing inheritance
2. Using inheritance
3. Defining interfaces
4. Using interfaces
5. Implementing factory methods
6. Working with exception classes
7. Defining own exception classes
8. Documenting ABAP code

### **Text Books:**

- 1 S4D401\_Intermediate ABAP Programming course available in SAP learning Hub.

### **Reference Books:**

- 1 Complete ABAP by Kiran Bandari, and available at SAP PRESS: [https://www.sap-press.com/complete-abap\\_5567/](https://www.sap-press.com/complete-abap_5567/).

## Advanced ABAP Programming

**Course Code: 2501CS76**

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

### Course Outcomes:

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

- CO1:** Define view entities in ABAP core data services.
- CO2:** Work with ABAP Restful Application Programming Model.
- CO3:** Create Transactional Apps.
- CO4:** Implement in app, key user, and side by side extensions.

### Mapping of Course Outcomes with Program Outcomes:

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

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PO      | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 3    |
| <b>CO2</b> |      | 3    |
| <b>CO3</b> |      | 3    |
| <b>CO4</b> |      | 3    |

## UNIT – I

### CDS Views

SQL features in CDS views, advanced concepts, database specific features, consumption of CDS views.

### Practice:

1. Create project, package, and program in ADT
2. Analyze CDS view and use in open SQL
3. Define CDS view
4. Use SQL expressions in CDS views
5. Use built in functions in CDS views
6. Define CDS views with aggregation and UNION statement
7. Define CDS views with input parameter, associations
8. Enhance CDS views
9. Create and use access control
10. Define and use CDS table function

## UNIT – II

### **ABAP Restful Application Programming Model (RAP)**

ABAP Restful Application Programming Model (RAP), RAP Business Objects.

#### **Practice:**

1. Define CDS based data model
2. Define and preview an OData Ui service
3. Define a RAP business object and its behavior
4. Read and update RAP business object
5. Establish optimistic concurrency control
6. Define and implement an action
7. Implement authority checks

## UNIT – III

### **Transactional Apps**

Update and create in managed transactional apps, draft enabled transactional apps, transactional apps with composite business object, transactional apps with unmanaged business objects.

#### **Practice:**

1. Provide input fields and value help
2. Provide input checks through validations
3. Enable managed numbering and implement determinations
4. Implement dynamic actions and field control
5. Enabling draft handling for RAP object
6. Enable draft handling for SAP Fiori elements app and adjust implementations
7. Define composite RAP object
8. Define composite OData service with RAP
9. Implement behavior of a composite RAP object
10. Define an unmanaged business object
11. Implement an unmanaged business object

## UNIT – IV

### **Extensibility**

SAP S/4HANA extensibility overview, SAP Fiori launchpad adaptation, Key User Extensibility.

#### **Practice:**

1. Add new app in Fiori launchpad
2. Create Fiori launchpad plugin
3. Adapt filter settings and table parameters
4. Create data source extension
5. Create and enable custom fields
6. Create custom logic

7. Create custom business object
8. Create UI for custom business object
9. Implement custom logic for custom business object
10. Create and use custom library
11. Create and use custom code list
12. Assign extensions to software package and transport request

## **UNIT – V**

### **Side by Side Extensibility**

Side by Side extensibility overview, options for side by side extensibility, choice of right option for side by side extensibility.

#### **Practice:**

1. Connect ABAP development tools to SAP BTP ABAP environment
2. Create an ABAP package
3. Create database table in SAP BTP ABAP environment
4. Generate OData service for base application
5. Adjust labels for Fiori elements application
6. Create service consumption model for on premise OData service
7. Create console application to test service consumption model
8. Create custom entity
9. Implement query implementation class of custom entity
10. Expose custom entity via service definition and integrate into base application

#### **Text Books:**

- 1 S4D430 Data Modelling in ABAP Dictionary and ABAP Core Data Services.
- 2 S4D437-Building Transactional Apps with the ABAP RESTful Application Programming Model.
- 3 S4D425 Extensibility for SAP S/4HANA  
courses available in SAP learning Hub.

#### **Reference Books:**

- 1 ABAP RESTful Application Programming Model - The Comprehensive Guide by Lutz Baumbusch, Matthias Jäger, Michael Lensch , and available at SAP PRESS:  
[https://www.sap-press.com/abap-restful-application-programming-model\\_5647/?srsltid=AfmBOorn2-nGpiBdu5xrbc\\_m0Ha9OEzHDJkhs1sQr5x\\_4PQbpI6lQju](https://www.sap-press.com/abap-restful-application-programming-model_5647/?srsltid=AfmBOorn2-nGpiBdu5xrbc_m0Ha9OEzHDJkhs1sQr5x_4PQbpI6lQju)

## Fiori Programming-Basic

**Course Code: 2501CS77**

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

### Course Outcomes:

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

- CO1:** Configure and customize SAP Fiori.
- CO2:** Adapt and mobilize SAP Fiori applications
- CO3:** Integrate SAP Fiori in different environments.

### Mapping of Course Outcomes with Program Outcomes:

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

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 1    |
| <b>CO2</b> |      | 1    |
| <b>CO3</b> |      | 1    |

## UNIT – I

### End-User Perspective, Technology, Architecture

Fiori design, launchpad, data handling, user interfaces, data services, application types, ABAP platform, SAP HANA, SAP S/4HANA, SAP Fiori development, BTP services, launchpad services.

### Practice:

1. Explore SAP business application studio
2. Use Fiori tools
3. Operate SAP Gateway
4. Operate SAP Fiori apps reference library
5. Debug
6. Operate SAP HANA cockpit
7. Test ABAP CDS views
8. Test SAP Fiori elements list report

## UNIT – II

### Configuration, Content Administration, Adaptation, Mobility, Integration

Fiori content, spaces and pages, groups, catalogs, target mappings, rapid activation for SAP Fiori, basic roles, launchpad configuration, trouble shooting, UI theme designer, SAP Fiori mobile, SAP Fiori for iOS.

**Practice:**

1. Create business roles
2. Create SAP Fiori spaces and pages
3. Create SAP Fiori groups and catalogs
4. Create Target mapping
5. Create technical, standard, replicable catalogs
6. Configuring Fiori Launchpad

**UNIT – III****Adaptation, Mobility, Integration**

UI Theme Designer, Adapt and Extend SAP Fiori Launchpad, SAP Fiori Mobile, SAP Fiori for iOS, SAP Business Technology Platform, SAP Build Work Zone, standard edition.

**Practice:**

1. Create Fiori themes
2. Adapt Fiori themes in runtime
3. Activate plugin for Fiori launchpad
4. Test SAP Mobile cards
5. Test SAP Mobile Services Client
6. Test SAP Fiori Mentor
7. Connect to SAP Business Technology Platform
8. Operate SAP launchpad service

**UNIT – IV****SAP Business Application Studio**

SAP Business Application Studio, Loading and Initializing SAPUI5, Modules and Dependencies, Views and Controllers, Components, Implementing the UI, Fragments, Models and Data Binding, Localization.

**Practice:**

1. Create Fiori app using Layout Editor
2. Deploy SAP UI5 application using SAP Business application studio
3. Bootstrap SAP UI5
4. Create and use an XML view
5. Create and use a view controller
6. Add UI with a form
7. Implement popup using fragment
8. Add JSON model to application
9. Use aggregation and element bindings
10. Workflow with data types
11. Implement formatter function
12. Use translatable texts

## UNIT – V

### **OData Service, Models, Routing and Navigation**

OData Services, OData Model, Routing and Navigation.

#### **Practice:**

1. OData queries
2. Add OData model to application
3. Implement OData create operation
4. Configure routing
5. Add back navigation
6. Catch invalid hashes
7. Navigate to a route with a mandatory parameter

#### **Text Books:**

- 1 UX100\_SAP Fiori – Foundation.
- 2 UX400\_Developing UIs with SAPUI5  
courses available in SAP learning Hub.

#### **Reference Books:**

- 1 SAP Fiori Certification Guide written by Krishna Kishor Kammaje and available at SAP PRESS: [https://www.sap-press.com/sap-fiori-certification-guide\\_5221/](https://www.sap-press.com/sap-fiori-certification-guide_5221/).

## Fiori Programming – Intermediate

**Course Code: 2501CS78**

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

### Course Outcomes:

At the end of the course, student will be able to:

**CO1:** Implement full screen and master detail applications.

**CO2:** Extend UI5 applications.

**CO3:** Version control when working in Teams.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 2   |     |     |     | 2   | 1   |     | 1   | 1   |      | 1    |
| <b>CO2</b> | 2   |     |     |     | 2   | 1   |     | 1   | 1   |      | 1    |
| <b>CO3</b> | 2   |     |     |     | 2   | 1   |     | 1   | 1   |      | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 2    |
| <b>CO2</b> |      | 2    |
| <b>CO3</b> |      | 2    |

### UNIT – I

#### SAP User Experience and UI5 Strategy

SAP User Experience strategy, Tools and Techniques.

#### Practice:

1. Set up SAP cloud platform account.

### UNIT – II

#### MVC review and advanced UI controls

MVC architecture review, full screen application, master detail application, Controls, Testing.

#### Practice:

1. Create UI5 application project
2. Implement full screen application
3. Implement master detail application
4. Adjust applications for a mobile device
5. Extend existing controls
6. Create custom controls

7. Implement reusable UI library
8. Create XML composite control
9. Write Unit and OPA tests.

## **UNIT – III**

### **Advanced Data Handling**

OData Services, Smart Controls, Fiori Elements.

#### **Practice:**

1. Working with OData models
2. Run application with mock data
3. Implement deep insert
4. Implement OData service for smart fields
5. Implement an application using smart table
6. Implement SAP Fiori app using SAP Fiori elements and remote annotations.

## **UNIT – IV**

### **Application Extensibility**

Extension points, Fiori extensibility options.

#### **Practice:**

1. Extend an application

## **UNIT – V**

### **Version Control**

GIT, GIT repositories, branches.

#### **Practice:**

1. Work with local GIT repository
2. Work with remote GIT repository
3. Work with Branches

#### **Text Books:**

- 1 UX402\_Advanced SAPUI5 Development course available in SAP learning Hub.

#### **Reference Books:**

- 1 SAP Fiori Certification Guide written by Krishna Kishor Kammaje and available at SAP PRESS: [https://www.sap-press.com/sap-fiori-certification-guide\\_5221/](https://www.sap-press.com/sap-fiori-certification-guide_5221/).

## Fiori Programming - Advanced

**Course Code: 2501CS79**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 4 |

### Course Outcomes:

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

**CO1:** Use guided development of SAP business application studio.

**CO2:** Work with Fiori elements.

**CO3:** Adapt and extend Fiori elements applications.

**CO4:** Design, develop, and enhance SAP Fiori UIs.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|------|
| <b>CO1</b> | 3   |     | 3   |     | 3   | 1   |     | 1   | 1   |       | 1    |
| <b>CO2</b> | 3   |     | 3   |     | 3   | 1   |     | 1   | 1   |       | 1    |
| <b>CO3</b> | 3   | 1   | 3   |     | 3   | 1   |     | 1   | 1   |       | 1    |
| <b>CO4</b> | 3   | 1   | 3   |     | 3   | 1   |     | 1   | 1   |       | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 3    |
| <b>CO2</b> |      | 3    |
| <b>CO3</b> |      | 3    |
| <b>CO4</b> |      | 3    |

## UNIT – I

### SAP Fiori Elements

SAP UX strategy, SAP Fiori Elements overview, list report, object page, overview page, analytical list page, SAP Fiori elements applications.

### Practice:

1. Set up backend and frontend development environments
2. Create Fiori elements application
3. Create list reports using CDS annotation, metadata extension
4. Create basic list report and enhance with search and filtering capabilities
5. Build basic object page with CDS annotation
6. Add header facets
7. Add headers and sections to object page
8. Navigate to external URL
9. Visualize list report
10. Create charts
11. Create overview page
12. Create content area, filter area, title area of an analytical list page
13. Extend list report with custom actions

14. Extend overview page with customer filter and custom card

## **UNIT – II**

### **User experience design, guidelines, development basics**

Permissioned Blockchain, Permissionless Blockchain, Different Consensus Mechanisms- Proof of Work, Proof of Stake, Proof of Activity, Proof of Burn, Proof of Elapsed Time, Proof of Authority, Proof of Importance, voting-based consensus algorithms, and federated consensus.

#### **Practice:**

1. Create SAP UI5 application using layout editor
2. Set up SAP cloud connector
3. Deploy SAP UI5 application using SAP business application studio

## **UNIT – III**

### **SAP UI5 advanced topics**

Remote Vs Local OData services, OData models, OData inserts, smart controls.

#### **Practice:**

1. Work with Diagrams

## **UNIT – IV**

### **SAP Fiori launchpad, design guidelines**

Extension points, other types of extensibilities in SAP UI5.

#### **Practice:**

1. Navigate in SAP Fiori
2. Create a dynamic page app
3. Create master detail using flexible column layout
4. Implement value helps
5. Implement list report
6. Implement object page

## **UNIT – V**

### **SAP Fiori flexibility, elements, continuous integration and delivery**

GIT, GIT repositories, branches.

#### **Practice:**

1. Implement and extend an extension point
2. Implement list report using SAP Fiori elements
3. Implement search and filter
4. Implement object page SAP Fiori elements

## 5. Display dependent entities as SAP Fiori elements

### Text Books:

- 1 UX403 SAP Fiori Elements Development.
- 2 UX410 Developing SAP Fiori UIs.  
courses available in SAP learning Hub.

### Reference Books:

- 1 SAP Fiori implementation and development by Souvik Roy, Aleksandar Debelic, Gairik Acharya , and available at SAP PRESS: [https://www.sap-press.com/sap-fiori-implementation-and-development\\_5449/?srsltid=AfmBOorbWwvAUueDAGyehX6cjTORHxClyZWEf2R6koHhXBzfGcOMZ9MS](https://www.sap-press.com/sap-fiori-implementation-and-development_5449/?srsltid=AfmBOorbWwvAUueDAGyehX6cjTORHxClyZWEf2R6koHhXBzfGcOMZ9MS).

## Cloud ERP Implementation Methodology

|                              | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|------------------------------|----------|----------|----------|----------|
| <b>Course Code: 2501CS80</b> | <b>2</b> | <b>0</b> | <b>1</b> | <b>3</b> |

### Course Outcomes:

At the end of the course, student will be able to:

- CO1:** Understand foundations of the SAP Activate implementation framework and components.
- CO2:** Apply methodology to an S/4HANA implementation project, leveraging SAP Signavio and SAP Cloud ALM.
- CO3:** Release planning, sprint cycles using Agile approach.

### Mapping of Course Outcomes with Program Outcomes:

| CO/PO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| <b>CO1</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO2</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO3</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO4</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |
| <b>CO5</b> | 1   |     |     |     | 1   | 1   |     | 1   | 1   |      | 1    |

### Mapping of Course Outcomes with Program Specific Outcomes:

| CO/PSO     | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> | 1    |      |
| <b>CO2</b> | 1    |      |
| <b>CO3</b> | 1    |      |
| <b>CO4</b> | 1    |      |
| <b>CO5</b> | 1    |      |

### UNIT – I

#### SAP Activate Methodology

SAP Activate, 3 pillars of SAP activate, methodology structure, analyzing each phase of SAP Activate, accessing content, discovering clean core concept.

### UNIT – II

#### SAP Signavio and SAP Cloud ALM

Challenges and opportunities transforming to SAP S/4HANA, SAP Signavio, support to S/4HANA transformation projects, Illustrating SAP Cloud ALM.

## **UNIT – III**

### **Agile Framework**

Agile and SCRUM 101, identifying Agile Project Fit, Agile project organization, roles and responsibilities, Preparing Agile project.

#### **Practice:**

1. Simulate simple SCRUM
2. Access and navigate through SAP Activate
3. Case study on Agile project fit

## **UNIT – IV**

### **Creating Backlog**

Explore phase, create backlog, Definitions of ready and done.

#### **Practice:**

1. User story maps
2. Create user stories
3. Rank user stories and define releases

## **UNIT – V**

### **Iterative Build**

Release planning, sprint cycle, analysis / testing. deploy.

#### **Practice:**

1. Estimate user stories
2. Release planning using two SCRUM teams

#### **Text Books:**

- 1 ACT100 SAP Activate Methodology.
- 2 ACT200 Agile Project Delivery  
courses available in SAP learning Hub.

#### **Reference Books:**

- 1 SAP Activate Project Management Certification Guide written by Aditya Lal, Jeyaganesh Viswanathan. and available at SAP PRESS: [https://www.sap-press.com/sap-activate-project-management-certification-guide\\_6032/](https://www.sap-press.com/sap-activate-project-management-certification-guide_6032/)

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