

## **Curriculum and Syllabi**

### **B.TECH. Artificial Intelligence and Data Science**

#### **Semesters I to VIII**

#### **Regulations 2019**

(2021 Batch Onwards)

# **Dr. Mahalingam College of Engineering and Technology**

## **Department of Artificial Intelligence and Data Science**

### **Vision**

To build quality engineers with diversified knowledge to compete globally with innovations in the domain of Artificial Intelligence and Data Science

### **Mission**

- To impart technical content in latest technologies through industry collaborative curriculum
- To produce young engineers with expert knowledge to hoist industry's growth
- To foster ethical engineers for resolving community issues through automation solutions
- To motivate engineers to employ ethical conduct of research for societal benefits

## **Programme: B.TECH. Artificial Intelligence and Data Science**

### **Programme Educational Objectives (PEOs) - Regulations 2019**

B.TECH. Artificial Intelligence and Data Science graduates will:

**PEO1.Domain Knowledge:** Possess diversified knowledge and expertise in the domain of Artificial Intelligence and Data Science

**PEO2.Problem solving skills and Ethics:** Apply computing skills to identify the challenges and to develop creative ethical solutions

**PEO3.Lifelong Learning and development:** Involve in lifelong learning, research and development to fulfill social needs using latest technology

### **Programme Outcomes (POs) - Regulations 2019**

On successful completion of B.TECH. Artificial Intelligence and Data Science programme, graduating students/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 for complex problems.

**PO5. Modern 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 Society:** 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. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings

**PO10. 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.

**PO11. 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 multi-disciplinary environments

**PO12. 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.



### **Programme Specific Outcomes (PSOs) - Regulations 2019**

On successful completion of B.TECH. Artificial Intelligence and Data Science programme, graduating students/graduates will be able to:

**PSO1. Software Automation:** Develop customized automation solutions for Engineering and business problems using intelligent techniques.

**PSO2. Data Engineering:** Predict significant information and visualize large scale data using latest technologies.

**Programme: B.Tech Artificial Intelligence and Data Science**  
**2019 Regulations**  
**Curriculum for Semesters I to VI**

| Course Code | Course Title      | Duration | Credits | Marks |
|-------------|-------------------|----------|---------|-------|
| 19SHMG6101  | Induction Program | 3 Weeks  | -       | 100   |

**Semester I**

| Course Code  | Course Title   | Hours/Week |          |           | Credits   | Marks      | Common to Programmes |
|--------------|--|------------|----------|-----------|-----------|------------|----------------------|
|              |  | L          | T        | P         |           |            |                      |
| 19MABC1102   | Linear Algebra and Infinite Series                     | 3          | 1        | 0         | 4         | 100        | CS, IT, AD, AM & SC  |
| 19ENHG2101   | Communication Skills – I                               | 2          | 0        | 2         | 3         | 100        | All                  |
| 19EESC2101   | Introduction to Electrical and Electronics Engineering | 3          | 0        | 2         | 4         | 100        | CS, IT, AD, AM & SC  |
| 19ADSN2101   | Introduction to C Programming                          | 3          | 0        | 2         | 4         | 100        | -                    |
| 19CSSC4001   | IT Practices Lab                                       | 1          | 0        | 4         | 3         | 100        | CS, IT, AD, AM & SC  |
| 19PSHG6001   | Wellness for students                                  | 0          | 0        | 2         | 1         | 100        | All                  |
| <b>Total</b> |  | <b>12</b>  | <b>1</b> | <b>12</b> | <b>19</b> | <b>600</b> |                      |

**Semester II**

| Course Code  | Course Title                          | Hours/Week |          |           | Credits   | Marks      | Common to Programmes                |
|--------------|---------------------------------------|------------|----------|-----------|-----------|------------|-------------------------------------|
|              |                                       | L          | T        | P         |           |            |                                     |
| 19MABC1202   | Calculus and Transforms               | 3          | 1        | 0         | 4         | 100        | CS, IT, AD, AM & SC                 |
| 19ENHG2201   | Communication Skills – II             | 2          | 0        | 2         | 3         | 100        | All                                 |
| 19PHBC2002   | Physics for Information Sciences      | 3          | 0        | 2         | 4         | 100        | CS, IT, AD, AM & SC                 |
| 19ECSC2201   | Digital System Design                 | 2          | 0        | 2         | 3         | 100        | CS, IT, AD, AM & SC                 |
| 19ADSN2201   | Object Oriented Programming with Java | 3          | 0        | 3         | 4.5       | 100        | -                                   |
| 19MESC4001   | Engineering Drawing                   | 1          | 0        | 3         | 2.5       | 100        | AU, CS, EC, EI, IT, ME, AD, AM & SC |
| 19CHMG6201   | Environmental Sciences                | 1          | 0        | 0         | -         | 100        | All                                 |
| 19PSHG6003   | தமிழர் மரபு / Heritage of Tamils**    | 1          | 0        | 0         | 1         | 100        | All                                 |
| <b>Total</b> |                                       | <b>16</b>  | <b>1</b> | <b>12</b> | <b>22</b> | <b>800</b> |                                     |

\*\* Applicable only for 2022 Batch

### Semester III

| Course Code  | Course Title  | Hours/Week |          |           | Credits   | Marks       | Common to Programmes |
|--------------|---|------------|----------|-----------|-----------|-------------|----------------------|
|              |   | L          | T        | P         |           |             |                      |
| 19MABN1302   | Probability and Statistics for Data Science         | 3          | 1        | 0         | 4         | 100         | -                    |
| 19ADCN1301   | Data Structures and Algorithm Analysis – I          | 3          | 0        | 0         | 3         | 100         | CS & AD              |
| 19ADCN1302   | Computer Architecture                               | 3          | 0        | 0         | 3         | 100         | CS & AD              |
| 19ADCN1303   | Data Mining   | 3          | 0        | 0         | 3         | 100         | -                    |
| 19ADCN2301   | Database Systems                                    | 3          | 0        | 2         | 4         | 100         | CS & AD              |
| 19ADCN3301   | Data Structures and Algorithm Analysis Laboratory   | 0          | 0        | 3         | 1.5       | 100         | CS & AD              |
| 19ADCN4301   | Python Programming for Data Engineers Laboratory    | 1          | 0        | 3         | 2.5       | 100         | -                    |
| 19PSHG6002   | Universal Human Values 2 : Understanding Harmony    | 2          | 1        | 0         | 3         | 100         | All                  |
| XXXXXXXXXX   | One Credit Course                                   | 0          | 0        | 2         | 1         | 100         |                      |
| 19PSHG6004   | தமிழரும் தொழில்நுட்பமும்/<br>Tamil and Technology** | 2          | 0        | 0         | 1         | 100         | All                  |
| <b>Total</b> |   | <b>20</b>  | <b>2</b> | <b>10</b> | <b>26</b> | <b>1000</b> |                      |

### Semester IV

| Course Code  | Course Title                                     | Hours/Week |          |           | Credits   | Marks      | Common to Programmes |
|--------------|--|------------|----------|-----------|-----------|------------|----------------------|
|              |  | L          | T        | P         |           |            |                      |
| 19MABN1401   | Discrete Mathematics for Artificial Intelligence | 3          | 1        | 0         | 4         | 100        | -                    |
| 19ADCN1401   | Data Structures and Algorithm Analysis – II      | 3          | 1        | 0         | 4         | 100        | CS & AD              |
| 19ADCN1402   | Artificial Intelligence –I                       | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN1403   | Operating System Principles                      | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN1404   | Object Oriented Software Development             | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN3401   | Intelligent systems - I Laboratory               | 0          | 0        | 4         | 2         | 100        | -                    |
| 19ADPN6401   | Mini Project                                     | 0          | 0        | 4         | 2         | 100        | -                    |
| XXXXXXXXXX   | One Credit Course                                | 0          | 0        | 2         | 1         | 100        | -                    |
| <b>Total</b> |  | <b>15</b>  | <b>2</b> | <b>10</b> | <b>22</b> | <b>800</b> |                      |

| Course Code | Course Title                     | Duration | Credits | Marks |
|-------------|----------------------------------|----------|---------|-------|
| XXXXXXXXXX  | Internship or Skill Development* | 2 Weeks  | 1       | 100   |

\*Refer to clause: 4.8 in UG academic regulations 2019

\*\* Applicable only for 2022 Batch

**Semester V**

| Course Code  | Course Title  | Hours/Week |          |           | Credits   | Marks      | Common to Programmes |
|--------------|---|------------|----------|-----------|-----------|------------|----------------------|
|              |   | L          | T        | P         |           |            |                      |
| 19ADCN1501   | Exploratory Data Analysis                                 | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN1502   | Artificial Intelligence –II                               | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN2501   | Computer Networking                                       | 3          | 0        | 2         | 4         | 100        | -                    |
| XXXXXXXXXXXX | Professional Elective – I                                 | 3          | 0        | 0         | 3         | 100        | -                    |
| XXXXXXXXXXXX | Professional Elective – II                                | 2          | 0        | 2         | 3         | 100        | -                    |
| XXXXXXXXXXXX | Open Elective – I   | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN3501   | Exploratory Data Analysis Laboratory                      | 0          | 0        | 4         | 2         | 100        | -                    |
| 19ADCN3502   | Intelligent systems-II Laboratory                         | 0          | 0        | 4         | 2         | 100        | -                    |
| 19PSHG6501   | Employability Skills 1: Teamness and Interpersonal Skills | 0          | 0        | 2         | 1         | 100        | All                  |
| <b>Total</b> |   | <b>17</b>  | <b>0</b> | <b>14</b> | <b>24</b> | <b>900</b> |                      |

**Semester VI**

| Course Code  | Course Title                                | Hours/Week |          |           | Credits   | Marks      | Common to Programmes |
|--------------|---|------------|----------|-----------|-----------|------------|----------------------|
|              |   | L          | T        | P         |           |            |                      |
| 19ADCN2601   | Big Data Analytics Techniques               | 3          | 0        | 2         | 4         | 100        | -                    |
| 19ADCN2602   | Deep Learning Techniques                    | 3          | 0        | 2         | 4         | 100        | -                    |
| XXXXXXXXXXXX | Professional Elective – III                 | 3          | 0        | 0         | 3         | 100        | -                    |
| XXXXXXXXXXXX | Professional Elective – IV                  | 2          | 0        | 2         | 3         | 100        | -                    |
| XXXXXXXXXXXX | Open Elective – II                          | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN3601   | Cloud Technologies Laboratory               | 1          | 0        | 4         | 3         | 100        | -                    |
| 19ADPN6601   | Innovative and Creative Project             | 0          | 0        | 4         | 2         | 100        | -                    |
| 19PSHG6601   | Employability Skills 2: Campus to Corporate | 0          | 0        | 2         | 1         | 100        | All                  |
| <b>Total</b> |   | <b>15</b>  | <b>0</b> | <b>16</b> | <b>23</b> | <b>800</b> |                      |

| Course Code  | Course Title                     | Duration     | Credits | Marks |
|--------------|----------------------------------|--------------|---------|-------|
| XXXXXXXXXXXX | Internship or Skill Development* | 2 or 4 Weeks | 1       | 100   |

\*Refer to clause: 4.8 in UG academic regulations 2019

## Tentative Curriculum for Semester VII & VIII

### Semester VII

| Course Code  | Course Title                                   | Hours/Week |          |           | Credits   | Marks      | Common to Programmes |
|--------------|--|------------|----------|-----------|-----------|------------|----------------------|
|              |  | L          | T        | P         |           |            |                      |
| 19ADCN2701   | Computational Foundation for Robotics          | 3          | 0        | 2         | 4         | 100        | -                    |
| 19ADCN1701   | Data security                                  | 3          | 0        | 0         | 3         | 100        | -                    |
| XXXXXXXXXXXX | Professional Elective – V                      | 3          | 0        | 0         | 3         | 100        | -                    |
| XXXXXXXXXXXX | Professional Elective – VI                     | 2          | 0        | 2         | 3         | 100        | -                    |
| XXXXXXXXXXXX | Open Elective – III                            | 3          | 0        | 0         | 3         | 100        | -                    |
| 19ADCN3701   | Business Intelligence and Analytics Laboratory | 0          | 0        | 4         | 2         | 100        | -                    |
| 19ADCN3702   | Data Security Laboratory                       | 0          | 0        | 4         | 2         | 100        | -                    |
| <b>Total</b> |  | <b>14</b>  | <b>0</b> | <b>12</b> | <b>20</b> | <b>700</b> |                      |

### Semester VIII

| Course Code  | Course Title | Hours/Week |          |           | Credits  | Marks      | Common to Programmes |
|--------------|--------------|------------|----------|-----------|----------|------------|----------------------|
|              |              | L          | T        | P         |          |            |                      |
| 19ADPN6801   | Project      | 0          | 0        | 16        | 8        | 200        | -                    |
| <b>Total</b> |              | <b>0</b>   | <b>0</b> | <b>16</b> | <b>8</b> | <b>200</b> |                      |

| Course Code | Course Title                     | Duration      | Credits | Marks |
|-------------|----------------------------------|---------------|---------|-------|
| XXXXXXX     | Internship or Skill Development* | 8 or 16 weeks | 4       | 100   |

\*Refer to clause: 4.8 in UG academic regulations 2019

**Total Credits (2021 batch): 168**  
**Total Credits (2022 batch): 170**

## Vertical wise Electives

| Vertical I                    |  |            |   |   |         |       |                      |
|-------------------------------|--|------------|---|---|---------|-------|----------------------|
| Security Essentials Electives |  |            |   |   |         |       |                      |
| Course Code                   | Course Title                                 | Hours/Week |   |   | Credits | Marks | Common to Programmes |
|                               |  | L          | T | P |         |       |                      |
| 19ADEN1001                    | Ethics in Artificial Intelligence            | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1002                    | Ethical Hacking                              | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1003                    | Web Application Security                     | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1004                    | Fundamentals of Computation                  | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN2001                    | Cryptographic Techniques in Network Security | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2002                    | Blockchain Technology                        | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2003                    | Network and Web Security                     | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2004                    | Digital Forensics                            | 2          | 0 | 2 | 3       | 100   | -                    |

| Vertical II                      |                                  |            |   |   |         |       |                      |
|----------------------------------|----------------------------------|------------|---|---|---------|-------|----------------------|
| Full Stack Development Electives |                                  |            |   |   |         |       |                      |
| Course Code                      | Course Title                     | Hours/Week |   |   | Credits | Marks | Common to Programmes |
|                                  |                                  | L          | T | P |         |       |                      |
| 19ADEN1005                       | User Interface Design Principles | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1006                       | Visual Data Analysis             | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1007                       | Computational Vision             | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1008                       | Cloud Services Management        | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN2005                       | Web Programming                  | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2006                       | Game Designing Techniques        | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2007                       | Augmented reality for AI         | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2008                       | Security and Privacy in Cloud    | 2          | 0 | 2 | 3       | 100   | -                    |

| <b>Vertical III</b><br><b>Software Project Management Electives</b> |  |            |   |   |         |       |                      |
|---|--|------------|---|---|---------|-------|----------------------|
| Course Code   | Course Title                                   | Hours/Week |   |   | Credits | Marks | Common to Programmes |
|   |  | L          | T | P |         |       |                      |
| 19ADEN1009  | Principles of Business Management              | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1010  | Software Development Project Management        | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1011  | Software Quality Management                    | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1012  | Reliability Engineering and system safety      | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN2009  | Agile Software Development Program             | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2010  | Basic Skills in Integrated Product Development | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2011  | Design Patterns Concepts                       | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2012  | Marketing Analytics                            | 2          | 0 | 2 | 3       | 100   | -                    |

| <b>Vertical IV</b><br><b>Data Analytics Electives</b> |                               |            |   |   |         |       |                      |
|---|-------------------------------|------------|---|---|---------|-------|----------------------|
| Course Code   | Course Title                  | Hours/Week |   |   | Credits | Marks | Common to Programmes |
|   |                               | L          | T | P |         |       |                      |
| 19ADEN1013  | Data Analytics for Engineers  | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1014  | Business Analytics Management | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1015  | Health Care Analytics         | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1016  | Graph Analytics and Algorithm | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN2013  | Social Graph Analytics        | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2014  | Recommendation Systems        | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2015  | Text and Speech Analysis      | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2016  | Image and Video Analytics     | 2          | 0 | 2 | 3       | 100   | -                    |

| Vertical V<br>Emerging Technologies Electives |                                     |            |   |   |         |       |                      |
|---|-------------------------------------|------------|---|---|---------|-------|----------------------|
| Course Code                                   | Course Title                        | Hours/Week |   |   | Credits | Marks | Common to Programmes |
|   |                                     | L          | T | P |         |       |                      |
| 19ADEN1017                                    | Fuzzy Logic and Neural Computing    | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1018                                    | Optimization Techniques             | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1019                                    | Information Retrieval Methods       | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1020                                    | Reinforcement Learning              | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN2017                                    | Fundamentals of Virtualization      | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2019                                    | Natural Language Processing Systems | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2020                                    | Bio Inspired Algorithms             | 2          | 0 | 2 | 3       | 100   | -                    |
| 19SCEC2001                                    | Cyber Security                      | 2          | 0 | 2 | 3       | 100   | All                  |

| Vertical VI<br>Applied Robotics Electives |                               |            |   |   |         |       |                      |
|---|-------------------------------|------------|---|---|---------|-------|----------------------|
| Course Code                               | Course Title                  | Hours/Week |   |   | Credits | Marks | Common to Programmes |
|   |                               | L          | T | P |         |       |                      |
| 19ADEN1021                                | Drone Technologies            | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1022                                | Agricultural Robotics         | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1023                                | Robot Operating Systems       | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1024                                | Collaborative Robotics        | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN2021                                | Sensors and Instrumentation   | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2022                                | Embedded Computing Systems    | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2023                                | Robotic Automation technology | 2          | 0 | 2 | 3       | 100   | -                    |
| 19ADEN2024                                | Mobile Robotics               | 2          | 0 | 2 | 3       | 100   | -                    |



### Diversified Electives

| Course Code | Course Title                         | Hours/Week |   |   | Credits | Marks | Common to Programmes |
|-------------|--------------------------------------|------------|---|---|---------|-------|----------------------|
|             |                                      | L          | T | P |         |       |                      |
| 19ITEC1001  | Intellectual Property Rights         | 3          | 0 | 0 | 3       | 100   | -                    |
| 19MEEC1025  | Fundamentals of Entrepreneurship     | 3          | 0 | 0 | 3       | 100   | -                    |
| 19MEEC1026  | Design Thinking and Innovation       | 3          | 0 | 0 | 3       | 100   | -                    |
| 19ADEN1025  | Business and Sustainable Development | 3          | 0 | 0 | 3       | 100   | -                    |

### Open Electives

(Offered to other Programmes)

| Course Code | Course Title                | Hours/Week |   |   | Credits | Marks |
|-------------|-----------------------------|------------|---|---|---------|-------|
|             |                             | L          | T | P |         |       |
| 19ADOC1001  | Data Mining and Warehousing | 3          | 0 | 0 | 3       | 100   |
| 19ADOC1002  | Data Science for Engineers  | 3          | 0 | 0 | 3       | 100   |
| 19ADOC1003  | Business Analytics          | 3          | 0 | 0 | 3       | 100   |
| 19ADOC1004  | Cognitive Science           | 3          | 0 | 0 | 3       | 100   |
| 19ADOC1006  | Professional Ethics         | 3          | 0 | 0 | 3       | 100   |

# **Regulations 2019**

## **Detailed Syllabi for Semesters I to VI**

|   |  |                                   |
|---|--|-----------------------------------|
| <b>Course Code: 19SHMG6101</b>                      | <b>Course Title: Induction Program</b><br><b>(common to all B.E/B.Tech programmes)</b> |                                   |
| <b>Course Category: Mandatory Non-Credit Course</b> |  | <b>Course Level: Introductory</b> |
| <b>Duration: 3 Weeks</b>                            |  | <b>Max. Marks:100</b>             |

### **Pre-requisites**

- Nil

### **Course Objectives**

The course is intended to:

1. Explain various sources available to meet the needs of self, such as personal items and learning resources
2. Explain various career opportunities, opportunity for growth of self and avenues available in the campus
3. Explain the opportunity available for professional development
4. Build universal human values and bonding amongst all the inmates of the campus and Society

### **List of Activities:**

1. History of Institution and Management: Overview on NIA Education Institutions-Growth of MCET – Examination Process-OBE Practices – Code of Conduct – Centre of Excellence
2. Lectures by Eminent People, Motivational Talk – Alumni, Employer
3. Familiarization to Dept./Branch: HoD Interaction – Senior Interaction – Department Association
4. Universal Human Value Modules: Module 1, Module 2, Module 3 and Module 4
5. Orientation on Professional Skill Courses
6. Proficiency Modules – Mathematics, English, Physics and Chemistry
7. Introduction to various Chapters, Cell, Clubs and its events
8. Creative Arts: Painting, Music and Dance
9. Physical Activity: Games and Sports, Yoga and Gardening
10. Group Visits: Visit to Local areas and Campus Tour

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Explain various sources available to meet the needs of self, such as personal items and learning resources through visit to local areas and campus   | Understand             |
| CO2: Explain various career opportunities and avenues available in the campus through orientation sessions  | Understand             |
| CO3: Explain the opportunity available for professional development through professional skills, curricular, co-curricular and extracurricular activities | Understand             |
| CO4: Build universal human values and bonding amongst all the inmates of the campus and society for having a better life                                  | Apply                  |

### Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |
| CO2 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |
| CO3 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |
| CO4 | 2   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |

High-3; Medium-2; Low-1

### Assessment Pattern

| <b>Component</b>     | <b>Marks</b> | <b>Details</b>                               |
|----------------------|--------------|--|
| Attendance           | 10           | Minimum 80% and 1 mark for every 2% observed |
| Knowledge Test       | 40           | Objective type questions                     |
| Work plan for future | 50           | Career plan developed consulting mentor      |
| <b>Total</b>         | <b>100</b>   |  |

### Non-letter Grades

| <b>Marks Scored</b> | <b>Performance Level</b> |
|---------------------|--------------------------|
| 70 & above          | Good                     |
| 30 – 69             | Average                  |
| < 30                | Fair                     |

## Semester – I

|   |                  |  |                       |
|---|------------------|--|-----------------------|
| <b>Course Code:19MABC1102</b>               |                  | <b>Course Title: Linear Algebra and Infinite Series</b><br><b>(common to CS, IT, AD, AM &amp;SC)</b> |                       |
| <b>Course Category: Basic Science</b>       |                  | <b>Course Level: Introductory</b>  |                       |
| <b>L:T:P (Hours/Week)</b><br><b>3: 1: 0</b> | <b>Credits:4</b> | <b>Total Contact Hours:60</b>  | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ NIL

### **Course Objectives**

The course is intended to:

1. Determine the solution of system of equations using echelon forms
2. Apply the properties of vector spaces
3. Use the Gram-Schmidt process to orthogonalize set of vectors
4. Determine the canonical form of a quadratic form using orthogonal transformation
5. Use different testing methods to check the convergence of infinite series

### **Unit I            Matrices**

**9+3 Hours**

System of linear equations – Homogeneous and Non homogeneous forms – row echelon form – row reduced echelon form – rank of a matrix – Crout's method – Applications to linear systems.

### **Unit II            Basis and Dimension of Vector Spaces**

**9+3 Hours**

Vector spaces – Linear dependence of vectors – Basis, dimension, row space, column space, null space, rank nullity theorem – Linear transformations – matrix associated with a linear map, range and kernel of linear map – Inverse of linear transformation.

### **Unit III            Orthogonality and Inner Product Space**

**9+3 Hours**

Inner product space of vectors – Inner product spaces – length of a vector, distance between two vectors, orthogonality of vectors – orthogonal projection of a vector – Gram-Schmidt process – orthonormal basis.

### **Unit IV            Eigen Values and Eigen Vectors**

**9+3 Hours**

Eigen values and vectors – symmetric, skew symmetric and orthogonal matrices – Diagonalization of symmetric matrices through orthogonal transformation – reduction of quadratic forms to canonical form-rank, index, signature nature of quadratic forms – Singular Value decomposition.

**Unit V Sequences and Series****9+3 Hours**

Sequences – definitions and examples – Series – Tests for convergence – comparison test, integral test, Cauchy's root test, Alembert's ratio test – Alternating series – Leibnitz's test.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                                  |                 |
| CO1: Solve system of equations using echelon forms                                    | Apply           |
| CO2: Apply the properties of vector spaces  | Apply           |
| CO3: Determine orthogonal set of vectors using Gram Schmidt orthogonal process        | Apply           |
| CO4: Determine the canonical form of a quadratic form using orthogonal transformation | Apply           |
| CO5: Use different testing methods to check the convergence of infinite series        | Apply           |

**Text Book(s):**

- T1. Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & sons, 2010.
- T2. David C Lay, Linear Algebra and its Applications, 3<sup>rd</sup> Edition, Pearson India, 2011.
- T3. Howard Anton, Chris Rorres, Elementary Linear Algebra Applications version, 9<sup>th</sup> Edition,

**Reference Book(s):**

- R1. T. Veerarajan, "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
- R2. V. Krsihnamurthy, V. P. Mainra and J. L. Arora, "An Introduction to Linear Algebra", Affiliated East-West press, Re-print 2005.

**Web References:**

1. <https://nptel.ac.in/downloads/111102011/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|  |   |                               |                       |
|--|---|-------------------------------|-----------------------|
| <b>Course Code:19ENHG2101</b>              | <b>Course Title: Communication Skills – I</b><br><b>(common to all B.E/B.Tech Programmes)</b> |                               |                       |
| <b>Course Category: Humanities</b>         | <b>Course Level: Introductory</b>   |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>2: 0: 2</b> | <b>Credits:3</b>  | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

- The student should have undergone English as his/her first or second language in school.

#### **Course Objectives**

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with B1 of CEFR level
2. Speak in simple sentences to convey their opinions and ideas on par with B1 of CEFR level
3. Read and infer a given text on par with B1 of CEFR level
4. Draft basic formal written communication on par with B1 of CEFR level

#### **Unit I          Listening**

**15 Hours**

Importance of active listening – Physical condition needed for active listening – Identifying relevant points while taking notes – Framing questions at different linguistic contexts – Listening for specific details of concrete monologues and dialogues – Listening to organize ideas – Developing ideas – Listening to compose paragraphs – Paraphrasing the aural input.

#### **Unit II          Speaking**

**15 Hours**

Importance of note making to practice speaking – Traditional note making, developing Mind map – Collecting points from various sources – Identifying relevant ideas needed for the speech – Using mind-map to organize thought processing – Prioritizing the ideas – Types of sentences – Frequently used words (Institution, home and leisure) – Mother Tongue Influence – Expressing the thoughts in simple sentences – Tenses & Voices (Active & Passive) – Postures, gestures and eye contact – Intonation and Sentence stress – Express one's thoughts coherently.

#### **Unit III          Reading**

**15 Hours**

Reading strategies – Skimming -Scanning - Interpretation of visual data – Factual texts on subjects of relevance – Inferring texts – Reading to write a review – Checking the accuracy of reading while presenting the interpreted data – Reading to comprehend.

**Unit IV Writing****15 Hours**

Writing Simple and short sentences – Writing E-mail, Memo, Note and Message – Letter Writing – Importance of punctuations – Identifying the main points – Organising the main ideas – Writing a draft.

**List of Tasks**

1. BEC Preliminary Listening Test – I & Speaking Test – 1
2. BEC Preliminary Listening Test – 2 & Speaking Test – 2
3. BEC Preliminary Listening Test – 3 & Speaking Test – 3
4. BEC Preliminary Listening Test – 4 & Speaking Test – 4
5. BEC Preliminary Listening Test – 5 & Speaking Test – 5
6. BEC Preliminary Listening Test – 6 & Speaking Test – 6

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Listen actively and paraphrase simple messages and specific details of concrete monologues and dialogues | Apply                  |
| CO2: Express one's views coherently in a simple manner  | Apply                  |
| CO3: Read and comprehend factual texts on subjects of relevance   | Understand             |
| CO4: Write texts bearing direct meanings for different contexts maintaining an appropriate style              | Apply                  |

**Text Book(s):**

- T1. Whitby Norman, Business Benchmark Pre-intermediate to Intermediate Students' Book CUP Publications, 2<sup>nd</sup> Edition, 2014.
- T2. Wood Ian, Williams Anne, Cowper Anna, Pass Cambridge BEC Preliminary, Cengage Learning, 2<sup>nd</sup> Edition, 2015.
- T3. Learners Book prepared by the Faculty members of Department of English.

**Reference Book(s):**

- R1. BEC-Preliminary - Cambridge Handbook for Language Teachers, 2<sup>nd</sup> Edition, CUP 2000.
- R2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, 3<sup>rd</sup> Edition, 2013.



**Web References:**

1. <http://www.grammarinenglish.com> -Jan 23, 2018
2. [https://www.northshore.edu/support\\_centre /pdf/listen-notes.pdf](https://www.northshore.edu/support_centre /pdf/listen-notes.pdf)
3. [http://www.examenglish.com/BEC/BEC\\_Vantage.html](http://www.examenglish.com/BEC/BEC_Vantage.html)- Jan 23, 2018

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | 3    | -    | 2    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | 3    | -    | 2    | -    | -    |
| CO3 | -   | -   | -   | -   | -   | -   | -   | 1   | -   | 3    | -    | 2    | -    | -    |
| CO4 | -   | -   | -   | -   | -   | -   | -   | 1   | -   | 3    | -    | 2    | -    | -    |

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code:19EESC2101</b>               | <b>Course Title: Introduction to Electrical and Electronic Engineering<br/>(Common to CS, IT, AD, AM &amp;SC)</b> |                               |                       |
| <b>Course Category: Engineering Science</b> | <b>Course Level: Introductory</b>   |                               |                       |
| <b>L:T:P (Hours/Week)<br/>3: 0: 2</b>       | <b>Credits:4</b>  | <b>Total Contact Hours:75</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Explain basics of DC circuits
2. Explain the fundamentals of AC circuits
3. Describe the basic electrical machines
4. Summarize the semiconductor devices
5. Outline the display devices and transducers
6. Utilize carpentry and piping methods

### **Unit I Fundamentals of DC Circuits 9 Hours**

Definition, symbol and unit of quantities – Active and Passive elements – Ohm's Law: statement, illustration and limitation – Kirchhoff's Laws: statement and illustration – Resistance in series and voltage division rule – Resistance in parallel and current division rule – Method of solving a circuit by Kirchhoff's laws – Star to Delta and Delta to Star transformation.

### **Unit II AC Fundamentals 9 Hours**

Magnetic Circuits: Definition of magnetic quantities – Law of electromagnetic induction – Generation of single phase alternating EMF – Terminology – 3 Phase System: 3-Wire and 4 Wire system – Root Mean Square (RMS) – Average value of AC – Phasor representation of alternating quantities – Pure Resistive, Inductive and Capacitive circuits.

### **Unit III Electrical Machines 9 Hours**

DC Generator and DC Motor: Construction, Working Principle, Characteristics of shunt and series motor – Single phase transformer: Construction, working principle - Three phase and Capacitor start and run single phase induction motor: Construction and Working Principle.

### **Unit IV Semiconductor Devices 9 Hours**

Theory of Semiconductor: PN junction diode, Forward Bias Conduction, Reverse Bias Conduction, V-I Characteristics – Bipolar Junction Transistor: Operation of NPN and PNP Transistor, Common Emitter Configuration – Field Effect Transistor & MOSFET: construction and working principle.

**Unit V          Display Devices and Transducers****9 Hours**

Opto-Electronic Devices: Working principle of Photoconductive Cell, Photovoltaic Cell-solar cell  
Display Devices: Light Emitting Diode (LED) – Liquid Crystal Display (LCD) – Transducers:  
Capacitive and Inductive Transducer, Thermistors, Piezoelectric and Photoelectric Transducer.

**List of Experiments****30 Hours****[A] Electrical & Electronics :**

- 1) Identification of resistor and capacitor values
- 2) Soldering practice of simple circuit and checking the continuity
- 3) Fluorescent tube, staircase, house wiring and need for earthing

**[B] Civil & Mechanical:**

- 1) Make a wooden Tee joint to the required dimension
- 2) Make a tray in sheet metal to the required dimension
- 3) Assemble the pipeline connections with different joining components for the given  
Layout

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Explain basic laws and simplification techniques in electrical engineering using DC Circuits | Understand      |
| CO2: Explain the fundamentals and basic principles of AC Circuits                                 | Understand      |
| CO3: Describe the principles of basic electrical machines   | Understand      |
| CO4: Summarize the working of semiconductor devices   | Understand      |
| CO5: Outline the features of display devices and transducers                                      | Understand      |
| CO6: Utilize Carpentry and Piping methods   | Apply           |

**Text Book(s):**

T1. R.Muthusubramanian and S.Salivahanan, "Basic Electrical and Electronics Engineering",  
McGraw Hill India Limited, New Delhi, 2014.

**Reference Book(s):**

- R1. B.L Theraja, "Fundamental of Electrical Engineering and Electronics", S.Chand Limited – 2006.
- R2. J.B.Gupta, "Basic Electrical and Electronics Engineering", S.K.Kataria & Sons, 2009.
- R3. Smarajit Ghosh, "Fundamental of Electrical and Electronics Engineering", 2<sup>nd</sup> Edition, PHI Learning Private Limited New Delhi, 2010.
- R4. S. K. Sadhev, "Basic Electrical Engineering and Electronics ", Tata Mcgraw Hill, 2017.

**Web References:**

1. <https://www.nptel.ac.in/courses/108108076/>
2. <https://www.oreilly.com/library/view/basic-electrical-and/9789332579170/>
3. <http://www.ait.ac.jp/en/faculty/lab-engineering/latter/elec-material/>
4. <http://www.electrical4u.com>
5. <http://www.allaboutcircuits.com>

**Course Articulation Matrix**

| CO  | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| CO1 | 2   | 1    | -    | -    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |
| CO2 | 2   | 1    | -    | -    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |
| CO3 | 2   | 1    | -    | -    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |
| CO4 | 2   | 1    | -    | -    | -    | -    | -    | 1    | -    | 1    | -    | -    | -    | -    |
| CO5 | 2   | 1    | -    | -    | -    | -    | -    | 1    | -    | 1    | -    | -    | -    | -    |
| CO6 | 3   | 2    | 1    | 1    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADSN2101</b>              | <b>Course Title: Introduction to C Programming</b> |                               |                       |
| <b>Course Category: Engineering Science</b> | <b>Course Level: Introductory</b>                  |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 2</b>  | <b>Credits:4</b>                                   | <b>Total Contact Hours:75</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Build solutions using problem solving techniques and appropriate programming constructs
2. Develop programs using control Structures and arrays
3. Write Programs using Functions and Strings
4. Implement programs using pointers and structures
5. Write programs using files, preprocessor directives and graphics functions

### **Unit I Introduction**

**9 Hours**

General Problem solving strategy – Program development cycle - Problem Solving Techniques : Algorithm, Pseudocode and Flow Chart - Introduction – C Character set - Identifiers – keywords - Data types – Variables and constants –Structure of C Program- Operators and Expressions-Type Conversion-Formatting input and output statements.

### **Unit II Control Structures and Arrays**

**9 Hours**

Statements: Selection statement-Jumping statement-Iterative statements-Arrays-One dimensional Array-Two-dimensional Array-Applications: Linear search, Binary search, Matrix Operations.

### **Unit III Functions and Strings**

**9 Hours**

Functions: Declaration & Definition – Return statement – Types of functions –call by value – call by reference –Recursion. Strings: Declaration and Initialization of string –String library Functions-Storage classes.

### **Unit IV Pointers and Structures**

**9 Hours**

Pointers: Features of Pointers-Declaration of pointer-Operations on Pointers-void pointer-Dynamic memory allocation-Structures: Declaration & Initialization of Structures – Structure within Structure – Array of Structures.

**Unit V        Files and Preprocessor Directives****9 Hours**

Introduction to Files – Streams - File Types – File operations – Command line arguments – Preprocessor Directives: Macros, File Inclusion- Graphics: Initialization -Graphics functions.

**List of Exercises****30 Hours**

1. Write programs using Operators and Expressions
2. Develop programs using control structures and Arrays
3. Implement programs using Functions and Strings
4. Write programs using Pointers and Structures
5. Implement programs using Files and Preprocessor directives
6. Develop programs using Graphics functions

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Build solutions using problem solving techniques and appropriate programming constructs for a given scenario | Understand             |
| CO2: Develop programs using control Structures and arrays for a given application                                 | Apply                  |
| CO3: Write Programs using Functions and Strings for a given scenario  | Apply                  |
| CO4: Implement programs using pointers and structures for real time applications                                  | Apply                  |
| CO5: Write programs using files, preprocessor directives and graphics functions for a given application           | Apply                  |

**Text Book(s):**

T1. Ashok N.Kamthane, Amit.N.Kamthane, "Programming in C", 3<sup>rd</sup> Edition, Pearson Education, 2015.

**Reference Book(s):**

- R1. Ajay Mittal, "Programming in C - A Practical Approach", 3<sup>rd</sup> Edition, Pearson Education, 2010.
- R2. Yashavant P.Kanetkar, "Let Us C", 16<sup>th</sup> Edition, BPB Publications, 2017.
- R3. Brian W. Kernighan , Dennis Ritchie, "The C Programming Language", 2<sup>nd</sup> Edition, Pearson Education, 2015.

**Web References:**

1. NPTEL Course Introduction to Programming in C:  
[https://onlinecourses.nptel.ac.in/noc19\\_cs42](https://onlinecourses.nptel.ac.in/noc19_cs42)
2. Learn C: <https://www.learn-c.org/>
3. C Programming Tutorials: <https://www.cprogramming.com/>
4. C Programming Exercises: <https://codeforwin.org/>

**Course Articulation Matrix**

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

High-3; Medium-2;Low-1

|   |   |                                |                      |
|---|---|--------------------------------|----------------------|
| <b>Course Code:19CSSC4001</b>               | <b>Course Title: IT Practices Lab<br/>(Common to CS, IT, AD, AM &amp;SC)</b> (2020 Batch onwards) |                                |                      |
| <b>Course Category: Engineering Science</b> | <b>Course Level: Introductory</b>   |                                |                      |
| <b>L:T:P(Hours/Week)</b><br><b>1: 0: 4</b>  | <b>Credits: 3</b>   | <b>Total Contact Hours: 75</b> | <b>Max Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Build a web page with all web page elements
2. Develop a web design for any real time application
3. Design a Mobile application with GUI components
4. Build a real time mobile application

### **Unit I Introduction**

**7 Hours**

Internet and World Wide Web – Web Browser – Web Server – Web Page – URIs and URLs – Client Side Scripting – Server Side Scripting

Study of Open Source Tools: Open Element, MIT App Inventor, any other Open source Tool

### **Unit II HTML**

**8 Hours**

Structure of HTML -Special Characters and Horizontal rules – Headers - Lists – Tables – Forms – Links – Images - Internal Linking – frameset element - meta Elements.

### **List of Experiments**

**60 Hours**

#### **Web Applications**

1. Develop a web page with image, text, links, tables
2. Build a web page with Menus, Image links and Navigations bars
3. Create a web page with containers and Media
4. Construct a web page to display own resume
5. Construct a web page to display the products of a company

#### **Mobile Applications**

6. Design an application with GUI widgets
7. Design an application with Layouts and Media
8. Create an application using Event handlers
9. Develop a calculator application to perform all arithmetic operations
10. Construct an application to calculate BMI



| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO1: Build a web page with all web page elements   | Apply                  |
| CO2: Develop a web design for any real time application                                      | Apply                  |
| CO3: Design a Mobile application using mobile development framework involving GUI components | Apply                  |
| CO4: Build a real time mobile application to handheld devices                                | Apply                  |

### Reference(s):

- R1. Harvey M. Deitel , Paul J. Deitel, "Internet and World Wide Web – How to Program", 4<sup>th</sup> Edition ,Pearson Education Asia, 2009.
- R2. David Wolber , Hal Abelson , Ellen Spertus, Liz Looney, "App Inventor 2: Create Your Own Android Apps", 2nd Edition, O'Reilly Media, 2014.

### Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | -    | 2    | 3    | 1    |
| CO2 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | -    | 2    | 3    | 1    |
| CO3 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | -    | 2    | 3    | -    |
| CO4 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | -    | 2    | 3    | 1    |

High-3; Medium-2; Low-1

|  |                  |   |                       |
|--|------------------|---|-----------------------|
| <b>Course Code: 19PSHG6001</b>             |                  | <b>Course Title: Wellness for Students</b><br>(Common to all B.E/B.Tech Programmes)<br>(2020 Batch onwards) |                       |
| <b>Course Category: Humanities</b>         |                  | <b>Course Level: Introductory</b>   |                       |
| <b>L:T:P(Hours/Week)</b><br><b>0: 0: 2</b> | <b>Credits:1</b> | <b>Total Contact Hours:30</b>   | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ NIL

#### **Course Objectives**

The course is intended to:

1. Set SMART goals for academic, career and life
2. Apply time management techniques
3. Articulate the importance of wellness for success in life.
4. Understand the dimensions of wellbeing and relevant practices

#### **Unit I Goal Setting**

Understanding Vision and mission statements - Writing personal mission statements – ‘Focus’ as a way of life of most successful people. Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume. Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment.

#### **Unit II Time Management - Tools and Techniques**

Importance of planning and working to time. Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying ‘NO’ – Managing procrastination

#### **Unit III Practices for Physical Wellness**

Concept of wellness – impact of absence of wellness - Wellness as important component to achieve success. Wellbeing as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods

**Simplified Physical Exercises.** Fitness as a subset of Wellness – health related physical fitness - skill related physical fitness. Joint movements, Warm up exercises, simple asanas, WCSC simplified exercises.

#### **Unit IV Practices for Mental Wellness**

Meditation: Mind and its functions - mind wave frequency – Simple basic meditation – WCSC meditation and introspection tables. Greatness of friendship and social welfare – individual, family and world peace – blessings and benefits.

Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas

#### **Unit V Putting into Practice**

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1. Set well-articulated goals for academics, career, and personal aspirations             | Apply                  |
| CO2. Apply time management techniques to complete planned tasks on time                     | Apply                  |
| CO3. Explain the concept of wellness and its importance to be successful in career and life | Apply                  |
| CO4. Explain the dimensions of wellness and practices that can promote Wellness             | Apply                  |
| CO5. Demonstrate the practices that can promote wellness                                    | Valuing                |

#### **Text book(s):**

T1. Reading material, workbook and journal prepared by PS team of the college.

#### **Reference Book(s):**

R1. Stephen R Covey, “First things first”, Simon & Schuster UK, Aug 1997.

R2. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster UK, 2004.

R3. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, “Value education for harmonious life (Manavalakalai Yoga)”, Vethathiri Publications, Erode, (2010).

R4. Dr. R. Nagarathna, Dr.H.R. Nagendra, “Integrated approach of yoga therapy for positive health”, Swami Vivekananda Yoga Prakashana, Bangalore, 2008.

R5. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English).

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | -   | 1   | 1    | -    | 1    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | -   | 1   | -    | 1    | 1    | -    | -    |
| CO3 | -   | -   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    |
| CO4 | -   | -   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    |
| CO5 | -   | -   | -   | -   | -   | 1   | 1   | -   | 1   | -    | -    | 1    | -    | -    |

High-3; Medium-2; Low-1

## Semester - II

|   |   |                               |                                 |
|---|---|-------------------------------|---------------------------------|
| <b>Course Code:19MABC1202</b>               | <b>Course Title: Calculus and Transforms</b><br><b>(common to CS, IT, AD, AM &amp;SC)</b> |                               |                                 |
| <b>Course Category: Basic Science</b>       | <b>Course Level: Introductory</b>   |                               |                                 |
| <b>L:T:P (Hours/Week)</b><br><b>3: 1: 0</b> | <b>Credits:4</b>  | <b>Total Contact Hours:60</b> | <b>Max.</b><br><b>Marks:100</b> |

### **Pre-requisites**

➤ NIL

### **Course Objectives**

The course is intended to:

1. Determine the curvature and equation of evolutes of a curve
2. Apply partial derivatives to find extreme values of functions of two variables and to vector fields
3. Determine the solution of first and second order ordinary differential equations
4. Compute the Fourier series expansion for given periodic functions
5. Compute Z transform and inverse transform for discrete time sequences

### **Unit I                  Differential Calculus    9+3 Hours**

Curvature - Cartesian and Polar coordinates - radius of curvature - center of curvature - circle of curvature - Evolutes and Involutives.

### **Unit II                  Multivariable Calculus    9+3 Hours**

Partial derivatives - total derivatives - Jacobian - maxima and minima and saddle points - method of lagrange multipliers - Gradient - directional derivative - curl and divergence.

### **Unit III                  Ordinary Differential Equations of First and Second Order                          9+3 Hours**

Solution of differential equations of first order and first degree: homogeneous form - linear form and exact differential equations – Second order linear differential equations with constant coefficients – Solution by variation of parameters.

### **Unit IV                  Fourier Series    9+3 Hours**

Fourier series - Dirichlet's condition - Half range sine and cosine series - Parseval's identity - Harmonic Analysis - Applications.

### **Unit V                  Z Transforms    9+3 Hours**

Z transform - region of convergence - properties of z transforms - inverse transform - Solution to homogeneous linear constant difference equations - Interpretation of stability in Z domain.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Determine the curvature and equation of evaluates of a curve using differentiation techniques                      | Apply                  |
| CO2: Apply partial derivatives to find extreme values of functions and to vector fields                                 | Apply                  |
| CO3: Solve the various types of first, second and higher order ordinary differential equations using various techniques | Apply                  |
| CO4: Compute the Fourier series expansion for given periodic functions  | Apply                  |
| CO5: Compute Z transform and inverse transform for discrete time sequences  | Apply                  |

**Text Book(s):**

- T1. Erwin Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, John Wiley & sons, 2010.
- T2. B.S.Grewal, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers, 2014.

**Reference Book(s):**

- R1. Veerarajan Engineering Mathematics (for semester III), 3<sup>rd</sup> Edition, Tata McGraw-Hill, New Delhi, 2010.
- R2. Srimanta Pal &Subodh C. Bhunia. "Engineering Mathematics", Oxford University Press, 2015.

**Web References:**

1. <https://nptel.ac.in/courses/117105134/15>
2. <https://nptel.ac.in/courses/122101003/44>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code:19ENHG2201</b>               | <b>Course Title: Communication Skills – II</b><br><b>(Common to all B.E/B.Tech Programmes)</b> |                               |                       |
| <b>Course Category: Humanities</b>          | <b>Course Level: Introductory</b>  |                               |                       |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b> | <b>Credits:3</b>   | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Communication Skills – I

### **Course Objectives**

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with B2 of CEFR level
2. Speak in simple sentences to convey their opinion and ideas on par with B2 of CEFR level
3. Read and infer a given text on par with B2 of CEFR level
4. Draft basic formal written communication on par with B2 of CEFR level

#### **Unit I          Listening**

**15 Hours**

Importance and purpose of extensive listening and intensive listening - Body Language - Listening tasks on complex and abstract themes - Correlating Ideas related to listening input - importance of empathetic - listening for main ideas - Paraphrasing - Listening to native speakers English - Compound and Complex sentences - Developing ideas - Listening to compose paragraphs.

#### **Unit II          Speaking**

**15 Hours**

Jotting down ideas collected from listening to speak - organising the ideas - Expressing one's view coherently - Understanding grammatical elements (Noun - Pronoun Antecedent) - Expressing ideas assertively - Answering questions during presentations - Understanding the use of discourse markers - word stress and sentence stress - voice modulation and pauses - Highlighting significant points - interpretation of visual data - Using verbal cues - Preparing simple hand – outs.

#### **Unit III          Reading**

**15 Hours**

Reading strategies - Skimming & Scanning - Inferring meaning- Barriers to reading - sub vocalisation, Eye fixation, Regression - Speed Reading Techniques - Reading different types of texts and their contexts with speed - Note making - Reading a review - Paraphrasing - Reading to comprehend.

**Unit IV      Writing****15 Hours**

Reported speech & Concord (Subject - verb Agreement) - Report writing - Different kinds of Report - Structure of the report - Writing Proposal - Plagiarism - References - Appendices - Techniques for Report writing - Registers.

**List of Tasks**

1. BEC Vantage Listening Test - 1 & Speaking Test - 1
2. BEC Vantage Listening Test - 2 & Speaking Test - 2
3. BEC Vantage Listening Test - 3 & Speaking Test - 3
4. BEC Vantage Listening Test - 4 & Speaking Test - 4
5. BEC Vantage Listening Test - 5 & Speaking Test - 5
6. BEC Vantage Listening Test - 6 & Speaking Test - 6

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Listen actively and empathetically, and paraphrase discussions and presentations on complex and abstract themes and topics               | Apply                  |
| CO2: Express one's views coherently, fluently and confidently highlighting the significant points with supporting details                     | Apply                  |
| CO3: Read and comprehend different types of texts and their contexts reasonably at moderate speed   | Understand             |
| CO4: Write detailed reports on variety of subjects synthesizing information gathered during listening & reading citing appropriate references | Apply                  |

**Text Book(s):**

T1. Whitby Norman, Business Benchmark Upper Intermediate Students' Book CUP Publications, 2<sup>nd</sup> Edition, 2014.

T2. Learners Book prepared by the Faculty members of Department of English.

**Reference Book(s):**

R1. Cambridge BEC Vantage - Practice Tests, Self-study Edition, Cambridge University Press, 2002.

R2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, 3<sup>rd</sup> Edition, 2013.



**Web References:**

1. <http://www.grammarinenglish.com>-Jan 23,2018
2. [https://www.northshore.edu/support\\_centre/pdf/listen-notes.pdf](https://www.northshore.edu/support_centre/pdf/listen-notes.pdf)
3. [http://www.examenglish.com/BEC/BEC\\_Vantage.html](http://www.examenglish.com/BEC/BEC_Vantage.html)-Jan 23, 2018

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | 3    | -    | 2    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | 2   | 3   | 3    | -    | 2    | -    | -    |
| CO3 | -   | -   | -   | -   | -   | -   | -   | 1   | -   | 3    | -    | 2    | -    | -    |
| CO4 | -   | -   | -   | -   | -   | -   | -   | 1   | -   | 3    | -    | 2    | -    | -    |

High-3; Medium-2;Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19PHBC2002</b>              | <b>Course Title: Physics for Information Sciences</b><br><b>(common to CS, IT, AD, AM &amp;SC)</b> |                               |                       |
| <b>Course Category: Basic Science</b>       | <b>Course Level: Introductory</b>  |                               |                       |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 2</b> | <b>Credits:4</b>   | <b>Total Contact Hours:75</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ NIL

### **Course Objectives**

The course is intended to:

1. Explain the fundamental concepts of light
2. Illustrate the characteristics, principles and applications of laser
3. Explain the mode of propagation and losses in optical fibers
4. Identify a suitable technique for fabricating integrated circuits
5. Use the concept of luminescence in various electronic display devices

### **Unit I Wave Optics**

**9 Hours**

Nature of Light - Laws of reflection and refraction - Total internal reflection - Reflectivity and Transmissivity - The electromagnetic spectrum - properties of electromagnetic radiation - Interference of light waves- Young's double slit experiment - Newton's rings : determination of radius of bright and dark rings - Diffraction of light waves - Fresnel and Fraunhofer diffraction at single slit and circular aperture - Diffraction grating and resolving power.

### **Unit II Laser**

**9 Hours**

Characteristics of laser light- Einstein's theory of matter radiation interaction A& B Coefficients - Stimulated and spontaneous emissions of radiations - Population inversion and pumping methods - Types of laser: Neodymium Yttrium Aluminum (Nd: YAG) laser and Carbon di oxide (CO<sub>2</sub>) molecular gas laser - Semiconductor laser (Homo junction and hetro junction) - Applications: Holograms and Holographic data storage (record/read).

### **Unit III Fiber Optics**

**9 Hours**

Optical fibers - Principle of light propagation through optical fibers - Expressions for numerical aperture and acceptance angle - Types of optical fibers based on material, refractive index, and mode of propagation - Fabrication of optical fiber: Double crucible method - Dispersion and attenuation in optical fiber - Photo detectors: PN, PIN & Avalanche photo diodes - Fiber optic communication system and its advantages.

**Unit IV Integrated Circuits****9 Hours**

Introduction to semiconductors: Intrinsic and extrinsic semiconductors - Advantages of Integrated circuits (ICs) over discrete components - IC classification - Construction of bipolar transistor - Epitaxial growth & Oxidation - Photolithography- Isolation diffusion - Base diffusion - Emitter diffusion - Contact mask - Aluminium metallization - Passivation - Structures of integrated PNP transistor.

**Unit V Display Devices****9 Hours**

Human vision - Red, Blue, and Green (RGB) color scheme - Primary and secondary colors - Color addition and subtraction - Optical Emissions: Luminescence, photoluminescence, cathodoluminescence - electroluminescence - Injection electro Luminescence - Displays (Working principles): Plasma display, LED display, Liquid crystal display (LCD) and Numeric display.

**List of Experiments****30 Hours**

1. Determination of Laser parameters - Wave length and particle size
2. Determination of Acceptance angle and Numerical aperture of an optical fiber
3. Determination of band gap of semi conducting material - Thermistor
4. Light Illumination characteristics of Light Dependent Resistor
5. Thickness of thin material - Air wedge
6. Determination of wavelength of the given light source using spectrometer

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO1: Explain the fundamentals of light and properties of electromagnetic spectrum                    | Understand             |
| CO2: Explain the application of Laser through their properties                                       | Understand             |
| CO3: Differentiate various types of optical fiber and its usefulness towards industrial applications | Understand             |
| CO4: Explain the suitable methodology for fabricating integrated circuits                            | Understand             |
| CO5: Describe the concept of colors and luminescence in various display devices                      | Understand             |

**Text Book(s):**

- T1. M. N. Avadhanulu and P. G. Kshirsagar, "Text Book of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2018.
- T2. David Armitage, "Introduction to Micro displays", John Wiley & Ltd, 2006.

T3. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 3<sup>rd</sup> Edition, New Age International Pvt. Ltd, 2010

**Reference Book(s):**

R1. D. Halliday., R. Resnick and J. Walker, "Fundamentals of Physics", Wiley Publications, 10<sup>th</sup> Edition, 2014

R2. Ajoy Ghatak, "Optics", Tata McGraw-Hill Education, New Delhi, 5<sup>th</sup> Edition, 2012.

R3. A. Marikani, "Engineering Physics", 2<sup>nd</sup> Edition, PHI Learning, New Delhi, 2014.

R4. Dr. Jayaraman, V. Umadevi, S. Maruthamuthu and B. Saravanakumar, "Engineering

**Web References:**

1. [https://onlinecourses.nptel.ac.in/noc17\\_cy07/preview](https://onlinecourses.nptel.ac.in/noc17_cy07/preview)
2. [https://onlinecourses.nptel.ac.in/noc17\\_ph01/preview](https://onlinecourses.nptel.ac.in/noc17_ph01/preview)
3. <http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>

**Course Articulation Matrix**

| CO  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| CO1 | 2    | 1    | 1    | -    | -    | -    | 1    | 2    | 3    | 2    | -    | 1    | -    | -    |
| CO2 | 2    | 1    | 1    | -    | -    | -    | 1    | 2    | 3    | 2    | -    | 1    | -    | -    |
| CO3 | 2    | 1    | 1    | -    | -    | -    | 1    | 2    | 3    | 2    | -    | 1    | -    | -    |
| CO4 | 2    | 1    | 1    | -    | -    | -    | 1    | 2    | 3    | 2    | -    | 1    | -    | -    |
| CO5 | 2    | 1    | 1    | -    | -    | -    | 1    | 1    | -    | 1    | -    | 1    | -    | -    |

High-3; Medium-2; Low-1

|   |   |                                |                       |
|---|---|--------------------------------|-----------------------|
| <b>Course Code: 19ECSC2201</b>              | <b>Course Title: Digital System Design<br/>(common to CS, IT, AD, AM &amp;SC)</b> |                                |                       |
| <b>Course Category: Engineering Science</b> | <b>Course Level: Introductory</b>   |                                |                       |
| <b>L:T:P(Hours/Week)<br/>2: 0: 2</b>        | <b>Credits: 3</b>   | <b>Total Contact Hours: 60</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Introduction to Electrical and Electronics Engineering

### **Course Objectives**

The course is intended to:

1. Identify and explain fundamental concepts of digital logic design
2. Explain logic processes and implement logical operations using combinational logic circuits
3. Understand concepts of synchronous sequential circuits and to analyze synchronous sequential systems
4. Understand concepts of asynchronous sequential circuits and to analyze asynchronous sequential systems
5. Understand the basic computer system and the peripherals

#### **Unit I          Digital Fundamentals**

**6 Hours**

Number System Representation and Conversion - Logic Gates, Universal Gates - Boolean Algebra and Simplification Techniques: SOP - POS and Karnaugh Map Methods for Boolean Expression Simplification.

#### **Unit II          Combinational Circuits**

**6 Hours**

Implementing Combinational Logic - Arithmetic Circuits: Full Adder - Full Subtractor - Magnitude Comparator - Multiplexer - Demultiplexer - Encoder and Decoder.

#### **Unit III          Synchronous Sequential Circuits**

**6 Hours**

Flip-Flop: RS - JK - T and D - Types of Triggering - Analysis of synchronous sequential circuit - Shift Register.

#### **Unit IV          Asynchronous Sequential Circuits**

**6 Hours**

Analysis of asynchronous sequential circuit - Hazards - Static, Dynamic and Essential Hazards

#### **Unit V          Basic Computer System, Memory and I/O Peripherals**

**6 Hours**

Computer System – Computer Memory - Random Access Memory - Read Only Memory - Expanding Memory Capacity - Input / Output Devices - Secondary Storage.

**List of Experiments****30 Hours**

1. Verification of Boolean theorems using digital logic gates
2. Implementation of combinational circuits using basic gates
3. Logic verification of half adder and full adder
4. Logic verification of Multiplexer / Demultiplexer
5. Logic verification of 4 bit shift register
6. Logic verification of 3 bit binary counter

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:                                 |                        |
| CO1: Explain fundamental concepts in digital logic design                            | Understand             |
| CO2: Explain the design of combinational logic circuits                              | Understand             |
| CO3: Elucidate the analysis of synchronous sequential logic circuits                 | Understand             |
| CO4: Elucidate the analysis of asynchronous sequential logic circuits                | Understand             |
| CO5: Categorize a computer system including Input /Output devices and Memory devices | Understand             |

**Text Book(s):**

- T1. Anil K. Maini, "Digital Electronics Principles, Devices and Applications", John Wiley & Sons, 2007.
- T2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", 6<sup>th</sup> Edition, McGraw-Hill, 2011.

**Reference Book(s):**

- R1. Morris Mano, Michael ciletti, "Digital Degin", 5<sup>th</sup> Edition, Pearson Publication, New Delhi, 2014.
- R2. Charles H.Roth, Jr. "Fundamentals of Logic Design", 7<sup>th</sup> Edition, Jaico publishing House, New Delhi, 2014.
- R3. Tokheim, "Digital Electronics Principles and Applications", Tata McGraw Hill, 6<sup>th</sup> Edition, 2004.
- R4. Leach P Donald, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", 7<sup>th</sup> Edition, Mcgraw Hill, 2010.

**Web References:**

1. [http://www.nptel.ac.in/courses/ 108105132](http://www.nptel.ac.in/courses/108105132)
2. <https://www.surrey.ac.uk/Projects/Labview/boolalegebra/index.html>
3. [https://scilab.in/textbook\\_run/2672/42/5](https://scilab.in/textbook_run/2672/42/5)

**Course Articulation Matrix**

| CO  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| CO1 | 2    | 1    | -    | -    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |
| CO2 | 2    | 1    | -    | -    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |
| CO3 | 2    | 1    | -    | -    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |
| CO4 | 2    | 1    | -    | -    | -    | -    | -    | 2    | 3    | 2    | -    | -    | -    | -    |
| CO5 | 2    | 1    | -    | -    | -    | -    | -    | 1    | -    | 1    | -    | -    | -    | -    |

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADSN2201</b>              | <b>Course Title: Object Oriented Programming with Java</b> |                               |                       |
| <b>Course Category: Engineering Science</b> |  | <b>Course Level: Practice</b> |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 3</b>  | <b>Credits:4.5</b>   | <b>Total Contact Hours:90</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Introduction to C Programming

### **Course Objectives**

The course is intended to:

1. Develop simple java programs using classes, objects and static methods
2. Utilize the principles of inheritance, interfaces and packages
3. Apply the error handling techniques and multithreading concepts
4. Develop java programs using Collection frameworks and built in classes
5. Design java applications using Streams and Java Swing

### **Unit I Introduction**

**9 Hours**

Object Oriented Programming Concepts - Java Features - Data Types -Variables - Constants - Operators - Java Virtual Machine - Classes & Methods - Constructors - Constructors overloading - Static Members - Garbage Collection - Command Line Arguments -Arrays - String Class.

### **Unit II Inheritance, Interfaces and Packages**

**9 Hours**

Class Inheritance: Types - Method Overriding - Super Keyword - Final Variables and Methods - Final Classes - Method Overloading - Abstract Classes and Methods - Interfaces - Packages - Importing Packages - Visibility Control.

### **Unit III Exception Handling and Thread**

**9 Hours**

Exception: Types - Try - Catch - Multiple Catch - Nested Try - Throw - Throws - Finally - Built in Exceptions - User Defined Exceptions - Thread - Extending the Thread Class - Thread Life Cycle -Multithreading.

### **Unit IV Java Collections and Built in Classes**

**9 Hours**

Collection Interfaces - Set, List, Queue, Collections Classes - ArrayList, LinkedList, HashSet - Accessing a Collection via an Iterator -Map interfaces - Utility Classes: String Buffer - StringTokenizer - Math.



**Unit V Streams and GUI Programming****9 Hours**

Streams - Byte Streams - Character Streams – Reading and Writing Files- SWING Basics - Layout Managers -Swing Components: JLabel - JTextField - JButton - JcheckBox - JTextArea - JRadioButton - Event Handling.

**List of Exercises****45 Hours**

1. Write programs using constructors and static members
2. Write programs using Inheritance, and Interfaces
3. Write programs using Method overriding and Packages
4. Write programs using Exception Handling and Thread
5. Write programs using Java Collections and String Tokenizer
6. Write programs using Streams and Swing components

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Develop simple java programs using classes, objects and static methods for solving real time problems | Understand      |
| CO2: Utilize the principles of inheritance, interfaces and packages for achieving the code reusability     | Apply           |
| CO3: Apply the error handling techniques and multithreading concepts to solve the business problems        | Apply           |
| CO4: Develop java programs using Collection frameworks and built in classes for efficient programming      | Apply           |
| CO5: Design java applications using Streams and Java Swing for the real word scenarios                     | Apply           |

**Text Book(s):**

T1. Schildt. Herbert., “Java - The complete Reference”, 11<sup>th</sup> Edition, McGraw Hill Education, 2019.

**Reference Book(s):**

R1. Deitel and Deitel, “Java How to Program”, Prentice Hall, 11<sup>th</sup> Edition, 2017.

R2. Allen B. Downey, Chris Mayfield, “Think Java: How to Think Like a Computer Scientist”, O'Reilly,2016.

**Web References:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_cs84/preview](https://onlinecourses.nptel.ac.in/noc19_cs84/preview)
2. <https://www.w3schools.com/java/>
3. <https://www.tutorialspoint.com/java/index.htm>
4. <http://www.javamex.com>

**Course Articulation Matrix**

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

High-3; Medium-2;Low-1

|   |   |                                |                       |
|---|---|--------------------------------|-----------------------|
| <b>Course Code: 19MESC4001</b>              | <b>Course Title: Engineering Drawing</b><br><b>(Common to AU,CS, EC, EI, IT, ME, AD, AM &amp; SC)</b> |                                |                       |
| <b>Course Category: Engineering Science</b> | <b>Course Level: Introductory</b>   |                                |                       |
| <b>L:T:P (Hours/Week)</b><br><b>1: 0: 3</b> | <b>Credits: 2.5</b>   | <b>Total Contact Hours: 60</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ NIL

### **Course Objectives**

The course is intended to:

1. Develop skills for communication of concepts and ideas
2. Expose them to existing national standards related to technical drawings

#### **Unit I Orthographic Projection**

**12 Hours**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations. Visualization principles – conversion of pictorial into orthographic views.

#### **Unit II Projection of Solids**

**12 Hours**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

#### **Unit III Projection of Sectioned Solids**

**12 Hours**

Sectioning of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by cutting planes inclined to one reference plane and perpendicular to the other – Orthographic views of sections of simple solids.

#### **Unit IV Development of Surfaces**

**12 Hours**

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

#### **Unit V Isometric Projection**

**12 Hours**

Principles of isometric projection - Isometric scale - Isometric projections of simple solids and truncated solids.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Sketch the orthographic projections of the given pictorial view of the object using first angle projection     | Apply                  |
| CO2: Sketch the projections of simple solids such as prism, pyramid, cylinder and cone using rotating object method | Apply                  |
| CO3: Sketch the projections of simple sectioned solids with all necessary dimensions meeting the standards          | Apply                  |
| CO4: Sketch the lateral surface of simple solids using straight line and radial line development methods            | Apply                  |
| CO5: Sketch the isometric view of simple solids and truncated solids using principles of isometric projection       | Apply                  |

**Text Book(s):**

- T1. Cencil Jensen, Jay D.Helsel and Dennis R. Short, “ Engineering Drawing and Design”, Tata McGraw Hill India, New Delhi, 7<sup>th</sup> Edition, 2017.
- T2. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, Gujarat, 53<sup>rd</sup> Edition, 2015.
- T3. K. V. Natrajan, “A Text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai,

**Reference Book(s):**

- R1. BasantAgarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill India, New Delhi, 2<sup>nd</sup> Edition, 2013.
- R2. John K.C., “Engineering Graphics”, PHI Learning, Delhi, 2009.
- R3. Dhananjay A. Jolhe, “Engineering Drawing with an introduction to AutoCAD” Tata McGraw India, New Delhi, 3<sup>rd</sup> Edition, 2008.

**Publications of Bureau of Indian Standards**

1. IS 10711 - 2001: Technical products Documentation - Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) - 2001: Technical products Documentation - Lettering.
3. IS 10714 (Part 20) - 2001 & SP 46 - 2003: Lines for technical drawings.
4. IS 11669 - 1986 & SP 46 - 2003: Dimensioning of Technical Drawings.

**Web References:**

1. Engineering Drawing - <http://nptel.ac.in/courses/112103019/>
2. [https://en.wikipedia.org/wiki/Engineering\\_drawing](https://en.wikipedia.org/wiki/Engineering_drawing)

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |   |                        |  |
|---|---|------------------------|--|
| <b>Course Code: 19CHMG6201</b>                      | <b>Course Title: Environmental Sciences<br/>(Common to all B.E/B.Tech Programmes)</b> |                        |  |
| <b>Course Category: Mandatory Non-Credit Course</b> | <b>Course Level: Introductory</b>   |                        |  |
| <b>L:T:P(Hours/Week)<br/>1: 0: 0</b>                | <b>Total Contact Hours:15</b>   | <b>Max. Marks: 100</b> |  |

#### **Pre-requisites**

➤ NIL

#### **Course Objectives**

The course is intended to:

1. Create awareness for conservation and equitable use of natural resources.
2. Explain the measures of prevention of pollution and disaster management.
3. State the importance of environmental legislation in India.
4. Expose the general environmental issues relevant to human health.
5. Explain the innovative measures for day to day environmental issues.

#### **Unit I Natural Resources**

**2 Hours**

Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

#### **Unit II Environmental Pollution and Disaster Management**

**2 Hours**

Role of an individual in prevention of pollution; Disaster management : floods, earthquake, cyclone and landslides.

#### **Unit III Environmental Ethics and Legislations**

**2 Hours**

Environmental ethics : Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.

#### **Unit IV Environmental Issues and Public Awareness**

**2 Hours**

Public awareness - Environment and human health

#### **Unit V Environmental Activities**

**7 Hours**

##### **(a) Awareness Activities:**

- i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
- ii) Slogan making event
- iii) Poster making event

**(b) Actual Activities:**

- i) Plantation
- ii) Cleanliness drive
- iii) Drive for segregation of waste
- iv) To know about the different varieties of plants
- v) Shutting down the fans and ACs of the campus for an hour or so

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:                               |                 |
| CO1: Describe the measures for conservation and equitable use of natural Resources | Understand      |
| CO2: Describe the measures for pollution prevention and disaster Management        | Understand      |
| CO3: Brief the importance of environmental legislation in India                    | Understand      |
| CO4: Explain the general environmental issues in relevant to human health          | Understand      |
| CO5: Demonstrate innovative measures for day to day environmental issues           | Understand      |

**Text Book(s):**

- T1. Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi, 2006.
- T2. Mackenzie Davis and Susan Masten, "Principles of environmental engineering and science", Mc-Graw Hill, 3<sup>rd</sup> Edition, 2014.

**Reference Book(s):**

- R1. Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, Enviro Media.
- R2. Cunningham, W.P.Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |
| CO2 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |
| CO3 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |
| CO4 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |
| CO5 | 1   | -   | -   | -   | -   | -   | -   | 2   | 1   | 2    | -    | -    | -    | -    |

High-3; Medium-2; Low-1

|                                       |                  |   |                      |
|---------------------------------------|------------------|---|----------------------|
| <b>Course Code: 23VAT101</b>          |                  | <b>Course Title: HERITAGE OF TAMILS<br/>(Common to all B.E/B.Tech Programmes)</b> |                      |
| <b>Course Category: Humanities</b>    |                  | <b>Course Level: Introductory</b>   |                      |
| <b>L:T:P (Hours/Week)<br/>1: 0 :0</b> | <b>Credit: 1</b> | <b>Total Contact Hours: 15</b>  | <b>Max Marks:100</b> |

### Pre-requisites

➤ NIL

### Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

**CO.1** மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்ள இயலும்.

**CO.2** இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்ள இயலும்.

### தமிழர் மரபு

#### அலகு 1 - மொழி மற்றும் இலக்கியம்

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

#### அலகு 2 - மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதாங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

#### அலகு 3 - நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.



**அலகு 4 - தமிழர்களின் திணைக் கோட்பாடுகள்****3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக் கோட்பாடு - சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு 5 - இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு****3**

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுய மரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப் படிக்கல்- தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

**TOTAL : 15 PERIODS**

| Course Outcomes               |  | Cognitive Level        |
|-------------------------------|--|------------------------|
| மாணவர்கள் இப்பாடத்தை கற்றபின் |  |                        |
| CO.1                          | மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்வார்கள். | அறிதல்<br>(Understand) |
| CO.2                          | இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்வார்கள்.  | அறிதல்<br>(Understand) |

## TEXT - CUM REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by:  
Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

## Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |

High-3; Medium-2; Low-1

|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 23VAT101</b>                |                  | <b>Course Title: HERITAGE OF TAMILS</b><br>(Common to all B.E/B.Tech Programmes) |                      |
| <b>Course Category: Humanities</b>          |                  | <b>Course Level: Introductory</b>  |                      |
| <b>L:T:P (Hours/Week)</b><br><b>1: 0 :0</b> | <b>Credit: 1</b> | <b>Total Contact Hours: 15</b>   | <b>Max Marks:100</b> |

#### **Pre-requisites**

➤ NIL

#### **Course Objectives**

The course is intended to:

1. Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinaï Concept.
2. Understand the Contribution of Tamils to Indian National Movement and Indian Culture.

### **HERITAGE OF TAMILS**

#### **UNIT I LANGUAGE AND LITERATURE**

**3**

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

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

**3**

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

**UNIT III FOLK AND MARTIAL ARTS****3**

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

**UNIT IV THINAI CONCEPT OF TAMILS****3**

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

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

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

**TOTAL : 15 PERIODS**

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO.1 Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinaï Concept. | Understand             |
| CO.2 Understand the Contribution of Tamils to Indian National Movement and Indian Culture.   | Understand             |

## TEXT - CUM REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by:  
Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

### Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |

High-3; Medium-2; Low-1

### Semester III

|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19MABN1302</b>              |                  | <b>Course Title: Probability and Statistics for Data Science</b> |                      |
| <b>Course Category: Basic Science</b>       |                  | <b>Course Level: Introductory</b>                                |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 1: 0</b> | <b>Credits:4</b> | <b>Total Contact Hours:60</b>                                    | <b>Max Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Calculate expectations and variances of random variables and solve practical problems using standard distributions
2. Calculate the correlation and regression for two variables
3. Test the samples based on hypothesis
4. Analyze the samples based on variance
5. Acquire the knowledge of control charts

#### **Unit I Probability and Random Variables**

**9+3 Hours**

Axioms of Probability- Conditional Probability- Total Probability -Baye's Theorem- Random Variables- Probability Mass Function- Probability Density Functions- Properties - Moments- Moment generating functions and their properties- Binomial- Poisson- Uniform –Exponential- Normal Distributions and their properties.

#### **Unit II Two Dimensional Random Variables**

**9+3 Hours**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression using least square method – Transformation of random variables.

#### **Unit III Testing of Hypotheses**

**9+3 Hours**

Sampling Distributions- Estimation of parameters-Testing of hypotheses for mean, variance, proportions and differences using Normal, t, Chi-Square and F distributions – Tests for independence of attributes and Goodness of fit.

#### **UNIT IV Design of Experiments**

**9+3 Hours**

Analysis of Variance (ANOVA)- One way Classification – Completely Randomized Design(CRD) – Two way Classification – Randomized Block Design (RBD) – Latin square.

#### **Unit V Statistical Quality Control**

**9+3 Hours**

Control charts for measurements(X and R Charts)-Control charts for attributes (p,c and np charts –Tolerance limits-Acceptance sampling.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Apply the concepts of random variables and solve practical problems using standard distributions | Apply           |
| CO2: Calculate the correlation and regression for two variables                                       | Apply           |
| CO3: Test the samples based on hypothesis   | Apply           |
| CO4: Analyze the samples based on variance  | Apply           |
| CO5: Construct group control chart, draw charts for variables and attributes.                         | Apply           |

### Text Book(s):

- T1. Veerajan T, "Probability, Statistics and Random process", 3<sup>rd</sup> Edition, Tata McGraw-Hill, New Delhi, 2017.
- T2. Dr.J.Ravichandran, "Probability and Statistics for Engineers", 1<sup>st</sup> Edition, Wiley India Pvt. Ltd., 2010.

### Reference Book(s):

- R1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", 9<sup>th</sup> Edition Pearson Education, Asia, 2013.
- R2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", 4<sup>th</sup> Edition Tata McGraw Hill edition, 2012.
- R3. Morris DeGroot, Mark Schervish, "Probability and Statistics", Pearson Educational Ltd, 4<sup>th</sup> Edition, 2014.
- R4. M.R. Spiegel, L.J. Stephens, "Schaum's Outlines Theory and Problems of Statistics", 3<sup>rd</sup> edition, McGraw Hill International edition, 1999.

### Web References:

1. <https://onlinecourses.nptel.ac.in/111105041/>
2. <https://nptel.ac.in/downloads/111105041/>
3. <https://nptel.ac.in/courses/111105090/>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1





| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Describe the importance of data structures and the notations used in algorithm analysis   | Understand      |
| CO2: Perform operations on List data structures for various applications   | Apply           |
| CO3: Perform operations on Stack and Queue data structures for various applications  | Apply           |
| CO4: Apply suitable methods for efficient data access through hashing and determine the complexity of algorithms using mathematical analysis | Apply           |
| CO5: Compare the efficiency of brute force & divide and conquer techniques for problem solving   | Apply           |

#### Text Book(s):

T1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 2<sup>nd</sup> Edition, Pearson Education, 2011.

T2. AnanyLevitin, "Introduction to the Design & Analysis of Algorithms", 3<sup>rd</sup> Edition, Pearson Education, 2011.

#### Reference Book(s):

R1. SartajSahni, "Data Structures, Algorithms and Applications in C++", 2<sup>nd</sup> Edition, Universities Press, 2005.

R2. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structures and Algorithms in C++", 2<sup>nd</sup> Edition, John Wiley & Sons, 2010.

R3. Cormen.T.H.,Leiserson.C.E., Rivest. R.L. and Stein.C., "Introduction to Algorithms", PHI Pvt. Ltd., 2001.

#### Web Reference(s):

1. Animation of Various Data Structures URL:<http://visualgo.net/>
2. NPTEL Course Content URL: <http://nptel.ac.in/courses/106102064/> Data Structures and Algorithms
3. The Animation of Recursion URL: <http://www.animatedrecursion.com/>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |  |                       |
|---|------------------|--|-----------------------|
| <b>Course Code: 19ADCN1302</b>              |                  | <b>Course Title: Computer Architecture</b> |                       |
| <b>Course Category: Professional Core</b>   |                  | <b>Course Level: Practice</b>              |                       |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b> | <b>Total Contact Hours:45</b>              | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Describe the memory organization and various addressing modes
2. Explain the various components of the processing unit and bus organization
3. Design cache memory organization
4. Use various pipeline techniques
5. Describe the various Parallel Processing architectures

#### **Unit I Memory Organization and Addressing**

**9 Hours**

Evolution of Microprocessor – Basic Processor Architecture – Operational concepts – Performance – Memory location – Memory Operations – Instructions and sequencing – Addressing modes – CISC Vs RISC – DMA.

#### **Unit II Input / Output and Basic Processing Unit**

**9 Hours**

Accessing I/O devices – Interrupts – Buses – Instruction Execution – Hardware Components – Instruction Fetch and Execution Steps – Control Signals – Hardwired Control, CISC Style Processors: Micro programmed Control.

#### **Unit III Cache Memory Design**

**9 Hours**

Characteristics of Memory Systems – Cache Memory Principles – Elements of Cache Design – Mapping Function – Example of Mapping Techniques – Replacement Algorithms – Performance Consideration.

#### **Unit IV Pipelining**

**9 Hours**

Pipelining Concept – Pipeline Organization and issues- Data Dependencies – Memory Delays – Branch Delays – Resource Limitations – Performance Evaluation – Superscalar operation– Pipelining in CISC Processors

#### **Unit V Parallelism**

**9 Hours**

Instruction Level Parallelism – Parallel Processing Challenges – Flynn's Classification – Hardware multithreading – Multicore Processors: GPU, Multiprocessor Network Topologies – Case Study: ARM, Intel 32/64.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Describe the memory organization and various addressing modes with example                           | Understand             |
| CO2: Explain the various components of the processing unit and bus organization for instruction execution | Understand             |
| CO3: Design cache memory organization using various mapping techniques                                    | Apply                  |
| CO4: Use various pipeline techniques to improve the performance of processors                             | Apply                  |
| CO5: Describe the various Parallel Processing architectures to implement parallelism                      | Understand             |

### **Text Book(s):**

- T1. Carl Hamacher, Zvonok Vranesic, Safwat Zaky, NaraigManjikian “Computer Organization and Embedded Systems”, 6<sup>th</sup> Edition, McGraw Hill, 2012. (Unit 1,2,3,4)
- T2. David A. Patterson and John L. Hennessey, “Computer Organization and Design: The Hardware/Software Interface”, 5<sup>th</sup> Edition, Morgan Kauffman / Elsevier, 2014.(Unit 5)

### **Reference Book(s):**

- R1. William Stallings, “Computer Organization and Architecture: Designing for Performance”, 10<sup>th</sup> Edition, Pearson Education, 2016.
- R2. S.S.S.P.Rao, “Basics of Computer Organisation and Architecture: Problems and Solutions”, Alpha Science International Ltd, 2014.
- R3. John L. Hennessey and David A. Patterson, “Computer Architecture: A Quantitative Approach”, Morgan Kauffman / Elsevier, 5<sup>th</sup> Edition, 2012

### **Web Reference(s):**

1. Computer Architecture – Coursera URL:  
<https://www.coursera.org/lecture/comparch/course-introduction-Ouq7L>
2. Computer System Architecture-MIT Open Courseware Notes URL:  
<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-823-computer-system-architecture-fall-2005/index.htm>
3. Computer Architecture: NPTEL Course URL: <http://www.nptel.ac.in/courses/106102062/>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|  |                                  |                               |                       |
|--|----------------------------------|-------------------------------|-----------------------|
| <b>Course Code: 19ADCN1303</b>             | <b>Course Title: Data Mining</b> |                               |                       |
| <b>Course Category: Professional Core</b>  | <b>Course Level: Practice</b>    |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b>                 | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ NIL

#### **Course Objectives**

The course is intended to:

1. Distinguish the types of data to be pre-processed for the given dataset
2. Describe the basic principles, concepts and applications of data warehousing
3. Categorize the kinds of patterns that are discovered by association rule mining
4. Classify data for the given dataset.
5. Analyze the data mining trends and applications.

#### **Unit I Introduction 10 Hours**

Introduction to Data Mining: Kinds of Data – Kinds of Patterns – Technologies - Applications – Issues - Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity - Preprocessing: Data Quality - Major Tasks in Data Preprocessing - Data Reduction – Data Transformation and Data Discretization - Data Cleaning and Data Integration.

#### **Unit II Data Warehousing 8 Hours**

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.

#### **Unit III Association 9 Hours**

Mining Frequent Patterns - Associations and Correlations: Basic Concepts and Methods: Frequent Item set Mining Methods, Pattern Evaluation Methods, Frequent Pattern and Association Mining: A Road Map, Multidimensional Space, Constraint-Based Frequent Pattern Mining, Applications of frequent pattern Mining.

#### **Unit IV Classification and Clustering 10 Hours**

Classification: Basic Concepts - Decision Tree Induction – Bayes Classification Methods – Rule Based Classification – K-Nearest-Neighbor Classifier - Model Evaluation and Selection – Techniques to Improve Classification Accuracy. Cluster Analysis: Basic Concepts and Methods- Cluster Analysis - Partitioning Methods - Hierarchical Methods - Density-Based Methods - Grid-Based Methods.

**UNIT V      Data Mining Trends****8 Hours**

Mining Complex Data Types - Statistical Data Mining - Views on Data Mining Foundations  
-Visual and Audio Data Mining - Data Mining Applications - Data Mining and Society - Data Mining Trends.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Distinguish the types of data to be pre-processed for the given dataset using the preprocessing technique. | Apply                  |
| CO2: Describe the basic principles, concepts and applications of data warehousing in real world scenario.       | Apply                  |
| CO3: Categorize the kinds of patterns that are discovered by association rule mining for transaction database   | Analyze                |
| CO4: Classify data for the given dataset using real world applications  | Apply                  |
| CO5: Analyze the data mining trends and applications for societal problems                                      | Analyze                |

**Text Book(s):**

T1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3<sup>rd</sup> Edition, Elsevier, 2012.

**Reference Book(s):**

R1. Jure Leskovec, Anand Rajaraman, Jeffery David Ullman, "Mining of Massive Datasets", 2<sup>nd</sup> Edition, Cambridge University Press, 2014.

R2. Ian H.Witten, Eibe Frank, Mark A.Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3<sup>rd</sup> Edition, Elsevier, 2011.

R3. EMC Education Services, "Data Science and Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data", Wiley, 2015.

R4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons 2013.

**Web References:**

1. <http://www.cs.waikato.ac.nz/ml/weka/documentation.html>
2. <https://cran.r-project.org/manuals.html>
3. <https://archive.ics.uci.edu/ml/index.html>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |                                       |                      |
|---|------------------|---------------------------------------|----------------------|
| <b>Course Code: 19ADCN2301</b>              |                  | <b>Course Title: Database Systems</b> |                      |
| <b>Course Category: Professional Core</b>   |                  | <b>Course Level: Practice</b>         |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 2</b> | <b>Credits:4</b> | <b>Total Contact Hours:75</b>         | <b>Max Marks:100</b> |

### Pre-requisites

➤ NIL

### Course Objectives

The course is intended to:

1. Describe the functions and architecture of database management system
2. Design relational databases using ER model and normalization concepts
3. Construct SQL queries using DDL, DML and DCL commands
4. Develop applications using database connectivity through advanced SQL concepts
5. Explain the concurrency control and recovery mechanisms

### **Unit I Foundations of DBMS 7 Hours**

File System – Database System – File System Vs. DBMS – Roles in DBMS Environment – Data Models and Conceptual Modeling – Functions of DBMS – Components of DBMS – Multi user DBMS Architecture.

### **Unit II Relational Model, ER Model and Normalization 10 Hours**

Relational Model: Terminology, Integrity Constraints – Relational Algebra – ER Modeling: Concepts, Relationship Types, Attributes, Structural Constraints – Normalization: Data Redundancy and Update Anomalies, Functional Dependencies, 1NF, 2NF, 3NF, BCNF.

### **Unit III SQL Fundamentals 10 Hours**

SQL: Overview of Query Language, Data Types, Data Definition, Views, Access Control – Data Manipulation – Joins – Nested Queries.

### **Unit IV Advanced SQL and Query Processing 9 Hours**

Advanced SQL: Functions and procedures, Cursors, Triggers – Accessing SQL from a Programming Language – Query Processing: Decomposition, Heuristical Approach to Query Optimization, Cost Estimation for Relational Algebra Operations.

### **Unit V Transaction and Concurrency Control 9 Hours**

Transaction: Properties – Concurrency Control: Locking methods, Deadlock, Timestamp Ordering, Multi-version Timestamp Ordering, Optimistic Techniques – Database Recovery: Transaction and Recovery, Recovery facilities, Recovery Techniques.



**List of Exercises****30 Hours**

1. Design a database using ER diagrams
2. Create and modify the tables using DDL commands and manipulate the data using DML commands
3. Implement Joins and nested queries
4. Implement Functions and procedures
5. Create Cursors and Triggers
6. Access database through programming language

**The suggested applications are (not limited to)**

1. Library management system
2. Hotel Management system
3. Student management system
4. Ticket reservation system
5. Hospital management system
6. Employee management system

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Describe the functions and architecture of database management system using its components                       | Understand             |
| CO2: Design relational databases using ER model and normalization concepts for real world scenarios                   | Apply                  |
| CO3: Construct SQL queries using DDL, DML and DCL commands for effective retrieval of data from database              | Apply                  |
| CO4: Develop applications using database connectivity through advanced SQL Concepts for solving real world problems   | Apply                  |
| CO5: Explain the concurrency control and recovery mechanisms to manage multiple transactions in real time application | Understand             |

**Text Book(s):**

- T1. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", 6<sup>th</sup> Edition, Pearson Education, 2015.
- T2. A Silberschatz, H Korth, S Sudarshan, "Database System Concepts", 7<sup>th</sup> Edition, McGraw-Hill, 2019.

**Reference Book(s):**

- R1. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7<sup>th</sup> Edition, Pearson Education, 2017.
- R2. C.J. Date, A. Kannan and S. Swamynathan– "An Introduction to Database Systems", 8<sup>th</sup> Edition, Pearson Education, 2006.

**Web References:**

1. Text book handouts: <http://www.inf.unibz.it/~nutt/IDBs1011/idbs-slides.html>
2. NPTEL lecture videos and notes: <https://nptel.ac.in/courses/106106093/>
3. SQL practice exercises with solutions: <https://www.w3resource.com/sql-exercises/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |                    |   |                      |
|---|--------------------|---|----------------------|
| <b>Course Code: 19ADCN3301</b>              |                    | <b>Course Title:Data Structures and Algorithm Analysis Laboratory</b> |                      |
| <b>Course Category: Professional Core</b>   |                    | <b>Course Level: Practice</b>   |                      |
| <b>L:T:P (Hours/Week)</b><br><b>0: 0: 3</b> | <b>Credits:1.5</b> | <b>Total Contact Hours:45</b>   | <b>Max Marks:100</b> |

#### **Pre-requisites**

- Introduction to C Programming

#### **Course Objectives**

The course is intended to:

1. Implement list data structures using array and linked list
2. Implement stack data structure for various applications
3. Implement queue data structure and hashing techniques
4. Compare the efficiency of Brute-Force and Divide & Conquer approaches

#### **List of Exercises**

1. Implementation of List using array representation
2. Implementation of List using linked list representation
3. Implementation of Doubly linked list
4. Implementation of Stack application: Balancing parenthesis
5. Implementation of Stack application: Evaluation of postfix expression
6. Implementation of Circular Queue using array representation
7. Implementation of Hashing
8. Implementation of String Matching algorithm
9. Implementation of Searching techniques
10. Implementation of Sorting techniques: Bubble and Merge sort

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Implement list data structures and perform various operations using array and linked list representation.    | Apply                  |
| CO2: Implement stack data structure for various applications using array representation                           | Apply                  |
| CO3: Implement circular queue using array and hashing techniques for efficient data handling in various scenarios | Apply                  |
| CO4: Compare the efficiency of Brute-Force and Divide & Conquer approaches for solving problems.                  | Apply                  |

**Text Book(s):**

- T1. Mark A. Weiss., “Data Structures and Algorithm Analysis in C”, 2<sup>nd</sup> Edition, Pearson Education, 2011.
- T2. Anany Levitin, “Introduction to the Design & Analysis of Algorithms”, Pearson Education,

**Reference Book(s):**

- R1. Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, 2<sup>nd</sup> Edition, Universities
- R2. Michael T. Goodrich, Roberto Tamassia, David M. Mount, “Data Structures and Algorithms in C++”, 2<sup>nd</sup> Edition, John Wiley & Sons, 2010.
- R3. Cormen.T.H.,Leiserson.C.E., Rivest. R.L. and Stein.C., “Introduction to Algorithms”, PHI Pvt. Ltd., 2001.

**Web References:**

1. Animation of Various Data Structures URL:<http://visualgo.net/>
2. NPTEL Course Content URL: <http://nptel.ac.in/courses/106102064/> Data Structures and Algorithms
3. The Animation of Recursion URL: <http://www.animatedrecursion.com/>

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3   | 2   | 2   | 2   | 2   | -   | -   | 2   | 3   | 2    | -    | 1    | 3    | 1    |
| CO2 | 3   | 2   | 2   | 2   | 2   | 1   | -   | 2   | 3   | 2    | -    | 1    | 3    | 1    |
| CO3 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 1    |
| CO4 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 1    |

High-3; Medium-2;Low-1

|   |                    |   |                      |
|---|--------------------|---|----------------------|
| <b>Course Code: 19ADCN4301</b>                |                    | <b>Course Title: Python Programming for Data Engineers Laboratory</b> |                      |
| <b>Course Category: Professional Core</b>     |                    | <b>Course Level: Practice</b>   |                      |
| <b>L: T: P (Hours/Week)</b><br><b>1: 0: 3</b> | <b>Credits:2.5</b> | <b>Total Contact Hours:</b><br><b>60</b>                              | <b>Max Marks:100</b> |

### **Pre-requisites**

- Object Oriented Programming with Java

### **Course Objectives**

The course is intended to:

1. Develop Python programs using variables and statements
2. Utilize suitable data structures for a given problem
3. Create classes and objects for given business requirement
4. Create a GUI based application with data persistence

### **Unit I Introduction to Python and Data Structures 7 Hours**

Introduction to Python- Variables, Expressions and Statements – File handling operations- Conditionals - Lists- Tuples- -Dictionaries – Strings –Functions.

### **Unit II OOPS Concepts and GUI Programming in Python 8 Hours**

Classes- Creating Instance Objects- Built-In Class Attributes- Inheritance- TKinter – Widget creation- Database Connection: INSERT - READ - UPDATE - DELETE Operation-GUI application with database connection.

### **List of Exercises 45 Hours**

1. Implement data types, operators and expressions
2. Implementation of branching statements, looping constructs & functions
3. Implementation of list, tuple and dictionary
4. Implementation of file handling techniques
5. Implementation of class and objects with exception handling
6. Implementation of polymorphism
7. Implementation of Inheritance
8. Implementation of pickle and shelve objects
9. Implement Database Connectivity with SQL Server
10. Design a GUI programming with Tkinter for given application

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:                                  |                        |
| CO1: Develop Python programs using variables and statements for simple business logic | Apply                  |
| CO2: Utilize suitable data structures for a given problem and its constraints         | Apply                  |
| CO3: Create classes and objects for provided business requirement                     | Apply                  |
| CO4: Create a GUI based application with data persistence using databases             | Apply                  |

### **Reference Book(s):**

R1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python", 3rd Edition, O'Reilly, 2016.

R2. Mark Lutz, "Powerful Object Oriented Programming Python", 4<sup>th</sup> Edition, O'Reilly, 2012

### **Web References:**

1. <https://docs.python.org/3/tutorial/>

2. <https://www.pyschools.com/>

### **Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3   | 2   | 2   | 2   | 3   | 1   | 1   | 2   | 3   | 2    | 2    | 2    | 3    | 3    |
| CO2 | 3   | 2   | 2   | 2   | 3   | 1   | 1   | 2   | 3   | 2    | 2    | 2    | 3    | 3    |
| CO3 | 3   | 2   | 2   | 2   | 3   | 1   | 1   | 2   | 3   | 2    | 2    | 2    | 3    | 3    |
| CO4 | 3   | 2   | 2   | 2   | 3   | 1   | 1   | 2   | 3   | 2    | 2    | 2    | 3    | 3    |

High-3; Medium-2; Low-1

|  |                  |  |                      |
|--|------------------|--|----------------------|
| <b>Course Code: 19PSHG6002</b>             |                  | <b>Course Title: Universal Human Values 2 :Understanding Harmony (common to all B.E/B.Tech programmes)</b> |                      |
| <b>Course Category: Humanities</b>         |                  | <b>Course Level: Practice</b>  |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2:1: 0</b> | <b>Credits:3</b> | <b>Total Contact Hours:45</b>  | <b>Max Marks:100</b> |

#### **Pre-requisites**

- Induction Program (UHV 1)

#### **Course Objectives**

The course is intended to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Strengthening of self-reflection
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Development of commitment and courage to act

#### **Unit I Introduction to Value Education**

**6+3 Hours**

Need for the Value Education;. Self -exploration as the process for value education ; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding: Relationship and Physical Facilities ; Happiness and Prosperity: current scenario ; Method to fulfill the Basic human aspirations

#### **Unit II Harmony in Human Being**

**6+3 Hours**

Human being as a co-existence of self ('I') and the material 'Body'; needs of Self ('I') and 'Body'; The Body as an instrument of 'I' ; Harmony in the self('I'); Harmony of the self('I') with body ;Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

#### **Unit III Harmony in the Family and Society**

**6+3 Hours**

Harmony in the Family the basic unit of human interaction; Values in human to human relationship; Trust as the foundational values of relationship; Respect as the right evaluation ;Understanding harmony in the society ( society being an extension of family); Vision for the universal human order

#### **Unit IV Harmony in the Nature**

**6+3 Hours**

Understanding the harmony in the Nature Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature; Existence as Co-existence at all levels; Holistic perception of harmony in existence.

**Unit V Harmony on Professional Ethics****6+3 Hours**

Natural acceptance of human values ;Definitiveness of Ethical Human Conduct; Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics ;Case study: holistic technologies, management models and production systems ;Strategy for transition towards value based life and profession

| <b>Course Outcomes</b>   | <b>Affective Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO1. Reflect on values, aspiration, relationships and hence identify strengths and weaknesses.                                 | Responding             |
| CO2. Appraise physical, mental and social well being of self and practice techniques to promote well being.                    | Responding             |
| CO3. Value human relationships in family and society and maintain harmonious relationships.                                    | Valuing                |
| CO4. Respect nature and its existence for survival and sustainable of all life forms and hence practice conservation of nature | Valuing                |
| CO5. Appreciate ethical behaviour as a result of value system in personal and professional situations                          | Receiving              |

**Text Book(s):**

T1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

**Reference Book(s):**

R1.Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

R2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

R3. The story of stuff, Annie Leonard, Free Press, New York 2010.

**Web References:**

1. <https://aktu.ac.in/hvpe/ResourceVideo.aspx>
2. <http://hvpenotes.blogspot.com/>
3. <https://nptel.ac.in/courses/109/104/109104068/>

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | 1   | 2   | 2   | -    | -    | 2    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | 1   | 2   | 2   | 2   | 1    | -    | 2    | -    | -    |
| CO3 | -   | -   | -   | -   | -   | 2   | 2   | 2   | 2   | 1    | -    | 2    | -    | -    |
| CO4 | -   | -   | -   | -   | -   | 2   | 2   | 2   | 2   | -    | -    | 2    | -    | -    |
| CO5 | -   | -   | -   | -   | -   | 1   | 2   | 2   | 2   | -    | -    | 2    | -    | -    |

High-3; Medium-2; Low-1



|                                       |                  |   |                      |
|---------------------------------------|------------------|---|----------------------|
| <b>Course Code: 23VAT201</b>          |                  | <b>Course Title:TAMILS AND TECHNOLOGY<br/>(Common to all B.E/B.Tech Programmes)</b> |                      |
| <b>Course Category: Humanities</b>    |                  | <b>Course Level: Introductory</b>   |                      |
| <b>L:T:P (Hours/Week)<br/>1: 0 :0</b> | <b>Credit: 1</b> | <b>Total Contact Hours: 15</b>  | <b>Max Marks:100</b> |

### Pre-requisites

➤ NIL

### Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

- CO.1** நெசவு மற்றும் பாணைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்ள இயலும்.
- CO.2** அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்ள இயலும்.

### தமிழரும் தொழில்நுட்பமும்

#### அலகு 1 - நெசவு மற்றும் பாணைத் தொழில்நுட்பம்

3

சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கிறல் குறியீடுகள்

#### அலகு 2 - வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ஷ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.

#### அலகு 3 - உற்பத்தித் தொழில்நுட்பம்

3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்****3**

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக் குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

**அலகு 5 - அறிவியல் தமிழ் மற்றும் கணினித் தமிழ்****3**

அறிவியல் தமிழின் வளர்ச்சி - கணினித் தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பதிப்பு செய்தல் - தமிழ் மென் பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

**TOTAL : 15 PERIODS**

| Course Outcomes   | Cognitive Level        |
|---|------------------------|
| மாணவர்கள் இப்பாடத்தை கற்றபின்   |                        |
| CO.1 நெசவு மற்றும் பாணைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்வார்கள். | அறிதல்<br>(Understand) |
| CO.2 அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்வார்கள்.   | அறிதல்<br>(Understand) |

## Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |

High-3; Medium-2; Low-1

## TEXT - CUM REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே.பிள்ளை  
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

|                                       |                  |   |                       |
|---------------------------------------|------------------|---|-----------------------|
| <b>Course Code: 19PSHG6004</b>        |                  | <b>Course Title:TAMILS AND TECHNOLOGY<br/>(Common to all B.E/B.Tech Programmes)</b> |                       |
| <b>Course Category: Humanities</b>    |                  | <b>Course Level: Introductory</b>   |                       |
| <b>L:T:P (Hours/Week)<br/>1: 0 :0</b> | <b>Credit: 1</b> | <b>Total Contact Hours: 15</b>  | <b>Max Marks: 100</b> |

### Pre-requisites

➤ NIL

### Course Objectives

The course is intended to:

1. Understand Weaving and Ceramic Technology, Design and Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology.
2. Understand the Scientific Tamil & Tamil Computing.

## TAMILS AND TECHNOLOGY

### UNIT I WEAVING AND CERAMIC TECHNOLOGY

**3**

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

### UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY

**3**

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

### UNIT III MANUFACTURING TECHNOLOGY

**3**

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

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY****3**

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

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

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

**TOTAL : 15 PERIODS**

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO.1 Understand Weaving and Ceramic Technology, Designand Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology. | Understand             |
| CO.2 Understand the Scientific Tamil & Tamil Computing.   | Understand             |

## TEXT - CUM REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

## Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 1    | -    | -    |

High-3; Medium-2; Low-1

### Semester IV

|  |                  |   |                       |
|--|------------------|---|-----------------------|
| <b>Course Code:19MABN1401</b>              |                  | <b>Course Title: Discrete Mathematics for Artificial Intelligence</b> |                       |
| <b>Course Category: Basic Science</b>      |                  | <b>Course Level: Introductory</b>                                     |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 1: 0</b> | <b>Credits:4</b> | <b>Total Contact Hours:60</b>   | <b>Max. Marks:100</b> |

#### **Pre-requisites**

- Linear Algebra and Infinite Series

#### **Course Objectives**

The course is intended to:

1. Use the concepts of propositional logic to test the validity of arguments.
2. Use the concepts of sets, relations and functions in programming.
3. Use combinatorics in counting problems.
4. Use the concepts of groups to study the algebraic structures.
5. Use the fundamental concepts in graph theory in practical problems.

#### **Unit I            Logic**

**9+3 Hours**

Propositions- Logical operators – Logical equivalences and implications - Normal forms –Rules of inference-Consistency and inconsistency- Theory of Inference – Proofs – Predicates-Quantifiers- Universe of discourse – Validity of arguments.

#### **Unit II            Relations, Lattices and Functions**

**9+3 Hours**

Relations –Types of relations – Properties of relations - Equivalence relations –Relational matrix - Graph of relations – Partial ordering relation - Poset – Hasse Diagram - Lattices – Properties of Lattices. Functions - Type of functions: Injective, surjective and bijective functions –Composition of functions – Inverse functions.

#### **Unit III            Combinatorics**

**9+3 Hours**

Mathematical induction- Basics of counting–Pigeon hole principle – Permutations with and without repetition – Circular permutation – Combinations - Recurrence relations-Solution of linear recurrence relations.

#### **Unit IV            Algebraic Structures**

**9+3 Hours**

Algebraic Systems – properties – Semi groups and monoids – Homomorphism – Sub semi groups and sub monoids – Groups – Abelian group – Cyclic group – Cosets – Lagrange's theorem – Codes and Group codes.

**Unit V          Graphs****9+3 Hours**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:                             |                        |
| CO1: Apply logic to test the validity of arguments.                              | Apply                  |
| CO2: Apply the concepts of sets, relations and functions in discrete structures. | Apply                  |
| CO3: Solve the counting problems using combinatorics.                            | Apply                  |
| CO4: Apply the concepts of groups and its properties to algebraic structures.    | Apply                  |
| CO5: Apply the concepts of graph theory to solve practical problems              | Apply                  |

**Text Book(s):**

- T1. J.P.Trembly, R. Manohar, Discrete Mathematical Structures with applications to Computer Science, First edition, TMH International Edition, July 2017.
- T2. T.Veerarajan, "Discrete Mathematical Structures with Graph Theory and Combinatorics", First edition, Tata McGraw-Hill Education Private Limited, New Delhi, July 2017.

**Reference Book(s):**

- R1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Seventh edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, July 2017.
- R2. Ralph P Grimaldi, Ramana. B. V, " Discrete and Combinatorial Mathematics", Fifth Edition, Pearson Education India, 2011.

**Web References:**

1. Logic, Relations: <http://nptel.ac.in/courses/106106094>
2. Combinatorics: <https://nptel.ac.in/courses/111/104/111104026/>
3. Algebraic Structures: <https://nptel.ac.in/courses/106/103/106103205/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1





| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO1: Perform various operations on Binary trees and Heaps for real world applications  | Apply                  |
| CO2: Implement operations on Search tree structures for efficient storage and retrieval of data                              | Apply                  |
| CO3: Perform various operations on Graphs and Sets by using suitable storage organizations                                   | Apply                  |
| CO4: Apply Greedy strategy & Dynamic Programming techniques for solving optimization problems                                | Apply                  |
| CO5: Compare the working of Backtracking & Branch and Bound techniques and choose the suitable technique for problem solving | Apply                  |

#### **Text Book(s):**

- T1. Mark A. Weiss., "Data Structures and Algorithm Analysis in C", 2<sup>nd</sup> Edition, Pearson Education, 2011.
- T2. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 3<sup>rd</sup> Edition, Pearson Education, 2011.

#### **Reference Book(s):**

- R1. Ellis Horowitz, Sartaj Sahni, Rajasekaran, "Fundamentals of Computer Algorithms", 2<sup>nd</sup> Edition, Galgotia Publications, 2010.
- R2. Adam Drozdek, "Data Structures and Algorithms in C++", 4<sup>th</sup> Edition, Cengage Learning, 2013.
- R3. Cormen.T.H.,Leiserson.C.E., Rivest R.L and Stein C, "Introduction to Algorithms", PHIPvt Ltd, 2001.

#### **Web Reference(s):**

1. SWAYAM Course Design and Analysis of Algorithms:  
[https://swayam.gov.in/nd1\\_noc19\\_cs47/preview](https://swayam.gov.in/nd1_noc19_cs47/preview)
2. Animation Videos: <http://www.animatedrecursion.com/>
3. Course Material: THE P VERSUS NP PROBLEM  
<https://www.claymath.org/sites/default/files/pvsnp.pdf>

## Course Articulation Matrix

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

High-3; Medium-2;Low-1

|   |                  |  |                       |
|---|------------------|--|-----------------------|
| <b>Course Code: 19ADCN1402</b>              |                  | <b>Course Title: Artificial Intelligence - I</b> |                       |
| <b>Course Category : Professional Core</b>  |                  | <b>Course Level: Introductory</b>                |                       |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b> | <b>Total Contact Hours:45</b>                    | <b>Max Marks: 100</b> |

### **Pre-requisites**

- Data Structures and Algorithms

### **Course Objectives**

The course is intended to:

1. Describe agent types and behaviour.
2. Compare the efficiency of various searching techniques.
3. Apply real time searching to the given problem
4. Apply Inference rules to the given Knowledge Base
5. Choose the appropriate planning technique.

### **Unit I Introduction to Artificial Intelligence 9 Hours**

Introduction – Definitions - Foundations - History – State of Art – Intelligent Agents: Agents and Environments – The concept of Rationality - Nature of Environments - Structure of Agents - Problem Solving agents

### **Unit II Solving Problems by Searching 9 Hours**

Searching for Solutions – Uninformed Search Strategies : Breadth First, Uniform Cost, Depth First, Depth Limited, Iterative Deepening, Bidirectional Search – Comparison of Uninformed Search Strategies - Informed Search strategies : Greedy BFS, A\* search – Optimality of A\* - Memory Bounded Heuristic Search – Heuristic Functions

### **Unit III Real Time Searching 9 Hours**

Local search algorithms and Optimization Problems – Local Search in Continuous Spaces - Online search agents - Adversarial search – Optimal decision in games - Alpha – Beta Pruning – Imperfect Real Time Decisions - Constraint Satisfaction Problem – Inference in CSPs - Backtracking search for CSP.

### **Unit IV Knowledge and Reasoning 9 Hours**

Logical Agents – Knowledge Based Agents - Propositional Logic – Theorem Proving - Resolution - Forward and Backward chaining – Agents Based on Propositional Logic - First Order Logic - Syntax and Semantics of FOL - Using First Order Logic - Knowledge Engineering in FOL - Inference in FOL - Unification and Lifting - Forward and Backward chaining – Resolution.

**Unit V Planning****9 Hours**

Classical Planning - Planning as State space search - Planning and acting in Real world and Non deterministic domains - Hierarchical planning – Multi-agent planning.

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:                             |                        |
| CO1: Describe the types and behavior of problem solving agents                   | Apply                  |
| CO2: Compare the efficiency of various searching techniques in solving a problem | Apply                  |
| CO3: Apply real time searching technique to solve the given problem              | Apply                  |
| CO4: Apply Inference rules to the given Knowledge Base for theorem proving       | Apply                  |
| CO5: Choose the appropriate planning technique to solve the given problem        | Apply                  |

**Text Book(s):**

T1. Stuart J. Russell, Peter Norvig, “Artificial Intelligence – A modern Approach”, 3rd Edition, Pearson Education Inc., 2021.

**Reference Book(s):**

R1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning, 2019.

R2. Lavika Goel, “Artificial Intelligence – Concepts and Applications”, Wiley, 2021.

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADCN1403</b>              |                  | <b>Course Title: Operating System Principles</b> |                      |
| <b>Course Category: Professional Core</b>   |                  | <b>Course Level: Practice</b>                    |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b> | <b>Total Contact Hours:45</b>                    | <b>Max Marks:100</b> |

#### **Pre-requisites**

➤ NIL

#### **Course Objectives**

The course is intended to:

1. Describe the components of operating systems and its services
2. Solve process scheduling and synchronization problems
3. Compare different memory management techniques
4. Develop solutions for free space management
5. Summarize various administrative tasks in Linux environment

#### **Unit I Introduction**

**9 Hours**

Computer System Organization– Operating System Operations – Kernel Data Structures – Operating Systems Structures: System Components, Operating System Services, System calls, System Programs – Process Concepts: Process Scheduling, Operation on Process, CoOperating process, Inter Process Communication.

#### **Unit II Process Management**

**10 Hours**

CPU scheduling: Scheduling Algorithms – Process Synchronization: The Critical Section Problem, Peterson's Solution, Hardware Support for Synchronization, Mutex Locks, Semaphores, Monitors – Classical problems of Synchronization – Deadlock: Deadlock Characterization – Methods for handling Deadlocks: Deadlock Prevention, Avoidance, Detection and Recovery from Deadlock.

#### **Unit III Memory Management**

**9 Hours**

Main Memory: Contiguous Memory Allocation, Paging, Structure of Page Table, Swapping – Virtual Memory: Demand paging, Copy-on-write, Page Replacement Algorithms, Allocation of Frames, Thrashing.

#### **Unit IV File Systems**

**9 Hours**

Mass Storage System: Disk Structure, Disk Attachment, Disk Scheduling – File System Interface: File Concepts, Access methods, Directory Structure, File Protection – File System Implementation: File System Structure and Operations, Directory Implementation, Allocation methods, Free Space Management.

**Unit V Case Study – Linux****8 Hours**

Design Principles – Kernel Modules – Process Management – Scheduling – Memory Management – File Systems – Input and Output – Inter-process Communication – Network Structure – Security.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO 1: Describe the components of operating systems and its services based on system calls           | Understand      |
| CO 2: Solve process scheduling and synchronization problems using algorithms                        | Apply           |
| CO 3: Compare different memory management techniques using allocation schemes                       | Apply           |
| CO 4: Develop solutions for free space management using file systems and disk scheduling concepts.  | Apply           |
| CO 5: Summarize various administrative tasks in Linux environment using its components and services | Understand      |

**Text Book(s):**

T1. AviSilberschatz, Galvin. P.B. and Gagne. G. “Operating System Concepts”, 10<sup>th</sup> Edition, John Wiley & Sons, 2018.

**Reference Book(s):**

- R1. Andrew S. Tanenbaum, “Modern Operating Systems”, 4<sup>th</sup> Edition, Pearson Education, 2015.
- R2. William Stallings, “Operating Systems Internals and Design Principles”, 9<sup>th</sup> Edition, Pearson Education, 2018.

**Web References:**

1. MIT open course on Operating System Engineering: <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operating-system-engineering-fall-2012/>
2. Bell’s Course Notes on Operating Systems Processes:  
[https://www2.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/3\\_Processes.html](https://www2.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/3_Processes.html)
3. NPTEL course on Operating System Fundamentals:  
<https://nptel.ac.in/courses/106/105/106105214/>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1





| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO 1: Impart the knowledge on Software Life cycle models for Software development process         | Understand      |
| CO 2: Derive the requirements for a Software system through Requirement Engineering process       | Apply           |
| CO 3: Analyze classes with appropriate relationships in problem statement using activity diagrams | Apply           |
| CO 4: Design classes, interface and subsystems by using Interaction and State diagrams            | Apply           |
| CO 5: Develop functional object oriented software, test it with necessary deployment techniques   | Apply           |

#### Text Books:

- T1. Roger. S. Pressman and Bruce R. Maxim, "Software Engineering – A Practitioner's Approach", 8<sup>th</sup> Edition, McGraw Hill, 2015.  
T2. Jim Arlow, Ila Neustadt, "UML2 and The Unified Process: Practical Object Oriented Analysis and Design", Pearson Education, 2015.

#### Reference Books:

- R1. Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", 3<sup>rd</sup> Edition, Addison Wesley Professional, 2015.  
R2. Ian Sommerville, "Software Engineering", 9<sup>th</sup> edition, Pearson Education Asia, 2011.

#### Web References:

1. Roger S.Pressman online learning Center URL:<http://www.mhhe.com/engcs/compsci/pressman/>
2. NPTEL Course on Object Oriented Analysis and Design  
URL:<http://nptel.ac.in/courses/106105153/>

#### Course Articulation Matrix

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

High– 3; Medium– 2; Low– 1

|  |                  |   |                      |
|--|------------------|---|----------------------|
| <b>Course Code: 19ADCN3401</b>             |                  | <b>Course Title: Intelligent systems - I Laboratory</b> |                      |
| <b>Course Category: Professional Core</b>  |                  | <b>Course Level: Practice</b>                           |                      |
| <b>L:T:P(Hours/Week)</b><br><b>0: 0: 4</b> | <b>Credits:2</b> | <b>Total Contact Hours:60</b>                           | <b>Max Marks:100</b> |

### **Pre-requisites**

- Object Oriented Programming with Java

### **Course Objectives**

The course is intended to:

1. Identify the types of data to be pre-processed
2. Generate association rules and cluster the data
3. Analyze the type of search technique
4. Develop AI application

### **List of Exercises**

1. Identification of characteristic of data and perform data pre-processing techniques for any given dataset.
2. Perform data Classification using Decision Tree on the given data set
3. Identification of frequent item set and generation of association rules using Apriori algorithm
4. Cluster the given data set using K-Means clustering algorithm
5. Visualize and analyze the results for the given dataset using different types of charts.
6. Implementation of Breadth First and Depth First searching techniques
7. Implementing state space search algorithms
  - Hill climbing algorithms
  - A\* algorithm
8. Demonstrate the Min-Max algorithm
9. Knowledge representation and inference using first order logic
10. Develop Simple AI applications

**Suggested list (not limited to)**

Chat bot creation, Smart assistants, Natural language processing tools,  
Travel booking agent etc.,

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                        |                 |
| CO1 :Identify the types of data to be pre-processed for the given dataset   | Apply           |
| CO2: Generate association rules and cluster the data for the given data set | Apply           |
| CO3: Analyze the type of search technique over the given scenario.          | Analyze         |
| CO4: Develop AI application to interact with environment                    | Apply           |

**Reference (s):**

- R1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence – A modern Approach", Third Edition, Pearson Education Inc., 2021.
- R2. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier, 2014.

**Course Articulation Matrix**

| CO  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| CO1 | 3    | 2    | 2    | 2    | 2    | 2    | 1    | 2    | 3    | 2    | 1    | 2    | 3    | 3    |
| CO2 | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 3    | 2    | 1    | 2    | 3    | 3    |
| CO3 | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 2    | 3    | 2    | 1    | 2    | 3    | 3    |
| CO4 | 3    | 2    | 2    | 2    | 2    | 2    | 3    | 2    | 3    | 2    | 1    | 2    | 3    | 3    |
| CO5 | 3    | 2    | 2    | 2    | 2    | 2    | 1    | 2    | 3    | 2    | 1    | 2    | 3    | 3    |

High-3; Medium-2; Low-1

|  |                                   |                               |                      |
|--|-----------------------------------|-------------------------------|----------------------|
| <b>Course Code: 19ADPN6401</b>             | <b>Course Title: Mini Project</b> |                               |                      |
| <b>Course Category: Professional Core</b>  |                                   | <b>Course Level: Practice</b> |                      |
| <b>L:T:P(Hours/Week)</b><br><b>0: 0: 4</b> | <b>Credits:2</b>                  | <b>Total Contact Hours:60</b> | <b>Max Marks:100</b> |

### Course Objectives

The course is intended to:

1. Identify solution to simple engineering problems.
2. Use knowledge of science and engineering and engineering tools to solve simple problems relevant to the discipline.

The objective of Project is to enable the student to take up investigative study in the broad field of Artificial Intelligence and Data Science, to solve relevant social/environmental/ethical issues on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment will normally include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic
3. Conducting Analysis, Design, Implementation/Modeling /Simulation.
4. Preparing a Written Report of the Study/Work
5. Final Presentation before a departmental committee.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1 : Design, develop and implement solutions using relevant modern tools to simple engineering problems that are relevant to the discipline                | Apply                  |
| CO2: Work in teams performing different roles for effective accomplishment of project goals following ethical practices.                                    | Apply                  |
| CO3: Communicate the process, methods and materials, findings, results and solutions through reports and presentations in appropriate forums.               | Apply                  |
| CO4: Demonstrate the use of prior knowledge of science and engineering and engineering tools to formulate, analyze and investigate problems systematically. | Analyze                |

### Course Articulation Matrix

| CO  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| CO1 | 3    | -    | 3    | -    | 3    | 3    | 3    | -    | -    | -    | -    | 3    | 3    | 3    |
| CO2 | -    | -    | -    | -    | -    | -    | -    | 3    | 3    | -    | 3    | -    | -    | -    |
| CO3 | 3    | 3    | -    | 3    | -    | 3    | 3    | -    | -    | -    | -    | 3    | 3    | 3    |
| CO4 | -    | -    | -    | -    | -    | -    | 3    | -    | -    | 3    | -    | -    | -    | -    |

High-3; Medium-2; Low-1

## Semester V

|  |  |                               |                       |
|--|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADCN1501</b>             | <b>Course Title: Exploratory Data Analysis</b> |                               |                       |
| <b>Course Category: Professional Core</b>  |  | <b>Course Level: Practice</b> |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b>                               | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Data Mining

### **Course Objectives**

The course is intended to:

1. Outline the fundamentals of exploratory data analysis
2. Identify the appropriate method for data and information visualization
3. Make use of time series dataset to analyze univariate data
4. Apply bivariate data analysis for various dataset
5. Utilize visualization techniques for multivariate and time series data

### **Unit I      Exploratory Data Analysis      9 Hours**

EDA fundamentals - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, transformation techniques - Grouping datasets - Data aggregation – Pivot tables and cross-tabulations.

### **Unit II      Visualizing using Matplotlib      9 Hours**

Importing Matplotlib – Histograms – legends – colors – subplots – text and annotation customization – three dimensional plotting - Geographic data with basemap – Visualization with Seaborn.

### **Unit III      Univariate Analysis      9 Hours**

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

### **Unit IV      Bivariate Analysis      9 Hours**

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

### **Unit V      Multivariate And Time Series Analysis      9 Hours**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Visualizing – Grouping – Resampling.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1. Outline the fundamentals of exploratory data analysis using various data transformation techniques | Apply           |
| CO2. Identify the appropriate method for data and information visualization using Matplotlib            | Apply           |
| CO3. Experiment with univariate data to analyze time series dataset                                     | Apply           |
| CO4. Make use of appropriate transformation techniques to analysis bivariate dataset                    | Apply           |
| CO5. Utilize visualization techniques for analyzing multivariate and time series data                   | Apply           |

#### Text Book(s):

- T1.Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit-1)  
T2.Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016. (Unit-2)  
T3.Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008. (Unit-3,4&5)

#### Reference Book(s):

- R1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.  
R2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.  
R3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

#### Web References:

1. Coursera content on Exploratory Data :  
<https://www.coursera.org/learn/exploratory-data-analysis>
2. NPTEL course content: <https://nptel.ac.in/courses/110106064>
3. Online courses for EDA: <https://analyticsindiamag.com/8-online-courses-for-exploratory-data-analysis/>



### Course Articulation Matrix

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

High-3; Medium-2; Low-1



| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1. Outline uncertainty factors with Probabilistic and Bayesian models                                     | Understand      |
| CO2. Apply probabilistic reasoning models on uncertain knowledge With probabilistic temporal processes      | Apply           |
| CO3. Make use of utility theory and Sequential decision problems for uncertain environments                 | Apply           |
| CO4. Illustrate Statistical Learning algorithms on complex probabilistic models for active area of research | Apply           |
| CO5. Examine reinforcement learning model and for real time applications using RIL algorithms               | Apply           |

**Text Book(s):**

- T1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Pearson Education, 2021.

**Reference Book(s):**

- R1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007  
R2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hil, 2008  
R3. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006  
R4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013

**Web References:**

1. A beginner's guide to artificial intelligence and machine learning:  
<https://developer.ibm.com/articles/cc-beginner-guide-machine-learning-ai-cognitive/>
2. NPTEL course content on Applied Accelerated Artificial Intelligence:  
[https://onlinecourses.nptel.ac.in/noc22\\_cs83](https://onlinecourses.nptel.ac.in/noc22_cs83)

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1



**List of Exercises****30 Hours**

1. Implementation of TCP/UDP socket programming.
2. Implementation of Sliding Window Protocol.
3. Simulation of IEEE LAN topologies.
4. Implementation of Routing Protocols with Router configuration.
5. Implementation of TCP congestion control algorithms.
6. Implementation of SNMP.

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Characterize the functionalities of various layers in network architecture                                  | Understand      |
| CO2: Differentiate various encoding and medium access coordination services for node– to– node data transmission | Apply           |
| CO3: Design a network with appropriate addressing using subnetting and routing algorithms                        | Apply           |
| CO4: Illustrate the functionalities of transport layer protocols for reliable data transmission                  | Apply           |
| CO5: Demonstrate the working principles of application layer protocols for end– to– end communication            | Apply           |

**Text Book(s):**

- T1. Larry L. Peterson and Bruce S. Davie, “Computer Networks – A Systems Approach”, 6<sup>th</sup> Edition, Morgan Kaufmann Publishers, 2019.

**Reference Book(s):**

- R1. James F. Kurose, Keith W. Ross, “Computer Networking – A Top Down Approach Featuring the Internet”, 7<sup>th</sup> Edition, Pearson Education, 2017.
- R2. William Stallings, “Data and Computer Communication”, 10<sup>th</sup> Edition, Pearson Education, 2013.

**Web References:**

1. NPTEL Course Content: <http://nptel.ac.in/courses/106106091/>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|  |                  |   |                       |
|--|------------------|---|-----------------------|
| <b>Course Code: 19ADCN3501</b>             |                  | <b>Course Title: Exploratory Data Analysis Laboratory</b> |                       |
| <b>Course Category: Professional Core</b>  |                  | <b>Course Level: Practice</b>                             |                       |
| <b>L:T:P(Hours/Week)</b><br><b>0: 0: 4</b> | <b>Credits:2</b> | <b>Total Contact Hours:60</b>                             | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Python Programming for Data Engineers Laboratory

### **Course Objectives**

The course is intended to:

1. Utilize the preprocessing techniques for identified datasets
2. Build the appropriate method for data and information visualization
3. Make use of time series dataset to analyze univariate and bivariate data
4. Develop a project for an application using data analysis technique

### **List of Exercises:**

1. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data
2. Working with Numpy arrays, pandas data frames, basic plots using Matplotlib
3. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize
4. Perform Time Series Analysis and apply the various visualization techniques
5. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc.
6. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc
7. Perform EDA on Wine Quality Data Set
8. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report
9. Mini project
10. Mini project

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Utilize the preprocessing techniques for identified datasets using python library function and R Programming               | Understand             |
| CO2: Build the appropriate method for data and information visualization using Matplotlib, seaborn and basemap library function | Apply                  |
| CO3: Make use of time series dataset to analyze univariate and bivariate data using scipy.                                      | Apply                  |
| CO4: Develop a project for an application for data analysis of real time dataset.   | Apply                  |

### Reference Book(s):

- R1. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016.
- R2. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
- R3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.

### Web References:

1. Coursera content on Exploratory Data :  
<https://www.coursera.org/learn/exploratory-data-analysis>
2. NPTEL course content: <https://nptel.ac.in/courses/110106064>

### Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3   | 2   | -   | 2   | 2   | -   | -   | 2   | 3   | 2    | -    | 1    | 3    | 1    |
| CO2 | 3   | 2   | -   | 2   | 2   | -   | -   | 2   | 3   | 2    | -    | 1    | 3    | 1    |
| CO3 | 3   | 2   | 2   | 2   | 2   | -   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 1    |
| CO4 | 3   | 2   | 2   | 2   | 2   | -   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 1    |

High-3; Medium-2; Low-1



|  |                  |  |                       |
|--|------------------|--|-----------------------|
| <b>Course Code: 19ADCN3502</b>             |                  | <b>Course Title: Intelligent Systems - II Laboratory</b> |                       |
| <b>Course Category: Professional Core</b>  |                  | <b>Course Level: Practice</b>                            |                       |
| <b>L:T:P(Hours/Week)</b><br><b>0: 0: 4</b> | <b>Credits:2</b> | <b>Total Contact Hours:60</b>                            | <b>Max. Marks:100</b> |

### Pre-requisites

- Intelligent systems - I Laboratory

### Course Objectives

The course is intended to:

1. Develop the bayesian belief networks and HMM
2. Classify the data using naïve bayes classifier
3. Build the Gaussian mixture model
4. Construct the reinforcement learning model for real time applications

### List of Exercises:

1. Implement Bayesian Belief networks
2. Implement Hidden Markov Models
3. Implement EM algorithm for HMM
4. Implement decision problems for various real-world applications
5. Design a Naïve Bayes classifier to classify the given dataset
6. Implement Gaussian mixture models
7. Implement EM algorithm for Gaussian mixture model
8. Implement the Reinforcement learning for various reward based applications
9. Mini project
10. Mini project

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:                                    |                        |
| CO1: Develop the uncertainty factors using bayesian belief networks and HMM             | Apply                  |
| CO2: Classify the data using naïve bayes classifier for various real-world applications | Apply                  |
| CO3: Build the Gaussian mixture model for time series data Modeling                     | Apply                  |
| CO4: Construct the reinforcement learning model for real time AI Problems               | Apply                  |

**Reference Book(s):**

- R1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Pearson Education, 2021.

**Web References:**

1. NPTEL Course Content: <http://nptel.ac.in/courses/106106091/>

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3   | 2   | 2   | 2   | 2   | -   | -   | 2   | -   | 2    | -    | 1    | 3    | 1    |
| CO2 | 3   | 2   | 2   | 2   | 2   | 1   | -   | 2   | -   | 2    | -    | 1    | 3    | 1    |
| CO3 | 3   | 2   | 2   | 2   | 2   | 1   | -   | 2   | 3   | 2    | 1    | 1    | 3    | 1    |
| CO4 | 3   | 2   | 2   | 2   | 2   | 1   | -   | 2   | 3   | 2    | 1    | 1    | 3    | 1    |

High-3; Medium-2; Low-1

|  |  |                                   |                       |
|--|--|-----------------------------------|-----------------------|
| <b>Course Code: 19PSHG6501</b>             | <b>Course Title: Employability Skills 1: Teamness and Interpersonal Skills</b> |                                   |                       |
| <b>Course Category: Humanities</b>         |  | <b>Course Level: Introductory</b> |                       |
| <b>L:T:P(Hours/Week)</b><br><b>0: 0: 2</b> | <b>Credits:1</b>   | <b>Total Contact Hours:30</b>     | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ NIL

### **Course Objectives**

The course is intended to:

1. Demonstrate effective communicative attributes and facilitate presentation and public speaking skills
2. Identify and explore the true self and handle negatives
3. Develop interpersonal skills and to groom as a professional
4. Educate the importance of Nonverbal skill set to attain perfection
5. Build teamness and its ethics to facilitate corporate working

### **Unit I                      Effective Communication & Presentation Skills                      6 Hours**

Barriers of Communication – Fear of English – Handling Social Factors – Handling Psychological Factors – Handling Practical Problems – Do's & Don'ts– Effective Presentation – Presentation – Importance of Presentation – Slide orientation – Introduction in a presentation – Styles of a slide – Slide Templates – Font, color, Background – Graph Diagrammatic representation – Delivery of presentation – Body Language & Gestures – Verbal Attributes – Communication – Handling stammers and breaks – Handling fear of stage – Maintaining Confidence – Content delivery methods – Do's and Don'ts in a presentation– Tips to handle it– Effective Conclusion

### **Unit II                      Positive Attitude & Handling Rejections                      6 Hours**

A,B,C's of Attitude – Influencing Factors – Individual Factors – Character Comparison – Strategies to Handle ourselves– Benefits of Positive Attitude – Do's& Don'ts – Handling Rejections– Identifying Negativities – How to handle it ??– Necessary changes – To do List – Creating One's self – Self Qualifiers.

### **Unit III                      Interpersonal Skills                      6 Hours**

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

### **Unit IV                      Body Language, Dressing & Grooming                      6 Hours**

Unconscious Physical moments – Metrics of Body Language – Good Posture – Head Motion – Facial Expression – Eye contact – Gestures – Dressing – Grooming & Outlook – Necessity of good Body Language.

**Unit V Team Ethics****6 Hours**

Team Ethics – Necessity of Team Work – Teams Everywhere – Benefits of team culture – Reason for team failure – Conflicts – Handling Conflicts – Being a team player – Work difference from college.

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1. Demonstrate effective communicative attributes as part of their skills and facilitate presentation & public speaking skills | Apply           |
| CO2. Identify and explore the true self and handle negatives   | Apply           |
| CO3. Develop interpersonal skills and to groom as a professional   | Apply           |
| CO4. Explain the importance of Nonverbal skill set to attain Perfection  | Understand      |
| CO5. Build teamness and its ethics to facilitate corporate working   | Apply           |

**Text Book(s):**

- T1. John C Maxwell, " The 17 Indisputable Laws of Teamwork: Embrace Them and Empower Your Team", Harper Collins Leadership Publishers, 2013.

**Reference Book(s):**

- R1. Patrick Lencioni, " The Five Dysfunctions of a Team: A Leaders Fable" Jossey Bass Publishers, 2006.  
R2. Malcolm Gladwell, "Talking to Strangers: What We Should Know about the People We Don't Know",Penguin Publishers, 2019.  
R3. Harvey Segler, "Body Language: Discovering & Understanding the Psychological secrets behind reading & Benefiting from Body Language" ,Kindle Edition, 2016.

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

## Semester VI

|  |                   |  |                       |
|--|-------------------|--|-----------------------|
| <b>Course Code: 19ADCN2601</b>             |                   | <b>Course Title: Big Data Analytics Techniques</b> |                       |
| <b>Course Category: Professional Core</b>  |                   | <b>Course Level: Practice</b>                      |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 2</b> | <b>Credits: 4</b> | <b>Total Contact Hours: 75</b>                     | <b>Max. Marks:100</b> |

## Pre-requisites

- ## ➤ Database Systems

## Course Objectives

The course is intended to:

1. Illustrate the concepts of big data and analytics
2. Understand about map reduce programming model to run big data applications
3. Explain various operations on NoSQL databases
4. Describe about classification algorithms
5. Demonstrate different clustering algorithms and recommendation systems

|               |                                 |                |
|---------------|---------------------------------|----------------|
| <b>Unit I</b> | <b>Fundamentals of Big Data</b> | <b>7 Hours</b> |
|---------------|---------------------------------|----------------|

Database Evolution – Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Big data use cases – Characteristics of big data Applications.

|                |                                       |                |
|----------------|---------------------------------------|----------------|
| <b>Unit II</b> | <b>Understanding Big Data Storage</b> | <b>9 Hours</b> |
|----------------|---------------------------------------|----------------|

## High Performance Architecture – HDFS – Map reduce and YARN – Map reduce Programming Model.

|                 |   |                |
|-----------------|---|----------------|
| <b>Unit III</b> | <b>NoSQL Data Management for Big Data</b> | <b>9 Hours</b> |
|-----------------|---|----------------|

NoSQL Databases: Schema less Models – Increasing Flexibility for Data Manipulation– Key Value Stores – Document Stores – Tabular Stores – Object Data Stores – Graph Databases – Hive – Sharding – Hbase.

|                |                       |                 |
|----------------|-----------------------|-----------------|
| <b>Unit IV</b> | <b>Classification</b> | <b>10 Hours</b> |
|----------------|-----------------------|-----------------|

Classification: Decision Trees – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes Theorem – Naïve Bayes Classifier .

|               |   |                 |
|---------------|---|-----------------|
| <b>Unit V</b> | <b>Clustering and Recommendation System</b> | <b>10 Hours</b> |
|---------------|---|-----------------|

Clustering – K-means – Use Cases – Overview of the Method – Determining the Number of Clusters – Diagnostics – Recommendation System: Collaborative Recommendation–Content Based Recommendation – Knowledge Based Recommendation – Hybrid Recommendation Approaches.

## List of Exercises

30 Hours

1. Implementation of commands in HDFS
2. Implement Map Reduce application for word counting on Hadoop cluster
3. Implement simple operations in NoSQL databases
4. Perform advanced analysis using hiveql
5. Implement classification algorithm using map reduce in Hadoop
6. Implement K-means clustering using map reduce in Hadoop

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1:Describe fundamental concepts of big data and analytics.                                 | Understand      |
| CO2:Apply Map reduce programming model to run big data applications.                         | Apply           |
| CO3:Use NoSQL databases for processing large scale data.                                     | Apply           |
| CO4:Apply classification algorithms on large scale data.                                     | Apply           |
| CO5:Demonstrate different clustering algorithms and recommendation systems using map reduce. | Apply           |

### Text Book(s):

- T1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013 (Unit-I, II,III).
- T2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012 (Unit- IV,V).

### Reference Book(s):

- R1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2015.
- R2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Publication and Yahoo! Press, 4th Edition, 2015.
- R3. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication,2015.

### Web References:

1. NPTEL Course content URL: [https://onlinecourses.nptel.ac.in/noc20\\_cs92/](https://onlinecourses.nptel.ac.in/noc20_cs92/)
2. Hadoop complete reference URL: <https://hadoop.apache.org>
3. Tutorial on Hive URL:<https://data-flair.training/blogs/apache-hive-tutorial/>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|  |                   |   |                       |
|--|-------------------|---|-----------------------|
| <b>Course Code: 19ADCN2602</b>             |                   | <b>Course Title: Deep Learning Techniques</b> |                       |
| <b>Course Category: Professional Core</b>  |                   | <b>Course Level: Practice</b>                 |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 2</b> | <b>Credits: 4</b> | <b>Total Contact Hours: 75</b>                | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ NIL

#### **Course Objectives**

The course is intended to:

1. Develop feed forward and deep Networks
2. Describe various regularization techniques of deep neural network
3. Design a Convolutional Neural Network
4. Apply Recurrent Neural Network
5. Apply deep learning concepts

#### **Unit I      Deep Networks      9 Hours**

Neural Networks-Training Neural Networks-Activation Functions-Loss Functions-Hyper parameters - Deep Networks-Architectural Principles of Deep Networks-Building Blocks of Deep Networks.

#### **Unit II      Regularization for Deep Learning      9 Hours**

Parameter Norm Penalties-Norm Penalties as Constrained Optimization-Regularization and Under-Constrained Problems-Dataset Augmentation-Noise Robustness-Semi supervised Learning-Multitask Learning-Early Stopping-Bagging.

#### **Unit III      Convolutional Neural Networks      9 Hours**

The convolution operation-Motivation-Pooling-Variants of basic convolution function-Structured outputs-Convolution algorithms-Unsupervised features.

#### **Unit IV      Sequence Modeling      9 Hours**

Recurrent Neural Networks-Bidirectional RNNs- Encoder-Decoder Sequence to sequence Architectures-Deep Recurrent Networks-Recursive Neural Networks-The Long Short Term Memory-Explicit Memory.

#### **Unit V      Applications      9 Hours**

Performance Metrics-Large Scale Deep Learning-Computer Vision-Speech Recognition-Natural Language Processing.



## List of Exercises

30 Hours

1. Implement a Feed-Forward Network
2. Implement an Image Classifier using CNN
3. Implement a Simple LSTM
4. Implement an Opinion Mining in Recurrent Neural network
5. Implement an Autoencoder.
6. Implement an Object Detection using CNN

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                      |                 |
| CO1: Develop feed forward and deep Networks for solving simple problems   | Apply           |
| CO2: Describe various regularization techniques of deep neural network    | Apply           |
| CO3: Design a Convolutional Neural Network for solving real time problems | Apply           |
| CO4: Apply Recurrent Neural Network in various real time problems         | Apply           |
| CO5: Apply deep learning concepts for any target application              | Apply           |

### Text Book(s):

- T1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
- T2. Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

### Reference Book(s):

- R1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", O'Reilly Media, 2017.
- R2. Santosh Kumar K, Kogent Solutions, "JDBC Servlets and JSP Includes JSF and Design Patterns Black Book", Dream Tech Press, 2008.
- R3. Sheng Liang, "The Java Native Interface: Programmer's Guide and Specification", Addison-Wesley, 1999.

### Web References:

1. NPTEL course content: [https://onlinecourses.nptel.ac.in/noc23\\_cs112/](https://onlinecourses.nptel.ac.in/noc23_cs112/)

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|  |                   |   |                       |
|--|-------------------|---|-----------------------|
| <b>Course Code: 19ADCN3601</b>             |                   | <b>Course Title: Cloud Computing Laboratory</b> |                       |
| <b>Course Category: Professional Core</b>  |                   | <b>Course Level: Practice</b>                   |                       |
| <b>L:T:P(Hours/Week)</b><br><b>1: 0: 4</b> | <b>Credits: 3</b> | <b>Total Contact Hours: 75</b>                  | <b>Max. Marks:100</b> |

#### **Pre-requisites**

- Computer Networking

#### **Course Objectives**

The course is intended to:

1. Implement the core concept of Cloud Computing
2. Demonstrate the concept of Virtualization Techniques.
3. Deploy application in Amazon Web Services
4. Create application using Google App Engine

#### **Unit I      Cloud Computing      3 Hours**

Defining a Cloud - Cloud Computing Reference Model -Characteristics and Benefits.

#### **Unit II      Virtualization      4 Hours**

Virtualization and Cloud Computing- Types of Virtualization: Full Virtualization and Para Virtualization.

#### **Unit III      Amazon Web Services      4 Hours**

Cloud Architectural Model - Types of Clouds- AWS Overview- Application Migration-EC2 Instance-S3 Bucket-Deployment

#### **Unit IV      Google App Engine      4 Hours**

Google App Engine Overview- Web services- Google Big Query-Microsoft Azure

#### **List of Exercises      60 Hours**

1. Configure a network adapter connection in Oracle Virtual Box.
2. Install Single node / Multi node setup using DevStack
3. Perform various operations of Cloud using Horizon
4. Perform application migration using AWS
5. Deploy Java Web Application using Amazon-EC2
6. Host a Static Website using Amazon S3
7. Deploy web application in AWS.
8. Implement database migration in Google App Engine
9. Store and Query massive Datasets using Google Cloud Big Query
10. Create a web application using Microsoft Azure

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:                                    |                        |
| CO1: Implement the Core Concept of Cloud Computing by using Cloud setup software        | Apply                  |
| CO2: Demonstrate the concept of Virtualization Techniques using Virtualization Software | Apply                  |
| CO3: Deploy application in cloud platform using Amazon Web Services                     | Apply                  |
| CO4: Create application in cloud platform using Google App Engine                       | Apply                  |

**Text Book(s):**

- T1. Dr. Rajkumar Buyya, Dr. Christian Vecchiola, Dr. S Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited, 2013.
- T2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Cloud Computing – From Parallel processing to the Internet of Things", Morgan Kaufmann Publishers, 2012

**Reference Book(s):**

- R1. Ronald L. Krutz, Russell Dean Vines, "Cloud Security A comprehensive guide to secure Cloud Computing", Wiley India Pvt. Ltd, Reprint 2016.
- R2. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and more", Jones & Bartlett Learning, 2013.

**Web References:**

1. Virtualization: <http://www.ibm.com/developerworks/library/os-Cloud-virtual1/>
2. Cloud Architecture: [http://docs.hpCloud.com/pdf/static/Eucalyptus\\_3.4/faststart-guide-](http://docs.hpCloud.com/pdf/static/Eucalyptus_3.4/faststart-guide-)

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | -   | -    | -    | 1    | 1    | 1    |
| CO2 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 2   | 3    | 1    | 1    | 1    | 1    |
| CO3 | 1   | 1   | 1   | -   | -   | -   | 1   | 1   | 2   | 3    | 1    | 1    | 1    | 1    |
| CO4 | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 1   | 2   | 3    | 2    | 2    | 2    | 2    |

High-3; Medium-2; Low-1

|   |  |                                |                       |
|---|--|--------------------------------|-----------------------|
| <b>Course Code: 19ADPN6601</b>              | <b>Course Title: Innovative and Creative Project</b> |                                |                       |
| <b>Course Category: Project</b>             |  | <b>Course Level: Practice</b>  |                       |
| <b>L:T:P (Hours/Week)</b><br><b>0: 0: 4</b> | <b>Credits: 2</b>                                    | <b>Total Contact Hours: 60</b> | <b>Max Marks: 100</b> |

**Pre-requisites:**

➤ Nil

**Course Objectives**

The course is intended to:

1. Identify solutions to complex engineering problems.
2. Use the knowledge of Science, engineering & engineering tools to solve complex problems relevant to the discipline.

The objective of Project is to enable the student to take up investigative study in the broad field of Computer Science and Engineering, to solve relevant social/environmental/ethical issues on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment will normally include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic
3. Conducting Analysis, Design, Implementation/Modeling /Simulation.
4. Preparing a Written Report of the Study/Work
5. Final Presentation before a departmental committee.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Design, develop and implement solutions to complex engineering problems using appropriate tools and techniques.  | Apply                  |
| CO2: Work in teams performing different roles for effective accomplishment of project goals following ethical practices.  | Apply                  |
| CO3: Demonstrate the use of prior knowledge of science and engineering critical reflection and continuous learning to formulate, analyze and investigate problems systematically. | Apply                  |
| CO4: Communicate the process, methods and materials, findings, results and solutions through reports, presentations and other media in appropriate forums.                        | Apply                  |

## Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | 3   | 3   | 3   | 3   | 3   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | 3   | 3   | -    | 3    | -    | -    | -    |
| CO3 | 3   | 3   | -   | 3   | -   | 3   | 3   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO4 | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | -    | -    | -    |

High– 3; Medium– 2; Low– 1

|   |                   |  |                       |
|---|-------------------|--|-----------------------|
| <b>Course Code:19PSHG6601</b>               |                   | <b>Course Title: Employability Skills 2: Campus to Corporate</b> |                       |
| <b>Course Category: Humanities</b>          |                   | <b>Course Level: Introductory</b>                                |                       |
| <b>L:T:P (Hours/Week)</b><br><b>0: 0: 2</b> | <b>Credits: 1</b> | <b>Total Contact Hours: 30</b>                                   | <b>Max Marks: 100</b> |

### **Pre– requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Understand emotions and necessity to handle it to evolve as an effective social animal
2. Build effective resumes to project the positives to be employable
3. Facilitate working in a collaborative work environment and to engage in healthy agreements for building person's professional facet
4. Formulate the growth attribute to outperform, initiate and grow in professional arena
5. Explain time management and impart leadership skills.

### **Unit I            Emotional Intelligence**

**6 Hours**

Nature of Emotions – Importance of EI – EQ vs IQ – Behavioral difference between EQ & IQ – Acquiring Emotional Intelligence – Benefits of high EI – Steps to develop EI – Role of EI in Interviews.

### **Unit II            Resume Preparation**

**6 Hours**

Importance of Resume – Good Resume – Planning Resume – Organizing Resume – Spell check – Benefits of good resume – Resume Writing.

### **Unit III           Group Discussion**

**6 Hours**

Purpose of GD – Prerequisites of GD– Benefits of GD– Features of GD– Do's & Don'ts in GD– Accept Criticism & Feedback– Accepting Suggestions– GD Phrases– Effective Introduction & Conclusion – Preferred Etiquette of GD.

### **Unit IV           Interview Etiquette( Netiquette)**

**6 Hours**

Definition of Interview– Types of Interview – Prior interview– Know the Company – Employer's perspective in interview– Non Verbal etiquette– Dressing – Verbal Communication in Interview– Facing Rejection in Interview– Do's & Don'ts in an Interview– Common Interview Questions – Handling Stress Questions – Handling Telephonic Interviews.

**Unit V Leadership Skills & Time Management****6 Hours**

**Leadership** – Leadership Traits – Leadership styles – Types of Leaders – Qualities of a leader – Developing Perspectives

**Time Management** – Necessity of Time Management – Types of time – Estimation of time – Process of Time management – Efficient utilization of Time – Time wasting culprits – Tips to manage time – Goal setting in Time Management

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Understand the emotions and necessity to handle them   | Apply           |
| CO2: Build effective resumes to project the positives to be employable  | Apply           |
| CO3: Facilitate collaborative work environment and to engage in healthy agreements for building person's professional facet | Understand      |
| CO4: Formulate the growth attribute to outperform, initiate and grow in professional arena                                  | Apply           |
| CO5: Explain time management and impart leadership skills   | Understand      |

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | 1   | -   | 1    | -    | 1    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | -   | -   | 2    | -    | 1    | -    | -    |
| CO3 | -   | -   | -   | -   | -   | -   | -   | -   | 1   | 1    | -    | 1    | -    | -    |
| CO4 | -   | -   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    |
| CO5 | -   | -   | -   | -   | -   | -   | -   | 1   | -   | -    | 1    | 1    | -    | -    |

High– 3; Medium– 2;Low– 1



## **Professional Elective Courses: Verticals**

### **Vertical I - Security Essentials Electives**

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1001</b>                | <b>Course Title: Ethics in Artificial Intelligence</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                           |                               |                       |
| <b>L:T:P(Hours/Week)<br/>3: 0: 0</b>          | <b>Credits:3</b>                                       | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Explain the morality and ethics in AI
2. Interpret the knowledge on ethical harms and ethical initiatives in AI
3. Make use of AI standards and Regulations
4. Identify the social and ethical issues of Robot Ethics
5. Apply the knowledge of real time application ethics, issues and its challenges

#### **Unit I Introduction 9 Hours**

Definition of morality and ethics in AI - Impact on society - Impact on human psychology  
Impact on the legal system - Impact on the environment and the planet - Impact on trust.

#### **Unit II Ethical Initiatives in AI 9 Hours**

International ethical initiatives - Ethical harms and concerns - Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

#### **Unit III AI Standards and Regulation 9 Hours**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems - Data Privacy Process - Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

#### **Unit IV Roboethics: Social and Ethical Implication of Robotics 9 Hours**

Robot - Roboethics - Ethics and Morality - Moral Theories - Ethics in Science and Technology - Ethical Issues in an ICT Society - Harmonization of Principles - Ethics and Professional Responsibility - Roboethics Taxonomy.

#### **Unit V Challenges and Opportunities 9 Hours**

Challenges – Opportunities - ethical issues in artificial intelligence - Societal Issues Concerning the Application of Artificial Intelligence in Medicine – decision - making role in industries - National and International Strategies on AI.

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO1: Explain about morality and ethics in AI   | Understand             |
| CO2: Interpret the knowledge on ethical harms and ethical initiatives in AI using real time application        | Understand             |
| CO3: Make use of AI standards and Regulations for design of automation Systems                                 | Apply                  |
| CO4: Identify the social and ethical issues raised by Robot Ethics including the professional responsibilities | Apply                  |
| CO5: Apply the knowledge of real time application ethics, issues and its challenges in professional life       | Apply                  |

**Text Book(s):**

- T1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield, "The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) P 634.452 — March 2020.
- T2. Patrick Lin, Keith Abney, George A Bekey, " Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

**Reference Book(s):**

- R1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017.
- R2. Mark Coeckelbergh, " AI Ethics", The MIT Press Essential Knowledge series, April 2020.

**Web References:**

1. Artificial Intelligence and Ethics: Sixteen Challenges and Opportunities:  
<https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence- and- ethics- sixteen- challenges- and- opportunities/>
2. Ethical issues in artificial intelligence:  
<https://www.weforum.org/agenda/2016/10/top- 10- ethical-issues- in- artificial- intelligence/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |                                      |                               |                       |
|---|--------------------------------------|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1002</b>                | <b>Course Title: Ethical Hacking</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>         |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3 0: 0</b>     | <b>Credits:3</b>                     | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Elucidate the various types of attacks, security threats and vulnerabilities
2. Explain the different foot printing, reconnaissance and scanning methods
3. Demonstrate the enumeration and vulnerability analysis method
4. Understand hacking options available in Web and wireless applications
5. Explore the options for network protection and to practice tools to perform ethical hacking to expose the vulnerabilities

#### **Unit I Introduction**

**9 Hours**

Ethical Hacking - Role of Security and Penetration Testers- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security.

#### **Unit II Foot Printing, Reconnaissance And Scanning Networks**

**9 Hours**

Footprinting Concepts - Footprinting through Search Engines- Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall.

#### **Unit III Enumeration And Vulnerability Analysis**

**9 Hours**

NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss.

#### **Unit IV System Hacking**

**9 Hours**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

#### **Unit V Network Protection Systems**

**9 Hours**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network- Based and Host- Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Elucidate the various types of attacks, security threats and vulnerabilities present in the computer system          | Understand      |
| CO2:   | Explain the different foot printing, reconnaissance and scanning methods for collecting data about the target system | Apply           |
| CO3:   | Demonstrate the enumeration and vulnerability analysis method  | Apply           |
| CO4:   | Demonstrate the tools available in Web and wireless applications   | Apply           |
| CO5:   | Acquire knowledge on the options for network protection  | Apply           |

#### **Text Book(s):**

- T1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
- T2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
- T3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

#### **Reference Book(s):**

- R1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz, 2014.

#### **Web References:**

- NPTEL Courses on Ethical Hacking:  
[https://onlinecourses.nptel.ac.in/noc22\\_cs13/preview](https://onlinecourses.nptel.ac.in/noc22_cs13/preview)
- COURSERA Courses on Ethical Hacking Essentials:  
<https://www.coursera.org/learn/ethical-hacking-essentials-ehe>

#### **Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1003</b>                | <b>Course Title: Web Application Security</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                  |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3 0: 0</b>     | <b>Credits:3</b>                              | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Explain the fundamentals of web application security
2. Describe the principles adopted in web application security
3. Develop web applications including secure development methodologies
4. Design Secure Web Applications using Secure APIs
5. Identify the importance of carrying out vulnerability assessment and penetration testing

#### **Unit I Introduction**

**9 Hours**

The history of Software Security - Introduction to Web Application Reconnaissance - Recognizing Web Application Security Threats, Web Application Security, Web Servers, Secure Socket layer, Transport layer Security, Session Management - Input Validation.

#### **Unit II Web Application Security Principles**

**9 Hours**

Authentication: Access Control - Authentication Fundamentals - Two factor and three Factor Authentication - Web Application Authentication - Authorization: Access Control - Session Management - Securing Web Application Session Management.

#### **Unit III Secure Development And Deployment**

**9 Hours**

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), Software Assurance Maturity Model (SAMM).

#### **Unit IV Secure API Development**

**9 Hours**

API Security - Elements of API Security, Security mechanism, Natter API - Overview, Implementation - Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Authentication to prevent spoofing, Encryption, Audit logging - Securing Session Cookies - Authentication in Web browsers, Token Based Authentication.

#### **Unit V Hacking Techniques and Tools**

**9 Hours**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud - based vulnerability scanners, Host - based vulnerability scanners, Network - based vulnerability scanners, Database - based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Explain the fundamentals of web application security                                     | Understand      |
| CO2:   | Describe the principles adopted in web application security                              | Understand      |
| CO3:   | Develop web applications including secure development                                    | Apply           |
| CO4:   | Design Secure Web Applications using Secure APIs   | Apply           |
| CO5:   | Identify the importance of carrying out vulnerability assessment and penetration testing | Apply           |

#### **Text Book(s):**

- T1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
- T2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
- T3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

#### **Reference Book(s):**

- R1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
- R2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
- R3. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

#### **Web References:**

1. Web Application Security Vulnerabilities and How to prevent them in 2023: <https://relevant.software/blog/web-application-security-vulnerabilities/>

#### **Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1004</b>                | <b>Course Title: Fundamentals of Computation</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                     |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3 0: 0</b>     | <b>Credits:3</b>                                 | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

- Data Structures and Algorithm Analysis –

#### **Course Objectives**

The course is intended to:

1. Choose the suitable technique for constructing NFA and DFA
2. Construct Finite Automata from regular expressions
3. Develop Pushdown Automata for accepting context free languages
4. Construct a Turing Machine
5. Explain decidable and undecidable languages

#### **Unit I Finite Automata**

**9 Hours**

Automata - Computability – Complexity – Chomsky Hierarchy of Languages – Finite Automata – Finite Automata for Vending Machine – Non-determinism – Finite Automata with Epsilon Transitions – Equivalence of NFA and DFA – Minimization of DFA.

#### **Unit II Regular Languages**

**9 Hours**

Regular Grammars – Regular Languages and Operations – Regular Expressions – Equivalence of Finite Automata and Regular Expressions: Thompson Construction – State Elimination Method – Closure Properties of Regular Languages – Pumping lemma for Regular Languages.

#### **Unit III Context Free Languages**

**9 Hours**

Context Free Grammars – Derivations, Parse Tree and Ambiguity – Simplification of Grammars – Normal Forms – CNF – GNF – Pushdown Automata – Language Acceptance of PDA – Applications of PDA – Equivalence of Pushdown Automata and CFG – Closure Properties of Context Free Languages.

#### **Unit IV Turing Machine**

**9 Hours**

Turing Machine – Language Acceptance – Techniques for Turing Machine Construction – Storage in Finite Control – Subroutine – Checking off Symbols – Multiple Tracks – Variants of Turing Machines – Universal Turing Machine.

#### **Unit V Computability Theory**

**9 Hours**

Decidability: Decidable Languages – Undecidability – Reducibility: Undecidable Problems from Language Theory – Halting Problem – Post Correspondence Problem.

| Course Outcomes                                      |   | Cognitive  |
|--|---|------------|
| At the end of this course, students will be able to: |   | Level      |
| CO1:   | Explain the basic properties of Finite Automata   | Understand |
| CO2:   | Construct Finite Automata from regular expressions using various techniques                                   | Understand |
| CO3:   | Develop Pushdown Automata for accepting context free languages using normal forms                             | Understand |
| CO4:   | Define basic properties of Turing machines and Computing with Turing machines                                 | Understand |
| CO5:   | Understand the concepts of tractability and decidability, the concepts of NP completeness and NP-hard problem | Understand |

**Text Book(s):**

- T1. John E.Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education Publishers, 2012.  
T2. Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, Cengage Learning, 2013.

**Reference Book(s):**

- R1. Kamala Krithivasan, R. Rama, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009.  
R2. R2.K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", 3rd Edition, PHI, 2006.

**Web References:**

1. Course Material URL: <http://www.ics.uci.edu/~goodrich/teach/cs162/notes/>  
2. NPTEL Course Content URL: <http://nptel.ac.in/courses/106106049/>  
3. JFLAP tool – Home URL: [www.jflap.org/](http://www.jflap.org/)

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1



|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2001</b>                | <b>Course Title: Cryptographic Techniques in Network</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                             |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>   | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |
| <b>2: 0: 2</b>                                |  |                               |                       |

#### **Pre-requisites**

- Calculus and Transforms
- Discrete Mathematics for Artificial Intelligence

#### **Course Objectives**

The course is intended to:

1. Employ classical encryption techniques
2. Implement symmetric key algorithms
3. Apply number theory concepts
4. Apply hash functions and digital signature
5. Describe key management and authentication protocols

#### **Unit I Classical Encryption**

**6 Hours**

Basic concepts – Security attacks – services and mechanisms – Characteristics of good ciphers – Security Standards – Classical encryption techniques: Symmetric cipher– Substitution techniques and Transposition techniques.

#### **Unit II Symmetric Ciphers**

**6 Hours**

Block cipher design principles – Data Encryption Standard (DES) – Fields and finite field arithmetic – Advanced Encryption Standard (AES) – Block cipher modes of operation. Principles of random number generation – random number generators – Stream ciphers – RC4.

#### **Unit III Asymmetric Ciphers**

**6 Hours**

Number theory concepts: Euclidean algorithm – Modular arithmetic – Prime numbers – Fermat's and Euler's theorem – Discrete logarithms – Principles of public-key cryptosystems – RSA algorithm – Diffie-Hellman key exchange – ElGamal cryptographic system.

#### **Unit IV Hash Function and Digital Signature**

**6 Hours**

Hash function: Applications – Requirements – Secure Hash Algorithm (SHA) – Message authentication codes: Requirements – functions – Hash based Message Authentication Codes (HMAC) – Digital signature: Properties – ElGamal digital signature scheme – Schnorr Digital Signature Scheme – Digital Signature Standard (DSS).

#### **Unit V Key Management and Authentication**

**6 Hours**

Key management and distribution – X.509 certificate – Public key infrastructure – Kerberos protocol.

**List of Exercises****30 Hours**

1. Implement various traditional Substitution and Transposition techniques (without using built-in package).
2. Implement DES and AES algorithms using Java built-in packages.
3. Implement RSA algorithm using Java built-in packages.
4. Develop Diffie-Hellman key exchange algorithm (without using built-in package).
5. Implementation of Hash Function using Java built-in packages.
6. Implementation of Digital signature using Java built-in packages.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Employ classical encryption techniques for providing confidentiality Service   | Apply           |
| CO2:   | Implement symmetric key algorithms for encrypting text and multimedia Data   | Apply           |
| CO3:   | Apply number theory concepts to design asymmetric key algorithms for providing confidentiality and key exchange services | Apply           |
| CO4:   | Apply hash function and digital signature for protecting digital Documents   | Apply           |
| CO5:   | Describe key management and user authentication protocols for providing key sharing and authentication services          | Understand      |

**Text Book(s):**

- T1. William Stallings, "Cryptography and Network Security - Principles and Practices", 7<sup>th</sup> Edition, Pearson Education, 2017.

**Reference Book(s):**

- R1. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 3<sup>rd</sup> Edition, Tata McGraw Hill, New Delhi, 2016.
- R2. Atul Kahate, "Cryptography and Network Security", 3<sup>rd</sup> Edition, Tata McGraw Hill, New Delhi, 2017.
- R3. Douglas R Stinson, "Cryptography - Theory and Practice", Chapman and Hall / CRC Press, New York, 2013.

**Web References:**

1. NPTEL Course Content URL: <https://nptel.ac.in/courses/106/105/106105162/>
2. Tutorials point Course Content on cryptography URL : <https://www.tutorialspoint.com/cryptography/index.htm>
3. Khan Academy Course Content on cryptography URL : <https://www.khanacademy.org/computing/computer-science/cryptography>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1



| Course Outcomes                                      |   | Cognitive Level |
|--|---|-----------------|
| At the end of this course, students will be able to: |   |                 |
| CO1:   | Interpret the significance of decentralization using blockchain             | Understand      |
| CO2:   | Demonstrate the concept of crypto currency using Bitcoin.                   | Apply           |
| CO3:   | Develop smart contracts in ethereum network using solidity                  | Apply           |
| CO4:   | Create a distributed ledger using hyperledger fabric for a web3 application | Apply           |
| CO5:   | Explore the challenges and trends using various blockchain projects         | Apply           |

#### Text Book(s):

- T1. Kang – Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, 2<sup>nd</sup> Edition, Packt Publishing, 2018.

#### Reference Book(s):

- R1. Arshdeep Bahga, Vijay Madisetti, “Blockchain Applications: A Hands On Approach”, VPT, 2017.
- R2. Andreas Antonopoulos, Satoshi Nakamoto, “Mastering Bitcoin”, O’Reilly, 2014.
- R3. Roger Wattenhofer, “The Science of the Blockchain”, CreateSpace Independent Publishing, 2016.
- R4. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.

#### Web References:

1. Blockchain Architecture Design and Use Cases: <https://nptel.ac.in/courses/106105184>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2003</b>                | <b>Course Title: Network and Web Security</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                  |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                              | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |
| <b>2: 0: 2</b>                                |   |                               |                       |

#### **Pre-requisites**

- Computer Networking

#### **Course Objectives**

The course is intended to:

1. Describe intrusion detection techniques and firewalls
2. Apply IP security and Web security protocols
3. Identify suitable e-mail security protocols
4. Utilize wireless security protocols
5. Identify security services in cloud environment

#### **Unit I NETWORK SECURITY**

**6 Hours**

Threats in networks - Network security controls – Intruders - Intrusion detection - Password management - Malicious software - Firewalls: Characteristics – Types - Firewall basing - Firewall location and configurations.

#### **Unit II IP AND WEB SECURITY**

**6 Hours**

IP security: IP security policy, Encapsulating Security Payload - Web security: Secure Socket Layer, Transport Layer Security – HTTPS - Secure Shell (SSH).

#### **Unit III ELECTRONIC MAIL SECURITY**

**6 Hours**

Store and forward, Security services, Source authentication, Message integrity, Non-Repudiation, Proof of submission and delivery, Pretty Good Privacy (PGP), Secure/Multipurpose Internet Mail Extension (S/MIME).

#### **Unit IV WIRELESS NETWORK SECURITY**

**6 Hours**

IEEE 802.11 wireless LAN overview - IEEE 802.11i wireless LAN security - Wireless Application Protocol - Wireless Transport Layer Security - WAP end-to-end security.

#### **Unit V SECURITY IN CLOUD COMPUTING**

**6 Hours**

Cloud Information Security Objectives, Cloud Security Services, Cloud Security Design Principles - Penetration Testing Tools and Techniques - Cloud Computing Risk Issues: CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure, Data and Access Control, Cloud Service Provider Risks.

#### **List of Exercises**

**30 Hours**

1. Demonstrate Intrusion Detection System using any simulation tool (Example: Snort).
2. Setup a honey pot and monitor it on the available network (Example: KF Sensor).
3. Implement packet filtering firewall. (Example: Using jpcap package)
4. Perform wireless audit on an access point or a router and decrypt WEP and WPA. (Example : Net Stumbler)
5. Implement the encryption and decryption process used in PGP protocol.
6. Study and analyze the various security protocols used to secure the transport layer for a gmail account.

| Course Outcomes                                      |   | Cognitive Level |
|--|---|-----------------|
| At the end of this course, students will be able to: |   |                 |
| CO1:   | Describe intrusion detection techniques and firewalls for preventing security attacks | Understand      |
| CO2:   | Apply IP security and web security protocols for providing data security services     | Apply           |
| CO3:   | Identify suitable security protocols for securing e-mail services.                    | Apply           |
| CO4:   | Utilize wireless security protocols for protecting data in wireless environment       | Apply           |
| CO5:   | Identify security services in cloud environment for secure data sharing               | Apply           |

**Text Book(s):**

- T1. William Stallings, "Cryptography and Network Security – Principles and Practice", 7<sup>th</sup> Edition, Pearson Education, 2017.
- T2. Ronald L Krutz and Russell Dean Vines, "Cloud Security- A Comprehensive Guide to Secure Cloud Computing", Wiley, 2016.

**Reference Book(s):**

- R1. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, 2014.
- R2. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 3<sup>rd</sup> Edition, Tata McGraw Hill, New Delhi, 2016.
- R3. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", John Wiley and Sons, 2013.

**Web References:**

- T1.NPTEL Course contents on Cryptography and Network Security  
URL:<http://nptel.ac.in/courses/106105162/>
- T2.NPTEL Course contents on Cryptography and Network Security  
URL:<http://nptel.ac.in/courses/106105162/>
- T3.NPTEL Course contents on Cryptography and Network Security  
URL:<http://nptel.ac.in/courses/106105162/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2004</b>                | <b>Course Title : Digital Forensics</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Introductory</b>       |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>2: 0: 2</b>    | <b>Credits:3</b>                        | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ NIL

### **Course Objectives**

The course is intended to:

1. Discuss the cybersecurity policy and its evolution.
2. Summarize the scope and laws of Computer Forensics.
3. Explain the process of acquiring and documenting Computer Forensic Evidence
4. Describe the steps involved in investigating Network Forensics.
5. Comprehend the steps involved in investigating Mobile Forensics.

### **Unit I      Cyber Security      6 Hours**

Cyber Security — Cyber Security policy — Domain of Cyber Security Policy: Laws and Regulations, Enterprise Policy, Technology Operations, Technology Configuration - Strategy Versus Policy — Cyber Security Evolution: Productivity, Internet, E-commerce, Counter Measures, Challenges.

### **Unit II      Scope and Laws of Computer Forensics      6 Hours**

Scope of Computer Forensics: Introduction, Types of Evidence, Investigator skills, Importance - History of Computer Forensics, Law Enforcement Training- Operating Systems and File Systems.

### **Unit III      Acquiring Evidence and Documentation      6 Hours**

Lab requirements - Private sector computer forensics laboratories- Computer Forensics laboratory requirements- Extracting evidence from a device- Documenting the Investigation.

### **Unit IV      Network Forensics      6 Hours**

Tools- Networking devices- Network forensics- OSI Model- Advanced Persistent Threat -Investigating a Network Attack.

### **Unit V      Mobile Forensics      6 Hours**

Cellular Network - Handset Specifications - Mobile Operating Systems - Standard Operating Procedures for Handling Handset Evidence - Handset Forensics – Case Studies.



**List of Exercises****30 Hours**

1. Study of Computer Forensics and different tools used for forensic investigation
2. Live Forensics Case Investigation using Autopsy
3. How to Recover Deleted Files using Forensics Tools
4. Find Last Connected USB on your system (USB Forensics)
5. How to Extracting Browser Artifacts
6. Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Discuss the cyber security policy and its evolution for the purpose ofComputer forensics     | Understand      |
| CO2:   | Summarize the scope and laws of Computer Forensics for Cyber Security Professionals          | Understand      |
| CO3:   | Explain the process of acquiring and documenting Computer ForensicEvidence for investigation | Understand      |
| CO4:   | Describe the steps involved in investigating Network Forensics for attacks                   | Understand      |
| CO5:   | Comprehend the steps involved in investigating Mobile Forensics with Case Studies            | Understand      |

**Text Book(s):**

- T1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs, Jeffrey Schmidt, Joseph Weiss, "Cyber Security Policy Guidebook", John Wiley & Sons, 2017.
- T2. Darren R. Hayes, "A Practical Guide to Computer Forensics Investigations", Pearson, 2014.

**Reference Book(s):**

- R1. Bill Nelson, Amelia Phillips, Christopher Steuart, "Computer Forensics and Investigations", 6<sup>th</sup> Edition, Cengage learning, 2018.
- R2. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", Auerbach Publications 2017.
- R3. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", 3<sup>rd</sup> Edition, Tata McGraw -Hill, 2014.

**Web References:**

1. Basic Research in Cyber Security: <http://dst.gov.in/basic-research-cyber-security>
2. Developing a Computer Forensics Team: <https://www.sans.org/reading-room/whitepapers/incident/developing-computer-forensics-team-628>
3. Advanced Executive Program in Cyber Security: <https://www.cybrary.it/cyber-security/>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

## Vertical II - Full Stack Development Electives

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN1005</b>                |                  | <b>Course Title: User Interface Design Principles</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                          |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>   | <b>Credits:3</b> | <b>Total Contact Hours:45</b>                         | <b>Max.Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Explain the principles and process of UI design
2. Design User Interfaces using appropriate Windows and Menu controls
3. Develop Interaction design, Evaluation and Testing process
4. Design mobile applications by choosing appropriate Mobile Design elements
5. Design the webpages by selecting appropriate Interaction methods

### **Unit I Principles and Process**

**9 Hours**

Importance of the User Interface – Interaction Styles – Graphical User Interface – Direct Manipulation – Characteristics – Web User Interface – Principles of User Interface Design – User Interface Design Process – Human Characteristics in Design.

### **Unit II Windows and Menus**

**9 Hours**

Windows – Characteristics – Components – Presentation Styles – Types – Organizations – Operations – Web Systems – Device Based Controls – Screen Based Controls – Menus– Structures – Functions – Contents – Formatting – Phrasing – Selecting Menu Choices – Web Site Navigation – Graphical Menus. Case Study: Pencil Project tool.

### **Unit III Design and Testing**

**9 Hours**

Emotions and the User Experience – Expressive Interfaces – Frustrating Interfaces – Models of Emotion – Interfaces – Process of Interaction Design – Requirements Gathering – Analysis – Interpretation – The Evaluation Framework – Usability Testing – Prototypes – Kinds of Test. Case Study: Just in mind Prototype.

### **Unit IV Mobile HCI**

**9 Hours**

Mobile Ecosystem: Platforms – Application frameworks – Types of Mobile Applications – Mobile Information Architecture – Mobile Design – Elements of Mobile Design – Case study: Mobile 2.0.

### **Unit V Web HCI**

**9 Hours**

In Page Editing – Drag & Drop – Direct Selection – Contextual Tools – Overlays – Inlays and Virtual Pages – Process Flow – Static Invitations – Dynamic Invitations.

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Explain the principles and process of UI design for developing an Interface                     | Understand      |
| CO2: Design User Interfaces using appropriate Windows and Menu controls for any given application    | Apply           |
| CO3: Develop Interaction design, Evaluation and Testing process to solve real world problems         | Apply           |
| CO4: Design mobile applications by choosing appropriate Mobile Design elements for a given scenario  | Apply           |
| CO5: Designing the webpages by selecting appropriate Interaction methods for building an application | Apply           |

#### Text Book(s):

T1. Wilbert O. Galitz, "The Essential Guide to User Interface Design", 3<sup>rd</sup> Edition, John Wiley & Sons, 2007.

T2. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human – Computer Interaction", 5<sup>th</sup> Edition, John Wiley & Sons, 2019.

T3. Brian Fling, "Mobile Design and Development", O'Reilly Media Inc., 2009.

T4. Bill Scott and Theresa Neil, "Designing Web Interfaces", O'Reilly, 2009.

#### Reference Book(s):

R1. Jenifer Tidwell, "Designing Interfaces", 2<sup>nd</sup> Edition, O'Reilly Publications, 2011.

R2. Marc Silver, "Exploring Interface Design", Delmar Cengage Learning, 2013.

#### Web References:

- NPTEL Course: [https://onlinecourses.nptel.ac.in/noc21\\_ar05/preview](https://onlinecourses.nptel.ac.in/noc21_ar05/preview)
- User interface design for the mobile web  
URL: <https://www.ibm.com/developerworks/library/wa-interface/>
- Designing web applications URL: <http://nathanbarry.com/webapps/>
- Ten Great Sites for UI Design Patterns URL: <https://www.interaction-design.org/literature/article/10-great-sites-for-ui-design-patterns>.

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN1006</b>                |                  | <b>Course Title: Visual Data Analysis</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>              |                      |
| <b>L:T: P (Hours/Week)</b><br><b>3: 0: 0</b>  | <b>Credits:3</b> | <b>Total Contact Hours:45</b>             | <b>Max.Marks:100</b> |

### **Pre-requisites**

- Engineering Drawing

### **Course Objectives**

The course is intended to:

1. Create interactive computer graphics
2. Demonstrate the basic principles of implementing graphical output primitives and their attributes
3. Implement 2D transformation and viewing operations
4. Design a 3D object and perform transformation and viewing operations
5. Identify suitable surface detection, lighting and rendering methods

### **Unit I Graphics Software Standards and Primitives 9 Hours**

Coordinate Representations – Graphics Functions – Software Standards – Introduction to OpenGL – Coordinate reference frame – Specifying 2D using OpenGL – OpenGL Point Functions – OpenGL Line Functions – Fill Area Primitives – Polygon Fill Area – OpenGL polygon Fill Area Functions.

### **Unit II Output Primitives and Attributes 9 Hours**

Line Drawing Algorithms – DDA Line Drawing Algorithm – Bresenham's Line Drawing Algorithm – Circle Drawing Algorithm. Point attributes – Line attributes – Fill Area attributes – Character attributes – OpenGL Functions.

### **Unit III 2D Transformation and Viewing 9 Hours**

Basic Transformations – Homogeneous Representation – Composite Transformation – Other Transformations – OpenGL functions. Viewing Pipeline – Clipping Window – Window to Viewport transformation – OpenGL 2D viewing Functions – Clipping Algorithms: Point Clipping – Line Clipping – Cohen Sutherland Line Clipping Algorithm – Polygon Clipping – Sutherland Hodgeman and Weiler Atherton Method – Text Clipping

### **Unit IV 3D Transformations and Viewing 9 Hours**

3D Object Representation – OpenGL Functions– Quadric and Cubic Surfaces–Bezier and Spline Curves– 3D Transformation – OpenGL Functions – 3D Viewing – 3D Viewing Concepts – 3D Viewing Pipeline – Projection Transformations – Orthogonal Projections – Oblique Parallel Projections – Perspective Projections – OpenGL Functions.

### **Unit V Visualization of 3D Objects 9 Hours**

Visible Surface Detection Methods: Classification – Back face detection – Depth Buffer Method – A Buffer Method – Scan Line Method – Depth Sorting Method – BSP Tree Method – Oct Tree Method – Comparison. Illumination and Surface Rendering: Light Sources – Surface Lighting Effects – Surface Rendering–OpenGL Functions.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Create Interactive Computer Graphics using basic OpenGL functions  | Apply           |
| CO2: Demonstrate the basic principles in implementing graphical output primitives and their attributes for the given scenario | Apply           |
| CO3: Implement 2D Transformations and Viewing operations for the given 2D object  | Apply           |
| CO4: Design a 3D object and perform Transformation and Viewing operations using OpenGL built-in functions                     | Apply           |
| CO5: Identify suitable surface detection, lighting and rendering methods for displaying the real-world objects                | Apply           |

#### Text Book(s):

T1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", 4<sup>th</sup> Edition, Pearson Education, 2016.

#### Reference Book(s):

R1. D. F. Rogers and J. A. Adams, "Mathematical Elements for Computer Graphics", 2<sup>nd</sup> Edition, McGraw-Hill International Edition, 2017.

R2. Edward Angel, "Interactive Computer Graphics A Top-Down Approach with OpenGL", 5<sup>th</sup> Edition, Addison-Wesley, 2012.

R3. Shalini Govil Pai, "Principles of Computer Graphics Theory and Practice Using OpenGL and Maya", Springer, 2010.

#### Web References:

1. NPTEL Course: <https://nptel.ac.in/noc/courses/noc21/SEM2/noc21-cs97/>
2. The Official Guide to Learning OpenGL: <http://www.glprogramming.com/re d/>
3. OpenGL Reference Manual : <http://www.glprogramming.com/blue/>
4. OpenGL Latest : <http://nehe.gamedev.net/>
5. The Official site of OpenGL : <http://www.opengl.org/>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN1007</b>                |                  | <b>Course Title: Computational Vision</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>              |                      |
| <b>L:T: P (Hours/Week)</b><br><b>3: 0: 0</b>  | <b>Credits:3</b> | <b>Total Contact Hours:45</b>             | <b>Max.Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Summarize the fundamental concepts and methods related to Image formation and processing.
2. Apply feature detection, matching and detection
3. Make use of feature based alignment and motion estimation
4. Develop skills on 3D reconstruction
5. Select image based rendering and recognition

### **Unit I Introduction to Image Formation and Processing 9 Hours**

Computer Vision - Geometric primitives and transformations - Photometric image formation – The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

### **Unit II Feature Detection, Matching and Segmentation 9 Hours**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

### **Unit III Feature-Based Alignment and Motion Estimation 9 Hours**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment – Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion – Optical flow - Layered motion.

### **Unit IV 3D Reconstruction 9 Hours**

Shape from X - Active range finding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos.

### **Unit V Image-Based Rendering and Recognition 9 Hours**

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition – Category recognition - Context and scene understanding- Recognition databases and test sets.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Summarize the fundamental concepts related to image processing   | Apply           |
| CO2: Apply feature detection, matching and detection for real life scenarios                                      | Apply           |
| CO3: Make use of feature based recognition and motion estimation for identifying the characteristics of an object | Apply           |
| CO4: Utilize 3D reconstruction for capturing the shape and appearance of objects                                  | Apply           |
| CO5: Select image based rendering and recognition methods to generate 3D model                                    | Apply           |

#### Text Book(s):

T1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.

T2. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, Second Edition, 2015.

#### Reference Book(s):

R1. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, 2004.

R2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006

R3. E. R. Davies, "Computer and Machine Vision", Fourth Edition, Academic Press, 2012.

#### Web References:

1. NPTEL Course: [https://onlinecourses.nptel.ac.in/noc19\\_cs58/](https://onlinecourses.nptel.ac.in/noc19_cs58/)

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1



|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN1008</b>                |                  | <b>Course Title: Cloud Services Management</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                   |                      |
| <b>L:T: P (Hours/Week)</b><br><b>3: 0: 0</b>  | <b>Credits:3</b> | <b>Total Contact Hours:45</b>                  | <b>Max.Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Introduce Cloud Service Management terminology, definition & concepts.
2. Compare cloud service management with traditional IT service management
3. Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
4. Select appropriate structures for designing, deploying and running cloud-based services in a business environment
5. Illustrate the benefits and drive the adoption of cloud-based services

### **Unit I Introduction**

**9 Hours**

Cloud Ecosystem - The Essential Characteristics - Basics of Service Management - Service Perspectives - Cloud Service Models - Cloud Service Deployment Models.

### **Unit II Cloud Services Fundamentals**

**9 Hours**

Cloud Strategy Management Framework- Cloud Policy - Key Driver for Adoption - Risk Management - IT Capacity and Utilization - Demand and Capacity matching - Demand Queueing - Change Management - Cloud Service Architecture.

### **Unit III Cloud Service Management**

**9 Hours**

Cloud Service Reference Model - Cloud Service LifeCycle - Basics of Cloud Service Design - Dealing with Legacy Systems and Services - Benchmarking of Cloud Services - Cloud Service Capacity Planning - Deployment and Migration - Marketplace - Operations Management.

### **Unit IV Cloud Service Economics**

**9 Hours**

Pricing models for Cloud Services - Procurement of Cloud-based Services - Capex vs Opex Shift - Cloud service Charging - Cloud Cost Models.

### **Unit V Governance and Values**

**9 Hours**

Cloud Governance Framework & Structure - Cloud Governance Considerations - Cloud Service Model Risk Matrix - Value of Cloud Services - Balanced Scorecard - Total Cost of Ownership.

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Introduce Cloud Service Management terminology, definition & concepts   | Understand      |
| CO2: Compare cloud service management with traditional IT service management   | Apply           |
| CO3: Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services                | Apply           |
| CO4: Select appropriate structures for designing, deploying and running cloud-based services in a business environment | Apply           |
| CO5: Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems               | Apply           |

#### Text Book(s):

- T1.Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2020.
- T2.Thomas Erl, Ricardo Puttini, Zaigham Mohammad, "Cloud Computing: Concepts, Technology & Architecture", Pearson India, 2013.
- T3.Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns", Pearson Education, 2017.

#### Reference Book(s):

- R1.Praveen Ayyappa, "Economics of Cloud Computing", LAP Lambert Academic Publishing, 2020.
- R2.Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi, "Mastering Cloud Computing Foundations and Applications Programming", 2013.

#### Web References:

1. NPTEL Course: [https://onlinecourses.nptel.ac.in/noc21\\_cs14/preview](https://onlinecourses.nptel.ac.in/noc21_cs14/preview)

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |                                      |                      |
|---|------------------|--------------------------------------|----------------------|
| <b>Course Code: 19ADEN2005</b>                |                  | <b>Course Title: Web Programming</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>         |                      |
| <b>L:T: P (Hours/Week)</b><br><b>2: 0: 2</b>  | <b>Credits:3</b> | <b>Total Contact Hours:60</b>        | <b>Max.Marks:100</b> |

### **Pre-requisites**

- IT Practices Lab

### **Course Objectives**

The course is intended to:

1. Design a responsive web page
2. Develop interactive web pages using open source JavaScript Libraries
3. Construct complex user interfaces having a unidirectional data flow
4. Develop a back end solution for a given scenario
5. Build a Web Content Management System

### **Unit I          Bootstrap**

**6 Hours**

Containers – Grid System – Display Widths – Advanced Grid Techniques: Row Columns – Vertical Alignment – Horizontal Alignment – Nesting – Collapse and Expand – Navigation Bar – Buttons – Tables – Labels and Badges – Tabs – Alerts – Progress Bar – Cards – Carousels – Forms.

### **Unit II          JQuery and AJAX**

**6 Hours**

Selecting and Filtering – Events – Manipulating Content and Attributes – Iteration of Arrays and Objects – Working with CSS Properties – AJAX.

### **Unit III          React JS**

**6 Hours**

React Elements – React DOM – React Components – React with JSX – React State Management – Building Forms – React Context – Enhancing Components with Hooks – Incorporating Data.

### **Unit IV          Node JS**

**6 Hours**

Node.js Capabilities – Setting up Node.js – Modules –NPM – Event Emitters – Sending and receiving events with Event Emitters – HTTP server applications – HTTP Sniffer – Listening to the HTTP conversation– Express JS – Making HTTP Client requests – Calling a REST backend service – Mobile First Paradigm.

### **Unit V          Web Content Management**

**6 Hours**

Content Management system – Acquiring CMS – Content Management Team – Content Modeling – Content Aggregation – Output and Publication Management – Case Study : Joomla.

### **List of Exercises**

**30 Hours**

1. Develop a responsive web page using BootStrap
2. Develop interactive web pages using JQuery and AJAX
3. Create a front-end web page using React JS
4. Implement back-end web system using Node JS
5. Develop a web application using Node JS
6. Create a Web content management system using Joomla tool

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1:Design a responsive web page using Bootstrap Technology                                   | Apply           |
| CO2:Develop interactive web pages using open source JavaScript Libraries like JQuery and AJAX | Apply           |
| CO3:Construct complex user interfaces having a unidirectional data flow using React JS        | Apply           |
| CO4: Develop a back end solution for a given scenario using Node JS                           | Apply           |
| CO5: Build a Web Content Management System using tools like Joomla                            | Apply           |

#### Text Book(s):

T1.Panos Matsinopoulos, "Practical Bootstrap: Learn to Develop Responsively with One of the Most Popular CSS Frameworks" , APRESS, 2020.

T2.Richard York, "Web Development with jQuery", Wiley India, 2015.

#### Reference Book(s):

R1. C Xavier, "Web Technology and Design", First edition, New Age International Publishers, 2018.

R2. Porter Scobey, Pawan Lingras, "Web Programming And Internet Technologies: An E-Commerce Approach", 2<sup>nd</sup> Edition, Jones and Bartlett Publishers, Inc, 2016.

#### Web References:

1. React JS Tutorial: <https://reactjs.org/tutorial/tutorial.html>
2. nodejs Tutorial: <https://nodejs.org/en/>
3. joomla Tutorial: <https://docs.joomla.org/>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN2006</b>                |                  | <b>Course Title: Game Designing Techniques</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Practice</b>                  |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b> | <b>Total Contact Hours:60</b>                  | <b>Max.Marks:100</b> |

### **Pre-requisites**

- Artificial Intelligence-II

### **Course Objectives**

The course is intended to:

1. Explain the theory of game elements
2. Develop varied gaming experience
3. Design a dynamic gaming system
4. Apply various dynamic aspects of gameplay
5. Build prototype of game design

### **Unit I Elements & Player Experience**

**6 Hours**

Design Process - Model Description – Practice of game design - Player Experience – Player theories – User Personas – Empirical models – Experience design.

### **Unit II Game Mechanics**

**6 Hours**

Mechanics as Building Blocks - Composition of Mechanics - Games as State Spaces Game State - Explicit and Implicit Mechanics - Families of Mechanics: Control Mechanics - Progression Mechanics - Uncertainty Mechanics - Resource Management Mechanics – Mechanics Design.

### **Unit III Game System**

**6 Hours**

Game system - Mechanic chains and loops – Feedback loops - Effects of Positive Feedback - Effects of Negative Feedback – Emergence and Chaos – System design – System tuning - Case Study: Diablo.

### **Unit IV Game Play**

**6 Hours**

Gameplay Loops - Player Motivation: Intrinsic and Extrinsic Motivation - Intrinsic Motivation: Flow and Learning Flow - Extrinsic Motivation: Work and Rewards - Gameplay Loop Design Heuristics – Case Study: The Sims.

### **Unit V Macrostructure & Prototype**

**6 Hours**

Game Fiction - Macrostructure and Content Arcs – Prototyping: Playable Prototypes - Iterative Process - Playtesting - Documenting Design - Finishing Iteration – Case study: The Witcher, Project Highrise.

### **List of Exercises**

**30 Hours**

1. Develop a game design document for a simple game
2. Build a prototype of the game designed in Exercise 1
3. Develop different game mechanics required to provide the expected user experience
4. Integrate the mechanics developed in Exercise 3 to provide a dynamic gaming experience
5. Design a suitable user interface for the game developed
6. Include audio and special effects to the game environment

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                              |                 |
| CO1: Explain the elements of games by preparing a design document for a real game | Understand      |
| CO2: Develop gaming experience by applying various game mechanics                 | Apply           |
| CO3: Design a dynamic gaming system by integration a variety of mechanics         | Apply           |
| CO4: Apply various dynamic aspects of gameplay to maximize the player's           | Apply           |
| CO5: Build prototype of game design by iterative and incremental model            | Apply           |

#### Text Book(s):

T1.Robert Zubek, “ Elements of Game Design” , The MIT Press, 2020

#### Reference Book(s):

R1. Nicolas Alejandro Borromeo, “Hands-on Unity 2020 Game development”, Packt Publishing Ltd, 2020.

R2.James R. Parker , “Introduction to game development using Processing”, Mercury Learning And Information LLC, 2015.

R3.Ernest Adams and Andrew Rollings, “Fundamentals of Game Design”, Pearson Education, 3<sup>rd</sup> Edition, 2014.

R4.Casey Reas, Ben Fry, “Processing : A programming handbook for visual designers and artists”, MIT Press, 2007.

#### Web References:

1. Introduction to Game Design URL: <https://www.coursera.org/learn/game-design>
2. Introduction to Game Design Theory URL: <https://www.udemy.com/course/welcome-to-game-design-introduction-to-game-theory/>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN2007</b>                |                  | <b>Course Title: Augmented Reality for AI</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                  |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b> | <b>Total Contact Hours:60</b>                 | <b>Max.Marks:100</b> |

### **Pre-requisites**

- Nil

### **Course Objectives**

The course is intended to:

1. Describe the fundamentals of XR.
2. Outline the Virtual Reality Architecture and Modelling.
3. Develop Virtual Reality applications
4. Explain the basics of Augmented Reality
5. Apply the design principles of Augmented Reality apps

#### **Unit I XR Overview**

**6 Hours**

Introduction – XR Spectrum – Definitions - Augmented Reality – Virtual Reality – Mixed Reality – History – Challenges – XR and Business – Applications : Retail, Training, Education, Healthcare, Entertainment, Sports, Manufacturing, Military.

#### **Unit II VR IO, Modelling**

**6 Hours**

VR Definition, Input Devices: Trackers, Navigation and Gesture Interfaces, Output Devices: Graphics, Three Dimensional Sound and Haptic Displays, Computer Architecture for VR, Modelling.

#### **Unit III VR Application Development**

**6 Hours**

Enabling VR Environment, Building: Steam VR, Oculus Rift, Windows Gear VR, Oculus Go, Google VR, Setting up for Android Devices - 3D walkthrough, Object Grabbing, Transformation, Hand Avatar manipulation, World space menu creation.

#### **Unit IV AR Principles**

**6 Hours**

AR Definition, Displays: Multimodal Displays, Spatial Display Model, Visual Displays, Tracking, Calibration and Registration - Mobile Sensors - Computer Vision for AR.

#### **Unit V AR Application Development**

**6 Hours**

Mobile Application for Image Tracking, Image Dataset Generation, Setting up AR Environment, Animation and transformation (Scale, Move, Rotate, Transform), Build Generation for ios and Android. Case Study: Picture Puzzle.

### **List of Exercises**

**30 Hours**

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender
2. Use the primitive objects and apply various projection types by handling camera
3. Download objects from asset store and apply various lighting and shading effects
4. Model three dimensional objects using various modelling techniques and apply textures over them
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity
6. Add audio and text special effects to the developed application

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Describe the fundamentals of XR with example applications                                  | Understand      |
| CO2: Outline the Augmented Reality Architecture and Modelling for real time applications        | Understand      |
| CO3: Develop the Augmented reality applications by choosing appropriate tools                   | Apply           |
| CO4: Explain the basics of augmented reality with real time examples                            | Apply           |
| CO5: Apply the design principles and practices of augmented reality apps for industrial sectors | Apply           |

### Text Book(s):

T1. Berbard Marr, "Extended Reality in Practice", Wiley, 2021

T2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", 2nd Edition, John Wiley & Sons Inc., 2014.

T3. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles and Practice", Pearson Education (US), 2017.

T4. Jesse Glover, Jonathan Linowes, "Complete Virtual Reality and Augmented Reality Development with Unity", Packt Publishing Ltd, 2019.

### Reference Book(s):

R1. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technology Applications, and Human Factors for AR and VR", Addison-Wesley, 2016.

R2. Robert Scoble, Shel Israel, "The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything", Patrick Brewster Press, 2016.

### Web References:

1. Build Virtual Worlds URL: <https://developers.google.com/vr/>

2. Quick Start for unreal URL: <https://developers.google.com/ar/develop/unreal/quickstart>

3. Unity User Manual URL: <https://docs.unity3d.com/Manual/UnityManual.html>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1





**Unit V          Monitoring, Provisioning and Administration Patterns****6 Hours**

User Monitoring- Pay as you Go- Real time Resource Availability- Rapid Provisioning- Platform Provisioning- Bare-metal Provisioning- Automated Administration- Centralized remote Administration- resource Management- Self Provisioning- Power Consumption Reduction

**List of Exercises****30 Hours**

1. Simulate a cloud scenario using CloudSim and run a scheduling algorithm not present in CloudSim
2. Simulate resource management using CloudSim
3. Simulate a secure file sharing using CloudSim
4. Implement data anonymization techniques over the simple dataset (masking, k-anonymization, etc)
5. Implement any encryption algorithm to protect the images
6. Develop a log monitoring system with incident management in the cloud

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Describe the cloud concepts and fundamentals  | Understand      |
| CO2: Explain the risks and challenges associated with access control in cloud                    | Understand      |
| CO3: Implement audit and monitoring mechanisms in the cloud                                      | Apply           |
| CO4: Utilize security patterns for designing applications to protect from various attacks        | Apply           |
| CO5: Illustrate the monitoring and administration patterns for usage of IT resource in the cloud | Apply           |

**Text Book(s):**

- T1. Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns", Pearson Education, 2015.
- T2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy", O'Reilly Media, 2009.

**Reference Book(s):**

- R1. Mark C. Chu-Carroll, "Code in the Cloud", CRC Press, 2011.
- R2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing Foundations and Applications Programming", Elsevier, 2013.

**Web References:**

1. Cloud Security and Privacy ebook: <https://www.oreilly.com/library/view/cloud-security-0596806453/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

### **Vertical III Software Project Management Electives**

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1009</b>                | <b>Course Title: Principles of Business Management</b> |                               |                       |
| <b>Course Category: Professional Elective</b> |  | <b>Course Level: Mastery</b>  |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b>    | <b>Credits:3</b>                                       | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Describe the functions of management in a business organization
2. Analyze different forecasting techniques
3. Identify various types of organizational structures and patterns
4. Describe various leadership functions and Motivational Techniques
5. Illustrate the role of Information technology for performance control

#### **Unit I Introduction**

**9 Hours**

Historical developments-approaches to management-Management and Administration - Development of Management Thought Contribution of Taylor and Fayol's - Functions of Management-Types of Business Organization.

#### **Unit II Managers and Environment**

**9 Hours**

Social responsibility-Planning - Objectives - Setting Objectives-Process of Managing through Objectives Strategies- Policies and Planning Premises- Forecasting-Techniques- Decision making.

#### **Unit III Functional Area Organization**

**9 Hours**

Formal and Informal Organization Organization Chart - Structure and Processes Departmentalization by difference strategies - Line and Staff authority - Benefits and Limitations De-Centralization and Delegation of Authority Staffing Selection Process- Techniques.

#### **Unit IV Motivation And Directions**

**9 Hours**

Objectives Human Factors- Harmonizing-Objectives - Leadership Types of Leadership Motivation Hierarchy of needs- Motivational Techniques -Communication-Types.

#### **Unit V Controlling Strategies**

**9 Hours**

System and Process of Controlling - Requirements for effective control - The Budget as Control Technique - Information Technology- Computers in handling the information Control of Overall Performance Direct and Preventive Control -Globalization and Liberalization- International Management and Global theory of Management

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Describe the functions of management in a business organization  | Apply           |
| CO2:   | Analyze different forecasting techniques to set objectives and make decisions                                      | Apply           |
| CO3:   | Identify various types of organizational structures and patterns for effective management                          | Apply           |
| CO4:   | Describe various leadership functions and Motivational Techniques for performance Improvement                      | Apply           |
| CO5:   | Illustrate the role of Information technology for performance control in organizations and impact of globalization | Apply           |

### Text Book(s):

- T1. Harold Koontz, Heinz Weinrich, "Essentials of Management, Seventh Edition, TataMcGraw-Hill ,2007.
- T2. Tripathy PC, Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.
- T3. Stephen P Robins & Mary Coulter, Fundamentals of Management, Seventh Edition,2013.

### Reference Book(s):

- R1. JAF Stoner, Freeman RE and Daniel R Gilbert. "Management, Sixth Edition Pearson Education, 2004.

### Web References:

1. Principles of Management guide: <http://www.managementstudyguide.com/management-principles.html>
2. Principles of Management guide: <http://study.com/academy/course/principles-of-management-course.html>
3. Functional Areas of management  
Tutorial:<http://www.buisnessmanagementideas.com/management/5-functional-areas-of->
4. Characteristic of leadership Principles: <http://www.leadership-toolbox.com/characteristic-of-leadership.html>
5. Principles of Management guide:  
<http://discovery.bitsplani.ac.in/dipd/courses/coursecontent/courseMaterial/mgtszc211> /

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1010</b>                | <b>Course Title: Software Development Project Management</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Practice</b>                                |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b>    | <b>Credits:3</b>   | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Object Oriented Software Development

### **Course Objectives**

The course is intended to:

1. Describe the activities of Project Management
2. Choose the appropriate process model
3. Estimate the software development effort
4. Evaluate the overall duration of the project
5. Discuss the work plan, schedule and state of a project

### **Unit I Project Evaluation and Management**

**9 Hours**

Importance of Software Project Management – Types of Project – Contract and Technical Project Management – Activities – Plans, Methods and Methodologies- Categorizing Software Projects – Stakeholders – Setting Objectives- Project Success and Failure – Management Control –Portfolio Management – Evaluation Techniques – Risk Evaluation-Programme Management.

### **Unit II Project Planning and selection of Approaches**

**9 Hours**

Stepwise Project Planning–Build or Buy- Choosing Methodologies and Technologies – Software Process and Models – Prototyping – Categorizing Prototypes – Incremental Delivery – Atern/Dynamic System Development –RAD – Agile Methods – Extreme Programming(XP) - SCRUM – Managing Iterative Process – Selecting Appropriate Process Model.

### **Unit III Software Effort Estimation**

**9 Hours**

Estimation – Problems in Estimation – Basis for Estimation – Software Effort Estimation Techniques – Bottom-up Estimating – Top-down Approach and Parametric Models – Expert Judgment – Estimating by Analogy – Albercht Function Point Analysis – FunctionPoints Mark II – COSMIC Full Function Points –Parametric Productivity Model – CapersJones Estimating Rules of Thumb.

### **Unit IV Activity Planning and Risk Management**

**9 Hours**

Objectives of Activity Planning– Project Schedules – Project and Activities - Sequencing and Scheduling Activities – Network Planning Model – Forward Pass – The Backward Pass – Activity Float – Project Duration – Critical Activities – Activity on Arrow Networks -Risk – Categories of Risk – Identification – Assessment – Planning – Management –Evaluating Risk – Applying PERT – Monte Carlo Simulation –Critical Chain Concepts.

### **Unit V Resource Allocation, Monitoring And Control**

**9 Hours**

Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths –Counting the Cost – Publishing Resource Schedule – Cost Schedules – Scheduling Sequence – Creating Framework – Collecting Data – Visualizing Progress – Cost Monitoring – Earned Value Analysis–Managing Contracts- Types of Contract-Stages in Contract Placement-Contract Management-Acceptance.

| Course Outcomes                                      |   | Cognitive Level |
|--|---|-----------------|
| At the end of this course, students will be able to: |   |                 |
| CO1:   | Describe the activities of Project Management by classifying projects               | Understand      |
| CO2:   | Choose the appropriate process model for a project planning                         | Apply           |
| CO3:   | Estimate the software development effort using various models                       | Apply           |
| CO4:   | Evaluate the overall duration of the project by categorizing and Prioritizing risks | Apply           |
| CO5:   | Discuss the work plan, schedule and state of a project for resource allocation      | Apply           |

### Text Book(s):

- T1. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", 6<sup>th</sup> Edition, TataMcGraw Hill Publishers, 2017.

### Reference Book(s):

- R1. Robert K. Wysocki "Effective Software Project Management", Wiley Publication, 2011.  
R2. Walker Royce: "Software Project Management" Addison, Wesley, 1998.  
R3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education, Fourteenth Reprint 2013.

### Web References:

1. Project Management URL: [http://www.inf.ed.ac.uk/teaching/courses/seoc/2006\\_2007/notes/LectureNote07\\_ProjectManagement.pdf](http://www.inf.ed.ac.uk/teaching/courses/seoc/2006_2007/notes/LectureNote07_ProjectManagement.pdf)
2. Software Project Management URL: <https://www.classle.net/#!/classle/largecontent/software-project-managment-lecture-slides/>
3. Project Risk Management URL: <http://nptel.ac.in/courses/106101061/38/management-buisness-management/512>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1011</b>                | <b>Course Title: Software Quality Management</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Practice</b>                    |                               |                       |
| <b>L:T:P(Hours/Week)<br/>3: 0: 0</b>          | <b>Credits:3</b>                                 | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Explain various factors and components of software quality
2. Demonstrate on integrating software quality assurance components in project lifecycle
3. Identify the appropriate software testing strategies for designing test cases
4. Choose a suitable type of software testing at the appropriate stage
5. Illustrate on automatic software testing for projects.

### **Unit I      Software Quality and Architecture      9 Hours**

Need for Software Quality – Software Quality Assurance (SQA) – Software Quality Factors: McCall's Factor Model – Components of SQA System: SQA System and Architecture – Pre- Project Components – Software Project Life Cycle Components – Infrastructure Component for error prevention and improvement – Management of SQA components – CASE Tools.

### **Unit II      Software Quality Assurance Components      9 Hours**

Reviews: Objectives – Formal design Review – Peer Review – Expert Opinions – Supporting Quality devices: Templates – Checklists – Corrective and Preventive Actions process – Documentation Control – SQA Units.

### **Unit III      Test Case Design      9 Hours**

Testing as a Process – Test Case Design Strategies – Black Box Approach: Equivalence Class Partitioning, Boundary Value Analysis, Cause-and-Effect Graphing – State Transition Testing – White Box Approach: Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic – Data Flow and White Box Test Design – Loop Testing – Mutation Testing.

### **Unit IV      Levels of Testing, Test and Defect Management      9 Hours**

Need for Levels of Testing – Unit Test: Need, Plan & Design – Integration Test – System Test: Functional Testing – Performance Testing – Stress Testing – Configuration Testing – Security Testing – Recovery Testing – Regression Testing – Alpha, Beta, and Acceptance Tests – Test Planning – Test plan Components – Defect Lifecycle – Fixing / Closing Defects.

### **Unit V      Test Automation      9 Hours**

Software Test Automation – Skill Needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Test Metrics and Measurements: Project, Progress and Productivity Metrics.



| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Explain various factors and components of software quality in any software related process and differentiate it with administration. | Understand      |
| CO2: Demonstrate on integrating software quality assurance components in project life cycle for any project                               | Apply           |
| CO3: Identify the appropriate software testing strategies for designing test cases for any given problem                                  | Apply           |
| CO4: Choose a suitable type of software testing at appropriate stage for any given application  | Apply           |
| CO5: Illustrate on automatic software testing for projects using automated testing tools  | Apply           |

#### Text Book(s):

T1. Daniel Galin, "Software Quality Assurance - From theory to implementation", Pearson Education, 2016.

T2. Ilene Burnstein, "Practical Software Testing - A Process Oriented Approach", Springer, 2010.

#### Reference Book(s):

R1. Alan Gilles, "Software Quality: Theory and Management", 3<sup>rd</sup> Edition, Thomson Computer Press, 2011.

R2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practice", Pearson Education, 2008.

R3. Dorothy Graham, Mark Fewster, "Experiences of Test Automation: Case Studies of Software Test Automation", Pearson Education, 2012.

#### Web References:

1. Software Quality Assurance Tutorial: <https://reqtest.com/testing-blog/software-quality-assurance/>

2. Software Project Management URL: <https://www.classle.net/#!/classle/largecontent/software-project-managment-lecture-slides/>

3. Software Testing: <https://www.toolsqa.com/software-testing/defect-life-cycle>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1012</b>                | <b>Course Title: Reliability Engineering and system safety</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                                   |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b>    | <b>Credits:3</b>   | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Object Oriented Software Development

### **Course Objectives**

The course is intended to:

1. Understand the importance of the concepts of reliability, system using various models
2. Use the static and dynamic model systems for reliability design
3. Design for maintainability with various maintenance models
4. Apply the analysis of Failure Data and Reliability Testing
5. Build reliability application using various case studies

### **Unit I Concepts of Reliability, System and Models 9 Hours**

The study of reliability and maintainability – Concepts, terms and definitions – Reliability function – MTTF – Hazard rate function – Bathtub curve – Conditional Reliability – Constant failure rate model – Time dependent failure models: Weibull distribution – Normal distribution – The lognormal distribution.

### **Unit II Design for Reliability 9 Hours**

Markov analysis – Load sharing systems – Standby system – Degraded systems, Three state devices – Covariate models – Static models – Dynamic models – Physics of failure models – Reliability Specification and System Measurements – Reliability allocation – Design methods – Failure analysis – System safety and FTA.

### **Unit III Design for Maintainability 9 Hours**

Maintainability - Analysis of downtime – The repair time distribution – Stochastic point processes – System repair time – Reliability under preventive maintenance – State dependent systems with repair – Design for Maintainability – Availability.

### **Unit IV Analysis of Failure Data and Reliability Testing 9 Hours**

Data collection and empirical methods – Reliability testing – Reliability Growth testing – Identifying failure and repair distributions.

### **Unit V Applications – Case Studies 9 Hours**

Goodness of Fit Tests - Applications: Reliability Estimation and Application - Implementation: Objectives, Functions and Processes – Economics of reliability and maintainability – Organizational Considerations – Data Sources and Data Collection methods – Product Liability, Warranties and Related Matters – Software Reliability.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                          |                 |
| CO1: Explain the concepts of reliability, system using various                | Understand      |
| CO2: Design the reliability for a system using static and dynamic             | Apply           |
| CO3: Develop the design for Maintainability with various maintenance concepts | Apply           |
| CO4: Identify the Failure data using Reliability testing methods              | Apply           |
| CO5: Construct reliable system by adapting various test case applications     | Apply           |

#### Text Book(s):

- T1. Charles E. Ebling, "An Introduction to Reliability and Maintainability Engineering", Tata McGraw-Hill, 2017.

#### Reference Book(s):

- R1. R.Subburaj, "Software Reliability Engineering", McGraw Hill Education, 2015.  
R2. P.K.Kapur, H.Pharm, A.Gupta, P.C.Jha, "Software Reliability with OR Assessments",

#### Web References:

- Reliability Engineering : Definition, Goals, Techniques:  
<https://limblecmms.com/blog/reliability-engineering>
- Introduction to Reliability Engineering:  
[https://reliabilityweb.com/articles/entry/introduction\\_to\\_reliability\\_engineering](https://reliabilityweb.com/articles/entry/introduction_to_reliability_engineering)  
Springer-Verlag London Limited, 2011

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2009</b>                | <b>Course Title: Agile Software Development<br/>Program safety</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                                       |                               |                       |
| <b>L:T:P(Hours/Week)<br/>3: 0: 0</b>          | <b>Credits:3</b>   | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Object Oriented Software Development

### **Course Objectives**

The course is intended to:

1. Implement the various activities involved in the agile software development process
2. Illustrate the User stories in agile software development
3. Understand scrum roles for agile software development
4. Learn various testing activities within an Agile project
5. Use design principles to achieve Agility

### **Unit I Agile Development**

**6 Hours**

Agile Manifesto – Agile Principles – Overview of Extreme Programming: User Stories – Pair Programming – Test Driven Development – Continuous Integration– Simple Design – Refactoring – Metaphor – Agile Process Models: Test Driven development, Lean Software Development.

### **Unit II Scrum, Sprint and Product Backlog**

**6 Hours**

Introduction to Scrum – Adapting to Scrum – Patterns for adopting Scrum – ProductBacklog– Sprints –Planning – Progressively Refine Requirements – Iceberg – Refining User stories.

### **Unit III Scrum Roles**

**6 Hours**

Individual New Roles: Scrum Master, Product Owner – Changed Roles: Analysts, Project Managers, Functional Managers, Programmers, Database Administrators, Testers, User Experience Designers.

### **Unit IV Agile Testing**

**6 Hours**

Test-Driven Development (TDD) Cycle – Acceptance tests –Continuous planning – Agile Test Automation: Agile Testing Quadrant, Test Automation Backlog and Pyramid – Unit TestCharacteristics –xUnit frameworks – Multidimensional Testing Coverage Matrix.

### **Unit V Agile Software Design and Development**

**6 Hours**

Agile Design: Design Smells – Agile Design Principles: Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Dependency Inversion Principle, Interface Segregation Principle.

### **List of Exercises**

**30 Hours**

1. Implement agile software development dashboard using Jira.
2. Create scrum using Jira software.
3. Apply Jira for assigning scrum roles in an organization.
4. Write test cases for Test driven Development using Junit.
5. Create user stories in scrum using Jira.
6. Create sprint in the backlog using Jira.

| Course Outcomes                                      |   | Cognitive Level |
|--|---|-----------------|
| At the end of this course, students will be able to: |   |                 |
| CO1:   | Develop the agile software through various methodologies using a dashboard                  | Understand      |
| CO2:   | Demonstrate the User stories in agile software development usings print and product backlog | Apply           |
| CO3:   | Create roles in scrum framework for Agile software Development                              | Apply           |
| CO4:   | Perform testing activities within an Agile project  | Apply           |
| CO5:   | Apply design principles to achieve Agility in software design                               | Apply           |

#### Text Book(s):

- T1. Roger S. Pressman and Bruce R Maxim, "Software Engineering - A Practitioner's
- T2. Mike Cohn, "Succeeding with Agile: Software Development Using Scrum", Addison- Wesley, 2013.
- T3. Robert C. Martin and Micah Martin, "Agile Principles, Patterns and Practicesin C#", Prentice Hall, 2013.

#### Reference Book(s):

- R1. Ken Schwaber, "Agile Project Management with Scrum Microsoft Professional", Microsoft Press, 2015.
- R2. ThomasStober, UweHansmann, "Agile Software Development - Best Practicesfor large Software Development Projects", Springer, 2014.
- R3. DavidHarned, "Hands-On Agile Software Development with JIRA", Packt Publishing,2018.

#### Web References:

1. Agile Methodology Tutorial : <https://www.tutorialspoint.com/agile/index.htm>
2. Scrum: <https://www.scrum.org/>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2010</b>                | <b>Course Title: Basic Skills in Integrated Product Development</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>  |                               |                       |
| <b>L:T:P(Hours/Week)<br/>3: 0: 0</b>          | <b>Credits:3</b>  | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Object Oriented Software Development

### **Course Objectives**

The course is intended to:

1. Describe about deciding the scope of a new product.
2. Develop design specification for new product development.
3. Perform validation of new product.
4. Implement sustenance engineering and End of Life support activities.
5. Implement sustenance engineering and End of Life support activities.

### **Unit I      Fundamentals of Product Development      6 Hours**

Global Trends Analysis and Product decision - Social Trends - Technical Trends - Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle –Product Development Planning and Management.

### **Unit II      Requirements and System Design      6 Hours**

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

### **Unit III      Design and Testing      6 Hours**

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing - System Integration, Testing, Certification and Documentation.

### **Unit IV      Sustenance Engineering and End-of-Life (EoL) Support      6 Hours**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation- Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal

### **Unit V      Business Dynamics – Engineering Services Industry      6 Hours**

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**List of Exercises****30 Hours**

1. PESTLE and SWOT Analysis.
2. Traceability Matrix and Analysis.
3. Concept Screening & Evaluation.
4. Product Testing standards and Certification.
5. Product Documentation.
6. Product EoL.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Describe about deciding the scope of a new product by considering various global trends                            | Understand      |
| CO2:   | Develop design specification for new product development based on the requirements                                 | Apply           |
| CO3:   | Perform validation of new product based on design specification  | Apply           |
| CO4:   | Implement sustenance engineering and End of Life support activities for engineering custome                        | Apply           |
| CO5:   | Develop product management plan for a new product based on the type of the new product and development methodology | Apply           |

**Text Book(s):**

- T1. NASSCOM student Handbook , "Foundation Skills in Integrated ProdDevelopment".
- T2. Karl T Ulrich and Stephen D Eppinger, "Product Design and DeveloEdition, Tata McGraw Hill, 2016.
- T3. John W Newstrom and Keith Davis, "Organizational Behavior", 11<sup>th</sup>McGraw Hill, 2014.

**Reference Book(s):**

- R1. Hiriappa B, "Corporate Strategy – Managing the Business", Autho
- R2. Mark S Sanders and Ernest J McCormick, "Human Factors in Engi Design", 7<sup>th</sup> Edition, McGraw Hill Education, 2013.
- R3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise ResourceConcepts", 2<sup>nd</sup> Edition Reprint, Prentice Hall, 2011.

**Web References:**

1. NPTEL Course Product Design and Development:  
[https://onlinecourses.nptel.ac.in/noc21\\_me83/preview](https://onlinecourses.nptel.ac.in/noc21_me83/preview)
2. Scrum: <https://www.scrum.org/> MIT Open Courseware Product Design and Development: <https://ocw.mit.edu/courses/sloan-school-of-management/15-783j-and-development-spring-2006/>
3. NPTEL Course Introduction to Strategic Management:  
<https://nptel.ac.in/courses/110/108/110108047/>

### Course Articulation Matrix

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

High-3; Medium-2; Low-1



|   |                  |   |                       |
|---|------------------|---|-----------------------|
| <b>Course Code: 19ADEN2011</b>                |                  | <b>Course Title: Design Patterns Concepts</b> |                       |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                  |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b>    | <b>Credits:3</b> | <b>Total Contact Hours: 60</b>                | <b>Max. Marks:100</b> |

### **Pre-requisites**

- Object Oriented Software Development

### **Course Objectives**

The course is intended to:

1. Understand the design pattern concepts
2. Identify the system requirements
3. Prepare a design pattern using the catalog
4. Use MVC architecture to implement the system
5. Describe the behavioral patterns & designing with distributed objects

### **Unit I Design Pattern Concepts**

**6 Hours**

Design pattern – Describing design patterns – The catalog & organizing the catalog –Solve design problems with Design patterns –Selecting & using a design pattern –Object-oriented development – Key concepts and related concepts – Benefits and drawbacks– Basics of OOP.

### **Unit II System Analysis, Design and Implementation**

**6 Hours**

Overview of the analysis phase– Gathering the requirements – Functional requirements specification – Defining conceptual classes and relationships – Using the knowledge of the domain – Design and Implementation: Design – Implementing our Design.

### **Unit III Design Pattern Catalog**

**6 Hours**

Structural patterns: Motivation –Applicability-Implementation– Adapter: Motivation – Applicability - Implementation – Bridge: Motivation –Applicability-Implementation – Composite: Motivation –Applicability-Implementation – Decorator– Facade– Flyweight– Proxy.

### **Unit IV Interactive systems and the MVC architecture**

**6 Hours**

Introduction – The MVC architectural pattern– Analyzing a simple drawing program – Designing the system– Designing of the subsystems– Getting into implementation – Implementing undo operation – Drawing incomplete items– Adding a new feature – Pattern based solutions.

### **Unit V Behavioral Patterns & Designing with Distributed Objects**

**6 Hours**

Behavioral Patterns: Chain of Responsibility – Command – Interpreter – Iterator – State- Designing with Distributed Objects: Client server system– Java remote method invocation– Implementing an object oriented system on the web.

**List of Exercises****30 Hours**

1. Illustrate an Use case Diagram for a suitable Scenario.
2. Implement the Adapter Design pattern for an appropriate Scenario in suitable Java based application.
3. Implement the MVC Design pattern for an appropriate Scenario in suitable Java based application.
4. Implement the Flyweight Design pattern for an appropriate Scenario in suitable Java based application.
5. Implement the Decorator Design pattern for a suitable Scenario in Text editor application.
6. Implement the Iterator Design pattern for a suitable Scenario in Text editor application.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Explain the design pattern using object-oriented concepts          | Understand      |
| CO2:   | Identify the system requirements for design and implementation     | Apply           |
| CO3:   | Develop a Design pattern using the catalog for Structural patterns | Apply           |
| CO4:   | Implement the Interactive system using MVC architecture            | Apply           |
| CO5:   | Design the behavioral patterns with distributed objects            | Apply           |

**Text Book(s):**

- T1. Brahma Dathan, Sarnath Ramnath, "Object-Oriented Analysis, Design and implementation: An Integrated Approach", 2nd Edition, Universities Press, 2015
- T2. Erich Gamma, Richard Helan, Ralph Johman, John Vlissides, "Design patterns", Pearson Publication, 2015

**Reference Book(s):**

- R1. Mainak Biswas, "Design Patterns: A Domain Agnostic Approach", Createspace Independent publication, 2016.
- R2. Martin Fowler, Dave Rice, Matthew Foemmel, Edward Hieatt, Robert Mee, and Randy Stafford, "Patterns of Enterprise Application Architecture", Pearson Publication, 2012.

**Web References:**

1. Software Architecture & Design Patterns: [https://hemanthrajhemu.github.io/CSE6/17SCHEME/PE/52\\_SADP/T2\\_M3.html](https://hemanthrajhemu.github.io/CSE6/17SCHEME/PE/52_SADP/T2_M3.html)
2. Creational, Structural & Behavioral Patterns: [https://sourcemaking.com/design\\_patterns](https://sourcemaking.com/design_patterns)

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

### Vertical IV-Data Analytics Electives

|   |   |                                   |                       |
|---|---|-----------------------------------|-----------------------|
| <b>Course Code: 19ADEN1013</b>                | <b>Course Title: Data Analytics for Engineers</b> |                                   |                       |
| <b>Course Category: Professional Elective</b> |   | <b>Course Level: Introductory</b> |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b>    | <b>Credits:3</b>                                  | <b>Total Contact Hours:45</b>     | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Understand data input and accessing data using R
2. Representation of data in graphical form
3. Analyzing data using probability and statistics
4. Inference of data using correlation and regression analysis

#### **Unit I Introduction to R**

**9 Hours**

Introduction R as a statistical software and language - R as a calculator - R preliminaries - Methods of data input - Data accessing or indexing. Some useful built-in functions - Graphics with R-Getting help, - saving, storing and retrieving work.

#### **Unit II Descriptive Statistics**

**9 Hours**

Introduction - Diagrammatic representation of data - Graphical representation of data - Measures of central tendency-dispersion - skewness and kurtosis - Selection of representative samples.

#### **Unit III Probability and probability distributions**

**9 Hours**

Probability: Definitions and properties - probability distributions - some special discrete distributions - continuous distributions.

#### **Unit IV Statistical Inference**

**9 Hours**

Sampling distribution of sample mean - Estimation of parameters - Plots to check normality - Hypothesis testing - Goodness of fit tests.

#### **Unit V Correlation and Regression analysis**

**9 Hours**

Correlation - Inference procedures for correlation coefficient - Linear regression - Inference procedure for simple linear model - validation of linear regression model - Transformation of the variables - Polynomial regression models.

| Course Outcomes                                      |   | Cognitive Level |
|--|---|-----------------|
| At the end of this course, students will be able to: |   |                 |
| CO1:   | Make use of various data analysis techniques and derive conclusions                         | Understand      |
| CO2:   | Make use of descriptive and inferential statistical techniques for data analysis            | Understand      |
| CO3:   | Perform exploratory data analysis on a given set of data including visualization techniques | Apply           |
| CO4:   | Build regression models and use them for prediction   | Apply           |
| CO5:   | Build time series models and use them for prediction  | Apply           |

**Text Book(s):**

- T1. Statistics using R, Sudha G. Purohit, Sharad D. Gore and Shailaja R. Deshmukh, Narosa Publications, 2019.

**Reference Book(s):**

- R1. "R for Data Science", Dan Toomey, PACKT Publishing, 2014.  
R2. "Practical Data Science with R", Nina Zumel, John Mount, Manning Publications, 2014.  
R3. "Building a Recommendation System with R", Suresh R Gorakala, Michelle Usuelli, PACKT Publishing, 2015.  
R4. "Learning Predictive Analytics with R", Eric Mayor, PACKT Publishing, 2015.  
R5. "Data Analytics with Open Source Tools", Philip K Janert, O'Reilly, 2010.  
R6. "Data Mining: Concepts and Techniques", Jiawei Han, Micheline Kamber, Jian Pei, The Morgan Kaufmann Series in Data Management Systems, 3rd Edition, 2011.

**Web References:**

1. NPTEL Course content : [https://onlinecourses.nptel.ac.in/noc21\\_cs69/](https://onlinecourses.nptel.ac.in/noc21_cs69/)

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1014</b>                | <b>Course Title: Business analytics Management</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                       |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                                   | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |
| <b>3 0: 0</b>                                 |  |                               |                       |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Choose appropriate Information Technology applications
2. Develop a Decision-Making Tool
3. Design Dashboard and Scorecard
4. Deploy a Knowledge Management System
5. Apply suitable platform for improving business intelligence

#### **Unit I Introduction to BI 9 Hours**

Business View of IT Applications – Digital Data – Getting started with BI – BI Component Framework – Users – Applications – Roles and Responsibilities – Concepts of data integration – Need and advantages of using data integration, Introduction to common data integration approaches – Introduction to data quality, data profiling concepts and applications – Tools – Case Study: Pentaho.

#### **Unit II Decision Support Systems 9 Hours**

Decision Making: Introduction – Models – Phases – DSS Description – Characteristics – Capabilities – Classifications – Components – Data, Model, User Interface (DIALOG) and Knowledge Based Management Subsystem – DSS User – Case Study: PHP MySQL implementation of DSS.

#### **Unit III Business Performance Management 9 Hours**

BPM Cycle – Performance Measurement – BPM Methodologies – Architecture and Applications – Introduction to enterprise reporting – Performance Dashboards and Scorecards – Case Study: Freeboard.

#### **Unit IV Knowledge Management 9 Hours**

Introduction – Organizational Learning and Transformation – KM Activities – Approaches – Information Technology and Roles of People in KM – KM System Implementation – Ensuring the Success of KM Efforts – Case Study: Apache Sling CMS.

#### **Unit V Emerging Trends 9 Hours**

Reality Mining – Virtual Worlds – Web 2.0 Revolution – Virtual Communities – OnlineSocial Networking – Cloud Computing and BI – MSS Impacts on Organization &Individual.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Choose appropriate Information Technology applications for Modern Business implementing Business Intelligence components | Understand      |
| CO2:   | Develop a Decision-Making Tool for given real time application using Decision Support System components                  | Apply           |
| CO3:   | Design Dashboard and Scorecard for any given application to Analyze its business performance                             | Apply           |
| CO4:   | Deploy a Knowledge Management System for effective functioning of an organization by choosing suitable KMS approach      | Apply           |
| CO5:   | Apply suitable platform for improving business intelligence in decision making   | Apply           |

#### Text Book(s):

- T1. R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", 2<sup>nd</sup> edition, Wiley, 2016.
- T2. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence and Analytics, Systems for Decision Support", 10<sup>th</sup> Edition, Pearson Education Inc, 2015.

#### Reference Book(s):

- R1. Vicki L. Sauter, "Decision Support Systems for Business Intelligence", Wiley, 2011.
- R2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", 2<sup>nd</sup> Edition, Morgan Kaufman, 2012.

#### Web References:

1. Mastering Microsoft Power BI URL: [https://www.tutorialspoint.com/power\\_bi/index.htm](https://www.tutorialspoint.com/power_bi/index.htm)
2. MIS-Business Intelligence System Business Intelligence as a Career Option URL: <https://www.tutorialspoint.com/business-intelligence-as-a-career-option>
3. Decision Support System Java Netbeans Project URL: <https://www.freeprojectz.com/java-jsp-netbeans-project/decision-support-system>
4. Open source dashboard tools for visualizing data URL: <https://opensource.com/business/16/11/open-source-dashboard-tools-visualizing-data>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1015</b>                | <b>Course Title: Health Care Analytics</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>               |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                           | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |
| <b>3 0: 0</b>                                 |  |                               |                       |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Understand health data formats, health care policy and standards
2. Learn the significance and need of data analysis and data visualization
3. Understand the health data management frameworks
4. Learn the use of machine learning and deep learning algorithms in healthcare
5. Apply healthcare analytics for critical care applications

#### **Unit I Introduction to Healthcare Analysis**

**9 Hours**

Overview - History of Healthcare Analysis Parameters on medical care systems - Health care policy - Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

#### **Unit II Analytics On Machine Learning**

**9 Hours**

Machine Learning Pipeline – Pre - processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables – Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

#### **Unit III Health Care Management**

**9 Hours**

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database - Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

#### **Unit IV Healthcare And Deep Learning**

**9 Hours**

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

#### **Unit V Case Studies**

**9 Hours**

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT – Hospital Acquired Conditions (HAC) program - Healthcare and Emerging Technologies – ECG Data Analysis.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Use machine learning and deep learning algorithms for health data analysis                                       | Apply           |
| CO2:   | Apply the data management techniques for healthcare data   | Apply           |
| CO3:   | Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications | Apply           |
| CO4:   | Implement health data analytics for real time applications   | Apply           |
| CO5:   | Apply Deep learning to health data analytics for emergency care system   | Apply           |

#### Text Book(s):

- T1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.

#### Reference Book(s):

- R1. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
- R2. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data
- R3. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
- R4. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

#### Web References:

1. Data Analytics In Healthcare Blog: <https://intellipaat.com/blog/data-analytics-in-healthcare/>
2. Watson for healthcare Data Analytics : <https://www.ibm.com/watson-health/learn/healthcare-data-analytics>
3. Data-Analytics used in Health-Care :<https://www.comptia.org/content/articles/how-is-data-analytics-used-in-health-care>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1



|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN1016</b>                | <b>Course Title: Graph Analytics and Algorithms</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                        |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                                    | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |
| <b>3 0: 0</b>                                 |   |                               |                       |

#### Pre-requisites

- Basics of Data Structures and Algorithm Analysis
- Basics of Artificial Intelligence

#### Course Objectives

The course is intended to:

1. Paraphrase the Graph Analytics and Algorithms
2. Summarize the Graph Platforms and processing
3. Illustrate the Community Detection Algorithms
4. Develop Graph Algorithm application
5. Relate Graph Algorithms with Machine Learning

#### Unit I Introduction to Graphs

**9 Hours**

Introduction – Graph Analytics and Algorithms - Graph Processing, Databases, Queries, and Algorithms OLTP and OLAP - Graph Analytics Use Cases - Graph Theory & Concepts-Terminology - Graph Types and Structures - Flavors of Graphs - Types of Graph Algorithms.

#### Unit II Graph Platforms and Processing

**9 Hours**

Graph Platform and Processing Considerations- Representative Platforms - Path Finding and Graph Search Algorithms - Example Data: The Transport Graph - Shortest Path & its types.

#### Unit III Community Detection Algorithms

**9 Hours**

Example Graph Data: The Software Dependency Graph - Triangle Count and Clustering Coefficient - Strongly Connected Components - Connected Components - Label Propagation - Louvain Modularity.

#### Unit IV Graph Algorithms in Practice

**9 Hours**

Analyzing Yelp Data with Neo4j - Overview of the Yelp Data - Analyzing Airline Flight Data with Apache Spark.

#### Unit V Using Graph Algorithms to Enhance Machine Learning

**9 Hours**

Machine Learning and the Importance of Context - Connected Feature Extraction and Selection - Graphs and Machine Learning in Practice: Link Prediction.

| Course Outcomes                                      |   | Cognitive Level |
|--|---|-----------------|
| At the end of this course, students will be able to: |   |                 |
| CO1:   | Paraphrase the different Graph Analytics and Algorithms terminologies     | Understand      |
| CO2:   | Summarize the Graph Platforms and processing                              | Understand      |
| CO3:   | Illustrate the Community Detection Algorithms using Graphs and components | Apply           |
| CO4:   | Develop Graph Algorithm application with Neo4j                            | Apply           |
| CO5:   | Relate Graph Algorithms with Machine Learning                             | Apply           |

#### Text Book(s):

- T1. Mark Needham, Amy E. Hodler, "Graph Algorithms: Practical Examples in Apache Spark and Neo4j", 2019.

**Reference Book(s):**

- R1. R. Ahuja, L. Magnanti, and J. Orlin, "Network Flows: Theory, Algorithms, and Applications" Prentice - Hall, Inc. Division of Simon and Schuster One Lake Street Upper Saddle River, NJ United States, 1993.
- R2. B. Mohar and C. Thomassen, "Graphs on Surfaces" Johns Hopkins University Press, 2001.

**Web References:**

1. Graph\_Algorithm Tutorial point :  
[https://www.tutorialspoint.com/parallel\\_algorithm/graph\\_algorithm.htm](https://www.tutorialspoint.com/parallel_algorithm/graph_algorithm.htm)
2. Graph-Algorithms real world application: <https://www.oracle.com/a/tech/docs/asktom-graph-algorithms.pdf>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2013</b>                | <b>Course Title: Social Graph Analytics</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                            | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |
| <b>2: 0: 2</b>                                |   |                               |                       |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Describe the graph features
2. Apply network measures and models
3. Implement data mining algorithms
4. Illustrate community mining and interactions
5. Develop social mining applications

### **Unit I Graph Basics**

**6 Hours**

Social Media Mining – Challenges – Graph Essentials – Representations – Types of Graphs – Connectivity – Special Graphs – Graph Algorithms.

### **Unit II Measures & Models**

**6 Hours**

Network Measures – Centrality – Transitivity and Reciprocity – Similarity. Network Models-Properties of Real-World Networks – Random Graphs – Small-World Model – Preferential Attachment Model.

### **Unit III Asymmetric Ciphers**

**6 Hours**

Number theory concepts: Euclidean algorithm – Modular arithmetic – Prime numbers – Fermat's and Euler's theorem – Discrete logarithms – Principles of public-key cryptosystems – RSA algorithm – Diffie-Hellman key exchange – ElGamal cryptographic system.

### **Unit IV Mining Twitter**

**6 Hours**

Community Analysis – Community Detection – Evolution – Evaluation – Information Diffusion in Social Media – Herd Behavior – Information Cascades – Diffusion of Innovations.

### **Unit V Applications**

**6 Hours**

Influence and Homophily – Recommendation in Social Media – Classical Recommendation Algorithms – Recommendation Using Social Context – Evaluating Recommendations.

### **List of Exercises**

**30 Hours**

1. Implementation of Shortest path and Minimum Spanning Tree algorithms.
2. Develop a program to identify degree centrality and Page rank for the given graph.
3. Apply decision tree learning to classify the given dataset samples into relevant groups.
4. Clustering of Twitter dataset using k-means algorithm.
5. Identification of user community using Brute-Force Clique technique.
6. Development of recommendation system using collaborative filtering approach.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                |                 |
| CO1: Describe the graph features for social media mining            | Understand      |
| CO2: Apply network measures and models to visualize social networks | Apply           |
| CO3: Implement data mining algorithms using real time social data   | Apply           |
| CO4: Illustrate community mining and interactions in social media   | Apply           |
| CO5: Develop social mining applications for real time scenarios     | Apply           |

#### Text Book(s):

- T1. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, "Social Media Mining: An Introduction", Cambridge University Press, 2014.
- T2. Lam Thuy Vo, "Mining Social Media: Finding Stories in Internet Data", No Starch Press, 2020.

#### Reference Book(s):

- R1. Peter Mika, "Social Networks and the Semantic Web", Springer Science, 2007.
- R2. Maksim Tsvetovat and Alexander Kouznetsov, "Social Network Analysis for Startups", O'Reilly Media Inc., 2011.
- R3. Charu. C. Aggarwal, "Social Network Data Analytics", Springer, 2011.
- R4. Matthew A. Russell, "Mining the Social Web", 2<sup>nd</sup> Edition, O'Reilly Media Inc., 2013.

#### Web References:

1. NPTEL – Social Networks course. URL: <http://nptel.ac.in/courses/106106169>
2. MIT Open Courseware. URL: <https://ocw.mit.edu/courses/media-arts-and-sciences/mas-961-networks-complexity-and-its-applications-spring-2011/index.htm>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2014</b>                | <b>Course Title: Recommendation Systems</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                            | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |
| <b>2: 0: 2</b>                                |   |                               |                       |

#### **Pre-requisites**

- Nil

#### **Course Objectives**

The course is intended to:

1. Understand the foundations of the recommender system.
2. Learn the significance of machine learning and data mining algorithms for Recommender systems
3. Learn about collaborative filtering
4. Design and implement a recommender system
5. Evaluate & design the recommender systems applications

#### **Unit I Introduction To Recommender Systems 6 Hours**

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems - similarity measures - Dimensionality reduction – Singular Value Decomposition (SVD).

#### **Unit II Content-Based Recommendation Systems 6 Hours**

High - level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity - based retrieval, and Classification algorithms.

#### **Unit III Collaborative Filtering 6 Hours**

A systematic approach, Nearest - neighbor collaborative filtering (CF), user - based and item - based CF, components of neighborhood methods (rating normalization, similarity weight computation and neighborhood selection).

#### **Unit IV Attack-Resistant Recommender Systems 6 Hours**

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

#### **Unit V Evaluating Recommender Systems 6 Hours**

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures.

#### **List of Exercises 30 Hours**

1. Implement Data similarity measures using Python.
2. Implement dimension reduction techniques for recommender systems.
3. Implement user profile learning.
4. Implement content-based recommendation systems.
5. Implement collaborative filter techniques.
6. Create an attack for tampering with recommender systems.
7. Implement accuracy metrics like Receiver Operated Characteristic curves.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Understand the basic concepts of recommender systems   | Apply                  |
| CO2: Implement machine-learning and data-mining algorithms in recommender systems data sets   | Apply                  |
| CO3: Implementation of Collaborative Filtering in carrying out Performance evaluation of recommender systems based on various metrics | Apply                  |
| CO4: Design and implement a simple recommender system   | Apply                  |
| CO5: Evaluate the advanced of recommender systems applications for real time applications   | Apply                  |

#### **Text Book(s):**

T1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.

#### **Reference Book(s):**

- R1. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
- R2. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011).
- R3. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3<sup>rd</sup> edition, Cambridge University Press, 2020.

#### **Web References:**

- 1. Courseera course material:  
<https://www.coursera.org/specializations/recommender-systems>.

#### **Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2016</b>                | <b>Course Title: Image and Video Analytics</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                   |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                               | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |
| <b>2: 0: 2</b>                                |  |                               |                       |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Infer the fundamentals of image processing techniques for computer vision and video analysis
2. Explain the techniques used for image pre-processing
3. Develop various object detection techniques
4. Recognize the face available in image using various face recognition mechanisms
5. Analyze the video using deep learning techniques

### **Unit I Introduction**

**6 Hours**

Computer Vision – Image representation and image analysis tasks - Image representations –digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

### **Unit II Image Pre-Processing**

**6 Hours**

Local pre - processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models – Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

### **Unit III Object Detection Using Machine Learning**

**6 Hours**

Object detection – Object detection methods – Deep Learning framework for Object detection – bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN - Faster R – CNN - You Only Look Once(YOLO) - Salient features - Loss Functions - YOLO architectures.

### **Unit IV Face Recognition And Gesture Recognition**

**6 Hours**

Face Recognition-Introduction-Applications of Face Recognition - Process of Face Recognition - DeepFace solution by Facebook - FaceNet for Face Recognition - Implementation using FaceNet - Gesture Recognition.

### **Unit V Video Analytics**

**6 Hours**

Video Processing – use cases of video analytics - Vanishing Gradient and exploding gradient Problem - ResNet architecture - ResNet and skip connections-Inception Network-GoogleNet Architecture - Improvement in Inception v2 - Video analytics - ResNet and Inception v3.

**List of Exercises****30 Hours**

1. Write a program that computes the T-pyramid of an image.
2. Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity.
3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.
4. Develop a program to implement Object Detection and Recognition.
5. Develop a program for Facial Detection and Recognition.
6. Write a program for event detection in video surveillance system.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Infer the fundamentals of image processing techniques for computer vision and video analysis | Understand      |
| CO2: Explain the techniques used for image pre-processing   | Understand      |
| CO3: Develop various object detection techniques  | Apply           |
| CO4: Recognize the face available in image using various face recognition mechanisms              | Apply           |
| CO5: Analyze the video using deep learning techniques   | Apply           |

**Text Book(s):**

- T1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2013.
- T2. Vaibhav Verdhhan, (2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021.

**Reference Book(s):**

- R1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London, Limited, 2011.
- R2. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business intelligence", Springer, 2012.
- R3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
- R4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

**Web References:**

1. Innovating-With-Video-Analytics-Technologies-And Use-Cases <https://wso2.com/whitepapers/innovating-with-video-analytic-technologies-use-cases/>



### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADEN2015</b>                | <b>Course Title: Text and Speech Analysis</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level: Mastery</b>                  |                               |                       |
| <b>L:T:P(Hours/Week)</b>                      | <b>Credits:3</b>                              | <b>Total Contact Hours:60</b> | <b>Max. Marks:100</b> |
| <b>2: 0: 2</b>                                |   |                               |                       |

### **Pre-requisites**

- Nil

### **Course Objectives**

The course is intended to:

1. Understand natural language processing basics
2. Apply classification algorithms to text documents
3. Build question-answering and dialogue systems
4. Develop a speech recognition system
5. Develop a speech synthesizer

### **Unit I Natural Language Basics**

**6 Hours**

Foundations– Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

### **Unit II Text Classification**

**6 Hours**

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model –Deep Learning models – RNN – Transformers.

### **Unit III Question Answering And Dialogue Systems**

**6 Hours**

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems – evaluating dialogue systems

### **Unit IV Text-To-Speech Synthesis**

**6 Hours**

Overview.-Text normalization-Letter-to-sound-Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems.

### **Unit V Automatic Speech Recognition**

**6 Hours**

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

### **List of Exercises**

**30 Hours**

1. Create Regular expressions in Python for detecting word patterns and tokenizing
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
3. Accessing Text Corpora using NLTK in Python
4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
5. Implement the Word2Vec model text
6. Use a transformer for implementing classification

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Explain existing and emerging deep learning architectures for text and speech processing | Apply           |
| CO2:   | Apply deep learning techniques for NLP tasks, language modelling and machine translation | Apply           |
| CO3:   | Explain coreference and coherence for text processing                                    | Apply           |
| CO4:   | Build question-answering systems, chatbots and dialogue systems                          | Apply           |
| CO5:   | Apply deep learning models for building speech recognition and text- to-speech systems   | Apply           |

#### Text Book(s):

- T1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

#### Reference Book(s):

- R1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress, 2018.
- R2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
- R3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
- R4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.

#### Web References:

1. Nptel Course content : <https://nptel.ac.in/downloads/111102011/>.

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

**Vertical V - Emerging Technologies Electives**

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN1017</b>                |                  | <b>Course Title: Fuzzy Logic and Neural Computing</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                          |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>   | <b>Credits:3</b> | <b>Total Contact Hours:45</b>                         | <b>Max.Marks:100</b> |

**Pre-requisites**

- Linear Algebra and Infinite Series

**Course Objectives**

The course is intended to:

1. Construct feed forward neural networks using supervised learning
2. Develop neural networks based on associative memory
3. Build unsupervised learning networks using competitive strategy
4. Model inference systems using fuzzy rules
5. Develop genetic algorithms

**Unit I          Supervised Learning Networks**

**9 Hours**

Evolution of computing – soft computing constituents – Biological neural networks – Artificial neurons – Applications. Supervised Learning Networks: Activation functions, Learning rules, Perceptron networks, Adaline, Madaline, Back propagation networks.

**Unit II          Associative Memory Networks**

**9 Hours**

Associative memories – Auto associative memory network – Hetero associative memory network – Bi-directional associative memory – Discrete Hopfield network.

**Unit III          Unsupervised Learning Networks**

**9 Hours**

Neural network based on competition – Maxnet – Hamming network – Self-Organizing feature maps – Learning vector quantization.

**Unit IV          Fuzzy Systems**

**9 Hours**

Classical sets – Fuzzy Sets – Classical relations – Fuzzy relations – Membership Functions – Defuzzification – Fuzzy rules – Fuzzy reasoning – Fuzzy inference systems – Neuro-fuzzy systems.

**Unit V          Genetic Algorithms**

**9 Hours**

Introduction – Traditional optimization and search techniques – Genetic algorithm and search space – Simple genetic algorithm – Operators in genetic algorithm – Solving Travelling Salesman Problem.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Construct feed forward neural networks using supervised learning for solving classification problems | Apply           |
| CO2: Develop neural networks based on associative memory for retrieving patterns                          | Apply           |
| CO3: Build unsupervised learning networks using competitive strategy for solving clustering problems      | Apply           |
| CO4: Model inference systems using fuzzy rules for solving uncertainty problems                           | Apply           |
| CO5: Develop genetic algorithm for solving optimization problems  | Apply           |

#### Text Book(s):

T1.S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", 3<sup>rd</sup> Edition, John Wiley & Sons, New Delhi, 2019.

#### Reference Book(s):

- R1. Hitoshi Iba, Nasimul Noman, "Deep Neural Evolution: Deep Learning with Evolutionary Computation", Springer, 2020.
- R2. N.P. Padhy, S.P. Simon, "Soft computing with matlab programming", Oxford University Press; 2015.
- R3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley, 2016.

#### Web References:

1. NPTEL, Introduction to Soft Computing, URL: [https://onlinecourses.nptel.ac.in/noc22\\_cs54/preview](https://onlinecourses.nptel.ac.in/noc22_cs54/preview)
2. Soft Computing IIT Kharagpur, URL: <https://cse.iitkgp.ac.in/dsamanta/courses/sca/index.html>
3. Fuzzy Sets, Logic and Systems & Applications, URL: <https://onlinecourses.nptel.ac.in/noc22ee21/preview>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN1018</b>                |                  | <b>Course Title: Optimization Techniques</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                 |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>   | <b>Credits:3</b> | <b>Total Contact Hours:45</b>                | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Solve optimization problems using Linear and Non-linear programming
2. Compute critical path for Activity Network models
3. Apply genetic Algorithm using Evolutionary Computation principles
4. Solve real world problems using Evolutionary Optimization techniques
5. Implement Swarm Intelligence approaches for optimizing practical applications.

#### **Unit I Classical Optimization Methods 9 Hours**

General Linear Programming Model: Two variable LP Model – Graphical LP Solution – Simplex Method – Artificial Starting Solution – Non-linear Programming Algorithms: Unconstrained Algorithms – Constrained Algorithms

#### **Unit II Network Models 9 Hours**

Scope and Definition of Network Models – Minimum Spanning Tree Algorithm –Maximal flow model – CPM and PERT – Critical path Method (CPM) Computations – Construction of the Time Schedule – Linear Programming formulation of CPM – PERT Networks

#### **Unit III Evolutionary Computation 9 Hours**

Genetic Algorithm – Conventional Optimization and Search Techniques – Comparison between Genetic Algorithm and traditional optimization method – Advantages, Limitations and Applications of Genetic Algorithm – Genetic Programming – Primitives of Genetic Programming – Attributes in Genetic Programming – Steps of Genetic Programming

#### **Unit IV Evolutionary Optimization 9 Hours**

Fuzzy optimization Problem – Multiobjective Reliability Design Problem – Combinatorial Optimization Problem – Scheduling Problems – Transportation Problems – Network Design and Routing Problems

#### **Unit V Nature Inspired Optimization 9 Hours**

Particle Swarm Optimization – Ant Colony Optimization – Fish School Search Algorithm – Cuckoo Search Algorithm – Bat Algorithm – Applications of Nature Inspired Optimization Algorithms

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:                               |                        |
| CO1: Solve optimization problems using Linear and Non-linear Programming           | Apply                  |
| CO2: Compute critical path for Activity Network Models using CPM/PERT              | Apply                  |
| CO3: Apply Genetic algorithm for any real time application                         | Apply                  |
| CO4: Solve real world problems using Evolutionary optimization techniques          | Apply                  |
| CO5: Implement Swarm Intelligence approaches for optimizing practical applications | Apply                  |

#### **Text Book(s):**

- T1. Taha H.A., "Operations and Research – An Introduction", Pearson Education, 11<sup>th</sup> Edition, 2022.
- T2. Sivanandam S.N., Deepa S. N., "Introduction to Genetic Algorithms", Springer, 2013.
- T3. A. Vasuki., "Nature-Inspired Optimization Algorithms", CRC Press, 2020.

#### **Reference Book(s):**

- R1. Richard Johannes Boucherie, Henk Tijms, Aleida Braaksma, "Operations Research: Introduction To Models And Methods," World Scientific Publishing Company, 2021.
- R2. Fouad Bennis, Rajib Kumar Bhattachariya, "Nature-Inspired Methods for Metaheuristics Optimization", Springer, 2020.
- R3. Sumathi S., Surekha P., "Computational Intelligence Paradigms Theory and Applications using MATLAB", CRC Press, 2019.

#### **Web References:**

1. NPTEL: [https://onlinecourses.nptel.ac.in/noc23\\_me40](https://onlinecourses.nptel.ac.in/noc23_me40)
2. NPTEL: [https://onlinecourses.nptel.ac.in/noc23\\_ma29](https://onlinecourses.nptel.ac.in/noc23_ma29)
3. Udemy: <https://www.udemy.com/course/geneticalgorithm/>
4. Coursera: <https://in.coursera.org/learn/operations-research-modeling>

### Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2   | 1   | -   | -   | -   | 1   | 1   | 2   | 3   | 1    | -    | 1    | -    | -    |
| C02 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |
| C03 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |
| C04 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | -    | 1    |
| C05 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |

High-3; Medium-2; Low-1



|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN1019</b>                |                  | <b>Course Title: Information Retrieval Methods</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                       |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>   | <b>Credits:3</b> | <b>Total Contact Hours:45</b>                      | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Implement the text retrieval systems based on Boolean retrieval model.
2. Deploy an algorithm for indexing using suitable index construction and compression methods
3. Evaluate the vector space model for any given document
4. Implement the query refinement process to match the semantically similar queries
5. Use web crawling and indexes to develop IR based web applications

#### **Unit I Text Retrieval Systems**

**9 Hours**

Boolean retrieval – The term vocabulary and postings lists: Document delineation – Determining the vocabulary of terms – Faster postings list intersection via skip pointers – Dictionaries and tolerant retrieval.

#### **Unit II Index construction and Compression**

**9 Hours**

Hardware basics – Blocked sort-based indexing – Single pass in-memory indexing – Distributed indexing – Dynamic indexing – Dictionary compression – Postings file compression – Term frequency and weighting.

#### **Unit III Vector Space Models and Evaluation**

**9 Hours**

Vector Space Model – TF-IDF functions – Scoring & Ranking – Evaluation in information retrieval: Information retrieval system evaluation – Standard test collections – Evaluation of unranked retrieval sets – Evaluation of ranked retrieval results – Assessing relevance.

#### **Unit IV Query Expansion**

**9 Hours**

Relevance feedback – Pseudo relevance feedback – Query Reformulation – Review of basic probability theory – Probability ranking principle – Binary independence model – Language models information retrieval.

#### **Unit V Web Search Basics and IR Applications**

**9 Hours**

Web Characteristic – Crawling – Distributing indexes – Connectivity servers – Web as a graph – Page Rank – Hubs and Authorities – Information extraction – Question answering – Opinion summarization – Social Network.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Implement the text retrieval systems based on Boolean retrieval model by determining the vocabulary of terms                       | Apply           |
| CO2: Deploy an algorithm for indexing using suitable index construction and compression methods for a given database                    | Apply           |
| CO3: Evaluate the vector space model for any given document using suitable evaluation techniques  | Apply           |
| CO4: Implement the query refinement process to match the semantically similar queries by Relevance feedback and query expansion methods | Apply           |
| CO5: Develop simple IR based web applications using web crawling and indexes  | Apply           |

### Text Book(s):

T1.Christopher D. Manning and Prabhakar Raghavan, "Introduction to Information Retrieval", Cambridge University Press, 2008.

### Reference Book(s):

R1. Bruce Croft, Donald Metzler, Trevor Strohman, "Search Engines: Information Retrieval in Practice", Pearson Education, 2015.

R2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval", 2<sup>nd</sup> Edition, Pearson Education, 2011.

### Web References:

1. Text Retrieval and Search Engines URL: <https://www.coursera.org/learn/text-retrieval?>
2. Search Engines: Information Retrieval in Practice URL: <https://ciir.cs.umass.edu/irbook/>
3. Introduction to Information Retrieval URL: <http://nlp.stanford.edu/IR-book/html/htmledition/irbook.html>
4. Modern Information Retrieval URL: <http://www.mir2ed.org/>

### Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2   | 1   | -   | -   | -   | 1   | 1   | 2   | 3   | 1    | -    | 1    | -    | -    |
| C02 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |
| C03 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |
| C04 | 3   | 2   | 2   | -   | -   | 1   | 1   | -   | -   | -    | 1    | 1    | -    | 1    |
| C05 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |

High-3; Medium-2; Low-1

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN1020</b>                |                  | <b>Course Title: Reinforcement Learning</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>   | <b>Credits:3</b> | <b>Total Contact Hours:45</b>               | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Utilize Reinforcement Learning tasks and the core principles of Markov Decision Process behind the RL
2. Apply Dynamic Programming algorithms and Monte Carlo methods in policies, value functions.
3. Develop value function with combined Temporal Difference Learning algorithm.
4. Apply Integrating the Planning with RL algorithms.
5. Analyze different solution methods for RL.

#### **Unit I Introduction to Reinforcement Learning & Problems 9 Hours**

Introduction – History of Reinforcement Learning, Elements of Reinforcement Learning - Multi-armed Bandits - Finite Markov Decision Processes.

#### **Unit II Dynamic Programming and Monte Carlo Methods 9 Hours**

##### **Dynamic Programming**

Policy Prediction & Evaluation, Policy Improvement, Iteration, Value Iteration, Asynchronous Dynamic Programming, Efficiency. **Monte Carlo Methods:** Prediction, Estimation, Controls without Exploring Starts, Off policy Prediction with Importance Sampling, Incremental Implementation, Off policy Monte Carlo Control

#### **Unit III Temporal Difference Learning 9 Hours**

Temporal Difference Learning: Prediction, Optimality, Sarsa, Q-learning - n step Bootstrapping: n-step TD Prediction, Tree backup algorithm, Off policy learning, Unifying Algorithm.

#### **Unit IV Integrating Planning with Learning 9 Hours**

Models and Planning, Dyna, Real-time Dynamic Programming, Planning at Decision Time, Heuristic Search, Rollout Algorithms, Monte Carlo Tree Search

#### **Unit V Solution Methods and Applications 9 Hours**

On-policy Prediction with Approximation: Value prediction and control ,Gradient Descent methods, Linear methods - On-policy Control with Approximation - Optimizing Memory Control, Video Game Play - Classical Games: Combining Minimax Search and RL

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Utilize Reinforcement Learning tasks and core principles for real time application.  | Apply           |
| CO2: Apply the Dynamic programming algorithms in policies and Monte carlo methods in value function for solving the problem based on  | Apply           |
| CO3: Develop & estimate value function with combined Temporal Difference Learning algorithm for policy prediction, learned estimates. | Apply           |
| CO4: Apply integrating planning with Reinforcement learning Algorithms for real time applications                                     | Apply           |
| CO5: Analyze different solution methods for policy prediction, approximation with real time applications                              | Apply           |

#### Text Book(s):

T1. Sutton R. S. and Barto A. G., "Reinforcement Learning: An Introduction", MIT Press, 2020.

#### Reference Book(s):

- R1. Csaba Szepesvári, "Algorithms for Reinforcement Learning", Morgan & Claypool, 2013
- R2. Kevin Murphy, "Machine Learning - A Probabilistic Perspective", MIT press, 2012
- R3. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2016
- R4. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, 2020.

#### Web References:

- 1. <https://www.javatpoint.com/reinforcement-learning>
- 2. <https://www.geeksforgeeks.org/what-is-reinforcement-learning>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN2017</b>                |                  | <b>Course Title: Fundamentals of Virtualization</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                        |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b> | <b>Total Contact Hours:60</b>                       | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Explain the importance of Virtualization.
2. Describe the significance of Server and Desktop Virtualization
3. Explore the tools in Network virtualization
4. Experiment the types storage virtualization
5. Apply the Virtualization Tools for any real time applications

#### **Unit I Introduction**

**6 Hours**

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization – Paravirtualization-Types of Hypervisors

#### **Unit II Server and Desktop Virtualization**

**6 Hours**

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

#### **Unit III Network Virtualization**

**6 Hours**

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization

#### **Unit IV Storage Virtualization**

**6 Hours**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

#### **Unit V Virtualization Tools**

**6 Hours**

VMWare-AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

## List of Exercises

**30 Hours**

1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.
2.
  - a. Shrink and extend virtual disk
  - b. Create, Manage, Configure and schedule snapshots
  - c. Create Spanned, Mirrored and Striped volume
  - d. Create RAID 5 Volume
3.
  - a. Desktop Virtualization using VNC
  - b. Desktop Virtualization using Chrome Remote Desktop
4. Create type 2 virtualization on ESXI 6.5 server
5. Create a VLAN in CISCO packet tracer
6. Create Nested Virtual Machine(VM under another VM)

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:           |                 |
| Explain the importance of Virtualization                       | Understand      |
| Describe the significance of Server and Desktop Virtualization | Understand      |
| Explore the tools in Network virtualization                    | Apply           |
| Experiment the types storage virtualization                    | Apply           |
| Apply the Virtualization Tools for any real time applications  | Apply           |

### Text Book(s):

- T1. Anthony T. Velte, Toby J. Velte Robert Elsenpeter, "Cloud computing a practical approach" TATA McGraw- Hill, New Delhi – 2010
- T2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing (Principles and Paradigms)", John Wiley & Sons, Inc. 2011
- T3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach, 2012

**Reference Book(s):**

- R1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.
- R2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
- R3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

**Web References:**

1. <https://www.sciencedirect.com/topics/computer-science/virtualization-technology>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1



|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN2019</b>                |                  | <b>Course Title: Natural Language Processing Systems</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                             |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b> | <b>Total Contact Hours:60</b>                            | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ NIL

#### **Course Objectives**

The course is intended to:

1. Perform word and sentence recognition
2. Identify POS tags for words
3. Perform syntax analysis and construct parse trees
4. Determine word sense, semantic role and similarity
5. Develop NLP applications

#### **Unit I Language Modeling**

**6 Hours**

Knowledge in Speech and Language Processing – Ambiguity – Regular Expressions  
Finite State Automata – Morphology –Finite State Transducers  
Word and Sentence Tokenization – Detecting and Correcting Spelling Errors –Minimum Edit Distance.

#### **Unit II Word Level Analysis**

**6 Hours**

N-grams –Unsmoothed N-grams – Perplexity – Smoothing –Word Classes – Part-of-Speech Tagging – Rule-based, Stochastic and Transformation based tagging – Evaluation and issues in PoS tagging – Markov chains – Hidden Markov Model – Forward, Viterbi, Forward-Backward algorithms.

#### **Unit III Syntax Analysis**

**6 Hours**

Context-Free Grammars –Grammar rules – Treebanks - Dependency Grammars – Parsing as Search – Ambiguity –Dynamic Programming parsing – Partial parsing – Probabilistic CFG – Probabilistic CKY parsing –Probabilistic Lexicalized CFGs.

#### **Unit IV Semantics**

**6 Hours**

First Order Logic –Description Logics – Syntax-driven semantic analysis – Word Senses – Relations between Senses –Semantic roles – Word Sense Disambiguation: Supervised, Dictionary & Thesaurus methods – Word Similarity: Thesaurus and Distributional methods.

#### **Unit V Pragmatics and Applications**

**6 Hours**

Discourse segmentation – Text Coherence – Reference, Anaphora and Co-reference resolution –Named Entity Recognition – Relation Detection and Classification – Information Retrieval – Factoid Question Answering – Summarization.

## List of Exercises

30 ours

1. Download nltk and packages. Use it to print the tokens in a document and the sentences from it. Include custom stop words and remove them and all stop words from a given document using nltk or spaCY package
2. Implement a stemmer and a lemmatizer program.
3. Implement a simple Part-of-Speech Tagger
4. Write a program to calculate TFIDF of documents and find the cosine similarity between any two documents.
5. Use nltk to implement a dependency parser
6. Implement a semantic language processor that uses WordNet for semantic tagging.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                          |                 |
| CO1: Construct Finite state automata and transducers for word recognition     | Apply           |
| CO2: Identify n-grams and Parts of Speech tags for sentences                  | Apply           |
| CO3: Perform syntax analysis using appropriate parsing algorithms             | Apply           |
| CO4: Determine word sense and similarity between words using suitable methods | Apply           |
| CO5: Implement NLP techniques for Information Extraction and retrieval        | Apply           |

### Text Book(s):

- T1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2<sup>nd</sup> Edition, 2008.
- T2. U. S. Tiwary and Tanveer Siddiqui, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
- T3. Richard M Reese, "Natural Language Processing with Java", Packt Publishing, 2015.

**Reference Book(s):**

- R1. Christopher Manning, “Foundations of Statistical Natural Language Processing”, MIT Press, 2009.
- R2. Nitin Indurkha, Fred J. Damerau, “Handbook of Natural Language Processing”, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover, 2010
- R3. Deepti Chopra, Nisheeth Joshi, “Mastering Natural Language Processing with Python”, Packt Publishing Limited, 2016
- R4. Mohamed Zakaria Kurdi “Natural Language Processing and Computational Linguistics: Speech, Morphology and Syntax (Cognitive Science)”, ISTE Ltd., 2016 28

**Web References:**

1. <https://nptel.ac.in/courses/106101007/>
2. <https://nlp.stanford.edu/software/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |  |                               |                      |
|---|--|-------------------------------|----------------------|
| <b>Course Code: 19ADEN2020</b>                | <b>Course Title: Bio Inspired Algorithms</b> |                               |                      |
| <b>Course Category: Professional Elective</b> |  | <b>Course Level: Mastery</b>  |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b>                             | <b>Total Contact Hours:60</b> | <b>Max.Marks:100</b> |

### **Pre-requisites**

- Data Structures and Algorithm Analysis - II

### **Course Objectives**

The course is intended to:

1. Explain the philosophy of natural computing
2. Apply optimization methods
3. Explore Swarm Intelligence and Immuno-Computing algorithms
4. Formulate solutions for Metaheuristic problems
5. Apply Bioinspired algorithms

#### **Unit I Natural Computing**

**6 Hours**

Introduction – General Concepts – Problem Solving as a Search Task – Hill Climbing and Simulated Annealing – Evolutionary Biology – Evolutionary Computing.

#### **Unit II Optimization methods**

**6 Hours**

Geometric programming – Dynamic programming – Multi-objective optimization – Nature-inspired algorithms for optimization – Algorithms and self-organization.

#### **Unit III Swarm Intelligence and Immuno-Computing**

**6 Hours**

Ant Colonies: Ant Colony Optimization – Ant Clustering Algorithm – Swarm Robotics – Artificial Immune Systems – Bone Marrow Models – Negative Selection Algorithms – Clonal Selection and Affinity Maturation.

#### **Unit IV Advanced Algorithms**

**6 Hours**

Bat algorithm – Cuckoo search algorithm – Firefly algorithm – Flower pollination algorithm - Bio-inspired algorithms: Differential evolution – Particle swarm Optimization – Bacterial foraging optimization.

#### **Unit V Applications**

**6 Hours**

Traveling salesman problem using bio-inspired meta heuristics – Clustering with nature-inspired meta heuristics – Bat-inspired algorithm for feature selection and white blood cell classification – Swarm robotics

**List of Exercises****30 Hours**

1. Implement Hill Climbing and Simulated Annealing.
2. Implement Nature-inspired algorithms for optimization
3. Implement Ant Colony Optimization and Bone Marrow Models
5. Implement Bat algorithm and Cuckoo search algorithm
6. Implement Particle swarm Optimization and Bacterial foraging optimization.
7. Mini Project based on bio-inspired meta heuristics

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Explain the philosophy of natural computing to solve computational problems                               | Understand      |
| CO2: Apply optimization methods to provide enhanced solutions for Multi-objective problems.                    | Apply           |
| CO3: Explore Swarm Intelligence and Immuno-Computing algorithms for optimization, design and learning problems | Apply           |
| CO4: Formulate solutions for Metaheuristic problems using advanced algorithms                                  | Apply           |
| CO5: Apply Bioinspired algorithms to provide optimal solutions for real world problems                         | Apply           |

**Text Book(s):**

- T1. Leandro Nunes de Castro, "Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications", Chapman & Hall: CRC, 2007
- T2. Xin-She Yang, "Nature-Inspired Computation and Swarm Intelligence Algorithms, Theory and Applications", Elsevier Academic Press, 2020

**Reference Book(s):**

- R1. Sukanta Nayak, "Fundamentals of Optimization Techniques with Algorithms", Elsevier Academic Press, 2020
- R2. George Lindfield and John Penny, "Introduction to Nature – Inspired Optimization", Academic Press, Elsevier, 2017.
- R3. Xin-She Yang, "Nature-Inspired Optimization Algorithms", Elsevier Inc., 2014.

### Web References:

1. NPTEL SWAYAM, Evolutionary Computation for Single and Multi-Objective Optimization, URL: [https://onlinecourses.nptel.ac.in/noc21\\_me43/preview](https://onlinecourses.nptel.ac.in/noc21_me43/preview)
2. Newfoundland University, Introduction to Nature-Inspired Computing, URL: <https://www.mun.ca/computerscience/undergraduates/courses/comp-3201-introduction-to-nature-inspired-computi/>
3. Magdeburg University, Swarm Intelligence, URL: [https://www.is.ovgu.de/Teaching/WS+2020\\_2021/SwarmIntelligence.html](https://www.is.ovgu.de/Teaching/WS+2020_2021/SwarmIntelligence.html)

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                                     |                                   |                      |
|---|-------------------------------------|-----------------------------------|----------------------|
| <b>Course Code: 19SCEC2001</b>                | <b>Course Title: Cyber security</b> |                                   |                      |
| <b>Course Category: Professional Elective</b> |                                     | <b>Course Level: Introductory</b> |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b>                    | <b>Total Contact Hours:60</b>     | <b>Max.Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Discuss the various concepts in Cyber security and infrastructures involved.
2. Describe the cyber-crimes, reporting procedures and legal remedies.
3. Explain various social media related security issues and reporting flaws.
4. Explain various settings related to E-Commerce and digital payments.
5. Demonstrate the security aspects related to digital devices and technology.

### **Unit I Introduction to Cyber Security**

**6 Hours**

Defining Cyberspace and Overview of Computer and Web-technology - Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security

### **Unit II Cyber crime and Cyber law**

**6 Hours**

Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies

### **Unit III Social Media Overview and Security**

**6 Hours**

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

## **Unit IV      E-Commerce and Digital Payments**

**6 Hours**

Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payment Settlement Act,2007.

## **Unit V      Digital Devices Security, Tools and Technologies for Cyber Security**

**6 Hours**

End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions

## **List of Exercises**

**30 Hours**

1. Prepare checklist for following scenarios :
  - a) Reporting cybercrime at Cybercrime Police station.
  - b) Reporting cybercrime online.
  - c) Using popular social media platforms.
  - d) Secure net banking
2. Demonstrate the following:
  - a) Reporting phishing emails, email phishing attack and preventive measures.
  - b) Reporting and redressal mechanism for violations and misuse of Social media platforms
3. Manage the following activities:
  - a) Privacy and security settings for popular Social media platforms, Mobile Wallets and UPIs.
  - b) Application permissions in mobile phone.
4. Perform the following activities:
  - a) Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
  - b) Setting and configuring two factor authentication in the Mobile phone.
5. Demonstrate the following:
  - a) Security patch management and updates in computer and mobiles
  - b) Wi-Fi security management in computer and mobile.
6. Install and configure computer Anti-virus & Computer Host Firewall..



| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                                      |                 |
| CO1: Describe the concept of Cyber Security and infrastructure involved.                  | Understand      |
| CO2: Develop procedures for reporting various cyber-crimes through available platforms.   | Apply           |
| CO3: Demonstrate various social media related security issues and reporting               | Apply           |
| CO4: Illustrate various settings in e-commerce and digital payment applications.          | Apply           |
| CO5: Demonstrate the digital devices security, tools and technologies for cyber security. | Apply           |

#### Text Book(s):

- T1.R. C Mishra , “Cyber Crime Impact in the New Millennium”,. Auther Press.T2,2010
- T2.Sumit Belapure and Nina Godbole, “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives “, 1<sup>st</sup> Edition, Wiley India Pvt. Ltd, 2011.
- T3.Henry A. Oliver , “Security in the Digital Age: Social Media Security Threats and Vulnerabilities” ,Create Space Independent Publishing Platform, Pearson Education, 2001.

#### Reference Book(s):

- R1. Eric Cole, Ronald Krutz, James W. Conley ,”Network Security Bible”, 2<sup>nd</sup> Edition, Wiley India Pvt. Ltd, 2001
- R2. E. Maiwald ,”Security Fundamentals of Network”, McGraw Hill ,2014
- R3. Kumar K ,”Cyber Laws: Intellectual Property & E-Commerce Security Dominant Publishers, 2011.

#### Web References:

1. <https://unacademy.com/content/upsc/study-material/science-and-technology/initiatives-taken-by-indian-government-for-cyber-security/>
2. <https://cybercrime.gov.in/>
3. <https://www.meity.gov.in/cyber-security-division>
4. <https://intellipaat.com/blog/what-is-cyber-security/>

### Course Articulation Matrix

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | -   | -   | -   | -   | -   | 3   | 3   | 3   | -   | 1    | -    | -    | 3    | 2    |
| C02 | 1   | 1   | 2   | 2   | 3   | 3   | -   | 3   | 3   | 2    | -    | 3    | 3    | 2    |
| C03 | 1   | 1   | 2   | 2   | 3   | 3   | -   | 3   | 3   | 2    | -    | 3    | 3    | 2    |
| C04 | 1   | 1   | 3   | 3   | 2   | 3   | -   | 3   | 3   | 2    | -    | 2    | 3    | 3    |
| C05 | 1   | 1   | 1   | 3   | 2   | 3   | -   | 3   | -   | 1    | -    | 3    | 3    | 3    |

High-3; Medium-2; Low-1

| <b><u>Vertical VI - Applied Robotics Electives</u></b> |                  |   |                      |
|--|------------------|---|----------------------|
| <b>Course Code: 19ADEN1021</b>                         |                  | <b>Course Title: Drone Technologies</b> |                      |
| <b>Course Category: Professional Elective</b>          |                  | <b>Course Level: Mastery</b>            |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>            | <b>Credits:3</b> | <b>Total Contact Hours:45</b>           | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Understand the basics of drone concepts
2. understand the fundamentals of design, fabrication and programming of drone
3. Impart the knowledge of an flying and operation of drone
4. Know about the various applications of drone
5. Understand the safety risks and guidelines of fly safely

#### **Unit I Introduction to Drone Technology 9 Hours**

Drone Concept - Current Breadth of Drone Use- The Future Breadth of Drone Use- The Risks of Drone Technology- Concept Design and Design Development- Construction Administration- Time-Based Site Comparisons.

#### **Unit II Drone Flying and Operation 9 Hours**

Drone Standard Features- Flying Skills - Flight Controller Automations - Support and troubleshooting - Drone Packages - Flight Conditions - Video and Photo Recording - Multimedia and Video Editing - Drone Flying Apps - Simulator Mode - Flight Operations - Emergency Operations - Pre-flight Planning for Automated Flights.

#### **Unit III Working with 3D Models 9 Hours**

Point Cloud versus 3D Mesh - Working with Point Clouds and 3D Meshes - Third-Party Sites. Construction Management Viewing and Sharing Software – Point Cloud to Mesh – Mesh Decimation - Mesh Manipulation and Proposed Features.

#### **Unit IV Drones and Photogrammetry 9 Hours**

Choosing a drone based on the application - Photogrammetry Accuracy and Precision- Ground Control Points- Collecting Data- RTK Drones, Ground Control Pads - Processing the Data- Photogrammetry Project Comparisons.

#### **Unit V Acquiring and Working with Drone Data 9 Hours**

Photo and Video Quality- Using DJI Standard Apps- Litchi Flight Planning Software- Litchi Smart Device App- Virtual Litchi Mission- Annotated Images- Photoshop Photo Matches-3D Model Photo Matches- Working with Drone Videos.

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                                  |                 |
| CO1: Know about a various type of drone technology, drone fabrication and programming | Apply           |
| CO2: Execute the suitable operating procedures for functioning a drone                | Apply           |
| CO3: Select appropriate sensors and actuators for Drones                              | Apply           |
| CO4: Develop a drone mechanism for specific applications                              | Apply           |
| CO5: Create the programs for various drones   | Apply           |

#### Text Book(s):

- T1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley & Sons, Inc.

#### Reference Book(s):

- R1. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
- R2. Završnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

#### Web References:

1. Drone TechnologyFuture trend and practical application  
<https://onlinelibrary.wiley.com/doi/book/10.1002/9781394168002>: Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN1022</b>                |                  | <b>Course Title: Agricultural Robotics</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>               |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>   | <b>Credits:3</b> | <b>Total Contact Hours:45</b>              | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Identify the areas in agricultural process
2. Build sensor and system for agricultural applications
3. Implement Mechanics to the design various robot parameters
4. Identify various mechanisms into agricultural robotic
5. Develop suitable robotic system for specific agricultural tasks

#### **Unit I Introduction**

**9 Hours**

History of Mechanized Agriculture — Farming Operations and Related Machines - Tillage, Planting Cultivation, and Harvesting, Agricultural Automation - Agricultural Vehicle Robot.

#### **Unit II Precision Agriculture**

**9 Hours**

Sensors — types and agricultural applications, Global Positioning System (GPS) - GPS for civilian use, Differential GPS, Carrier-phase GPS, Real-time kinematic GPS, Military GPS, Geographic Information System, Variable Rate Applications and Controller Area Networks.

#### **Unit III Traction And Testing**

**9 Hours**

Hitching- Principles of hitching, Types of hitches, Hitching and weight transfer, Control of hitches, Tires and Traction models, Traction predictor spread sheet, Soil Compaction, Traction Aids, Tractor Testing.

#### **Unit IV Soil Tillage and Weed Management**

**9 Hours**

Tillage Methods and Equipment, Mechanics of Tillage Tools, Performance of Tillage Implements, Hitching of Tillage Implements, Weed Management - Conventional Cropping Systems, Tools, Crop Rotation, Mechanical Cultivation.

#### **Unit V Machinery Selection**

**9 Hours**

Screw Conveyors, Pneumatic Conveyors, Bucket Elevators, Forage Blowers and miscellaneous Conveyors, Machinery Selection - Field Capacity And Efficiency, Draft And Power Requirements, Machinery Costs.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Recognize the areas in agricultural process where robotics can be applied                                  | Apply                  |
| CO2: Integrate sensor and system for a required specific process in agricultural applications                   | Apply                  |
| CO3: Apply Mechanics to the design various robot parameters   | Apply                  |
| CO4: Convert various mechanisms into robot by providing actuation at specific links and joints of the mechanism | Apply                  |
| CO5: Develop suitable robotic system for specific agricultural tasks.   | Apply                  |

**Text Book(s):**

- T1.Ajit K. Srivastava, Carroll E. Goering, Roger P. Rohrbach, Dennis R. buckmaster, "Engineering Principles of Agricultural Machines", ASABEPublication, 2012.
- T2.Myer Kutz , "Handbook of Farm, Dairy and Food Machinery Engineering", AcademicPress, 2019.
- T3.Howard Anton, Chris Rorres, "Elementary Linear Algebra Applications version", 9<sup>th</sup> Edition, Wiley India Publications, 2011.

**Reference Book(s):**

- R1.Qin Zhang, Francis J. Pierce, "Agricultural Automation Fundamentals and Practices",CRC Press, 2016.
- R2.Stephen L Young, Francis J. Pierce, "Automation: The Future of Weed Control in Cropping Systems", Springer, Dordrecht Heidelberg New York London, 2014.

**Web References:**

1. Agricultural Robotics: <https://www.annualreviews.org/doi/10.1146/annurev-control-053018-023617>

**Course Articulation Matrix**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2   | 1   | -   | -   | -   | 1   | 1   | 2   | 3   | 1    | -    | 1    | -    | -    |
| C02 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |
| C03 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | 1    | 1    | 3    | 2    |
| C04 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | -    | 1    | -    | 1    |
| C05 | 3   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 3   | 2    | -    | 1    | 3    | 2    |

High-3; Medium-2; Low-1

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN1023</b>                |                  | <b>Course Title: Robot Operating System</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                |                      |
| <b>L:T:P (Hours/Week)</b><br><b>3: 0: 0</b>   | <b>Credits:3</b> | <b>Total Contact Hours:45</b>               | <b>Max.Marks:100</b> |

### Pre-requisites

➤ Nil

### Course Objectives

The course is intended to:

1. Explain the basics of Robot Operating Systems and its architecture
2. Illustrate Linux commands on the file system, rights aspects
3. Explain the applications of ROS in real world complex applications
4. Identify navigation through Debugging and Visualization
5. Explain about the hardware interfaces

### Unit I Introduction to ROS

**9 Hours**

Introduction –The ROS Equation - History - distributions -difference from other meta-operating systems–services - ROS framework – operating system – releases.

### Unit II Introduction to Linux Commands

**9 Hours**

UNIX commands - file system – redirection of input and output - File system security - Changing access rights - process commands – compiling, building and running commands – handling variables

### Unit III Architecture of Operating System

**9 Hours**

File system - packages – stacks – messages – services – catkin workspace – working with catkin workspace - working with ROS navigation and listing commands

### Unit IV Debugging And Visualization

**9 Hours**

Navigation through file system -Understanding of Nodes – topics – service – messages – bags – master –parameter server.

### Unit V Files and Preprocessor Directives

**9 Hours**

Debugging of Nodes — topics — services — messages — bags — master — parameter — visualization using Gazebo - Rviz – URDF modeling – Xacro – launch files. Hardware Interface: Sensor Interfacing – Sensor Drivers for ROS – Actuator Interfacing – Motor Drivers for ROS.

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:             |                        |
| CO1: Explain the need for ROS and its significance               | Apply                  |
| CO2: Summarize the Linux commands used in robotics               | Understand             |
| CO3: Explain the concepts behind navigation through file system. | Apply                  |
| CO4: Explain the concepts of Node debugging                      | Apply                  |
| CO5: Summarize the issues in hardware interfacing                | Understand             |

### Text Book(s):

- T1. Lentin Joseph, “Robot Operating Systems (ROS) for Absolute Beginners, Apress, 2018
- T2. Aaron Martinez, Enrique Fernández, “Learning ROS for Robotics Programming”, Packt PublishingLtd, 2013.

**Reference Book(s):**

- R1. Jason M O'Kane, "A Gentle Introduction to ROS", CreateSpace, 2013.  
R2. AnisKoubaa, "Robot Operating System (ROS) – The Complete Reference (Vol.3), Springer 2018.  
R3. Kumar Bipin, "Robot Operating System Cookbook", Packt Publishing, 2018.

**Web References:**

1. Introduction of Robot operating system: <http://wiki.ros.org/ROS/Tutorials>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1



|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN2021</b>                |                  | <b>Course Title: Sensors and Instrumentation</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                     |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b> | <b>Total Contact Hours:60</b>                    | <b>Max.Marks:100</b> |

### **Pre-requisites**

- Nil

### **Course Objectives**

The course is intended to:

1. Understand the concepts of measurement technology
2. Explain the various sensors used to measure various physical parameters.
3. Apply the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development
4. Demonstrate about the optical, pressure and temperature sensor
5. Apply the signal conditioning and DAQ systems for given application

### **Unit I Introduction**

**6 Hours**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors Sensor calibration techniques – Sensor Output Signal Types.

### **Unit II Motion, Proximity and Ranging Sensors**

**6 Hours**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

### **Unit III Force, Magnetic and Heading Sensors**

**6 Hours**

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirements and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers

### **Unit IV Optical, Pressure and Temperature Sensors**

**6 Hours**

Photoconductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors – Smart Sensors - Film Sensors, MEMS & Nano Sensors, LASER sensors.

### **Unit V Signal Conditioning And DAQ Systems**

**6 Hours**

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multichannel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

### **List of Exercises**

**30 Hours**

1. Determination of Load, Torque and Force using Strain Gauge.
2. Determination of the characteristics of Pressure Sensor and Piezoelectric Force Sensor
3. Determination of Displacement using LVDT.
4. Determine the Characteristics of Various Temperature Sensors.
5. Determine the Characteristics of Various Light Detectors (Optical Sensors).
6. Distance Measurement using Ultrasonic and Laser Sensor

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:  |                 |
| CO1: Recognize various calibration techniques and signal types for sensors  | Apply           |
| CO2: Describe the working principle and characteristics of force, magnetic, heading, pressure and temperature, smart and other sensors and transducer | Apply           |
| CO3: Apply the various sensors and transducers in various applications  | Apply           |
| CO4: Select the appropriate sensor for different applications   | Apply           |
| CO5: Acquire the signals from different sensors using Data acquisition systems  | Apply           |

### Text Book(s):

T1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.

T2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", Dhanpat Rai & Co, 12th edition New Delhi, 2013.

### Reference Book(s):

R1. C. Sujatha ... Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2001.

R2. Hans Kurt Tönshoff, Ichiro, "Sensors in Manufacturing" Volume 1, Wiley- VCH April 2001.

### Web References:

1. <https://www.controleng.com/process-instrumentation-sensors/>: Process Instrumentation and sensors

### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |   |                      |
|---|------------------|---|----------------------|
| <b>Course Code: 19ADEN2022</b>                |                  | <b>Course Title: Embedded Computing Systems</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Practice</b>                   |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b> | <b>Total Contact Hours:60</b>                   | <b>Max.Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. Understand about the types of Embedded System and various devices in Arm Processor
2. Design ARM processor Peripherals using Embedded 'C'
3. Examine the significance of operating systems in embedded system design
4. Select the suitable communication technique to interface peripheral and sensors
5. Explain the system architecture using existing product design

#### **Unit I Introduction to Embedded system and Arm Processor 6 Hours**

Definition of Embedded System – Features of Embedded System – Types of Embedded System – List of Embedded System Devices - LPC 2148 ARM Block diagram – Memory and on chip peripheral devices – ARM 7 TDMI-S, CPU registers – Modes of Operation – PSW – Instruction set.

#### **Unit II ARM Processor Interfacing Techniques 6 Hours**

GPIO register map – Pin Connect Block - 8 bit LEDs – 8bit Switches – Buzzer – Relay – Timer/Counter -Vector Interrupt Controller (VIC) – ADC –Temperature sensor interfacing.

#### **Unit III Real Time Operating Systems 6 Hours**

Tasks and states, scheduling, Inter Process Communication- Semaphore(s), Shared data problem, Priority Inversion Problem and Deadlock Situations, Message Queues, Mailboxes, Pipes - Introduction to  $\mu$ C OS II – Porting of  $\mu$ C OS II– RTOS functions.

#### **Unit IV Communication Devices and Bus Standards 6 Hours**

I/O Devices: Types and Examples of I/O devices, Synchronous, ISO-synchronous and Asynchronous Communications from Serial Devices - Internal Serial-Communication Devices: SPI, UART – Serial Communication using I<sup>2</sup>C.

#### **Unit V System Design Techniques 6 Hours**

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design. Design Examples: Hardware Design and Software Design Telephone PBX- System Architecture, Ink jet printer, Personal Digital Assistants.

#### **List of Exercises 30 Hours**

#### **Write the Programs in Embedded C for the following experiments**

1. 8 bit LED and switch Interface
2. Buzzer and Relay Interface
3. Stepper Motor Interface
4. Time delay program using built in Timer / Counter feature

#### **RTOS based experiments**

5. Blinking two different LEDs
6. Reading temperature from LM 35 interface and plot the temperature Vs Time graph using Graphics LCD – Study Experiment

| Course Outcomes  | Cognitive Level |
|--|-----------------|
| At the end of this course, students will be able to:   |                 |
| CO1: Describe the programming concept involved in ARM Processor Architecture   | Understand      |
| CO2: Design ARM processor Peripherals using Embedded 'C' for any given problem scenario                              | Apply           |
| CO3: Examine the significance of operating systems in embedded system design for Real Time operating Systems         | Apply           |
| CO4: Select the suitable communication technique to interface peripheral and sensors for Real Time operating Systems | Apply           |
| CO5: Explain the system architecture using existing product design for any real time applications                    | Understand      |

#### Text Book(s):

- T1.Rajkamal, "Embedded Systems Architecture, Programming and Design", 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2017.
- T2.UWayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers, 2016.

#### Reference Book(s):

- R1.David E. Simon," An Embedded Software Primer", First Indian Reprint, Pearson Education Asia, 2002.
- R2. K.V.K.K.Prasad "Embedded /Real-Time Systems: Concepts, Design andProgramming", Dream Tech, Wiley 2013.
- R3.Steve Furber, "ARM System – on – chip Architecture", 2<sup>nd</sup> Edition, Addison Wesley, 2015.

#### Web References:

1. LPC214x User manual: [http://www.nxp.com/documents/user\\_manual/UM10139.pdf](http://www.nxp.com/documents/user_manual/UM10139.pdf)
2. NPTEL - Embedded Systems : <https://nptel.ac.in/courses/106/105/106105193/>
3. Coursera -Real-Time Embedded Systems Concepts andPractices: <https://www.coursera.org/learn/real-time-embedded-systems-concepts-practices>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|   |                  |  |                      |
|---|------------------|--|----------------------|
| <b>Course Code: 19ADEN2023</b>                |                  | <b>Course Title: Robotic Automation technology</b> |                      |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Mastery</b>                       |                      |
| <b>L:T:P (Hours/Week)</b><br><b>2: 0: 2</b>   | <b>Credits:3</b> | <b>Total Contact Hours:60</b>                      | <b>Max.Marks:100</b> |

### **Pre-requisites**

- Basic Programming Concepts

### **Course Objectives**

The course is intended to:

1. Explain RPA, where it can be applied and how it's implemented
2. Explain the different types of variables, Control Flow and data manipulation techniques
3. Identify and understand Image, Text and Data Tables Automation
4. Explain how to handle the User Events and various types of Exceptions and strategies
5. Build the Deployment of the Robot and to maintain the connection

### **Unit I Introduction to Robotic Process Automation 6 Hours**

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

### **Unit II Automation Process Activities 6Hours**

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

### **Unit III App Integration, Recording and Scraping 6 Hours**

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

### **Unit IV Exception Handling and Code Management 6 Hours**

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

### **Unit V Deployment and Maintenance 6 Hours**

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

### **List of Exercises 30 Hours**

1. Create a Sequence to obtain user inputs display them using a message box
2. Create a Flowchart to navigate to a desired page based on a condition
3. Create a State Machine workflow to compare user input with a random number.
4. Build a process in the RPA platform using UI Automation Activities.
5. Create an automation process using key System Activities, Variables and Arguments
6. Scraping data from website and writing to CSV.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Build the RPA and the ability to differentiate it from other types of Automation.                    | Apply           |
| CO2:   | Demonstrate to store and manipulate data in a more persistent way using such files as CSV and Excel. | Understand      |
| CO3:   | Develop to how the Citrix and the Image Recognition can be helpful.                                  | Apply           |
| CO4:   | Build to handle the exceptions and will troubleshoot towards the solution                            | Apply           |
| CO5:   | Apply the facility for scheduling bots and specifying the time intervals                             | Apply           |

### **Text Book(s):**

- T1. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.
- T2. Alok Mani Tripathi , “Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool — UiPath”, Packt Publishing, 2018.

### **Reference Book(s):**

- R1. Frank Casale ,Rebecca Dilla, Heidi Jaynes ,Lauren Livingston, “Introduction to Robotic Process Automation: a Primer” , Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
- R2. Robots, Automate Repetitive Tasks & Become An RPA Consultant” , Amazon Asia-Pacific Holdings Private Limited, 2018
- R3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020.

### **Web References:**

1. <https://www.uipath.com/rpa/robotic-process-automation>
2. <https://www.academy.uipath.com>

### **Course Articulation Matrix**

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

High-3; Medium-2; Low-1

## **Diversified Electives**

|   |                  |   |                       |
|---|------------------|---|-----------------------|
| <b>Course Code: 19ITEN1029</b>                |                  | <b>Course Title: Intellectual Property Rights<br/>(common to all B.E/B.Tech programmes)</b> |                       |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level : Introductory</b>  |                       |
| <b>L: T: P(Hours/Week)</b><br><b>3: 0: 0</b>  | <b>Credits:3</b> | <b>Total Contact Hours:45</b>   | <b>Max. Marks:100</b> |

## Pre-requisites

➤ Nil

## Course Objectives

The course is intended to:

1. Describe the basic concepts of Intellectual Property Law.
2. Explain the classification of Patents and its Rights and Limitations.
3. Explain the Patent Searching Process and Application Filling Process.
4. Describe the concepts and principles of Trademark.
5. Explain the principles of copyright and its sources.

|               |   |                |
|---------------|---|----------------|
| <b>Unit I</b> | <b>Intellectual Property: An Introduction</b> | <b>9 Hours</b> |
|---------------|---|----------------|

Intellectual Property Law: Patent Law-Copyright Law-Trademark Law- Trade secret Law-Right of Publicity-Paralegal tasks in Intellectual Property Law-Ethical obligations of the paralegal in Intellectual Property Law-Trade secrets: Protectible as a trade secret-Maintaining trade secrets-Protecting an Idea

|                |  |                |
|----------------|--|----------------|
| <b>Unit II</b> | <b>Patents: Rights and Limitations</b> | <b>9 Hours</b> |
|----------------|--|----------------|

Sources of patent law-Subject matter of Patents: Utility Patents-Plant Patents-Design Patents-Design Patents and copyright-Design Patents and trademarks-Computer Software, Business methods and Patent Protection-Rights under Patent Law-Patent Requirements-Limitations on Patent Rights-Patent Ownership

|                 |  |                |
|-----------------|--|----------------|
| <b>Unit III</b> | <b>Patents: Research, Applications, Disputes, and International Considerations</b> | <b>9 Hours</b> |
|-----------------|--|----------------|

Patent Search Process-Patent Application Process-Patent Infringement-Patent Litigation,  
International Patent laws

**Unit IV Principles of Trademark****9 Hours**

Trademarks and Unfair Competition-Acquiring Trademark Rights-Types of Marks, Strong Marks Versus Weak Marks-Selecting and Evaluating a Trademark-International Trademark Laws

**Unit V Principles of Copyrights****9 Hours**

Sources of Copyright Law- The Eight Categories of Works of Authorship-Derivative Works and Compilations- Rights and Limitations :Grant of Exclusive Rights–Copyrights Ownership- International Copyright Laws

| Course Outcomes   | Cognitive Level |
|---|-----------------|
| At the end of this course, students will be able to:                    |                 |
| CO1: Describe the basics of Intellectual Property Law                   | Apply           |
| CO2: Identify the Rights and Limitations of various patents             | Apply           |
| CO3: Apply the process of patent search and application filling process | Apply           |
| CO4: Explain the concept of trademark and its types                     | Apply           |
| CO5: Classify the concepts of copyrights and its limitations            | Apply           |

**Text Book(s):**

- T1. Richard Stim, "Intellectual Property: Copyrights, Trademark and Patents", Cengage learning, 2nd edition 2012.

**Reference Book(s):**

- R1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2013.
- R2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2017.

**Web References:**

<https://ipindia.gov.in/writereaddata/Portal/ev/sections-index.html>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1



|   |   |                               |                       |
|---|---|-------------------------------|-----------------------|
| <b>Course Code: 19MEEC1025</b>                | <b>Course Title: Fundamentals of Entrepreneurship<br/>(common to all B.E/B.Tech programmes)</b> |                               |                       |
| <b>Course Category: Professional Elective</b> | <b>Course Level : Introductory</b>  |                               |                       |
| <b>L: T: P(Hours/Week)<br/>3: 0: 0</b>        | <b>Credits:3</b>  | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Describe the types, characteristics of entrepreneurship and its role in economic development.
2. Define the types of entrepreneurship.
3. Explain the appropriate form of business ownership in setting up an enterprise.
4. Disseminate the support and management to entrepreneurs in the growth strategies in enterprise.
5. Explain the techniques involved in development of industries

### **Unit I Entrepreneurship**

**9 Hours**

Entrepreneur – Characteristics – Entrepreneurial Decision Process-Types of Entrepreneurs – Difference between Entrepreneur and a manager-Intrapreneur-Social Entrepreneur –Entrepreneurial Growth- Role of Entrepreneurship in Economic Development.

### **Unit II Types of Entrepreneurship**

**9 Hours**

Women Entrepreneurship-Rural Entrepreneurship-Tourism Enterprise, Entrepreneurship-Policy Measure of Tourism Entrepreneurship-Eco-Tourism/Nature Tourism/Rural Tourism-Need, Opportunities, Challenges for Developing Agri-preneurship-Social Entrepreneurship.

### **Unit III Start-Up**

**9 Hours**

Small Enterprises-Micro and Macro Units-Essentials, Features and Characteristics-Relationship between Micro and Macro Enterprises-Scope of Micro and Small Enterprises-Enterprise and Society-Package for Promotion of Micro and Small-Scale Enterprises-Problems of Micro and Small Enterprises- Identification of Business Opportunity-Steps in Setting Up of a Small Business Enterprise – Content of Business Plan- Significance of Business Plan, Formulation of Business Plan – Guidelines for Formulating Project Report– Project Appraisal.

**Unit IV Support and Management****9 Hours**

Institutional Finance-Types of Lease Agreements-Lease Financing-Concept and Procedure for Hire-Purchase-Institutional Support to Small Entrepreneurs-Tax Benefits-Depreciation, Rehabilitation Allowance- Investment Allowance-Expenditure to Scientific Research-Tax Concession in Rural and Backward Areas-Difference between Management and Administration-Management of Working Capital-Methods of Inventory Management-Production Design-Market Segmentation-Marketing Mix

**Unit V Development****9 Hours**

Accounting for Small Enterprise-Types of Growth Strategies-Signal and Symptoms, Causes and Consequences of Industrial Sickness-Forms of Export Business-Types of Documents-E-Commerce Suitability for Small Enterprises-Types of Franchising-Evaluation of Franchise Arrangement-Corporate Citizenship.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:  |                        |
| CO1: Explain the types, characteristics of entrepreneurship and its role in economic development.                                       | Apply                  |
| CO2: Classify various types of entrepreneurship and highlight the opportunities to improve the economy of India.                        | Apply                  |
| CO3: Select the appropriate form of business ownership in setting up an enterprise.   | Apply                  |
| CO4: Determine the financial planning to become an entrepreneur and manage tax benefits that can be provided to the small Entrepreneurs | Analyze                |
| CO5: Identify the techniques involved in the development of the small enterprise for the growth of industries.                          | Apply                  |

**Text Book(s):**

T1. S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 2020.

**Reference Book(s):**

R1.Charantimath, P. M., "Entrepreneurship Development and Small Business Enterprises", Pearson, 2006.

R1.Mathew J Manimala," Entrepreneurship theory at cross roads: paradigms and praxis" Dream tech, 2nd edition 2006.

R2.Rabindra N. Kanungo, "Entrepreneurship and innovation", Sage Publications, New Delhi, 2003.

R3.Singh, A. K., "Entrepreneurship Development and Management", University Science Press, 2009.

**Web References:**

1. <https://nptel.ac.in/courses/127105007>
2. <https://ncert.nic.in/ncerts/l/lebs213.pdf>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |                  |   |                       |
|---|------------------|---|-----------------------|
| <b>Course Code: 19MEEEC1026</b>               |                  | <b>Course Title: Design Thinking and Innovation<br/>(common to all B.E/B.Tech programmes)</b> |                       |
| <b>Course Category: Professional Elective</b> |                  | <b>Course Level: Introductory</b>   |                       |
| <b>L: T: P(Hours/Week)</b><br><b>3: 0: 0</b>  | <b>Credits:3</b> | <b>Total Contact Hours:45</b>   | <b>Max. Marks:100</b> |

### **Pre-requisites**

➤ Nil

### **Course Objectives**

The course is intended to:

1. Disseminate the fundamental concepts and principles of design thinking
2. Explain the design thinking methods in each stage of the problem
3. Conceptualize innovative ideas using prototypes
4. Explain the significance of Evaluating and Testing Ideas
5. Describe the design thinking approach to real world problems

#### **Unit I INTRODUCTION TO DESIGN THINKING 9 Hours**

Design thinking overview - Impact of Design Thinking - Design Process – Principles of Design Thinking – Creating Ideal Conditions – Case Study: Identify problem in AI

#### **Unit II UNDERSTAND THE PROBLEM 9 Hours**

Information Gathering – Analysis – Storytelling tool- Innovation- Ideation Finding and Evaluating Ideas –Mind Mapping Tool. Case Study: Analysis of the Identified Problem.

#### **Unit III DEFINING PROTOTYPES 8 Hours**

Tasks in Prototyping – Understanding Different Prototypes - Developing different prototypes – Demonstration – Prototyping Tools. Case Study: Prototype the solution.

#### **Unit IV EVALUATING AND TESTING IDEAS 10 Hours**

Finding Ideas – Developing Ideas Intuitively and Creatively - Selecting Evaluation method – Evaluating Ideas with checklist –Testing Ideas and Assumptions – Tasks in the Test Phase – Testing with Interviews – Testing with Online Studies – Case Study: Evaluate the solution.

#### **Unit V APPLICATIONS 9 Hours**

Politics and Society – Business – Strategic technology Plan – Creativity – Visioning, Listening and Diagramming - HealthCare and Science – Approach to treat Cancer – Law – Problem Definition – Alternatives.

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO1: Apply the key concepts of design thinking   | Apply                  |
| CO2: Relate design thinking in all stages of problem solving   | Apply                  |
| CO3: Identify the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices | Analyze                |
| CO4: Determine the significance of testing and evaluating the solution   | Analyze                |
| CO5: Apply design thinking skills to solve real time user experience problems  | Apply                  |

#### **Text Book(s):**

- T1. Muller-Roterberg "Design thinking for dummies" John Wiley & Sons, 2020. (Unit-I, III & IV)
- T2. Andrew Pressman "Design Thinking A Guide to Creative Problem Solving for Everyone", Routledge Publication, 2019. (Unit-II & V)

#### **Reference Book(s):**

- R1. Robert Curedale, "Design Thinking Process & Methods" Design Community College, 5th Edition, 2019.
- R2. Alyssa Gallagher and Kami Thordarson, "Design Thinking in Play: An Action Guide for Educators", ASCD Book, 2020
- R3. Brown.T, "Change by design: How design thinking transforms organizations and inspires innovation", HarperCollins, 2009.

#### **Web References:**

1. <https://www.open.edu/openlearn/science-maths-technology/design-innovation/design-thinking/content-section-6>
2. <https://www.interaction-design.org/literature/topics/design-thinking>
3. <https://venturewell.org/class-exercises/>

#### **Course Articulation Matrix**

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

High-3; Medium-2; Low-1

| Open Elective                              |   |                                   |                       |
|--|---|-----------------------------------|-----------------------|
| <b>Course Code: 19ADOC1001</b>             | <b>Course Title: Data Mining and Data Warehousing</b> |                                   |                       |
| <b>Course Category: Open Elective</b>      |   | <b>Course Level: Introductory</b> |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b>                                      | <b>Total Contact Hours:45</b>     | <b>Max. Marks:100</b> |

### Pre-requisites

- Database Management Systems

### Course Objectives

The course is intended to:

1. Identify the types of data to be pre-processed for the given dataset
2. Describe the basic principles, concepts and applications of data warehousing
3. Categorize the kinds of patterns that are discovered by association rule mining
4. Classify and construct a cluster of data for the given dataset
5. Analyze the data mining trends and applications

### Unit I      **An Overview of Database Systems** **9 Hours**

Introduction – Database system applications, Database versus file systems, View of data, Data models, Database languages, Database users and administrators, Database system structure, Entity – Relationship Model – Basic concepts, Constraints, Keys, Design issues, ER diagram, Weak entity sets, Design of an ER database schema.

### Unit II      **Data Mining Introduction** **9 Hours**

Introduction to Data Mining: Kinds of Data – Kinds of Patterns – Technologies - Applications – Issues – Data Preprocessing: Data Cleaning – Data Integration – Data Reduction – Data Transformation - Data Discretization - Data Visualization.

### Unit III      **Data Warehousing** **9 Hours**

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.

### Unit IV      **Association** **9 Hours**

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods: Frequent Item set Mining Method- Pattern Evaluation Methods- Pattern Mining: A Road Map, Multidimensional Space- Constraint-Based Frequent Pattern Mining- Applications pattern Mining.

### Unit V      **Classification and Clustering** **9 Hours**

Basic Concepts - Decision Tree Induction – Bayes Classification Methods – Rule Based Classification – Model Evaluation and Selection – Techniques to Improve Classification Accuracy. Cluster Analysis - Partitioning Methods - Hierarchical Methods - Density-Based Methods - Grid-Based Methods.

| Course Outcomes                                      |   | Cognitive Level |
|--|---|-----------------|
| At the end of this course, students will be able to: |   |                 |
| CO1:   | Construct the Entity Relationship Model for obtaining the structure of a database   | Apply           |
| CO2:   | Identify the types of data to be pre-processed for the given dataset using the preprocessing technique  | Apply           |
| CO3:   | Design a data mart or data warehouse for any organization   | Analyze         |
| CO4:   | Categorize the kinds of patterns that are discovered by association rule mining for transaction database  | Analyze         |
| CO5:   | Examine the prediction accuracy using different classification algorithms and construct a cluster of data using different clustering algorithms for the given dataset | Apply           |

#### Text Book(s):

- T1. Silberschatz, Korth, Sudarshan, "Database System Concepts", 6<sup>th</sup> Edition, McGraw Hill International Edition, New Delhi 2010.
- T2. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 4<sup>th</sup> edition, Elsevier, 2022.

#### Reference Book(s):

- R1. Jure Leskovec, Anand Rajaraman, Jeffery David Ullman, "Mining of Massive Datasets", 2nd Edition, Cambridge University Press, 2014.
- R2. Ian H.Witten, Eibe Frank, Mark A.Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3<sup>rd</sup> Edition, Elsevier, 2011.
- R3. EMC Education Services, "Data Science and Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data", Wiley, 2015.
- R4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons 2013.

#### Web References:

1. <http://www.cs.waikato.ac.nz/ml/weka/documentation.html>
2. <https://cran.r-project.org/manuals.html>
3. <https://archive.ics.uci.edu/ml/index.html>

#### Course Articulation Matrix

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

High-3; Medium-2; Low-1

|  |   |                               |                       |
|--|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADOC1002</b>             | <b>Course Title: Data Science for Engineers</b> |                               |                       |
| <b>Course Category: Open Elective</b>      | <b>Course Level: Introductory</b>               |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b>                                | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### Pre-requisites

➤ Nil

#### Course Objectives

The course is intended to:

1. Gain knowledge in the basic concepts of Data Analysis
2. Acquire skills in data preparatory and preprocessing steps
3. Understand the mathematical skills in statistics
4. Learn the tools and packages in Python for data science
5. Analysis classification and Regression Model

#### Unit I Overview of Data Science

**9 Hours**

Introduction – benefits and uses – facets of data – data science process : Retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

#### Unit II Describing Data I

**9 Hours**

Frequency distributions – Outliers – Types of frequency distributions – frequency distributions for Qualitative data – Graphs – Averages –Describing variability: Range – variance – standard deviation – interquartile range – variability for qualitative and ranked data.

#### Unit III Python For Data Handling

**9 Hours**

Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.

#### Unit IV Describing Data II

**9 Hours**

Normal distributions – z scores – normal curve problems – proportions – scores – correlation: scatter plots – correlation coefficient for quantitative data – Regression.

#### Unit V Python for Data Visualization

**9 Hours**

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh.

| <b>Course Outcomes</b>  | <b>Cognitive Level</b> |
|---|------------------------|
| At the end of this course, students will be able to:            |                        |
| CO1: Gain knowledge in the basic concepts of Data Analysis      | Apply                  |
| CO2: Acquire skills in data preparatory and preprocessing steps | Apply                  |
| CO3: Understand the mathematical skills in statistics           | Apply                  |
| CO4: Learn the tools and packages in Python for data science    | Apply                  |
| CO5: Gain understanding in classification and Regression Model  | Apply                  |



**Text Book(s):**

- T1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
- T2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and IV)
- T3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units III and V)

**Reference Book(s):**

- R1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

**Web References:**

1. <https://nptel.ac.in/downloads/111102011/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|  |   |                               |                       |
|--|---|-------------------------------|-----------------------|
| <b>Course Code: 19ADOC1003</b>             | <b>Course Title: Business Analytics</b> |                               |                       |
| <b>Course Category: Open Elective</b>      |   | <b>Course Level: Practice</b> |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b>                        | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

### Pre-requisites

➤ Nil

### Course Objectives

The course is intended to:

1. Choose appropriate Information Technology applications
2. Develop a Decision-Making Tool
3. Design Dashboard and Scorecard
4. Deploy a Knowledge Management System
5. Apply suitable platform for improving business intelligence

### Unit I Introduction to Business Intelligence 9 Hours

Business View of IT Applications-Digital Data-Getting started with BI-BI Component Framework-Users-Applications-Roles and Responsibilities-Concepts of data integration Need and advantages of using data integration-Tools-Case Study: Pentaho.

### Unit II Decision Support Systems 9 Hours

Decision Making: Introduction-Models-Phases-DSS Description-Characteristics-Capabilities-Classifications-Components-Data, Model, User Interface (DIALOG) and Knowledge Based Management Subsystem-DSS User-Case Study: PHP MySQL Implementation of DSS.

### Unit III Business Performance Management 9 Hours

BPM Cycle-Performance Measurement-BPM Methodologies-Architecture and Applications-Introduction to enterprise reporting-Performance Dashboards and corecards-Case Study: Freeboard.

### Unit IV Knowledge Management 9 Hours

Introduction-Organizational Learning and Transformation-KM Activities-Approaches-Information Technology and Roles of People in KM-KM System Implementation Ensuring the Success of KM Efforts-Case Study: Apache Sling CMS.

### Unit V Emerging Trends 9 Hours

Reality Mining- Virtual Worlds- Web 2.0 Revolution- Virtual Communities- Online Social Networking- Cloud Computing and BI- MSS Impacts on Organization & Individual.

| Course Outcomes                                      |  | Cognitive Level |
|--|--|-----------------|
| At the end of this course, students will be able to: |  |                 |
| CO1:   | Choose appropriate Information Technology applications for Modern Business implementing Business Intelligence components | Understand      |
| CO2:   | Develop a Decision-Making Tool for given real time application using Decision Support System components                  | Apply           |
| CO3:   | Design Dashboard and Score card for any given application to analyze its business performance                            | Apply           |
| CO4:   | Deploy a Knowledge Management System for effective functioning of an organization by choosing suitable KMS approach      | Apply           |
| CO5:   | Apply suitable platform for improving business intelligence in decision making   | Apply           |

**Text Book(s):**

- T1. RN Prasad, Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley, 2016.
- T2. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence and Analytics, Systems for Decision Support", 10th Edition, Pearson Education Inc, 2015.

**Reference Book(s):**

- R1. Vicki L. Sauter, "Decision Support Systems for Business Intelligence", Wiley, 2011.
- R2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", 2nd Edition, Morgan Kaufman, 2012.
- R3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley, 2009.

**Web References:**

1. MIS - Decision Support System Tutorialspoint URL:  
[https://www.tutorialspoint.com/management\\_information\\_system/decision\\_support\\_system.htm](https://www.tutorialspoint.com/management_information_system/decision_support_system.htm)
2. Mastering Microsoft Power BI URL:  
[https://www.tutorialspoint.com/power\\_bi/index.htm](https://www.tutorialspoint.com/power_bi/index.htm)
3. MIS - Business Intelligence System Business Intelligence as a Career Option  
URL:<https://www.tutorialspoint.com/business-intelligence-as-a-career-option>
4. Decision Support System Java Netbeans Project URL:  
<https://www.freeprojectz.com/javajsp-netbeans-project/decision-support-system>
5. Open source dashboard tools for visualizing data  
URL:<https://opensource.com/business/16/11/open-source-dashboard-tools-visualizing-data>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|   |  |                               |                       |
|---|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADOC1004</b>              | <b>Course Title: Cognitive Science</b> |                               |                       |
| <b>Course Category: Engineering Science</b> | <b>Course Level: Mastery</b>           |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b>  | <b>Credits:3</b>                       | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

- Knowledge in Big data Analytics, Probabilistic theory

#### **Course Objectives**

The course is intended to:

1. Explain the theoretical background of cognition
2. Explain the link between cognition and computational intelligence
3. Infer Deep learning Methodologies
4. Summarize the computational inference models of cognition
5. Summarize the computational learning Tools

#### **Unit I INTRODUCTION 9 Hours**

The Challenge of Cognitive Science - The Challenge of Cognitive Science - The Discipline Matures: Three Milestones - The Turn to the Brain- Physical Symbol Systems and the Language of Thought - Neural Networks and Distributed Information Processing

#### **Unit II NEURO SCIENCE 9 Hours**

Applying Dynamical Systems Theory to Model the Mind - Bayesianism in Cognitive Science - Modules and Architectures - Strategies for Brain Mapping - Models of Language Learning - Object Perception and Folk Physics

#### **Unit III COGNITIVE LANGUAGES 9 Hours**

Machine Learning: From Expert Systems to Deep Learning - Exploring Mindreading – Robotics: From GOFAL to Situated Cognition and Behavior - Based Robotics - The Cognitive Science of Consciousness

#### **Unit IV ARTIFICIAL INTELLIGENCE DESIGN METHODOLOGY 9 Hours**

The Emotions: From Cognitive Science to Affective Science -Coauthored with Dong An - Looking Ahead: Challenges and Opportunities - The Neuroscience Approach: Mind As Brain: Perspective - Methodology- Neuron Anatomy- Brain Anatomy- The Neuroscience of Visual Object Recognition

#### **Unit V COGNITIVE ROBOSCIENCE 9 Hours**

Artificial Intelligence I: Definitional Perspective: Historical and Philosophical Roots- defining - AI Methodologies – tools – Programming - Alan Turing and the Great Debate - Artificial Intelligence II: Operational Perspective: Approaches to the Design of Intelligent Agents - Machine Representation -Reasoning: Machine – Logical – Inductive - Expert Systems - Fuzzy Logic

| <b>Course Outcomes</b>                                       | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:         |                        |
| CO1: Apply the underlying theory behind cognition.           | Understand             |
| CO2: Experiment with the cognition elements computationally. | Apply                  |
| CO3: Organize deep learning with behaviour.                  | Apply                  |
| CO4: Relate applications using cognitive inference model.    | Apply                  |
| CO5: Explain applications using tools.                       | Apply                  |

**Text Book(s):**

- T1. Jose Luis Bermúdez, Cognitive Science - An Introduction to the Science of the Mind, Cambridge University Press 2020.
- T2. Jay Friesen, Gordon Silverman, Cognitive Science - An Introduction to the Study of Mind, Sage publication 2006.

**Reference Book(s):**

- R1. Noah D. Goodman, Andreas Stuhlmüller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, <https://dippl.org/>.
- R2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, <https://probmods.org/>.

**Web References:**

1. <https://www.problang.org/chapters/app-06-intro-to-webppl.html>
2. <https://www.hindawi.com/journals/aai/2010/918062/>

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1

|  |  |                               |                       |
|--|--|-------------------------------|-----------------------|
| <b>Course Code: 19ADOC1006</b>             | <b>Course Title: Professional Ethics</b> |                               |                       |
| <b>Course Category: Open Elective</b>      | <b>Course Level: Mastery</b>             |                               |                       |
| <b>L:T:P(Hours/Week)</b><br><b>3: 0: 0</b> | <b>Credits:3</b>                         | <b>Total Contact Hours:45</b> | <b>Max. Marks:100</b> |

#### **Pre-requisites**

➤ Nil

#### **Course Objectives**

The course is intended to:

1. The student should be able to apply ethics in society
2. Discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.
3. Apply the Ethics in real world.
4. Describe the safety, responsibilities and rights as an engineer
5. Discuss the Global issues around the world as an engineer perspective

#### **Unit I HUMAN VALUES**

**9 Hours**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

#### **Unit II ENGINEERING ETHICS**

**9 Hours**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

#### **Unit III ENGINEERING AS SOCIAL EXPERIMENTATION**

**9 Hours**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

#### **Unit IV SAFETY, RESPONSIBILITIES AND RIGHTS**

**9 Hours**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest - Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

#### **Unit V GLOBAL ISSUES**

**9 Hours**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

| <b>Course Outcomes</b>   | <b>Cognitive Level</b> |
|--|------------------------|
| At the end of this course, students will be able to:   |                        |
| CO1: The student should be able to apply ethics in society   | Understand             |
| CO2: Discuss the ethical issues related to engineering and realize the responsibilities and rights in the society. | Understand             |
| CO3: Apply the Ethics in real world.   | Understand             |
| CO4: Describe the safety, responsibilities and rights as an engineer   | Understand             |
| CO5: Discuss the Global issues around the world as an engineer perspective   | Understand             |

**Text Book(s):**

- T1. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi, 2003.
- T2. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

**Reference Book(s):**

- R1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
- R2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
- R3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
- R4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
- R5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility", Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.

**Course Articulation Matrix**

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

High-3; Medium-2; Low-1