

# **JERUSALEM COLLEGE OF ENGINEERING**

**(An Autonomous Institution)**

**Approved by AICTE & Affiliated to Anna University**

**Accredited by NAAC with 'A' Grade**

**Chennai – 600 100**



## **DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

**B.E. CSE  
(ARTIFICIAL INTELLIGENCE AND MACHINE  
LEARNING)**

# **CURRICULUM**

**REGULATION 2023**

**CHOICE BASED CREDIT SYSTEM**

**JERUSALEM COLLEGE OF ENGINEERING**  
**(An Autonomous institution affiliated to Anna University, Chennai)**  
**(Approved by AICTE, Affiliated to Anna University**  
**Accredited by NBA and NAAC with 'A' Grade)**  
**Velachery Main Road, Pallikaranai, Chennai 600 100**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE  
LEARNING**

**VISION OF THE INSTITUTION**

Jerusalem College of Engineering is committed in emerging as an international institution of excellence in imparting the finest quality engineering, technology and management education rooted in ethical and societal values through various academic programmes, multi-disciplinary research, consultancy and entrepreneurship activities, and hence in contributing towards social transformation and nation building.

**MISSION OF THE INSTITUTION**

- Generating abundant resources and making conducive policies, the management led by the Chief Executive Officer strives towards promoting globally competitive academic programmes augmented with value added courses, in-plant training, co-curricular activities and ambience that support intellectual growth and skill acquisition.
- Promoting collaborative trans-border research programmes, continuing education in synergy with academia, industries and research organizations leading to real time solutions and lifelong learning
- Transforming young men and women into competent professionals and entrepreneurs motivated by a passion for professional excellence, driven by human values and proactively engaging in the betterment of the society through innovative practices and academic excellence.
- Facilitating effective interaction among faculty and students, and fostering network of alumni, industries, institutions and other stakeholders for successful career gain and placement.

## **VISION OF THE DEPARTMENT**

To impart high quality knowledge in cutting edge contemporary Artificial Intelligence technologies in par with industrial standards and to produce highly competent graduates, researchers, entrepreneurs, innovative professionals and ethical engineers with the problem solving and leadership abilities of current and emerging technologies to meet the demands of society and global economy.

## **MISSION OF THE DEPARTMENT**

- To provide students a problem-solving and analytical education that emphasises skills and values in order to improve their roles in expertise domains.
- To transform students into technically competent graduates through research based Artificial Intelligence and Machine Learning projects and activities in the emerging areas.
- To educate the students to be successful entrepreneurs by providing quality education and enhancing skills of the students.
- To inculcate the values of professional ethics, social concerns, environment protection and life-long learning.

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

- PEO 1:** Graduates with ability to employ Artificial Intelligence and Machine Learning principles and techniques to analyze requirements, realize technical specifications and create engineering solutions.
- PEO 2:** Graduates with collaborative learning and team-work spirit through multi-disciplinary projects and diverse professional activities.
- PEO 3:** Graduates with strong knowledge, competence and soft skills that allows them to contribute ethically to the needs of society and accomplish sustainable progress in the emerging computing technologies through life-long learning.

## **II. PROGRAM OUTCOMES (POs)**

- PO 1:** Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- PO 2:** 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.
- PO 3:** 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
- PO 4:** 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.
- PO 5:** 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.
- PO 6:** 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.
- PO 7:** 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.
- PO 8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO 9:** Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO 10:** 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.
- PO 11:** Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 12:** Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.



### **III. PROGRAM SPECIFIC OUTCOMES (PSOs)**

**The graduates will be able to**

- PSO 1:** Apply the acquired knowledge to identify real-world research problems, using latest hardware and software tools, along with analytical skills to arrive at cost effective and appropriate solutions.
- PSO 2:** Expose design and programming skills to develop intelligent systems for solving problems from inter-disciplinary domains.
- PSO 2:** Develop themselves into professionals who are ready to serve the industry as well as society and to lead a product development company/team.

**JERUSALEM COLLEGE OF ENGINEERING**  
**(AN AUTONOMOUS INSTITUTION AFFILIATED TO ANNA**  
**UNIVERSITY, CHENNAI)**

**B.E. – COMPUTER SCIENCE AND ENGINEERING**  
**(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)**

**CURRICULUM 2023**  
**REGULATION – 2023**  
**CHOICE BASED CREDIT SYSTEM**

**COURSE SUMMARY SHEET**

| S.<br>NO. | CATEGORY | SEMESTER-WISE CREDITS |    |    |    |    |    |    |    | TOTAL<br>CREDITS |
|-----------|----------|-----------------------|----|----|----|----|----|----|----|------------------|
|           |          | 1                     | 2  | 3  | 4  | 5  | 6  | 7  | 8  |                  |
| 1         | HS       | 4                     | 4  | -  | -  | -  | 1  | 2  | -  | 11               |
| 2         | BS       | 10                    | 9  | 3  | 3  | 3  | -  | -  | -  | 28               |
| 3         | ES       | 8                     | 3  | -  | -  | -  | -  | -  | -  | 11               |
| 4         | PC       | -                     | 5  | 17 | 14 | 12 | 12 | -  | 10 | 70               |
| 5         | PE       | -                     | -  | -  | 3  | 3  | 6  | 6  | -  | 18               |
| 6         | OE       | -                     | -  | -  | 3  | 3  | 3  | 3  | -  | 12               |
| 7         | EEC      | -                     | 2  | *  | 3  | 2  | 3  | 6  | -  | 16               |
| 8         | NCM      | -                     | -  | *  | -  | -  | -  | *  | -  | -                |
| TOTAL     |          | 22                    | 23 | 20 | 26 | 23 | 25 | 17 | 10 | 166              |

### SEMESTER I

| S. NO.       | COURSE CODE | COURSE TITLE                                 | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P        | C         |
|--------------|-------------|----------------------------------------------|-----------|----------|-----------------|-----------|----------|----------|-----------|
| 1            | JHS2121     | English for Communicative Competence         | I         | HS       | 4               | 2         | 0        | 2        | 3         |
| 2            | JMA2101     | Matrices and Calculus                        | I         | BS       | 4               | 2         | 2        | 0        | 3         |
| 3            | JPH2101     | Engineering Physics 1                        | T         | BS       | 3               | 3         | 0        | 0        | 3         |
| 4            | JCY2101     | Engineering Chemistry                        | T         | BS       | 3               | 3         | 0        | 0        | 3         |
| 5            | JGE2101     | Basic Engineering                            | T         | ES       | 3               | 3         | 0        | 0        | 3         |
| 6            | JCS2121     | Programming in C                             | I         | ES       | 5               | 3         | 0        | 2        | 4         |
| 7            | JGE2102     | Heritage of Tamils                           | T         | HS       | 1               | 1         | 0        | 0        | 1         |
| 8            | JPC2111     | Engineering Physics and Chemistry Laboratory | P         | BS       | 2               | 0         | 0        | 2        | 1         |
| 9            | JGE2111     | Basic Engineering Laboratory                 | P         | ES       | 2               | 0         | 0        | 2        | 1         |
| <b>TOTAL</b> |             |                                              |           |          | <b>27</b>       | <b>17</b> | <b>2</b> | <b>8</b> | <b>22</b> |

### SEMESTER II

| S. NO.       | COURSE CODE | COURSE TITLE                                             | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|----------------------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JHS2221     | English for Science and Technology                       | I         | HS       | 4               | 2         | 0        | 2         | 3         |
| 2            | JMA2201     | Statistics for Engineers                                 | I         | BS       | 4               | 2         | 2        | 0         | 3         |
| 3            | JPH2201     | Engineering Physics 2                                    | T         | BS       | 3               | 3         | 0        | 0         | 3         |
| 4            | JCY2201     | Engineering Graphics                                     | I         | ES       | 4               | 2         | 0        | 2         | 3         |
| 5            | JCS2201     | Python Programming                                       | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 6            | JCY2201     | Environmental Science and Sustainability                 | T         | BS       | 2               | 2         | 0        | 0         | 2         |
| 7            | JGE2202     | Tamils and Technology                                    | T         | HS       | 1               | 1         | 0        | 0         | 1         |
| 8            | JPC2211     | Engineering Physics and Environmental Science Laboratory | P         | BS       | 2               | 0         | 0        | 2         | 1         |
| 9            | JCS2211     | Python Programming Laboratory                            | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 10           | JGE2241     | Gaming and Crafts Studio                                 | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                                          |           |          | <b>31</b>       | <b>15</b> | <b>2</b> | <b>14</b> | <b>23</b> |

### SEMESTER III

| S. NO.       | COURSE CODE | COURSE TITLE                                  | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|-----------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JMA2302     | Mathematical Foundations for Computer Science | T         | BS       | 4               | 2         | 2        | 0         | 3         |
| 2            | JAL2301     | Data Science                                  | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JCS2301     | Data Structures and Algorithms                | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 4            | JIT2301     | Object Oriented Programming                   | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 5            | JIT2321     | Digital Principles and Computer Organization  | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 6            | JNC2361     | Non-Credit Mandatory Course 1                 | T         | NCM      | 3               | 3         | 0        | 0         | -         |
| 7            | JPT2041     | Soft Skills and Aptitude                      | P         | EEC      | 2               | 0         | 0        | 2         | *         |
| 8            | JAL2311     | Data Science Laboratory                       | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 9            | JIT2311     | Object Oriented Programming Laboratory        | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                               |           |          | <b>31</b>       | <b>17</b> | <b>2</b> | <b>12</b> | <b>20</b> |

**\*Only internal assessment**

### SEMESTER IV

| S. NO.       | COURSE CODE | COURSE TITLE                                     | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|--------------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JMA2402     | Applied Linear Algebra                           | T         | BS       | 4               | 2         | 2        | 0         | 3         |
| 2            | JAL2401     | Principles of Artificial Intelligence            | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JCS2401     | Database Management Systems                      | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 4            | JIT2421     | Operating Systems                                | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 5            | -           | Professional Elective 1                          | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 6            | -           | Open Elective 1                                  | T         | OE       | 3               | 3         | 0        | 0         | 3         |
| 7            | JPT2041     | Soft Skills and Aptitude                         | P         | EEC      | 2               | 0         | 0        | 2         | 1         |
| 8            | JAL2411     | Principles of Artificial Intelligence Laboratory | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 9            | JCS2411     | Database Management Systems Laboratory           | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 10           | JGE2442     | Advanced IT Infrastructure Laboratory            | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                                  |           |          | <b>35</b>       | <b>17</b> | <b>2</b> | <b>16</b> | <b>26</b> |

## SEMESTER V

| S. NO.       | COURSE CODE | COURSE TITLE                         | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|--------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JMA2501     | Optimization Techniques              | T         | BS       | 4               | 2         | 2        | 0         | 3         |
| 2            | JAL2501     | Machine Learning                     | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JAL2521     | Time Series Analysis and Forecasting | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 4            | JCS2501     | Computer Networks                    | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 5            | -           | Professional Elective 2              | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 6            | -           | Open Elective 2                      | T         | OE       | 3               | 3         | 0        | 0         | 3         |
| 7            | JPT2042     | Technical Skills and Aptitude        | P         | EEC      | 2               | 0         | 0        | 2         | *         |
| 8            | JAL2511     | Machine Learning Laboratory          | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 9            | JGE2542     | MERN Stack Development Laboratory    | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                      |           |          | <b>31</b>       | <b>17</b> | <b>2</b> | <b>12</b> | <b>23</b> |

**\*Only internal assessment**

## SEMESTER VI

| S. NO.       | COURSE CODE | COURSE TITLE                                 | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|----------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JAL2601     | Neural Networks and Deep Learning            | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 2            | JAL2602     | Natural Language Processing                  | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JAL2621     | Robotic Process Automation                   | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 4            | -           | Professional Elective 3                      | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 5            | -           | Professional Elective 4                      | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 6            | -           | Open Elective 3                              | T         | OE       | 3               | 3         | 0        | 0         | 3         |
| 7            | JPT2042     | Technical Skills and Aptitude                | P         | EEC      | 2               | 0         | 0        | 2         | 1         |
| 8            | JHS2541     | Professional Communication                   | P         | HS       | 2               | 0         | 0        | 2         | 1         |
| 9            | JAL2611     | Neural Networks and Deep Learning Laboratory | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 10           | JGE2642     | Computational Intelligence Laboratory        | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                              |           |          | <b>32</b>       | <b>18</b> | <b>0</b> | <b>14</b> | <b>25</b> |

## SEMESTER VII

| S. NO.       | COURSE CODE | COURSE TITLE                        | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P        | C         |
|--------------|-------------|-------------------------------------|-----------|----------|-----------------|-----------|----------|----------|-----------|
| 1            | -           | Professional Elective 5             | T         | PE       | 3               | 3         | 0        | 0        | 3         |
| 2            | -           | Professional Elective 6             | T         | PE       | 3               | 3         | 0        | 0        | 3         |
| 3            | -           | Open Elective 4                     | T         | OE       | 3               | 3         | 0        | 0        | 3         |
| 4            | -           | Non-Credit Mandatory Course 2       | T         | NCM      | 3               | 3         | 0        | 0        | -         |
| 5            | JHS2741     | Universal Human Values              | I         | HS       | 3               | 1         | 0        | 2        | 2         |
| 6            | JGE2751     | Entrepreneurship Development        | I         | EEC      | 4               | 2         | 0        | 2        | 3         |
| 7            | JAL2741     | Comprehension and Technical Seminar | P         | EEC      | 2               | 0         | 0        | 2        | 1         |
| 8            | JAL2742     | Internship                          | P         | EEC      | -               | -         | -        | 4**      | 2         |
| <b>TOTAL</b> |             |                                     |           |          | <b>21</b>       | <b>15</b> | <b>0</b> | <b>4</b> | <b>17</b> |

**\*\*Internship of 1 month must be undertaken in industry through semester 4, 5 and 6 leading to 1 credit in semester 7**

## SEMESTER VIII

| S. NO.       | COURSE CODE | COURSE TITLE | T / P / I | CATEGORY | CONTACT PERIODS | L        | T        | P         | C         |
|--------------|-------------|--------------|-----------|----------|-----------------|----------|----------|-----------|-----------|
| 1            | JAL2831     | Project Work | P         | PC       | 20              | 0        | 0        | 20        | 10        |
| <b>TOTAL</b> |             |              |           |          | <b>20</b>       | <b>0</b> | <b>0</b> | <b>20</b> | <b>10</b> |

**TOTAL NO. OF CREDITS: 166**

## LIST OF PROFESSIONAL ELECTIVES (PE) - VERTICALS R2023

| <b>Vertical I<br/>Data Science</b>               | <b>Vertical II<br/>Full Stack<br/>Development</b> | <b>Vertical III<br/>Cloud Computing</b>      | <b>Vertical IV<br/>Cyber Security</b>                      | <b>Vertical V<br/>Internet of Things<br/>(IoT)</b>                              |
|--------------------------------------------------|---------------------------------------------------|----------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------------|
| JCS2001<br>Foundation of<br>Data science         | JIT2001 APP<br>Development                        | JAL2005<br>Foundations of<br>Cloud Computing | JCB2001 Cyber<br>Security<br>Fundamentals<br>and Practices | JIT2009 Internet<br>Of Things:<br>Architecture<br>Protocols And<br>Applications |
| JCS2002 Big<br>Data Analytics                    | JIT2002 Cloud<br>Services<br>Management           | JIT2002<br>Cloud Services<br>Management      | JCB2002<br>Cryptography<br>and<br>Cryptanalysis            | JIT2010<br>Programming For<br>IOT Boards                                        |
| JCS2003<br>Recommender<br>Systems                | JIT2003 UI<br>and UX<br>Design                    | JAL2006 Agile<br>Software<br>Development     | JCB2003 Cyber<br>Forensics                                 | JIT2011<br>Industrial IoT 4.0                                                   |
| JCS2004<br>Web and Speech<br>Analysis            | JIT2004<br>Devops                                 | JAL2007<br>Storage<br>Technologies           | JCB2004<br>Intrusion<br>Detection and<br>Prevention        | JIT2012 IoT in<br>HealthCare                                                    |
| JCS2005 Social<br>Media Analytics                | JIT2005 Web<br>Security and<br>Privacy            | JAL2008<br>Distributed<br>Computing          | JCB2005<br>Hardware<br>Security                            | JIT2013 Robotics<br>in IOT                                                      |
| JCS2006 Data<br>Exploration and<br>Visualization | JIT2006<br>MERN Stack<br>development              | JAL2009<br>IOT and Cloud<br>Computing        | JCB2006<br>Cloud Security                                  | JIT2014 Mobile<br>Application<br>Development For<br>IOT                         |
| JCS2007 Health<br>Care Analytics                 | JIT2007<br>Software<br>Testing And<br>Automation  | JAD2007<br>Cloud Computing<br>Tools          | JCB2007<br>Ethical Hacking                                 | JIT2015<br>Cognitive IOT                                                        |
| JCS2008 Image<br>and Video<br>Analytics          | JIT2008<br>NoSQL<br>Database                      | JAL2010 Security<br>and Privacy in<br>Cloud  | JCB2008 Web<br>Application<br>Security                     | JIT2016 Privacy<br>Security for IOT                                             |

**LIST OF OPEN ELECTIVES (OE) OFFERED BY AIML  
DEPARTMENT**

| S. No.                                  | COURSE CODE | COURSE TITLE                            | CATEGORY | CONTACT PERIODS | L | T | P | C |
|-----------------------------------------|-------------|-----------------------------------------|----------|-----------------|---|---|---|---|
| <b>SEMESTER – IV (OPEN ELECTIVE 1)</b>  |             |                                         |          |                 |   |   |   |   |
| 1                                       | JAL9201     | Basics of Artificial Intelligence       | OE       | 3               | 3 | 0 | 0 | 3 |
| 2                                       | JAL9202     | Ethics and Artificial Intelligence      | OE       | 3               | 3 | 0 | 0 | 3 |
| <b>SEMESTER – V (OPEN ELECTIVE 2)</b>   |             |                                         |          |                 |   |   |   |   |
| 1                                       | JAL9203     | Human Computer Interaction              | OE       | 3               | 3 | 0 | 0 | 3 |
| 2                                       | JAL9204     | Deep Learning Principles                | OE       | 3               | 3 | 0 | 0 | 3 |
| <b>SEMESTER – VI (OPEN ELECTIVE 3)</b>  |             |                                         |          |                 |   |   |   |   |
| 1                                       | JAL9205     | Nature Inspired Computing               | OE       | 3               | 3 | 0 | 0 | 3 |
| 2                                       | JAL9206     | Business Intelligence                   | OE       | 3               | 3 | 0 | 0 | 3 |
| <b>SEMESTER – VII (OPEN ELECTIVE 4)</b> |             |                                         |          |                 |   |   |   |   |
| 1                                       | JAL9207     | Text and Web Mining                     | OE       | 3               | 3 | 0 | 0 | 3 |
| 2                                       | JAL9208     | Applications of Artificial Intelligence | OE       | 3               | 3 | 0 | 0 | 3 |



## LIST OF PROFESSIONAL ELECTIVE (PE) COURSES - VERTICALS

### VERTICAL – I DATA SCIENCE

| S.No. | COURSE CODE | COURSE TITLE                       | CATEGORY | CONTACT PERIODS | L | T | P | C |
|-------|-------------|------------------------------------|----------|-----------------|---|---|---|---|
| 1     | JCS2001     | Foundation of Data Science         | PE       | 3               | 3 | 0 | 0 | 3 |
| 2     | JCS2002     | Big Data Analytics                 | PE       | 3               | 3 | 0 | 0 | 3 |
| 3     | JCS2003     | Recommender Systems                | PE       | 3               | 3 | 0 | 0 | 3 |
| 4     | JCS2004     | Web and Speech Analysis            | PE       | 3               | 3 | 0 | 0 | 3 |
| 5     | JCS2005     | Social Media Analytics             | PE       | 3               | 3 | 0 | 0 | 3 |
| 6     | JCS2006     | Data Exploration and Visualization | PE       | 3               | 3 | 0 | 0 | 3 |
| 7     | JCS2007     | Health Care Analytics              | PE       | 3               | 3 | 0 | 0 | 3 |
| 8     | JCS2008     | Image and Video Analytics          | PE       | 3               | 3 | 0 | 0 | 3 |

### VERTICAL – II FULL STACK DEVELOPMENT

| S.No. | COURSE CODE | COURSE TITLE                    | CATEGORY | CONTACT PERIODS | L | T | P | C |
|-------|-------------|---------------------------------|----------|-----------------|---|---|---|---|
| 1     | JIT2001     | App Development                 | PE       | 3               | 3 | 0 | 0 | 3 |
| 2     | JIT2002     | Cloud Services Management       | PE       | 3               | 3 | 0 | 0 | 3 |
| 3     | JIT2003     | UI and UX Design                | PE       | 3               | 3 | 0 | 0 | 3 |
| 4     | JIT2004     | DevOps                          | PE       | 3               | 3 | 0 | 0 | 3 |
| 5     | JIT2005     | Web Security and Privacy        | PE       | 3               | 3 | 0 | 0 | 3 |
| 6     | JIT2006     | MERN Stack Development          | PE       | 3               | 3 | 0 | 0 | 3 |
| 7     | JIT2007     | Software Testing and Automation | PE       | 3               | 3 | 0 | 0 | 3 |
| 8     | JIT2008     | NoSQL Database                  | PE       | 3               | 3 | 0 | 0 | 3 |

**VERTICAL – III**  
**CLOUD COMPUTING**

| S.No. | COURSE CODE | COURSE TITLE                   | CATEGORY | CONTACT PERIODS | L | T | P | C |
|-------|-------------|--------------------------------|----------|-----------------|---|---|---|---|
| 1     | JAL2005     | Foundations of Cloud Computing | PE       | 3               | 3 | 0 | 0 | 3 |
| 2     | JIT2002     | Cloud Services Management      | PE       | 3               | 3 | 0 | 0 | 3 |
| 3     | JAL2006     | Agile Software Development     | PE       | 3               | 3 | 0 | 0 | 3 |
| 4     | JAL2007     | Storage Technologies           | PE       | 3               | 3 | 0 | 0 | 3 |
| 5     | JAL2008     | Distributed Computing          | PE       | 3               | 3 | 0 | 0 | 3 |
| 6     | JAL2009     | IOT and Cloud Computing        | PE       | 3               | 3 | 0 | 0 | 3 |
| 7     | JAD2007     | Cloud Computing Tools          | PE       | 3               | 3 | 0 | 0 | 3 |
| 8     | JAL2010     | Security and Privacy in Cloud  | PE       | 3               | 3 | 0 | 0 | 3 |

**VERTICAL – IV**  
**CYBER SECURITY**

| S.No. | COURSE CODE | COURSE TITLE                              | CATEGORY | CONTACT PERIODS | L | T | P | C |
|-------|-------------|-------------------------------------------|----------|-----------------|---|---|---|---|
| 1     | JCB2001     | Cyber Security Fundamentals and Practices | PE       | 3               | 3 | 0 | 0 | 3 |
| 2     | JCB2002     | Cryptography and Cryptanalysis            | PE       | 3               | 3 | 0 | 0 | 3 |
| 3     | JCB2003     | Cyber Forensics                           | PE       | 3               | 3 | 0 | 0 | 3 |
| 4     | JCB2004     | Intrusion Detection and Prevention        | PE       | 3               | 3 | 0 | 0 | 3 |
| 5     | JCB2005     | Hardware Security                         | PE       | 3               | 3 | 0 | 0 | 3 |
| 6     | JCB2006     | Cloud Security                            | PE       | 3               | 3 | 0 | 0 | 3 |
| 7     | JCB2007     | Ethical Hacking                           | PE       | 3               | 3 | 0 | 0 | 3 |
| 8     | JCB2008     | Web Application Security                  | PE       | 3               | 3 | 0 | 0 | 3 |

**VERTICAL – V**  
**INTERNET OF THINGS**

| <b>S.No.</b> | <b>COURSE CODE</b> | <b>COURSE TITLE</b>                                         | <b>CATEGORY</b> | <b>CONTACT PERIODS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------|--------------------|-------------------------------------------------------------|-----------------|------------------------|----------|----------|----------|----------|
| 1            | JIT2009            | Internet of Things: Architecture Protocols and Applications | PE              | 3                      | 3        | 0        | 0        | 3        |
| 2            | JIT2010            | Programming for IoT Boards                                  | PE              | 3                      | 3        | 0        | 0        | 3        |
| 3            | JIT2011            | Industrial IoT 4.0                                          | PE              | 3                      | 3        | 0        | 0        | 3        |
| 4            | JIT2012            | IoT in Healthcare                                           | PE              | 3                      | 3        | 0        | 0        | 3        |
| 5            | JIT2013            | Robotics in IOT                                             | PE              | 3                      | 3        | 0        | 0        | 3        |
| 6            | JIT2014            | Mobile Application Development for IoT                      | PE              | 3                      | 3        | 0        | 0        | 3        |
| 7            | JIT2015            | Cognitive IoT                                               | PE              | 3                      | 3        | 0        | 0        | 3        |
| 8            | JIT2016            | Privacy Security for IOT                                    | PE              | 3                      | 3        | 0        | 0        | 3        |

## HUMANITIES AND SOCIAL SCIENCES (HS)

| S. NO. | COURSE CODE | COURSE TITLE                         | T / P / I | CATEGORY | CONTACT PERIODS | L | T | P | C |
|--------|-------------|--------------------------------------|-----------|----------|-----------------|---|---|---|---|
| 1      | JHS2121     | English for Communicative Competence | I         | HS       | 4               | 2 | 0 | 2 | 3 |
| 2      | JGE2102     | Heritage of Tamils                   | T         | HS       | 1               | 1 | 0 | 0 | 1 |
| 3      | JHS2221     | English for Science and Technology   | I         | HS       | 4               | 2 | 0 | 2 | 3 |
| 4      | JGE2202     | Tamils and Technology                | T         | HS       | 1               | 1 | 0 | 0 | 1 |
| 5      | JHS2541     | Professional Communication           | P         | HS       | 2               | 0 | 0 | 2 | 1 |
| 6      | JHS2741     | Entrepreneurship for Engineers       | P         | HS       | 2               | 0 | 0 | 2 | 1 |
| 7      | JHS2741     | Universal Human Values               | I         | HS       | 3               | 1 | 0 | 2 | 2 |

## BASIC SCIENCES (BS)

| S. NO. | COURSE CODE | COURSE TITLE                                             | T / P / I | CATEGORY | CONTACT PERIODS | L | T | P | C |
|--------|-------------|----------------------------------------------------------|-----------|----------|-----------------|---|---|---|---|
| 1      | JMA2101     | Matrices and Calculus                                    | I         | BS       | 4               | 2 | 2 | 0 | 3 |
| 2      | JPH2101     | Engineering Physics 1                                    | T         | BS       | 3               | 3 | 0 | 0 | 3 |
| 3      | JCY2101     | Engineering Chemistry                                    | T         | BS       | 3               | 3 | 0 | 0 | 3 |
| 4      | JPC2111     | Engineering Physics and Chemistry Laboratory             | P         | BS       | 2               | 0 | 0 | 2 | 1 |
| 5      | JMA2201     | Statistics for Engineers                                 | I         | BS       | 4               | 2 | 2 | 0 | 3 |
| 6      | JPH2201     | Engineering Physics 2                                    | T         | BS       | 3               | 3 | 0 | 0 | 3 |
| 7      | JCY2201     | Environmental Science and Sustainability                 | T         | BS       | 2               | 2 | 0 | 0 | 2 |
| 8      | JPC2211     | Engineering Physics and Environmental Science Laboratory | P         | BS       | 2               | 0 | 0 | 2 | 1 |
| 9      | JMA2302     | Mathematical Foundations for Computer Science            | T         | BS       | 4               | 2 | 2 | 0 | 3 |
| 10     | JMA2402     | Applied Linear Algebra                                   | T         | BS       | 4               | 2 | 2 | 0 | 3 |
| 11     | JMA2501     | Optimization Techniques                                  | T         | BS       | 4               | 2 | 2 | 0 | 3 |

## ENGINEERING SCIENCES (ES)

| S. NO. | COURSE CODE | COURSE TITLE                 | T / P / I | CATEGORY | CONTACT PERIODS | L | T | P | C |
|--------|-------------|------------------------------|-----------|----------|-----------------|---|---|---|---|
| 1      | JGE2101     | Basic Engineering            | T         | ES       | 3               | 3 | 0 | 0 | 3 |
| 2      | JCS2121     | Programming in C             | I         | ES       | 5               | 3 | 0 | 2 | 4 |
| 3      | JGE2111     | Basic Engineering Laboratory | P         | ES       | 2               | 0 | 0 | 2 | 1 |
| 4      | JCY2201     | Engineering Graphics         | I         | ES       | 4               | 2 | 0 | 2 | 3 |

## PROFESSIONAL CORE (PC)

| S. NO.               | COURSE CODE | COURSE TITLE                                     | T / P / I | CATEGORY | CONTACT PERIODS | L | T | P  | C  |
|----------------------|-------------|--------------------------------------------------|-----------|----------|-----------------|---|---|----|----|
| <b>SEMESTER II</b>   |             |                                                  |           |          |                 |   |   |    |    |
| 1                    | JCS2201     | Python Programming                               | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 2                    | JCS2211     | Python Programming Laboratory                    | P         | PC       | 4               | 0 | 0 | 4  | 2  |
| <b>SEMESTER III</b>  |             |                                                  |           |          |                 |   |   |    |    |
| 3                    | JAL2301     | Data Science                                     | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 4                    | JCS2301     | Data Structures and Algorithms                   | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 5                    | JIT2301     | Object Oriented Programming                      | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 6                    | JIT2321     | Digital Principles and Computer Organization     | I         | PC       | 5               | 3 | 0 | 2  | 4  |
| 7                    | JAL2311     | Data Science Laboratory                          | P         | PC       | 4               | 0 | 0 | 4  | 2  |
| 8                    | JIT2311     | Object Oriented Programming Laboratory           | P         | PC       | 4               | 0 | 0 | 4  | 2  |
| <b>SEMESTER IV</b>   |             |                                                  |           |          |                 |   |   |    |    |
| 9                    | JAL2401     | Principles of Artificial Intelligence            | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 10                   | JCS2401     | Database Management Systems                      | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 11                   | JIT2421     | Operating Systems                                | I         | PC       | 5               | 3 | 0 | 2  | 4  |
| 12                   | JAL2411     | Principles of Artificial Intelligence Laboratory | P         | PC       | 4               | 0 | 0 | 4  | 2  |
| 13                   | JCS2411     | Database Management Systems Laboratory           | P         | PC       | 4               | 0 | 0 | 4  | 2  |
| <b>SEMESTER V</b>    |             |                                                  |           |          |                 |   |   |    |    |
| 13                   | JAL2501     | Machine Learning                                 | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 14                   | JAL2521     | Time Series Analysis and Forecasting             | I         | PC       | 5               | 3 | 0 | 2  | 4  |
| 15                   | JCS2501     | Computer Networks                                | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 16                   | JAL2511     | Machine Learning Laboratory                      | P         | PC       | 4               | 0 | 0 | 4  | 2  |
| <b>SEMESTER VI</b>   |             |                                                  |           |          |                 |   |   |    |    |
| 17                   | JAL2601     | Neural Networks and Deep Learning                | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 18                   | JAL2602     | Natural Language Processing                      | T         | PC       | 3               | 3 | 0 | 0  | 3  |
| 19                   | JAL2621     | Robotic Process Automation                       | I         | PC       | 5               | 3 | 0 | 2  | 4  |
| 20                   | JAL2611     | Neural Networks and Deep Learning Laboratory     | P         | PC       | 4               | 0 | 0 | 4  | 2  |
| <b>SEMESTER VIII</b> |             |                                                  |           |          |                 |   |   |    |    |
| 21                   | JAL2831     | Project Work                                     | P         | PC       | 20              | 0 | 0 | 20 | 10 |

### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

| S. NO. | COURSE CODE | COURSE TITLE                          | T / P / I | CATEGORY | CONTACT PERIODS | L | T | P   | C |
|--------|-------------|---------------------------------------|-----------|----------|-----------------|---|---|-----|---|
| 1      | JGE2241     | Gaming and Crafts Studio              | P         | EEC      | 4               | 0 | 0 | 4   | 2 |
| 2      | JPT2041     | Soft Skills and Aptitude              | P         | EEC      | 2               | 0 | 0 | 2   | * |
| 3      | JPT2041     | Soft Skills and Aptitude              | P         | EEC      | 2               | 0 | 0 | 2   | 1 |
| 4      | JGE2442     | Advanced IT Infrastructure Laboratory | P         | EEC      | 4               | 0 | 0 | 4   | 2 |
| 5      | JPT2042     | Technical Skills and Aptitude         | P         | EEC      | 2               | 0 | 0 | 2   | * |
| 6      | JGE2542     | MERN Stack Development Laboratory     | P         | EEC      | 4               | 0 | 0 | 4   | 2 |
| 7      | JPT2042     | Technical Skills and Aptitude         | P         | EEC      | 2               | 0 | 0 | 2   | 1 |
| 8      | JGE2642     | Computational Intelligence Laboratory | P         | EEC      | 4               | 0 | 0 | 4   | 2 |
| 9      | JGE2751     | Entrepreneurship Development          | I         | EEC      | 4               | 2 | 0 | 2   | 3 |
| 10     | JAL2741     | Comprehension and Technical Seminar   | T         | EEC      | 2               | 0 | 0 | 2   | 1 |
| 11     | JAL2742     | Internship                            | P         | EEC      | -               | - | - | 4** | 2 |

### NON CREDIT MANDATORY COURSES (NCM)

| S. NO. | COURSE CODE | COURSE TITLE                           | T / P / I | CATEGORY | CONTACT PERIODS | L | T | P | C |
|--------|-------------|----------------------------------------|-----------|----------|-----------------|---|---|---|---|
| 1      | JNC2361     | Disaster Risk Reduction and Management | T         | NCM      | 3               | 3 | 0 | 0 | - |
| 2      | JNC2761     | Industrial Safety                      | T         | NCM      | 3               | 3 | 0 | 0 | - |

**JERUSALEM COLLEGE OF ENGINEERING**  
**(AN AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI)**  
**B.E. – COMPUTER SCIENCE AND ENGINEERING**  
**(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)**  
**CURRICULUM 2023**  
**REGULATION – 2023**  
**CHOICE BASED CREDIT SYSTEM**

**SEMESTER I**

| S. NO.       | COURSE CODE | COURSE TITLE                                 | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|----------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JHS2121     | English for Communicative Competence         | I         | HS       | 4               | 2         | 0        | 2         | 3         |
| 2            | JMA2101     | Matrices and Calculus                        | T         | BS       | 4               | 2         | 0        | 2         | 3         |
| 3            | JPH2101     | Engineering Physics 1                        | T         | BS       | 3               | 3         | 0        | 0         | 3         |
| 4            | JCY2101     | Engineering Chemistry                        | T         | BS       | 3               | 3         | 0        | 0         | 3         |
| 5            | JGE2101     | Basic Engineering                            | T         | ES       | 3               | 3         | 0        | 0         | 3         |
| 6            | JCS2121     | Programming in C                             | I         | ES       | 5               | 3         | 0        | 2         | 4         |
| 7            | JGE2102     | Heritage of Tamils                           | T         | HS       | 1               | 1         | 0        | 0         | 1         |
| 8            | JPC2111     | Engineering Physics and Chemistry Laboratory | P         | BS       | 2               | 0         | 0        | 2         | 1         |
| 9            | JGE2111     | Basic Engineering Laboratory                 | P         | ES       | 2               | 0         | 0        | 2         | 1         |
| <b>TOTAL</b> |             |                                              |           |          | <b>27</b>       | <b>17</b> | <b>0</b> | <b>10</b> | <b>22</b> |

|                |                                                 |          |          |          |          |
|----------------|-------------------------------------------------|----------|----------|----------|----------|
| <b>JHS2121</b> | <b>ENGLISH FOR COMMUNICATIVE<br/>COMPETENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                 | <b>2</b> | <b>0</b> | <b>2</b> | <b>3</b> |

### **Course Objectives:**

- To enable the students of Engineering to develop their reading and other language skills
- To facilitate the learners to reflect and share their ideas effortlessly
- To develop their skills to communicate thoughts effectively in social contexts
- To expose them to different genres to develop their understanding and expression
- To train the students to improve their writing skills for efficient communication

### **UNIT I Analytical Grammar and Information Sharing 12**

Parts of speech – Functional units – Tenses – Affixes; Reading comprehension: short general passages for skimming and scanning

#### **Language Practice**

**Reading:** Biographical essays, short stories; **Speaking:** Self-introduction, peer introduction; **Listening:** Inspiring speeches, newscasts; **Writing:** Journal writing

### **UNIT II Foundational Grammar and Expressing Thoughts 12**

Framing questions – Prepositions – Compound nouns – Contextual meaning; Letter writing (informal letters)

#### **Language Practice**

**Reading:** Travelogues; **Speaking:** Small talks, Just A Minute (JAM); **Listening:** Anecdotes, stories, podcasts; **Writing:** Fill in the blanks in short dialogues

### **UNIT III Functional Grammar and Social Communication 12**

Articles – Subject-verb agreement – Synonyms and antonyms – Email etiquette; Dialogue writing

#### **Language Practice**

**Reading:** Adverts; **Speaking:** Role play, storytelling / completion; **Listening:** Messages from social network; **Writing:** Writing messages for social network / emails

### **UNIT IV Structural Grammar and Visual Communication 12**

Modal verbs – Simple, complex and compound sentences – Discourse markers – Correction of errors; Interpretation of posters on social issues

#### **Language Practice**

**Reading:** Excerpts from literature; **Speaking:** Asking for / giving directions - Picture description; **Listening:** Talks on English and language skills; **Writing:** Reporting on events / incidents

### **UNIT V - Transformational Grammar and Written Communication 12**

Degrees of comparison – Reported speech – Connotations – One-word substitutes (general); Essay writing: narrative / descriptive / expository / argumentative

#### **Language Practice**

**Reading:** Newspaper articles, social media messages (educational contexts); **Speaking:** Group discussions (general topics); **Listening:** Formal and informal talks, Ted talks; **Writing:** Writing short stories / poems (guided)

**TOTAL: 60 PERIODS**



## Course Outcomes:

### At the end of the course, students will be able:

- To comprehend reading passages and express themselves
- To communicate their thoughts confidently and skillfully
- To participate in activities of daily life using appropriate communicative strategies
- To be creative and critical in expressing themselves
- To write effectively and persuasively and produce different types of writing

### Text Books:

1. Department of English, Anna University, English for Engineers & Technologists, Volume 2, Orient BlackSwan Private Limited, Chennai, 2022.
2. Dhanavel, SP. English and Communication Skills for Students of Science and Engineering. Orient BlackSwan Private Limited, Chennai, 2011.
3. Interact English: Lab Manual for Undergraduate Students. Orient BlackSwan Private Limited, Chennai, 2017.

### Reference Books:

1. Chellammal, V. Learning to Communicate. Allied Publishing House, New Delhi, 2004.
2. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practices. Oxford University Press, New Delhi. 2015.
3. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2008.
4. Rizvi M, Ashraf. Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2017.

### Web Links:

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishgrammar.org](http://www.englishgrammar.org)
3. [www.englishclub.com](http://www.englishclub.com)
4. [www.usingenglish.com](http://www.usingenglish.com)
5. [www.esl.about.com](http://www.esl.about.com)
6. [www.bbc.co.uk/learningenglish/](http://www.bbc.co.uk/learningenglish/)
7. <https://esl-bits.net/>
8. <https://elt.oup.com/>
9. <https://learnenglish.britishcouncil.org>
10. <https://quizizz.com/>

### Mapping of PO with CO

|      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|
| CO-1 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-2 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-3 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-4 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-5 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |

|                |                              |          |          |          |          |
|----------------|------------------------------|----------|----------|----------|----------|
| <b>JMA2101</b> | <b>MATRICES AND CALCULUS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                              | <b>2</b> | <b>2</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To equip students with the knowledge of matrices required for applications in engineering.
- To enable students understand the concepts of multivariable calculus.
- To introduce concepts of integral calculus as tools required for applications in engineering.
- To familiarize students in the concepts of vector calculus and its applications.
- To help students understand theory of analytic functions and provide knowledge of Cauchy Residue theorem and its applications.

### **UNIT I MATRICES**

**12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Reduction of a quadratic form to canonical form – Nature of quadratic forms.

### **UNIT II FUNCTIONS OF SEVERAL VARIABLES**

**12**

Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

### **UNIT III APPLICATIONS OF INTEGRAL CALCULUS**

**12**

Double integrals in Cartesian coordinates – Change of order of integration – Area enclosed by plane curves – Triple integrals – Volume of solids.

### **UNIT IV VECTOR CALCULUS**

**12**

Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields.

Green's theorem, Gauss' divergence theorem, Stoke's theorem – Verification and evaluation in simple problems.

### **UNIT V COMPLEX ANALYSIS**

**12**

Analytic functions – Cauchy-Riemann equations – Milne-Thomson rule (given real or imaginary part) – Bilinear transformation.

Residues – Application of Cauchy's Residue theorem for evaluation of real integrals (Circular contour and semi-circular contour only).

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, students will be able

- To apply matrix method in reducing quadratic form to canonical form.
- To solve simple optimization problems through differential calculus.
- To evaluate multiple integrals required for solving area and volume problems.
- To apply vector calculus for verifying Green's, Gauss' and Stoke's theorems.
- To solve problems arising in analytic functions and solve real integrals through Cauchy Residue theorem.

**TEXT BOOKS:**

1. Grewal B S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44<sup>th</sup> Edition, 2018.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, New Delhi, 10<sup>th</sup> Edition, 2016.
3. Anuradha P and Sudhakar V, "Matrices and Calculus", Scitech Publications, 1<sup>st</sup> Edition, Chennai, 2019.

**REFERENCES:**

1. Anton H, Bivens I and Davis S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R K and Iyengar S R K, "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 8<sup>th</sup> Edition, 2022.
3. Srimantha Pal and Bhunia S C, "Engineering Mathematics" Oxford University Press, 1<sup>st</sup> Edition, 2015.
4. Weir, M D and Joel Hass, "Thomas Calculus", 15<sup>th</sup> Edition, Pearson India, 2022.

**WEB REFERENCES:**

1. <https://nptel.ac.in/courses/111107112>
2. <https://nptel.ac.in/courses/111108157>
3. <https://nptel.ac.in/courses/111107108>
4. <https://nptel.ac.in/courses/111106141>
5. <https://nptel.ac.in/courses/111103070>

**CO-PO MAPPINGS:**

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

|         |                       |   |   |   |   |
|---------|-----------------------|---|---|---|---|
| JPH2101 | ENGINEERING PHYSICS-1 | L | T | P | C |
|         |                       | 3 | 0 | 0 | 3 |

### OBJECTIVES:

- To enable the students to understand the basics of Properties of Matter
- To expand their knowledge about thermal properties of materials
- To enhance their understanding of Photonics
- To familiarize the students with the principles of quantum mechanics
- To enrich their knowledge on Solid State of Materials

### UNIT I - PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic moduli and tensile strength - Torsion pendulum: theory and experiment - Bending of beams - stress due to bending in beams - bending moment – Cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment.

### UNIT II - THERMAL PHYSICS 9

Fundamentals of thermal energy - expansion joints – Bimetallic strips - Thermal conductivity, conduction in solids, Differential equation of one dimensional heat flow – Forbes’s and Lee’s disc method - Conduction through compound media- Solar heater

### UNIT III - LASERS AND FIBER OPTICS 9

Spontaneous and stimulated emission-Population inversion -Einstein’s A and B coefficients derivation – Laser Principle – Nd:YAG and Semiconductor lasers (homojunction & heterojunction) Principle and propagation of light in optical fiber, Derivation of Numerical aperture and Acceptance angle – Fiber optical communication (Block diagram) – Active and passive sensors – Medical endoscope.

### UNIT IV - BASIC QUANTUM PHYSICS 9

Black body radiation –Planck’s theory (derivation) –Deduction of Wien’s displacement law and Rayleigh –Jeans’ Law from Planck’s theory –Compton effect-theory –Properties of Matter waves - Schrödinger's wave equation –Time independent and time dependent equations –Physical significance of wave function –Particle in a one dimensional box –Scanning Transmission electron microscope.

### UNIT V - SOLID STATE PHYSICS 9

Single crystal, Polycrystalline and Amorphous materials – Single Crystals: Unit cell, Crystal systems, Bravais lattices, Directions and Planes in a crystal, Miller indices – Inter planar distances – Coordination number and Packing factor for SC, BCC, FCC, HCP and Diamond structures - Crystal imperfections: Point defects, Line defects – Burgers vector, Surface defects and Volume defects.

**TOTAL: 45 PERIODS**



|         |                       |   |   |   |   |
|---------|-----------------------|---|---|---|---|
| JCY2101 | ENGINEERING CHEMISTRY | L | T | P | C |
|         |                       | 3 | 0 | 0 | 3 |

## **COURSE OBJECTIVES**

- To inculcate the significance of water quality parameters and water treatment techniques.
- To acquaint the properties and applications of industrial polymers.
- To acquire knowledge in corrosion of material and its prevention.
- To import knowledge over energy conversion methods and of energy storage devices.
- To acquire knowledge on the basics of nanomaterials and its preparatory methods.

**TOTAL: 45 PERIODS**

### **UNIT 1 WATER AND ITS TREATMENT**

9

Water quality parameters (pH, TDS, DO, BOD, COD) - Hardness - Types and estimation (EDTA method). Alkalinity – Types and estimation. Water softening methods- Limesoda Process (Cold and Hot methods) - Zeolite Process - Ion exchange process. Desalination of brackish water –reverse osmosis. Municipal water treatment- Primary treatment and Disinfection (UV, Ozonation, Chlorination) - Break point chlorination.

### **UNIT 2: POLYMER AND COMPOSITES**

9

Classification of polymers – Functionality – Types of polymerisation (addition & condensation) – Mechanism of addition polymerisation (free radical, cationic, anionic) - Degree of polymerization - Thermoplastic and Thermosetting. Bio degradable polymer- Polylactic acid, Polyvinyl acetate- Preparation – Properties – applications. Conducting polymer – types – Mechanism – application - Polymer composites – types – properties and application.

### **UNIT 3 CORROSION AND ITS PREVENTION**

9

Corrosion - chemical, electrochemical corrosion, galvanic corrosion and differential aeration corrosion. Factors influencing the rate of corrosion. Corrosion control - material selection, design aspects, cathodic protection, Corrosion inhibitors - Electroplating (copper) and electroless plating (nickel) – Organic coating (Paints – Constituents and function).

### **UNIT 4 ENERGY SOURCES AND STORAGE DEVICES**

9

Nuclear energy- critical mass light water nuclear power plant and Breeder reactor. Principle, working and applications of solar energy and wind energy. Primary battery (dry cell and alkaline battery). Secondary

battery (lead acid, nickel-cadmium and lithium-ion-battery). H<sub>2</sub>-O<sub>2</sub> fuel cell.

## UNIT 5 NANOCHEMISTRY

9

Distinction between molecules, nanomaterials and bulk materials - Size-dependent properties - Types of nanomaterials - Nanoparticle, nanocluster, nanorod, nanowire and nanotube. Synthesis of nanomaterials - solvothermal, laser ablation, chemical vapour deposition and electrochemical deposition - General applications of nanomaterial.

## COURSE OUTCOMES

- To identify water quality and propose suitable methods to treat water.
- To analyze the compatibility of polymeric materials for biomedical and electronic applications.
- To recognize the nature of corrosive environment and implement preventive methods of corrosion.
- To design different forms of energy sources for suitable applications.
- To identify suitable synthetic method of nanomaterials for specific applications.

## TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008. S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
3. A.Ravikrishnan, "Engineering Chemistry" Sri Krishna Hitech Publishing Company Pvt.Ltd., 22<sup>nd</sup> edition, 2023

## REFERENCES:

1. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
2. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
3. B.R.Puri, L.R.Sharma, Madan S.Pathana, Principle of physical chemistry, 47<sup>th</sup> edition, Vishal

publishing Co, 2017.

4. S. Ananda Kumar (Editor)"Eco-friendly Nano-hybrid materials for Advanced Engineering Applications" CRC Press, USA. (2016)
5. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
6. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2013.

#### Website reference:

1. <https://nptel.ac.in/courses/113/101/113101098/>
2. <https://nptel.ac.in/courses/113/106/113106093/>

#### CO-POMapping

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



|                |                          |          |          |          |          |
|----------------|--------------------------|----------|----------|----------|----------|
| <b>JGE2101</b> | <b>BASIC ENGINEERING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                          | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To provide students with illustrations about mechanical engineering to satisfy societal needs
- To provide them knowledge on refrigeration, air-conditioning and power plants
- To help students acquire knowledge in the basics of surveying and building materials
- To impart knowledge on the electric circuits and working principles of Electrical Machines.
- To provide the knowledge on the Principles and characteristics of various electronic devices and measuring instruments.

### **UNIT I – BASICS OF MECHANICAL ENGINEERING**

**9**

Introduction to the concepts of Mechanization and Automation, Robotics - Manufacturing methods - casting, machining, forming operations. Introduction to IC Engine - Working principles of four stroke petrol and diesel engines. Electric vehicle Technology- Layout, components and control.

### **UNIT II–REFRIGERATION, AIR CONDITIONING SYSTEM AND POWER PLANT**

**9**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Classification of power plant and working principle of Thermal and Hydel power plant.

### **UNIT III - BASICS OF CIVIL ENGINEERING**

**9**

Introduction to Civil Engineering, Types of buildings, Components of a residential building, Building Materials. Surveying: Objects – Classification – Principles – Measurements of Distances and angles. Rain Water Harvesting, Solid Waste Management

### **UNIT IV ELECTRIC CIRCUITS AND ELECTRICAL MACHINES**

**9**

Basic circuit components - Ohms Law - Kirchhoff's Law – Introduction to AC circuits - Power and power factor –Construction, Principle of operation and characteristics of DC machines ,Transformers and Induction machines.

Types of Materials - N type and P type materials - Principle of operation and Characteristics: PN Junction diode , Zener Diode, BJT, MOSFET. Elements of generalized measurement system — Operating forces— Principle of operation of moving coil and moving iron instruments -Errors in measurement - Standards of Measurement.

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

- To be acquainted with the concepts in mechanical engineering and vehicle concept.
- To understand the fundamentals of refrigeration, air-conditioning and power plant.
- To summarise the surveying, planning of building, infrastructure and building materials.
- Apply the basic concepts of electric circuits and working principles of electrical machines.
- Gain knowledge on the basics of electronics and choose appropriate instruments for electrical measurement for a specific application.

**TEXT BOOKS:**

1. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018.
2. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2018.
3. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Mc Graw Hill, 2015.
4. D P Kothari and I.J Nagarath, , “ Electrical Machines - Basic Electrical and Electronics Engineering” , Third Reprint , Mc Graw Hill Education (India) Private Limited, , 2016.
5. A.K.Sawhney, “ A Course in Electrical & Electronic Measurements & Instrumentation” , Dhanpat Rai and Co, 2010.
6. S Salivahanan , N Suresh Kumar, "Electronic Devices And Circuits ", fifth Edition, Mc Graw Hill, 2022.

**REFERENCE BOOKS:**

1. Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd, 2013.
2. Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, First edition 2017.

3. Thereja. B.L., “ Fundament also f Electrical Engineering and Electronics” , S. Chand &Co.Ltd., 2008.
4. H.S.Kalsi, “Electronic Instrumentation “ , Tata Mc Graw-Hill, 2010.

#### WEB SITE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/103/112103262/>
2. <https://archive.nptel.ac.in/courses/112/105/112105129/>
3. <https://archive.nptel.ac.in/courses/105/106/105106201/>
4. <https://archive.nptel.ac.in/courses/105/106/105106201/>
5. <https://youtu.be/LPcQYXjPdIQ?list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV>
6. <https://www.youtube.com/playlist?list=PLMYtBmvT7X7QaLu0b0Jn1QQD4EOuT CA>
7. <https://youtu.be/5ZNeDxfgYAEhttps://youtu.be/36j6hCtL0E>

#### CO-PO & PSO MAPPING

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

|                |                         |          |          |          |          |
|----------------|-------------------------|----------|----------|----------|----------|
| <b>JCS2121</b> | <b>PROGRAMMING IN C</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                         | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

## **COURSE OBJECTIVES**

- To understand the concepts of C Language.
- To implement programs using basic constructs of C
- To develop C programs using Arrays and Strings
- To develop modular applications in C using functions and Pointers.
- To be able to use File operations and Structures in C.

## **UNIT I INTRODUCTION TO C PROGRAMMING 9**

Introduction to programming paradigms - Simple model of Computer - Algorithms and Flowcharts - Structure of C program - Applications of C Language - Data Types – Constants - Enumeration - Keywords – Number System.

## **UNIT II OPERATOR AND EXPRESSIONS 9**

Data Input and Output statements – Operators: Arithmetic Operators, Relational Operators, Logical Operators, Increment and Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation – Decision Making and Branching – Looping statements.

## **UNIT III ARRAYS AND STRINGS 9**

Arrays – Initialization – Declaration – One dimensional array – Two dimensional arrays - String - String operations: length, compare, concatenate, copy – Arrays of strings - Simple programs: Sorting, Searching and Matrix operations.

## **UNIT IV FUNCTIONS AND POINTERS 9**

Function – Definition of function – Function Prototypes - Pass by value - Pass by reference - Recursion. Pointers: Definition- Initialization -Pointer Arithmetic- Pointers and Arrays.

## **UNIT V STRUCTURES, UNION AND FILES 9**

Structure - Structure Definition - Structure Declaration - Nested structures - Array of structures - Union - Storage Classes - Files - Types of file processing: Sequential access, Random access - Sequential access file - Random access file - Command line arguments.

**TOTAL: 45 PERIODS**

## **LIST OF EXPERIMENTS**

1. Usage of Basic Linux commands.
2. C Programming using Simple I/O Statements, operators and expressions.
3. C Programming using decision making and looping.
4. Simple programming for one dimensional and two dimensional arrays.
5. Solving problems using Strings.
6. C Programming using user defined functions (Pass by value and Pass by reference).
7. C Programming using Recursion.
8. C Programming using Pointers and Array of Pointers.
9. C Programming using structures and union.

10. C Programming using storage classes.
11. C Programming using Files.

**TOTAL: 30 PERIODS**

### **COURSE OUTCOMES:**

**On completion of the course, the students should be able to:**

- Develop efficient algorithms for solving a problem.
- Develop simple applications using various operators in C.
- Design and Implement applications using Array and Strings.
- Develop applications using Functions and Pointers.
- Design and Develop applications using Structures and Files.

### **TEXT BOOKS**

1. Paul J. Deitel, Harvey M. Deitel, “C: How to Program”, 9<sup>th</sup> Edition, Prentice Hall.
2. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
3. E. Balaguruswamy, “Programming in ANSI C”, 8<sup>th</sup> Edition, 2019, McGraw Hill Education.
4. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 16<sup>th</sup> edition 2017.

### **REFERENCE BOOKS**

1. Pradip Dey, Manas Ghosh, “Programming in C”, 2<sup>nd</sup> Edition, 2018, Oxford University Press, ISBN: 978-01-9949-147-6.
2. Kernighan B.W and Dennis M. Ritchie, “The C Programming Language”, 2<sup>nd</sup> Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.
3. Jacqueline A Jones and Keith Harrow, “Problem Solving with C”, Pearson Education. ISBN: 978-93-325-3800-9.
4. PradipDey, ManasGhosh, “Programming in C - As per the latest AICTE syllabus”, First Edition, Oxford University Press, 2018.
5. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Third Edition, McGraw- Hill, 2010.

### **WEBSITE REFERENCES**

1. <http://elearning.vtu.ac.in/econtent/courses/video/BS/14CPL16.html>
2. <https://nptel.ac.in/courses/106/105/106105171/>
3. <https://www.w3resource.com/c-programming-exercises/>
4. <https://www.programiz.com/c-programming/c-structures-pointers>
5. <https://www.sitesbay.com/cprogramming/c-applications>

### **CO-PO MAPPING**

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

**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, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

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

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

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

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

**TOTAL : 15 PERIODS****TEXT-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 சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – 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.

## தமிழர் மரபு

L T P C  
1 0 0 1

### அலகு I 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 II 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 – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

### அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

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

### அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால

நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:**

**3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

**TOTAL : 15 PERIODS**

**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 சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை – 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.



|         |                                              |   |   |   |   |
|---------|----------------------------------------------|---|---|---|---|
| JPC2111 | ENGINEERING PHYSICS AND CHEMISTRY LABORATORY | L | T | P | C |
|         |                                              | 0 | 0 | 2 | 1 |

#### OBJECTIVES:

To provide students the firsthand experience of verifying various concepts learnt in theory courses.

#### LIST OF EXPERIMENTS

1. Determination of Young's Modulus for the given Uniform bar by Uniform Bending method
2. Determination of Moment of Inertia of the given Circular disc and Rigidity Modulus of thin metal wire using Torsional Pendulum
3. Determination of Planck's constant using different color filters
4. Determine the Wavelength of Mercury Spectrum using Spectrometer.
5. Determine the Thermal conductivity of a Bad conductor using Lee's Disc
6. Determination of Wavelength of the Diode Laser and hence determine the Size of the coated powder particle
7. Estimation of Alkalinity of Water Sample.
8. Estimation of Total, Temporary and Permanent Hardness of Water by EDTA method.
9. Determination of Molecular Weight of a Polymer by Viscosity Average method
10. Estimation of Amount of an Acid by Conductometric Titration
11. Estimation of Ferrous ions by Potentiometric Titration
12. Estimation of Amount of Hydrochloric Acid using pH Meter.

**TOTAL: 30 PERIODS**

#### OUTCOMES:

Students will be able

1. To evaluate elasticity of a linear body.
2. To discriminate different wavelengths of optical spectrum and the behavior of particles and waves at the atomic scale.
3. To identify the materials which are utilized for thermal insulation.
4. To estimate and analyse the amount of hardness and alkalinity in water for domestic consumption.
5. To apply the principles of conductivity and viscosity of substances in aqueous solutions for quantitative analysis using analytical instruments.

#### REFERENCES:

1. D. Bailey and E. Wright, Practical Fiber Optics, 2003.
2. Jerrad H.G. and Mc Neil D.B. -Theoretical and Experimental Physics.
3. Fretter W.B. -Introduction to Experimental Physics.
4. J. Mendham, RC Denney, JD Barnes, MJK Thomas, Text book of quantitative chemical analysis, Vogel's, 2008.

## WEBSITE REFERENCES

1. <https://www.jhotpotinfo.com/2020/02/determination-of-youngs-modulus-of-bar.html>
2. <https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=1518&cnt=1>
3. <https://vlab.amrita.edu/?sub=1&brch=281&sim=851&cnt=2>
4. [http://sites.iiserpune.ac.in/~bhasbapat/phy221\\_files/Lee%27s%20Method.pdf](http://sites.iiserpune.ac.in/~bhasbapat/phy221_files/Lee%27s%20Method.pdf)
5. [https://edisciplinas.usp.br/pluginfile.php/4212400/mod\\_resource/content/0/Dunnivant%2021.pdf](https://edisciplinas.usp.br/pluginfile.php/4212400/mod_resource/content/0/Dunnivant%2021.pdf)
6. [https://chem.libretexts.org/Bookshelves/General\\_Chemistry/Map%3A\\_A\\_Molecular\\_Approach\\_\(Tro\)/17%3A\\_Aqueous\\_Ionic\\_Equilibrium/17.04%3A\\_Titrations\\_and\\_pH\\_Curves](https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_A_Molecular_Approach_(Tro)/17%3A_Aqueous_Ionic_Equilibrium/17.04%3A_Titrations_and_pH_Curves)

## CO-PO Mapping

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

|                |                                     |          |          |          |          |
|----------------|-------------------------------------|----------|----------|----------|----------|
| <b>JGE2111</b> | <b>BASIC ENGINEERING LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                     | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

## **COURSE OBJECTIVES**

- To provide an exposure to students with hands-on experience on various basic engineering practices in Civil, Mechanical Engineering
- To impart knowledge on creativity, ideation and realize the importance of team working
- To gain knowledge through experience in handling of engineering aggregates.
- To appreciate the use of various mechanisms involved in engineering products like vehicles.
- To provide exposure to the students with hands-on experience on various basic engineering practices in Electrical and Electronics Engineering
- To kindle your own creativity, ideation and realize the importance of team working.
- To gain knowledge through experience in handling of engineering aggregates.

## **GROUP A**

### **I CIVIL ENGINEERING PRACTICE**

#### **BUILDINGS:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

#### **PLUMBING WORKS:**

- a) Study of pipe line joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- b) Hands-on-exercise: Basic pipe connections - Mixed pipe material connection Pipe connections with different joining components.

### **II MECHANICAL ENGINEERING PRACTICE**

#### **WELDING AND DRILLING**

- (a) Preparation of but joints, lap joints and T-joints by Shielded metal arc welding.
- (b) Drilling Practice

#### **TWO WHEELER DISMANTLING AND DIAGNOSIS**

- a. Brake Adjustment and Replacing
- b. Chain Adjustment and lubrication
- c. Air Filter and Spark plug Cleaning
- d. Engine oil Replacement and Carburetor Tuning

**STUDY AND DEMONSTRATION ON:**

- (a) Study of Lathe Machine, tools and components, Safety aspects
- (b) Study of Sheet Metal work, tools and components, Safety aspects

**GROUP B****I ELECTRICAL ENGINEERING PRACTICE**

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

**II ELECTRONICS ENGINEERING PRACTICE**

1. Study of Electronic components and equipment's - Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**COURSE OUTCOMES:**

At the end of the course, students will be able

- To fabricate carpentry components and pipe connections including plumbing works.
- To weld various joints in steel plates using arc welding work.
- To understand various mechanism involved in automobiles.
- To illustrate on lathe machine and sheet metal work.
- Carry out basic home electrical works and appliances.
- Measure the electrical quantities.
- Elaborate on the components, gates, soldering practices.

**WEBSITE REFERENCE:**

1. <https://nptel.ac.in/courses/107106088>
2. [www.vikaspublishing.com/engineering-practices-lab](http://www.vikaspublishing.com/engineering-practices-lab)
3. <https://archive.org/mechanicalengineeringworkshoplaboratory>

## SEMESTER II

| S. NO.       | COURSE CODE | COURSE TITLE                                             | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|----------------------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JHS2221     | English for Science and Technology                       | I         | HS       | 4               | 2         | 0        | 2         | 3         |
| 2            | JMA2201     | Statistics for Engineers                                 | T         | BS       | 4               | 2         | 0        | 2         | 3         |
| 3            | JPH2201     | Engineering Physics 2                                    | T         | BS       | 3               | 3         | 0        | 0         | 3         |
| 4            | JGE2221     | Engineering Graphics                                     | I         | ES       | 4               | 2         | 0        | 2         | 3         |
| 5            | JCS2201     | Python Programming                                       | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 6            | JCY2201     | Environmental Science and Sustainability                 | T         | BS       | 2               | 2         | 0        | 0         | 2         |
| 7            | JGE2202     | Tamils and Technology                                    | T         | HS       | 1               | 1         | 0        | 0         | 1         |
| 8            | JPC2211     | Engineering Physics and Environmental Science Laboratory | P         | BS       | 2               | 0         | 0        | 2         | 1         |
| 9            | JCS2211     | Python Programming Laboratory                            | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 10           | JGE2241     | Gaming and Crafts Studio                                 | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                                          |           |          | <b>31</b>       | <b>15</b> | <b>0</b> | <b>16</b> | <b>23</b> |

|                |                                           |          |          |          |          |
|----------------|-------------------------------------------|----------|----------|----------|----------|
| <b>JHS2221</b> | <b>ENGLISH FOR SCIENCE AND TECHNOLOGY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                           | <b>2</b> | <b>0</b> | <b>2</b> | <b>3</b> |

### **Course Objectives:**

- To enable the students of Engineering to comprehend technical texts
- To improve their technical writing skill for better transmission of messages
- To help them acquire language skills required in academic and workplace contexts
- To facilitate them to hone their skills to prepare effective reports
- To equip them with effective communicative skills to meet their future needs

### **UNIT I Communicating Technical Information**

**12**

Definitions – Conditional clauses – Technical vocabulary; Comprehension of short technical passage and note-making

#### **Language Practice**

**Reading:** Short technical texts / excerpts; **Speaking:** Interviewing on social or global issues;

**Listening:** Talks on science, engineering, medicine / interviews of achievers; **Writing:** Sentence Completion, gap filling, verbal aptitude: sentence correction

### **UNIT II Graphical Analysis and Interpretation**

**12**

Purpose statements – Numerical adjectives – Collocation; Process Description - Interpretation of Graphs and Charts

#### **Language Practice**

**Reading:** Emails, invitations; **Speaking:** Describing charts and tables; **Listening:** Process descriptions; **Writing:** Paraphrasing – Developing outlines

### **UNIT III Persuasive Writing and Information Dissemination**

**12**

Cause and effect – Voice (active, personal and impersonal passive) – Words used as nouns and verbs; Instructions – Recommendations

#### **Language Practice**

**Reading:** User manuals, gadget reviews; **Speaking:** Presentation on social / technical topics;

**Listening:** Announcements, instructions; **Writing:** Instructions – Recommendations

### **UNIT IV Report Writing and Group Interaction**

**12**

Determiners – Editing - Initialisms and acronyms; Report writing: survey, accident – Minutes of meeting

#### **Language Practice**

**Reading:** Notices, reviews; **Speaking:** Group discussions (technical topics) and debates;

**Listening:** IELTS and TOEFL; **Writing:** Writing profiles of personalities and industries

### **UNIT V Career and Business Communication**

**12**

Adverbials – Misspelt words – Formal and informal English; Letter writing – Job application and resume by mail and email – Inviting and sending quotations and placing orders

#### **Language Practice**

**Reading:** Email invitations to job interviews; **Speaking:** About future / career; **Listening:**

Talks by entrepreneurs; **Writing:** Career objective, short-term and long-term goals, tagline

**TOTAL: 60 PERIODS**

## Course Outcomes:

### On the completion of the course, students will be able:

- To read and understand different types of technical texts
- To write procedural texts logically and sequentially in English
- To communicate effectively in academic and professional contexts
- To prepare effective reports and participate in group activities
- To use language precisely and accurately in business relations

### Text Books:

1. Department of English, Anna University, Fluency in English, Orient BlackSwan Private Limited, Chennai, 2018.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering, Orient BlackSwan Private Limited, Chennai, 2011.
3. Interact English: Lab Manual for Undergraduate Students, Orient BlackSwan Private Limited. Chennai, 2017.

### Reference Books:

1. Chellammal, V. Learning to Communicate, Allied Publishing House, New Delhi, 2004.
2. Raman, Meenakshi & Sangeetha Sharma, Technical Communication: Principles and Practices, Oxford University Press, New Delhi, 2015.
3. Regional Institute of English. English for Engineers, Cambridge University Press, New Delhi, 2008.
4. Rizvi M, Ashraf. Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2017.

### Web Links:

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishgrammar.org](http://www.englishgrammar.org)
3. [www.englishclub.com](http://www.englishclub.com)
4. [www.usingenglish.com](http://www.usingenglish.com)
5. [www.esl.about.com](http://www.esl.about.com)
6. [www.bbc.co.uk/learningenglish/](http://www.bbc.co.uk/learningenglish/)
7. <https://esl-bits.net/>
8. <https://elt.oup.com/>
9. <https://learnenglish.britishcouncil.org>
10. <https://quizizz.com/>

### Mapping of PO with CO

|      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|
| CO-1 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-2 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-3 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-4 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |
| CO-5 | - | - | - | 1 | - | 1 | - | 1 | 1 | 3  | -  | 1  |

2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

## REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.

## TAMILS AND TECHNOLOGY

L T P C  
1 0 0 1

**UNIT I WEAVING AND CERAMIC TECHNOLOGY 3**  
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3**  
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**UNIT III MANUFACTURING TECHNOLOGY 3**  
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**  
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3**  
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL : 15 PERIODS**



## TEXT-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 சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருளை – 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.

## தமிழரும் தொழில்நுட்பமும்

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### அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்:

3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

### அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:

3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான 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 III உற்பத்தித் தொழில் நுட்பம்:

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 – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:**

**3**

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

**அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:**

**3**

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

**TOTAL : 15 PERIODS**

**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 சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
  4. பொருறை – 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)
- Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JMA2201</b> | <b>STATISTICS FOR ENGINEERS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>2</b> | <b>2</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To provide basic concepts of discrete, continuous random variables and moments.
- To acquaint students in the concepts and problems of standard distributions.
- To familiarize students in problems of correlation and regression.
- To provide students knowledge of testing of hypothesis and its applications.
- To introduce Design of Experiments for practical problem solving.

### **UNIT I RANDOM VARIABLES 12**

Discrete and continuous random variables – Moments – Moment generating functions.

### **UNIT II STANDARD DISTRIBUTIONS 12**

Discrete distributions: Binomial distribution – Poisson distribution – Geometric distribution.

Continuous distributions: Uniform distribution – Exponential distribution – Normal distribution.

### **UNIT III STATISTICAL CORRELATION AND REGRESSION 12**

Correlation coefficient – Rank correlation – Correlation for bivariate data – Regression coefficients – Lines of regression.

### **UNIT IV TESTING OF HYPOTHESIS 12**

Normal tests for mean and difference of means – t tests for mean and difference of means – Chi-square test for goodness of fit – Chi-square test for independence of attributes.

### **UNIT V DESIGN OF EXPERIMENTS 12**

ANOVA classification – Completely Randomized Design – Randomized Block Design – Latin Square Design.

**TOTAL: 60 PERIODS**

### **COURSE OUTCOMES:**

At the end of the course, students will be able

- To solve problems of discrete and continuous type random variables for finding mean and variance.
- To apply standard probability distributions in solving real time problems.
- To solve correlation problems and to use regression analysis for predicting values of variables.
- To apply hypothesis testing for making statistical inferences in large and small sample real life problems.
- To compare and contrast various design of experiments methods and use them in problems.

**TEXT BOOKS:**

1. Gupta S C and Kapoor V K, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 12<sup>th</sup> Edition, 2020.
2. Ibe O C, "Fundamentals of Applied Probability and Random Processes", Elsevier, 2<sup>nd</sup> Edition, 2014.
3. Johnson R A, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9<sup>th</sup> Edition, 2018.

**REFERENCES:**

1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 3<sup>rd</sup> Edition 2014.
2. Trivedi K S, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2<sup>nd</sup> Edition, 2016.

**WEB REFERENCES:**

1. <https://nptel.ac.in/courses/117105085>
2. <https://nptel.ac.in/courses/111105041>
3. <https://nptel.ac.in/courses/102101056>
4. <https://nptel.ac.in/courses/102106051>

**CO-PO MAPPINGS:**

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

|                |                                |          |          |          |          |
|----------------|--------------------------------|----------|----------|----------|----------|
| <b>JPH2201</b> | <b>ENGINEERING PHYSICS – 2</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **OBJECTIVES:**

To enlighten the students on the principles of semiconductor materials and  
 Electron transport properties  
 To acquaint them with the applications of magnetic materials  
 To impart knowledge on superconducting materials  
 To help them acquire a basic understanding of dielectric materials  
 To introduce the basic principles in nano electronic devices

### **UNIT I – SEMICONDUCTING MATERIALS**

**9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Hall Effect- Hall Coefficient in N-type and P-type semiconductors.

### **UNIT II – MAGNETIC MATERIALS**

**9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism Domain theory – Hysteresis – Soft and Hard magnetic materials– Ferrites and its applications – Memory devices-ROMs and RAMs(R/W)

### **UNIT III – SUPERCONDUCTING MATERIALS**

**9**

Properties of Superconductors – Josephson junction - Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) – High T<sub>c</sub> superconductors - Applications – SQUIDS. Cryotron and Maglev train.

### **UNIT IV – DIELECTRIC MATERIALS**

**9**

Polarization mechanisms in dielectrics– dielectric loss – internal field – Clausius-Mosotti relation- dielectric loss and dielectric breakdown – high-k dielectrics – Types of dielectrics – Applications in transformers and capacitors.

### **UNIT V – NANOELECTRONIC MATERIALS**

**9**

Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures - Single electron phenomena and Single Electron Transistor.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

Students will be able

- To be familiar with the functioning of semiconductors
- To assess the magnetic properties of materials
- To make use of superconductors in real life situations
- To understand the nuances of advanced solid state physics
- To recognize the uses of Nano electronic materials

**TEXT BOOKS:**

1. Dr.P.Mani, "Engineering Physics – II", Dhanam Publications, First Edition, 2019.
2. Dr.G.Senthil Kumar "Engineering Physics – II", VRB Publications, Revised Edition 2018.
3. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
4. S.O.Pillai, "Solid State Physics", New Age International Publications, Revised Edition.
5. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
6. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

**REFERENCES:**

1. R. Murugesan, "Modern Physics", Sultan chand & sons, 2021.
2. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2020.
3. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2017.
4. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics".
5. William F Smith, "Material Science and Engineering", Tata McGraw - Hill Publications, 4<sup>th</sup> Edition.

**WEBSITE REFERENCES:**

1. <https://archive.nptel.ac.in/courses/108/108/108108122/>
2. <https://archive.nptel.ac.in/courses/115/103/115103038/>
3. <https://archive.nptel.ac.in/courses/115/103/115103108/>
4. [https://www.brainkart.com/article/Dielectric-Materials\\_6827/](https://www.brainkart.com/article/Dielectric-Materials_6827/)
5. <https://archive.nptel.ac.in/courses/117/108/117108047/>

**CO-PO Mapping**

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

|                |                                                 |          |          |          |          |
|----------------|-------------------------------------------------|----------|----------|----------|----------|
| <b>JCY2201</b> | <b>ENVIRONMENTAL SCIENCE AND SUSTAINABILITY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                 | <b>3</b> | <b>0</b> | <b>0</b> | <b>2</b> |

## **COURSE OBJECTIVES:**

- To study the inter-relationship between living organisms and environment.
- To learn causes, effects and preventive methods of environmental pollution.
- To import knowledge on the needs of renewable and new energy sources.
- To acquire broad knowledge on sustainable development and its values on society.
- To expertise sustainability practices of sustainable habitat, sustainable energy and green engineering.

### **UNITI ENVIRONMENT AND BIODIVERSITY**

**6**

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow–ecological succession. Biodiversity – Types and values. India as mega-diversity nation–hot-spots of biodiversity - endangered and endemic species of India – threats to biodiversity –conservation of biodiversity - In-situ and ex-situ - Field visit

### **UNITII ENVIRONMENTAL POLLUTION**

**6**

Causes, Effects and preventive measures of water, air, soil and thermal pollution. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHSMS).Environmental protection acts - Field visit

### **UNITIII RENEWABLE SOURCES OF ENERGY**

**6**

Energy management and conservation – Need of new energy sources- Applications of- Hydrogen energy - Ocean energy resources - Tidal energy conversion. Concept, origin and power plants of geothermal energy.

### **UNITIV SUSTAINABLE DEVELOPMENT**

**6**

Sustainability- concept, needs and challenges- economic and social aspects of sustainability – millennium development goals and protocols- Sustainable Development Goals - targets, indicators and intervention areas. Climate change - Global, Regional and local environmental issues and possible solutions - case studies. Concept of carbon credit and carbon footprint.

### **UNITV SUSTAINABILITY PRACTICES**

**6**

Zero waste and 3R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment,

Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency and sustainable transports. Sustainable energy: Energy Cycles - carbon cycle, emission and sequestration. Green Engineering: Sustainable urbanization - Socio-economic and technological change.

**TOTAL: 30 PERIODS**

## **COURSE OUTCOMES**

At the end of course completion, students will be able

- To recognize the function of ecosystem and contribute to conservation of biodiversity.
- To identify the causes and effects of environmental pollution and practice the preventive measures.
- To recognize various types of new renewable sources of energy and their potential applications.
- To apply the sustainable development goals for technological advancement and societal development.
- To adopt sustainability practices for energy efficiency and sustainable urbanization.

## **TEXT BOOKS:**

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2016.
3. Sanjay K Sharma, Green Corrosion Chemistry and Engineering: Opportunities and challenges, Wiley-VCH Verlag GmbH & Co. KGaA, Germany (2011).
4. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.

## **REFERENCES:**

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . Edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. ErachBharucha "Textbook of Environmental Studies for Undergraduate Courses" OrientBlackswan Pvt. Ltd. 2013.

## **Related Links**

1. <https://www.hzu.edu.in/bed/E%20V%20S.pdf>
2. <https://catalogimages.wiley.com/images/db/pdf/9781119582052.excerpt.pdf>
3. <https://ncert.nic.in/textbook/pdf/keec109.pdf>



## CO-PO Mapping

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

|                |                             |          |          |          |          |
|----------------|-----------------------------|----------|----------|----------|----------|
| <b>JGE2221</b> | <b>ENGINEERING GRAPHICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                             | <b>2</b> | <b>0</b> | <b>2</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To acquaint students with the importance of graphics in engineering
- To develop their skills in the preparation of basic drawing
- To improve their technical communication skill in the form of communicative drawing
- To impart knowledge about standard principle of orthographic projection of objects
- To improve their visualization skills for developing new products

## **UNIT ICONIC SECTIONS AND SPECIAL CURVES 12**

Conics - Construction of ellipse, Parabola and hyperbola by eccentricity method , Rectangle method- Drawing of tangents and normal to the above curves.

Special curves: Cycloid-Involute-Drawing of tangents and normal to the curves.

## **UNIT II PROJECTION PLANE SURFACESAND ORTHOGRAPHIC PROJECTIONS 12**

Introduction to Points, Lines (Only theory not for Exam Practice) – Projection of Plane Surfaces- Projection of polygonal surface and circular lamina inclined to both reference planes.

Representation of Three Dimensional objects - General principles of orthographic projection – Need for importance of multiple views and their placement - First angle projection - layout views - Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

## **UNIT III PROJECTION OF SOLIDS 12**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

## **UNIT IV DEVELOPMENT OF SURFACES 12**

Introduction to Section of Solids (Only theory not for Exam Practice)

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

Principles of isometric projection – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Conversion of orthographic views into Isometric Drawing (Simple Objects) - Perspective projection of prisms and pyramids by visual ray method.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

On successful completion of this course, the student will be able

- To be familiar with the fundamental and standards of engineering graphics.
- To perform free hand sketching of basic geometrical constructions and multiple views of object.
- To project orthographic projections of lines and plane surfaces.
- To draw projection of solids and development of surfaces.
- To interpret isometric and perspective view of objects.

**TEXT BOOKS:**

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
2. Venugopal K and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2016.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53<sup>rd</sup> Edition, 2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I & II combined), Subhas Stores, Bangalore, 2017..
3. Shah M.B and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.
4. Publication of Bureau of Indian Standards(BIS):
  - i. IS 10711 - 2001: Technical products Documentation - Size and lay out of drawing sheets.
  - ii. IS 9609 (Parts 0 & 1) - 2001: Technical products Documentation - Lettering.
  - iii. IS 10714 (Part 20) - 2001 & SP 46 - 2003: Lines for technical drawings.
  - iv. IS 11669 - 1986 & SP 46 - 2003: Dimensioning of Technical Drawings.
  - v. IS 15021 (Parts 1 to 4) - 2001: Technical drawings - Projection Methods.

**Website References:**

1. [www.pdfdrive.com/engineering drawing-books.html](http://www.pdfdrive.com/engineering-drawing-books.html)
2. <https://freevideolectures.com>
3. <https://nptel.ac.in/courses>

|                |                           |          |          |          |          |
|----------------|---------------------------|----------|----------|----------|----------|
| <b>JCS2201</b> | <b>PYTHON PROGRAMMING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To provide a basics Python programming concept
- To understand the control structures and string concepts
- To learn different Python collections
- To acquire knowledge on functions, modules and packages
- To comprehend the file and exception handling concepts and GUI

## **UNIT 1 INTRODUCTION TO PYTHON PROGRAMMING**

**9**

History of Python, Features, Installing Python, Demo Of Interactive and script mode, Identifiers, Reserved Words, Indentation, Comments, Variables, Data Types and its Conversion, Operators and its precedence, Expressions, Input and Print functions. Command-Line arguments.

## **UNIT 2 CONTROL STRUCTURES AND STRINGS**

**9**

Selective statements – if, if-else, nested if, if –elif ladder statements. Iterative statements - while, for, Nested loops, else in loops, break, continue and pass statement. Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions.

## **UNIT 3 COLLECTIONS**

**9**

List: Create, Access, Slicing, Negative Indices, List Methods, and comprehensions. Tuples: Create, Indexing and Slicing, Operations on tuples. Dictionary: Create, add, and replace values, operations on dictionaries. Sets: Create and operations on set.

## **UNIT 4 FUNCTIONS, MODULES AND PACKAGES**

**9**

Functions: Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments, Scope of variables: Local and global scope, Recursion and Lambda functions. Date and Time Methods. Modules and Packages.

## **UNIT 5 FILES, EXCEPTIONS, GRAPHICS AND GUI**

**9**

Files: Open, Read, Write, Append and Close. Tell and seek methods. Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Exception Chaining, User-defined Exceptions, Defining Clean-Up actions. Simple graphics: simple 2D drawing shapes and coloring. GUI using Tkinter.

**TOTAL : 45 PERIODS**

## **COURSE OUTCOMES**

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

- To write basic python programs
- To develop program using control structure and simple string processing.
- To create a code for different collection types and can differentiate them and to compose the code for functions, modules and packages.
- To learn how to handle file and exception.
- To design an user interface using Tkinter.



|         |                                                             |   |   |   |   |
|---------|-------------------------------------------------------------|---|---|---|---|
| JPC2211 | ENGINEERING PHYSICS AND ENVIRONMENTAL SCIENCE<br>LABORATORY | L | T | P | C |
|         |                                                             | 0 | 0 | 2 | 1 |

#### OBJECTIVES:

To provide students the first hand experience of verifying various concepts learnt in theory courses.

#### LIST OF EXPERIMENTS:

1. Determination of Numerical Aperture of the given Fiber and Estimate the Linearity of the Laser Source.
2. Determine the Dispersive power of a given Prism using Spectrometer
3. Determination of Thickness of the given thin Wire by forming Interference fringes using air-wedge setup
4. Analysis of I-V Characterization of Solar cell
5. Determination of Energy gap of the given Semiconductor Diode by plotting the graph between current and temperature.
6. Determination of Young's Modulus for the given bar by Nonuniform Bending method.
7. Determination of Dissolved oxygen by Winkler's method
8. Estimation of amount of chloride in water.
9. Estimation of the amount of mixture of acids in water
10. Estimation of Iron content in water by Spectrophotometric method
11. Estimation of acetic acid adsorbed on charcoal.
12. Determination of per capita energy consumption and carbon footprint.

**TOTAL: 30 PERIODS**

#### COURSE OUTCOMES

At the end of the course, the students will able

1. To lucid the effective communication system and to scrutiny the required wavelength.
2. To quantify micro sized linear objects and to ascertain band gap of semiconducting materials.
3. To configure solar power system as close as possible to its maximum peak power point.
4. To quantify the degree of pollution of water samples by measuring water quality parameters.
5. To carry out energy audit and practice energy conservation methods.

#### REFERENCES

1. D. Bailey and E. Wright, Practical Fiber Optics, Newnes publications, 2003.
2. Fretter W.B. -Introduction to Experimental Physics UCL Press, 2005
3. Gurdeep R.Chatwal, Sham K. Anand, Instrumental methods of chemical analysis, Himalaya Publishing House, 2007.

**WEBSITE REFERENCES:**

1. <https://vlab.amrita.edu/?sub=1&brch=281&sim=851&cnt=2>
2. <https://anilpangantiwar.tripod.com/expt10.htm>
3. <https://praxilabs.com/en/3d-simulations/i-v-characteristics-of-solar-cell-i-physics-simulation>
4. <https://vlab.amrita.edu/?sub=2&brch=193&sim=575&cnt=1>
5. <https://jigyasa-csir.in/neeri/n32-t1-a2/>

**CO-PO Mapping**

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



|                |                                          |          |          |          |          |
|----------------|------------------------------------------|----------|----------|----------|----------|
| <b>JCS2211</b> | <b>PYTHON PROGRAMMING<br/>LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                          | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Represent compound data using Python lists, tuples, dictionaries.
- Use functions for structuring Python programs.
- To implement basic 2D diagrams and create simple GUI.

### **LIST OF EXPERIMENTS:**

1. Write a python program using simple data types. Get the input from the keyboard. (Do not use built-in functions).
  - a) To find the square and cube of a number
  - b) To find the roots of a quadratic equation
  - c) To find the square root and cube root of a number
  - d) To calculate Simple Interest
2. Using command line arguments get the value from user. (Do not use built-in functions).
  - a) To convert Celsius to Fahrenheit
  - b) Exchange the value of two variables
  - c) To find the area and perimeter of a circle
  - d) To convert inch into meter
3. Exercise programs on conditional statements.
  - a) Write a program to find the grade of a student. Get student name, marks for 20 students.
  - b) Write a code to get the age of a person and print an age group. (Infant, Children, Adolescents, Adults , Older adults)
4. Exercise programs on basic control structures & loops.
  - a) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
  - b) Write a Python Program to Check the Prime Number using While Loop.
  - c) Write a python program to print Pascal triangle using for loop.
  - d) Write a program to print the multiplication table of the number entered by the user.
5. Programs using strings.
  - a) Make a program that displays your favorite actor/actress and print the word 'lucky' inside the string.
  - b) Print the day, month, year in the form "Today is 2/2/2016".
  - c) Write a program that asks console input and searches for a query.
  - d) Given an article, split it based on phrases.

6. Do the program using python collections.
  - a) Create a dictionary containing names of students and marks obtained by them in three subjects. Write a program to replace the marks in three subjects with the total in three subjects, and average marks. Also report the topper of the class.
  - b) Suppose a list contains several words. Write a program to create another list that contains first character of each word present in first list. Also, for the given first letter display the corresponding word from the list along with index.
  - c) Suppose a date is represented as a tuple (d, m, y). Write a program to create two date tuples and find the number of days between the two dates.
  - d) Write a program to create a set containing 10 randomly generated numbers in the range 15 to 45. Count how many of these numbers are less than 30. Delete all numbers which are greater than 35.
7. Do program using function and recursive function.
  - a) A string is entered through the keyboard. Write a recursive function that checks whether the string is a palindrome or not.
  - b) Write a recursive function to obtain length of a given string.
  - c) Get the height and weight value of five persons. Write a function BMI\_Calc( ) to calculate the BMI. (BMI = weight/height<sup>2</sup>) using all four prototypes.
8. Programs using files and exception.
  - a) Write a program to read a file and display its contents along with line numbers before each line. Also, handle EOF error.
  - b) Suppose a file contains student's records with each record containing name and age of a student. Write a program to read these records and display them in sorted order by name. How will you handle if file is not found.
9. Draw simple drawings using turtle and fill it with color.
10. Using DateTime method, Get current local time, UTC time, GMT time, ISO time and Get current time in the specific time zone.
11. Create a simple registration form using Tkinter.

**TOTAL: 60 PERIODS**

### **COURSE OUTCOMES:**

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

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Use Python lists, tuples, dictionaries for representing compound data.
- Develop Python programs step-wise by defining functions and calling them
- Implement file operations and also draw basic 2D diagrams

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

### SOFTWARE REQUIREMENTS

- PYTHON3 and above

### HARDWARE REQUIREMENTS

- Standalone desktops (or) Server supporting 30 terminals or more

### TEXTBOOKS:

1. Allen B. Downey, “Think Python : How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.
3. Alan D. Moore, Python GUI Programming with Tkinter - Develop Responsive and Powerful GUI Applications with Tkinter, Packt Publishing, First Edition, 2018.

### REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.

### WEB SITE REFERENCE:

- <https://www.programiz.com/python-programming/examples>
- <https://www.javatpoint.com/python-condition-and-loops-programs>
- <https://realpython.com/python-lists-tuples/>
- <https://www.tutorialsteacher.com/python/python-user-defined-function>
- <https://www.cdslab.org/python/notes/visualization/2d/2d.html>

### CO-PO Mapping

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 2   | 3   | 2   | 3   | -   | -   | -   | 3   | 2    | 1    | 2    |
| CO2 | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | 3   | 3    | 2    | 2    |
| CO3 | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | 3   | 3    | 2    | 3    |
| CO4 | 3   | 3   | 3   | 3   | 3   | 2   | -   | -   | 3   | 3    | 3    | 3    |
| CO5 | 3   | 3   | 3   | 3   | 3   | 2   | -   | -   | 3   | 3    | 3    | 3    |
| AVG | 3   | 2.8 | 3   | 2.8 | 3   | 2   | -   | -   | 3   | 2.8  | 2.2  | 2.6  |

|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JGE2241</b> | <b>GAMING AND CRAFTS STUDIO</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **OBJECTIVES:**

- Understand the fundamental principles of game development and the Unity interface.
- Analyse various game design principles to enhance gameplay experience.
- Evaluate and integrate audio and visual assets to create immersive game environments.
- Create a complete game project that incorporates learned techniques and personalized creative elements.
- Reflect on the game development process and critique peer projects to foster a collaborative learning environment.

### **Module 1: The World of Game Development and Gaming Fundamentals**

- Introduction to Game Development & Unity
- Understanding the core elements of gameplay, such as mechanics, dynamics, and aesthetics.
- Interactive tutorial on Unity, exploring the interface and project setup.
- Navigate Unity and set up a basic project.

### **Module 2: Game Design Principles, Visual and Audio Design**

- Game Design Principles & Basic Scripting - implementing basic game mechanics.
- implement simple player controls and game mechanics using C#.
- create responsive player controls using various input methods.
- Player Control and Game Technologies - Hands-on scripting for player controls.

### **Module 3: Game Mechanics, Technology, and Development**

- Creating Game Assets- modelling and texturing basic game assets.
- Physics and Interactions - Practical exercises adding physics and collisions to objects.
- UI & Menus - UI development sessions for creating intuitive game menus.
- Audio and Visual Effects - Implementing background music and particle effects.

### **Module 4: Critical Analysis, Feedback, and Ethical Considerations**

- Coding challenges to implement state machines and level progression.
- Testing and Debugging
- Debugging tools and techniques,
- Refine gameplay and fix issues, Optimisation

### **Module 5: Game Project & Presentation**

- Students will work in groups of 4-5 to design and develop a functional video game prototype.
- The game should incorporate concepts and mechanics from at least two different

genres.

- A GDD (Game Design Document) will be required as part of this project.
- Students will present their game prototype and GDD to the class and receive feedback from peers and instructors.

### **COURSE OUTCOMES:**

Upon successful completion of the course, students will be able to:

- Navigate Unity and set up a basic project, implement simple player controls and game mechanics using C#.
- Create responsive player controls using various input methods and import custom assets into Unity.
- Integrate Unity's Physics engine into their game projects and develop functional game menus and UI elements.
- Enhance their games with audio cues and visual effects.
- Use advanced scripting to manage game states and progression and perform debugging to refine gameplay and fix issues.

### **RESOURCES:**

- <https://www.youtube.com/watch?v=XtQMytORBmM>
- <https://www.youtube.com/watch?v=AmGSEH7QcDg>
- <https://www.youtube.com/watch?v=AmGSEH7QcDg>
- <https://www.youtube.com/watch?v=HAvfA1F3qTo>
- <https://www.youtube.com/playlist?list=PLfhhBaEcybmg-WnFoWDxgSlatmrzBRWSQ>
- <https://www.youtube.com/watch?v=ldP0c2o1FJI>
- <https://www.youtube.com/watch?v=ldP0c2o1FJI>

## SEMESTER III

| S. NO.       | COURSE CODE | COURSE TITLE                                  | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|-----------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JMA2302     | Mathematical Foundations for Computer Science | T         | BS       | 4               | 2         | 2        | 0         | 3         |
| 2            | JAL2301     | Data Science                                  | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JCS2301     | Data Structures and Algorithms                | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 4            | JIT2301     | Object Oriented Programming                   | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 5            | JIT2321     | Digital Principles and Computer Organization  | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 6            | JNC2361     | Non-Credit Mandatory Course 1                 | T         | NCM      | 3               | 3         | 0        | 0         | -         |
| 7            | JPT2041     | Soft Skills and Aptitude                      | P         | EEC      | 2               | 0         | 0        | 2         | *         |
| 8            | JAL2311     | Data Science Laboratory                       | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 9            | JIT2311     | Object Oriented Programming Laboratory        | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                               |           |          | <b>31</b>       | <b>17</b> | <b>2</b> | <b>12</b> | <b>20</b> |

**\*Only internal assessment**

## SEMESTER III

|         |                                                  |   |   |   |   |
|---------|--------------------------------------------------|---|---|---|---|
| JMA2302 | MATHEMATICAL FOUNDATIONS FOR<br>COMPUTER SCIENCE | L | T | P | C |
|         |                                                  | 2 | 2 | 0 | 3 |

### COURSE OBJECTIVES:

- To equip students with the ability to deal with abstraction by teaching propositional logic.
- To familiarize students in combinatorial problems with applications.
- To outline the basics of graph theory and algorithms.
- To explain concepts of number theory and its applications.
- To conceptualize congruence, its applications and standard classical theorems.

### UNIT I LOGIC

9 + 3

Propositional logic – Propositional equivalences – Normal forms – Predicates and quantifiers – Rules of inference.

### UNIT II COMBINATORICS

9 + 3

Mathematical induction – Pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations using Generating functions – Inclusion and exclusion principle.

### UNIT III GRAPHS

9 + 3

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

### UNIT IV DIVISIBILITY THEORY AND CANONICAL DECOMPOSITION

9 + 3

Division algorithm – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM – Linear Diophantine equations.

### UNIT V CONGRUENCES AND CLASSICAL THEOREM

9 + 3

Congruences – Linear Congruences – Modular exponentiation – Chinese remainder theorem (without proof) – Wilson's theorem (without proof) – Fermat's little theorem (without proof) – Euler's theorem (without proof) – Euler's Phi functions.

**TOTAL: 60 PERIODS**

### COURSE OUTCOMES:

**At the end of the course, students will be able**

- Apply propositional logic in practical problems.
- Solve combinatorial problems using counting principle and mathematical induction.
- Demonstrate efficient use of graph theory in solving connectivity and shortest path problems.
- Apply divisibility theory and canonical decompositions in problems.
- Solve practical problems using classical theorems of number theory.

### TEXT BOOKS:

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

3. Koshy. T., "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2<sup>nd</sup> Edition, 2007.

#### REFERENCES:

1. Grimaldi R.P., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2007.
2. Niven I, Zuckerman H.S. and Montgomery. H.L., "An Introduction to Theory of Numbers", John Wiley and Sons, Singapore, 2004

#### WEB REFERENCES:

1. <https://nptel.ac.in/courses/111106086/>
2. <https://nptel.ac.in/courses/111106155/>
3. <https://nptel.ac.in/courses/111106102/>
4. <https://nptel.ac.in/courses/111101137/>
5. <https://nptel.ac.in/courses/111103020/>

#### CO-PO MAPPING

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



|                |                     |          |          |          |          |
|----------------|---------------------|----------|----------|----------|----------|
| <b>JAL2301</b> | <b>DATA SCIENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                     | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python.

### **UNIT I INTRODUCTION TO DATA SCIENCE 9**

Data Science: Benefits and uses – Facets of data - Data Science Process - The big data ecosystem and data science - Overview of the data science process – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – Build the models – Presenting findings and building applications - Basic Statistical descriptions of data.

### **UNIT II DESCRIPTIVE STATISTICS - DESCRIBING DATA 9**

Types of Data - Types of Variables - Describing Data with Tables and Graphs – Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores.

### **UNIT III DESCRIPTIVE STATISTICS - DESCRIBING RELATIONSHIPS 9**

Correlation – Scatter plots – Correlation coefficient for quantitative data – Computational formula for correlation coefficient. Regression – A regression line – Least squares regression line – Standard error of estimate – Interpretation of  $r^2$  – Multiple regression equations – Regression towards the mean.

### **UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING 9**

Basics of NumPy arrays – Aggregations – Computations on arrays – Comparisons, masks, boolean logic – Fancy indexing – Sorting arrays - Structured data.  
Data manipulation with Pandas – Data indexing and selection – Operating on data – Handling missing data – Hierarchical indexing – Combining datasets – Pivot tables.

### **UNIT V DATA VISUALIZATION 9**

Importing Matplotlib – Line plots – Scatter plots – Visualizing errors – Density and contour plots – Histograms – Plot legends – Colorbars – Subplots – Text and annotation – Three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

**On completion of the course, the students should be able to:**

- Define the data science process.
- Understand different types of data description for data science process.
- Gain knowledge on relationships between data.
- Use the Python Libraries for Data Wrangling.
- Apply visualization libraries in Python to interpret and explore data.

### TEXT BOOK(S)

1. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

### REFERENCE BOOKS

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
2. Erick Thompson, “Python for Data Science Books in 1. A Practical Beginner’s Guide to Learn Python Programming, Introducing Into Data Analytics, Machine Learning, Web Development, with Hands-on Projects”, 2020, ISBN: 9798554509728

### WEBSITE REFERENCES

- <https://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/>
- <https://www.edureka.co/blog/learn-python-for-data-science/>
- <https://towardsdatascience.com/fundamentals-of-statistics-for-data-scientists-and-data-analysts-69d93a05aae7>
- <https://machinelearningmastery.com/data-visualization-in-python-with-matplotlib-seaborn-and-bokeh/>

### CO-PO MAPPING

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

|                |                                       |          |          |          |          |
|----------------|---------------------------------------|----------|----------|----------|----------|
| <b>JCS2301</b> | <b>DATA STRUCTURES AND ALGORITHMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                       | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To understand the concepts of ADTs.
- To design linear data structures – lists, stacks, and queues.
- To learn the non-linear data structure trees and its types.
- To understand the concepts of graphs and its applications.
- To understand sorting, searching, and hashing algorithms.

## **UNIT I ABSTRACT DATATYPE**

**9**

Introduction to Data structures - Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists - Doubly-linked lists - Circularly linked lists – Applications - Polynomial Manipulation.

## **UNIT II LINEAR STRUCTURE**

**9**

Stack ADT – Implementation - Array and Linked List – Applications - Queue ADT– Implementation – Array and Linked List – Applications- Infix to Postfix conversion - Evaluating arithmetic expressions.

## **UNIT III TREE STRUCTURE**

**9**

Tree ADT – Terminologies- Tree traversals - Binary Tree ADT – Complete and Full Binary Tree - Expression trees- Binary search trees – AVL trees – Heaps – Priority Queue using Heap- B Tree.

## **UNIT IV GRAPH STRUCTURES**

**9**

Graph ADT – Representations of graph – Types of graph - Graph traversals – Topological ordering – Applications - Shortest path: Dijkstra's algorithm – Minimum spanning trees: Prim's and Kruskal's algorithm.

## **UNIT V SORTING AND SEARCHING**

**9**

Sorting: Bubble sort – selection sort – insertion sort – merge sort – quick sort – Searching: linear search – binary search – Hashing: hash functions – Separate Chaining, Open addressing- Rehashing.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Explain abstract data types.
- Design, implement, and analyze linear data structures, such as lists, queues and stacks, according to the needs of different applications.
- Explore deeper into algorithms that operate on trees such as tree traversals and tree balancing concepts
- Model problems as graph problems and implement efficient graph algorithms to solve them.

- Design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting.

**TEXT BOOKS:**

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, An Indian Adaptation, John Wiley & Sons Inc., 2021.
2. Devraj Ganguly, “Introduction to Data Structures and Algorithms”: A Conceptual Guide. Paperback – 19 May 2021.

### REFERENCES:

1. Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer Edition, 2015.
2. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011.
3. Aho, Hopcroft, and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms”, Second Edition, McGraw Hill, 2002.
5. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014.

### WEB REFERENCES:

1. <https://dl.acm.org/doi/10.5555/577958>
2. <https://www.javatpoint.com/data-structure-tutorial>
3. <https://www.javatpoint.com/data-structures-and-algorithms-in-c-set-1>
4. <https://www.w3schools.in/data-structures/intro>

**CO-PO MAPPING:**

[illegible]

|                |                                    |          |          |          |          |
|----------------|------------------------------------|----------|----------|----------|----------|
| <b>JIT2301</b> | <b>OBJECT ORIENTED PROGRAMMING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                    | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To learn the basic concepts of OOP and getting started with C++
- To study the properties and usage of inheritance and polymorphism in C++
- To understand file and exception handling and exploring on templates
- To learn the OOP principles of JAVA and creation of package
- To learn interface and thread concept. Also, to learn the design of an GUI based application using JavaFX

### **UNIT – I BASICS OF C++**

**9**

Object Oriented Programming: Concepts of Object-Oriented Programming - Origins of C++ — Keywords - Classes and Objects – Constructors – Destructors – Static Data Members - Static Member Functions – Arrays Fundamentals – String Operations.

### **UNIT – II INHERITANCE AND POLYMORPHISM**

**9**

Inheritance: Single, Multi-Level, Multiple, Hierarchical and Hybrid – Abstract Classes - Polymorphism- Function Overloading: Overloading Constructor Functions - Copy Constructors- Operator Overloading: Unary Operators – Binary operators.

### **UNIT – III FILES, TEMPLATES AND EXCEPTION HANDLING**

**9**

Files: File Stream Operations - File Pointers Manipulation-Templates: Function templates – Class Templates – Exception handling: Try, Catch and Throw- Handling Derived-Class Exceptions - Exception Handling Options.

### **UNIT – IV FUNDAMENTALS OF JAVA AND PACKAGES**

**9**

An Overview of JAVA: Three OOP Principles – Java Class – Simple Program - This Keyword - Finalize Method- Inheritance: Basics- Using Super- Method Overriding- Using Final- Packages: Defining Package – Access Protection - Importing Packages.

### **UNIT – V INTERFACES, THREADS AND GUI**

**9**

Interfaces: Design and Implementation – Default Interface Methods - Thread Model: Creating a Thread – Synchronization – Interthread Communication – Multithreading - JavaFX: Basic Concepts – JavaFX Controls - Application Development.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Design a C++ programs with classes, objects and static member functions.
- Develop a C++ program using inheritance and polymorphism concept.
- Work with files and can handle exceptions. Also, design a program using template.
- Develop a simple Java Program and can create and import a package.
- Design an interface, synchronize various tasks and develop an GUI using JavaFX.

**TEXT BOOKS:**

1. Herbert Schildt, C++: The Complete Reference, 4<sup>th</sup> Edition, McGraw Hill Education, 2017.
2. Herbert Schildt, Java: The Complete Reference, 11<sup>th</sup> Edition, McGraw Hill Education, 2019.
3. J. F. DiMarzio, JavaFX A Beginners Guide, McGraw Hill Professional, 2011.

**REFERENCES:**

1. Bjarne Stroustrup, The C++ Programming Language, 4th Edition, Addison-Wesley, 2013
2. E. Balagurusamy, Object Oriented Programming with C++, 8<sup>th</sup> Edition, McGraw Hill, 2020.
3. E. Balagurusamy, Programming with JAVA - A Primer, Third Edition, McGraw-Hill Professionals, 2014.
4. R. Nageswara Rao and Kogent Solutions Inc., Core Java: An Integrated Approach, Dreamtech Press, 2008.

**WEB REFERENCES:**

1. [Java Tutorial - GeeksforGeeks](#)
2. [C++ Programming Language - GeeksforGeeks](#)
3. [C++ Tutorial | Learn C++ Programming Language - Scaler Topics](#)
4. [Java Tutorial | Learn Java Programming - Scaler Topics](#)
5. [Learn Java Programming \(programiz.com\)](#)
6. [JavaFX Tutorial \(tutorialspoint.com\)](#)

**CO-PO MAPPING:**

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

|                |                                                         |          |          |          |          |
|----------------|---------------------------------------------------------|----------|----------|----------|----------|
| <b>JIT2321</b> | <b>DIGITAL PRINCIPLES AND<br/>COMPUTER ORGANIZATION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                         | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

## **COURSE OBJECTIVES**

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

## **UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9**

Number Systems - Arithmetic Operations - Binary Codes - Boolean Algebra and Logic Gates - Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates.

## **UNIT II COMBINATIONAL LOGIC 9**

Combinational Circuits - Binary Adder - Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoder - Encoder - Multiplexers - De-multiplexer.

## **UNIT III COMPUTER FUNDAMENTALS 9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction types– Addressing Modes.

## **UNIT IV PROCESSOR 9**

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

## **UNIT V MEMORY AND I/O 9**

Memory Concepts and Hierarchy – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O.

**TOTAL: 45 PERIODS**

## **LIST OF EXPERIMENTS:**

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder circuits
4. Implementation of 4-bit binary Subtractor circuits.
5. Implementation of code converters.
6. Implementation of BCD adder.
7. Implementation of encoder and decoder circuits.
8. Implementation of functions using Multiplexers

9. Implementation of functions using Demultiplexers.
10. Simulator based study of Computer Architecture.

**TOTAL: 15 PERIODS**

### **COURSE OUTCOMES:**

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

- Simplify Boolean functions using KMap.
- Design combinational circuits and analyze the design procedures.
- State the fundamentals of computer systems and analyze the execution of an instruction.
- Analyze different types of control design and identify hazards.
- Identify the characteristics of various memory systems and I/O communication.

### **TEXT BOOKS:**

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

### **REFERENCES:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2016.

### **WEB REFERENCES:**

1. <https://www.geeksforgeeks.org/difference-between-multiplexer-and-demultiplexer/>
2. <https://www.geeksforgeeks.org/introduction-of-sequential-circuits/>
3. <https://www.geeksforgeeks.org/microarchitecture-and-instruction-set-architecture/>
4. NPTEL :: Com <https://archive.nptel.ac.in/courses/106/105/106105163/>
5. Difference bet <https://www.geeksforgeeks.org/difference-between-serial-port-and-parallel-ports/>

### **CO-PO MAPPING:**

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



|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JPT2041</b> | <b>SOFT SKILLS AND APTITUDE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>0</b> | <b>0</b> | <b>2</b> | <b>*</b> |

## **COURSE OBJECTIVES**

- To make students analyze and solve problems in technical as well as aptitude. Enhance the technical skills and basics of programming language
- To make the students understand how to apply the practical knowledge with real time applications.
- To make the students think and draw a conclusion from different scenarios.
- To help the students understand C programming concepts

### **UNIT-I SOFT SKILLS AND APTITUDE - I**

**6**

Synonyms - Antonyms - Odd Words - Idioms and Phrases - Error Spotting - Interpersonal Communication- Sentence Correction - Resume Writing Skills - Interview Skills.

### **UNIT-II SOFT SKILLS AND APTITUDE-II**

**6**

Reading Comprehension - Sentence Improvement - Jumbled Sentences - Parts of speech - Fact, Inference, Judgements - . Paragraph formation -Fill in the Blanks - Group Discussion - Mock Interview Sessions.

### **UNIT III QUANTITATIVE APTITUDE**

**6**

Number Theory - Divisibility rule - LCM and HCF - Simplification - Surds and Indices - Average – Percentage.

### **UNIT IV LOGICAL REASONING**

**6**

Number and letter Series - Coding and Decoding - Ranking and Ordering - Odd man out - Image Based Relationships.

### **UNIT V TECHNICAL APTITUDE IN C-I**

**6**

Pointers - Pointer dereferencing - Functions - Call by value, Call by reference - Structures - Structure Pointers - Arrays - One Dimensional, Two Dimensional, Multi-Dimensional - Sorting - Time Complexity - Strings - String Methods

**TOTAL: 30 PERIODS**

## **COURSE OUTCOMES:**

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

- Develop different types of content using the skills learnt.
- Manage time and stress competently.
- Find answers to real time application problems.
- Use Logical reasoning skills to solve problems differently.
- Apply C programming concepts for coding.

**TEXTBOOKS:**

1. Dr.RS Aggarwal, "Quantitative Aptitude", S Chand Publishing, 2020.
2. Dr.R.S Aggarwal. "A Modern Approach To Verbal Reasoning", S. Chand Publishing, 2017.
3. Dr. R. S. Aggarwal, "A Modern Approach to Non-Verbal Reasoning". S. Chand Publishing, 2017.
4. Pradip Dey, ManasGhosh, "Fundamentals of Computing and Programming in C", First edition.

**REFERENCES:**

1. Data Communications and Networks- 2nd edition -Achyut S Godbole- and AtulKahate Tata McGraw-Hill, 2017.
2. Computer Networking - James F. Kurose & Keith W. Ross- PEARSON, 6th EDITION, 2017.
3. Computer Communications and Networking Technologies - Michael A. Gallo & William M. Hancock - BROOKS & COLE, 2001.

**WEB REFERENCES:**

- <https://www.indiabix.com/aptitude questions-and-answers>
- <https://m4maths.com/placement-puzzles.php>
- [www.freshersworld.com](http://www.freshersworld.com)

|                |                                |          |          |          |          |
|----------------|--------------------------------|----------|----------|----------|----------|
| <b>JAL2311</b> | <b>DATA SCIENCE LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES**

- To understand the python libraries for data science
- To understand the basic Statistical and Probability measures for data science.
- To learn descriptive analytics on the benchmark data sets.
- To apply correlation and regression analytics on standard data sets.
- To present and interpret data using visualization packages in Python.

### **LIST OF PROGRAMS**

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays.
3. Working with Pandas data frames.
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
  - a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
  - b. Bivariate analysis: Linear and logistic regression modeling.
  - c. Multiple Regression analysis
  - d. Also compare the results of the above analysis for the two data sets.
6. Basic plots using Matplotlib.
7. Apply and explore various plotting functions on UCI data sets.
  - a. Normal curves
  - b. Density and contour plots
  - c. Correlation and scatter plots
  - d. Histograms
  - e. Three dimensional plotting
8. Visualizing Geographic Data with Basemap.

**TOTAL: 60 PERIODS**

### **COURSE OUTCOMES**

- Make use of the python libraries for data science
- Make use of the basic Statistical and Probability measures for data science.
- Perform descriptive analytics on the benchmark data sets.
- Perform correlation and regression analytics on standard data sets
- Present and interpret data using visualization packages in Python.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **HARDWARE**

Stand-alone desktops 30 Nos. (or) Server supporting 30 terminals or more.

## SOFTWARE

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

## WEB REFERENCES:

- <https://www.simplilearn.com/introduction-to-data-science-with-python-article>
- [https://www.tutorialspoint.com/python\\_data\\_science/index.htm](https://www.tutorialspoint.com/python_data_science/index.htm)
- <https://www.datacamp.com/tutorial/matplotlib-tutorial-python>

## CO-PO MAPPING

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

|                |                                                   |          |          |          |          |
|----------------|---------------------------------------------------|----------|----------|----------|----------|
| <b>JIT2311</b> | <b>OBJECT ORIENTED PROGRAMMING<br/>LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                   | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

## **COURSE OBJECTIVES**

- To understand basics of Object-Oriented Programming with C++ and Java programming language.
- To know the principles of polymorphism and templates.
- To define exceptions and use of inheritance.
- To develop a java application with threads and interfaces.
- To design and build Graphical User Interface Application using JAVAFX.

## **LIST OF PROGRAMS**

### **Implement the following programs**

1. a) Develop a C++ code to create a class and object and print the member variables.  
b) Develop a C++ program to show the working of default constructor, parametrized constructor and copy constructor and destruct any object.
2. Implement a C++ code to demonstrate the concept of static member function.
3. Develop a menu driven C++ program to find area of two-dimensional objects (any three) using function overloading.
4. (a) Develop a C++ code to overload the unary operators using operator function.  
(b) Develop a C++ code to overload binary operators using operator function.
5. (a) Implement a C++ code to swap any two values using function template.  
(b) Implement a C++ code to find the maximum of any three values using a class template.
6. Develop a C++ code to handle division-by-zero and out-of-range exception.
7. (a) Implement a Java code to print the sum, multiply, subtract, divide and remainder of two numbers. Get the input from the user.  
(b) Develop a Java program to print and return the current class instance using this keyword.
8. Develop an application with Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
9. Develop a Java program to create a 'Geometry' package with relevant classes (For e.g. Circle/ Square/ Polygon and so on.) and export it.
10. Create an interface for 'Playable' with classes Football, Volleyball and Basketball.
11. Develop a Java code to implement the concept of thread.

12. Design and develop an application using JavaFX.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

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

- Apply the concepts of classes and objects to solve simple problems.
- Develop programs using polymorphism and templates.
- Handle the exceptions and inherit a class.
- Build Java applications with thread models and interfaces.
- Develop GUI based applications in JavaFX using event handling concept and controls.

**TEXT BOOKS:**

1. Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill Education, New Delhi, 2017.
2. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019.
3. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015.

**WEBSITE REFERENCES:**

1. C++ Programming | Neso Academy
2. [cplusplus.com/doc/tutorial/](http://cplusplus.com/doc/tutorial/)
3. C++ Tutorial ([w3schools.com](http://w3schools.com))
4. Introduction to Java ([w3schools.com](http://w3schools.com))
5. Java Tutorials for Beginners ([tutorialspoint.com](http://tutorialspoint.com))

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**HARDWARE:** Stand-alone desktops 30 Nos. (or) Server supporting 30 terminals or more

**SOFTWARE:** Windows / Linux operating system, C++ compiler, JDK 1.8 (or above)

**CO-PO MAPPING:**

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

## SEMESTER IV

| S. NO.       | COURSE CODE | COURSE TITLE                                     | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|--------------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JMA2402     | Applied Linear Algebra                           | T         | BS       | 4               | 2         | 2        | 0         | 3         |
| 2            | JAL2401     | Principles of Artificial Intelligence            | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JCS2401     | Database Management Systems                      | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 4            | JIT2421     | Operating Systems                                | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 5            | -           | Professional Elective 1                          | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 6            | -           | Open Elective 1                                  | T         | OE       | 3               | 3         | 0        | 0         | 3         |
| 7            | JPT2041     | Soft Skills and Aptitude                         | P         | EEC      | 2               | 0         | 0        | 2         | 1         |
| 8            | JAL2411     | Principles of Artificial Intelligence Laboratory | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 9            | JCS2411     | Database Management Systems Laboratory           | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 10           | JGE2442     | Advanced IT Infrastructure Laboratory            | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                                  |           |          | <b>35</b>       | <b>17</b> | <b>2</b> | <b>16</b> | <b>26</b> |

## SEMESTER IV

|                |                               |          |          |          |          |
|----------------|-------------------------------|----------|----------|----------|----------|
| <b>JMA2402</b> | <b>APPLIED LINEAR ALGEBRA</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                               | <b>2</b> | <b>2</b> | <b>0</b> | <b>3</b> |

### COURSE OBJECTIVES:

- To impart knowledge of consistency of system of equations through Rouché-Capelli theorem.
- To familiarize students in the concepts of vector spaces, bases and dimension.
- To enable students understand concepts of linear transformation, Eigenvalues, Eigenvectors and Diagonalizability.
- To introduce inner product spaces, orthogonalization and least square approximations.

### UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS

**9 + 3**

Matrices – Row Echelon form – Rank – Non-homogeneous system of linear equations – Homogeneous system of linear equations – Rouché-Capelli theorem (without proof) – Consistency – Gauss Jordan method – Gauss Seidel method.

### UNIT II VECTOR SPACES

**9 + 3**

Definition of field – Vector spaces – Subspaces – Properties – Linear combinations – Linear independence and linear dependence – Span – Bases and dimensions.

### UNIT III LINEAR TRANSFORMATION

**9 + 3**

Linear transformation – Properties – Kernel and Range – One-to-One correspondence – Rank and Nullity – Dimension theorem.

### UNIT IV DIAGONALIZATION

**9 + 3**

Matrix representations of linear transformations – Eigenvalues and eigenvectors – Diagonalizability.

### UNIT V INNER PRODUCT SPACES

**9 + 3**

Inner products and norms – Gram Schmidt orthogonalization process – Least square approximation.

**TOTAL: 60 PERIODS**

### COURSE OUTCOMES:

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

- Apply Rouché-Capelli theorem for solving system of equations.
- Solve problems occurring in vector spaces and subspaces.
- Conceptualize linear transformation and use it in real-time problems.
- Demonstrate efficient use of matrix representations and diagonalization.
- Solve problems using orthogonalization process and use least square approximations.

### TEXT BOOKS:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44<sup>th</sup> Edition, 2021.
2. Kreyszig Erwin., "Advanced Engineering Mathematics", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.
3. Friedberg. A.H., Insel. A.J. and Spence. L., “Linear Algebra”, Prentice Hall of India, New Delhi, 2004



**REFERENCES:**

1. Kumaresan. S., “Linear Algebra – A Geometric Approach”, Prentice – Hall of India, New Delhi, Reprint, 2010.
2. 4. Lay D.C., “Linear Algebra and its Applications”, 5<sup>th</sup> Edition, Pearson Education, 2015.

**WEB REFERENCES:**

1. <https://nptel.ac.in/courses/111107105/>
2. <https://nptel.ac.in/courses/108104174/>
3. <https://nptel.ac.in/courses/111104137/>
4. <https://nptel.ac.in/courses/111106135/>
5. <https://nptel.ac.in/courses/111108157/>

**CO-PO MAPPING:**

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

|                |                                              |          |          |          |          |
|----------------|----------------------------------------------|----------|----------|----------|----------|
| <b>JAL2401</b> | <b>PRINCIPLES OF ARTIFICIAL INTELLIGENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To enable students understand the various characteristics of a problem solving agents.
- To explain about the different searching strategies involved in problem solving.
- To describe about solving problems with various constraints.
- To specify the representation of knowledge and reasoning
- To outline the various applications of Artificial Intelligence.

### **UNIT-I INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND INTELLIGENT AGENTS 9**

Introduction - The Foundations of Artificial Intelligence - The History of Artificial Intelligence - The State of the Art - Risks and Benefits of AI - Intelligent Agents - Agents and Environments - Good Behavior: The Concept of Rationality - The Nature of Environments - The Structure of Agents.

### **UNIT-II PROBLEM SOLVING AND SEARCHING 9**

Solving problems by searching - Problem-Solving agents - Example problems - Search algorithms - Uninformed search strategies - Informed (Heuristic) search strategies - Heuristic functions - Search in complex environments - Local search and optimization problems - Local search in continuous spaces - Search with nondeterministic actions - Search in partially observable environments - Online search agents and unknown environments.

### **UNIT-III CONSTRAINT SATISFACTION PROBLEMS AND GAME THEORY 9**

Constraint satisfaction problems - Defining constraint satisfaction problems - Constraint propagation: inference in CSPs - Backtracking search for CSPs - Local search for CSPs - Structure of problems - Adversarial search and games - Game theory - Optimal decisions in games - Heuristic Alpha-Beta tree search - Monte Carlo tree search - Stochastic games - Partially observable games - Limitations of game search algorithms.

### **UNIT-IV KNOWLEDGE AND REASONING 9**

First-Order Logic – Knowledge Representation - Syntax and Semantics of First-Order Logic - Using First-Order Logic - Knowledge Engineering in First-Order Logic - Inference in First-Order Logic - Propositional vs. First-Order Inference - Unification and First-Order Inference - Forward Chaining - Backward Chaining - Quantifying Uncertainty - Bayes' Rule and Its Use - Naive Bayes Model.

### **UNIT-V EXPERT SYSTEMS AND APPLICATIONS OF ARTIFICIAL INTELLIGENCE 9**

Expert systems - Architecture of expert systems - Roles of expert systems - MYCIN - DART - XOON - Application Domains Of AI - Artificial Intelligence in Environmental Management - Artificial Intelligence in Systems Biology: Opportunities in Agriculture, Biomedicine, and Healthcare - Artificial Intelligence in Disease Diagnosis via Smartphone Applications.

**TOTAL: 45 PERIODS**

## COURSE OUTCOMES:

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

- Understand the various characteristics of a problem solving agents.
- Explain about the different searching strategies involved in problem solving.
- Describe about solving problems with various constraints.
- Assess the representation of knowledge and reasoning.
- Develop applications using Artificial Intelligence.

## TEXT BOOKS:

1. Stuart J. Russell, Peter Norvig, “Artificial Intelligence - A Modern Approach”, 4<sup>th</sup> Edition, Pearson Publishers, 2022.
2. Kaliraj, P., & Devi T, “Artificial Intelligence Theory, Models, and Applications”, 1<sup>st</sup> edition, CRC Press, Taylor & Francis Group, Boca Raton, Auerbach Publications.

## REFERENCES:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, “Artificial Intelligence”, Third Edition, Tata McGraw-Hill Education, 2008.
2. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.
3. Nilsson, Artificial Intelligence: A New Synthesis (1 ed.), Morgan-Kaufmann, 1998. ISBN 978-1558605350.
4. Dheepak Khemani, “A first course in Artificial Intelligence”, McGraw Hill Education Pvt. Ltd., NewDelhi, 2013.
5. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, O’Reilly, 2009, <https://www.nltk.org/book/>.
6. Saroj Kaushik, Logic & Prolog Programming, New Age International, 1<sup>st</sup> edition, 2002.
7. Expert Systems: Principles and Programming, 11 March 1998. Edition: 4th. ISBN: 9788131501672.

## WEB LINKS:

1. <http://nptel.ac.in/courses/106105079/2>
2. <https://cloudsek.com/blog/intelligent-searching-techniques-in-artificial-intelligence>
3. <https://www.aiforanyone.org/glossary/first-order-logic>
4. <https://www.javatpoint.com/knowledge-representation-in-ai>
5. <https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP>
6. <https://www.guru99.com/expert-systems-with-applications.html>

## CO-PO MAPPING:

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

|                |                                        |          |          |          |          |
|----------------|----------------------------------------|----------|----------|----------|----------|
| <b>JCS2401</b> | <b>DATABASE MANAGEMENT<br/>SYSTEMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To learn the working of various data models and get exposed to SQL querying.
- To design data base with ER models and understand the significance of normalization.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques.
- To familiarize the students with different types of advanced databases.

### **UNIT I DATA MODELS AND QUERYING 9**

Purpose of Data base System–Views of data–Data Models–Data base System Architecture  
Introduction to relational databases–Relational Model–Keys–Relational Algebra–SQL  
fundamentals–Advanced SQL features–Embedded SQL–Dynamic SQL.

### **UNIT II DESIGN AND NORMALIZATION 9**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping  
Functional Dependencies–Non-loss Decomposition–First-Second-Third Normal Forms Dependency  
Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form–  
Join Dependencies and Fifth Normal Form.

### **UNIT III TRANSACTION PROCESSING 9**

Transaction Concepts–ACID Properties– Schedules–Serializability–Concurrency Control– Need for  
Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery–  
SavePoints –Isolation Levels–SQL Facilities for Concurrency and Recovery.

### **UNIT IV DATA ORGANIZATION AND QUERY OPTIMIZATION 9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing Ordered Indices  
– B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing  
Overview–Query optimization.

### **UNIT V ADVANCED DATABASES 9**

OODBMS- - Object-Based Databases - OO Data Model - OO Languages – Object Relational  
Databases - ODMG Object Model - XML – Structure of XML - Temporal Databases – Mobile  
Databases – Spatial Databases.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Design efficient databases and extract information with SQL queries
- Develop preliminary design of normalized databases
- Analyze the various transactions and provide smooth access of data
- Create organized databases and write optimized queries

- Apply the various advanced database concepts and security to the current project.

#### **TEXTBOOKS:**

1. Abraham Silberschatz, HenryF. Korth, S.Sudharshan, “Database System Concepts”, Seventh Edition, TataMcGraw Hill,2020
2. Ramez Elmasri, Shamkant B.Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.

#### **REFERENCES:**

1. Raghu Ramakrishnan, Johannes Gehrke , “Database Management Systems”, Third Edition, McGraw-Hill College Publications, 2015.
3. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2008.
4. G.K.Gupta, “Database Management Systems” ,Tata McGrawHill, 2011.

#### **WEBSITE REFERENCES:**

- <https://www.tutorialspoint.com/dbms/index.htm>
- <https://www.mygreatlearning.com/academy/learn-for-free/courses/database-management-systems-dbms>
- <https://www.w3schools.in/dbms/>
- [https://sqlzoo.net/wiki/SQL\\_Tutorial](https://sqlzoo.net/wiki/SQL_Tutorial)

#### **CO-PO MAPPING:**

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| <b>C01</b> | 3   | 3   | 3   | 2   | 3   | 3   | 2   | 3   | 1   | 3    | 2    | 3    | 2    | 2    | 1    |
| <b>C02</b> | 3   | 3   | 3   | 2   | 3   | 3   | 1   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    |
| <b>C03</b> | 3   | 3   | 3   | 2   | 3   | 3   | 2   | 3   | 2   | 3    | 2    | 3    | 2    | 1    | 2    |
| <b>C04</b> | 3   | 3   | 3   | 1   | 3   | 3   | 2   | 3   | 2   | 3    | 2    | 3    | 1    | 2    | 1    |
| <b>C05</b> | 3   | 3   | 3   | 2   | 3   | 3   | 2   | 3   | 1   | 3    | 2    | 3    | 2    | 3    | 2    |

|                |                          |          |          |          |          |
|----------------|--------------------------|----------|----------|----------|----------|
| <b>JIT2421</b> | <b>OPERATING SYSTEMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                          | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

### **COURSE OBJECTIVES**

- To understand the basics and functions of operating systems.
- To analyse scheduling algorithms and process synchronization.
- To interpret various memory management schemes.
- To classify and familiar with storage management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS

### **PREREQUISITE:**

- Computer Architecture

### **UNIT I COMPONENTS OF AN OS 9**

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs.

### **UNIT II PROCESS MANAGEMENT 9**

Processes - Process Concept - Process Scheduling- Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

### **UNIT III MEMORY MANAGEMENT 9**

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

### **UNIT IV STORAGE MANAGEMENT 9**

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management.

### **UNIT V VIRTUAL MACHINES AND MOBILE OS 9**

Virtual Machines – History, Benefits and Features - Building Blocks - Types of Virtual Machines and their Implementations - Virtualization; Mobile OS - iOS and Android Architecture - SDK Frameworks.

**TOTAL: 45 PERIODS**

**LIST OF EXPERIMENTS:**

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, open dir, read dir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Bankers Algorithm for Dead lock Avoidance
6. Implementation of Dead lock Detection Algorithm
7. Implementation of the following Memory Allocation Methods for fixed partition
  - a) FirstFit
  - b) WorstFit
  - c) BestFit
8. Implementation of Paging Technique of Memory Management
9. Implementation of the following Page Replacement Algorithms
  - a) FIFO
  - b) LRU
  - c) LFU

**COURSE OUTCOMES:**

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

- Classify operating system components and system calls based on functionality
- Analyze and evaluate CPU scheduling algorithms and assess the solutions for synchronization problems and dead lock prevention
- Familiarize in memory management and storage management techniques
- Analyze the File System Interface, Directory Structure
- Compare iOS and Android Operating Systems.

**TEXT BOOKS:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9<sup>th</sup> Edition, John Wiley and Sons Inc., 2018.
2. William Stallings, “Operating Systems – Internals and Design Principles”, 7<sup>th</sup> Edition, Prentice Hall, 2018.

**REFERENCES:**

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2014.
2. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education, 2018.
3. D M Dhamdhere, “Operating Systems: A Concept-Based Approach”, Second Edition, Tata McGraw Hill Education.

**WEB REFERENCES:**

1. [https://www.tutorialspoint.com/operating\\_system/os\\_overview.htm/](https://www.tutorialspoint.com/operating_system/os_overview.htm/)
2. <https://www.geeksforgeeks.org/introduction-of-process-management/>
3. <https://technobyte.org/memory-management-os-simple-explanation/>
4. <https://inst.eecs.berkeley.edu/~eecsba1/sp97/reports/eecsba1a/index-os.html/>

**CO-PO MAPPING:**

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



|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JPT2041</b> | <b>SOFT SKILLS AND APTITUDE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

### **COURSE OBJECTIVES:**

- To help students learn various forms of writing and develop content.
- To help students acquire time and stress management skills.
- To facilitate students to gain required knowledge to understand practical concepts in aptitude.
- To develop the thinking and analytical skills of students.
- To gain knowledge in concepts of C programming language.

### **UNIT - I      SOFT SKILLS AND APTITUDE - III      6**

Communication – on Specific topics – both oral and written – Content development – various forms of writing and specific writing – Brainstorming – Individual – Concept focusing – Public Speaking – Analytical writing.

### **UNIT – II      SOFT SKILLS AND APTITUDE - IV      6**

Importance of Time – Time Management techniques – The art of prioritizing and scheduling – Stress – Positive and Negative Stress - Stress Management techniques – Concept of Goal setting – Importance of Goals – Dream vs Goal – Reasons for failure of Goals – SMART.

### **UNIT III QUANTITATIVE APTITUDE      6**

Ratio and Proportions – Allegations and Mixtures – Problem on Ages - Profit and Loss and Discount.

### **UNIT IV      LOGICAL REASONING      6**

Odd man out series – Blood Relation – Seating arrangement – Number ranking.

### **UNIT V TECHNICAL APTITUDE IN C-II      6**

Strings - Storage Classes – Pointers – Preprocessor directives - Structures – Union. Type def – Input / Output – File I/O - Header Files – Type casting – Error handling – Command Line Arguments – Variable Arguments – Memory Management - Bitwise operators.

**TOTAL: 30 PERIODS**

### **COURSE OUTCOMES:**

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

- Develop different types of content using the skills learnt
- Manage time and stress competently
- Find answers to real time application problems
- Use Logical reasoning skills to solve problems differently
- Apply C programming concepts for coding

### **TEXTBOOKS:**

1. Dr. R.S Agrawal, “Quantitative Aptitude” and Non Verbal Reasoning published in 2000.
2. S.Chand – A Modern Approach to Logical Reasoning Published in 2000.

3. Pradip Dey, ManasGhosh, "Fundamentals of Computing and Programming in C. First

**WEBSITE REFERENCES:**

1. <https://www.indiabix.com/aptitude/questions-and-answers/>
2. <https://m4maths.com/placement-puzzles.php>
3. [www.freshers](http://www.freshersworld.com) world.com
4. [www.careerride.com](http://www.careerride.com)
5. [www.youtube.com/watch/python](http://www.youtube.com/watch/python)
6. [www.youtube.com/watch/concepts of python](http://www.youtube.com/watch/concepts%20of%20python)
7. <https://stackoverflow.com/>
8. <https://www.w3schools.com/>
9. <https://www.geeksforgeeks.org/>

|         |                                                  |   |   |   |   |
|---------|--------------------------------------------------|---|---|---|---|
| JAL2411 | PRINCIPLES OF ARTIFICIAL INTELLIGENCE LABORATORY | L | T | P | C |
|         |                                                  | 0 | 0 | 4 | 2 |

### COURSE OBJECTIVES:

- To provide students with a theoretical and practical base in Artificial Intelligence.
- Students will be able to design, implement, and analyse simple problem solving technique.
- Students will be able to identify, formulate, and solve problems.

### LIST OF EXERCISES

1. Study of Prolog.
2. Simple facts and rules for simple statements using PROLOG.
3. PROLOG programs for the following:
  - a. To convert centigrade temperatures to Fahrenheit and to check if a temperature is below freezing level.
  - b. For medical diagnosis and show the advantage and disadvantage of green and red cuts.
4. Solving water jug problem.
5. Implementation of depth first search and breadth first search.
6. Implementation of A\* search algorithm.
7. Solving 8-Queens problem.
8. Solving traveling salesman problem.
9. Implementation of minimax search algorithm.
10. Implementation of backward chaining and forward chaining.
11. Implementation of tic-tac-toe game.
12. Application development for any of the following areas:
  - a. Healthcare
  - b. Agriculture
  - c. Weather forecasting
  - d. Sales prediction

**TOTAL: 60 PERIODS**

### COURSE OUTCOMES:

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

- Understand the major areas and challenges of AI.
- Apply basic AI algorithms to solve problems.
- Develop programming solutions for given problem scenario.
- Describe search strategies and solve problems by applying a suitable search method.
- Solve the given problem scenario.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

**HARDWARE:** Standalone desktops 30 Nos. (or) Server supporting 30 terminals or more.

**SOFTWARE:** LISP / PROLOG, Java / Python

### WEB REFERENCES:

1. <https://www.tutorialspoint.com/lisp/index.htm>
2. <https://www.swi-prolog.org/>
3. <https://www.tutorialspoint.com/prolog/>
4. <https://www.javatpoint.com/java-tutorial>

**CO-PO MAPPING:**

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

|                |                                                   |          |          |          |          |
|----------------|---------------------------------------------------|----------|----------|----------|----------|
| <b>JCS2411</b> | <b>DATABASE MANAGEMENT<br/>SYSTEMS LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                   | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES:**

- To familiarize with DDL, DML and DCL Commands
- To learn the use of nested and join queries
- To understand functions, procedures and procedural extensions of databases
- To be familiar with database triggers for specific application
- To develop applications using front-end tools and back-end DBMS

### **PREREQUISITE:**

- Basics of Programming Concepts

### **LIST OF EXPERIMENTS**

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins.
3. Creation of Views, Sequences, Indexes, Savepoint and commit constraints.
4. Database Programming: Implicit and Explicit Cursors with PL/SQL block.
5. Creation of PL/SQL Procedures and Functions.
6. Creation of PL/SQL Triggers.
7. Exception Handling.
8. Database Design using ER modeling, Normalization and Implementation for any application.
9. Database Connectivity with Front End Tools
10. Mini project (Application Development) in one of the following systems:
  - a) Student database system
  - b) Inventory Control System
  - c) Online Library Management
  - d) Hospital Management System
  - e) Railway Reservation System
  - f) Personal Information System
  - g) Online Course registration and maintenance System
  - h) Attendance Management System
  - i) Hotel Management System
  - j) E-commerce portal
  - k) Online auction system

**TOTAL: 60 PERIODS**

### **COURSE OUTCOMES:**

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

- Execute typical data definitions, data control and data manipulation commands
- Familiarize with Nested and Join Queries for extracting combinatorial data
- Implement simple applications that use Views

- Develop PL/SQL procedures, functions and packages
- Develop applications using Front-end & Back-end Tools and also to handle report generation.

### TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Data base Systems", Sixth Edition, Pearson Education, 2015.

### WEBSITE REFERENCES:

- <https://www.w3schools.com/sql/default.asp>
- [https://www.tutorialspoint.com/dbms/er\\_diagram\\_representation.html](https://www.tutorialspoint.com/dbms/er_diagram_representation.html)
- [https://www.tutorialspoint.com/python/python\\_database\\_access.html](https://www.tutorialspoint.com/python/python_database_access.html)
- <https://sqlzoo.net>

### CO-PO MAPPING:

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

|                |                                                  |          |          |          |          |
|----------------|--------------------------------------------------|----------|----------|----------|----------|
| <b>JGE2442</b> | <b>ADVANCED IT INFRASTRUCTURE<br/>LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                  | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES:**

- Equip students with a strong foundation in network design, implementation, and troubleshooting.
- Develop skills in managing servers and data storage in enterprise environments.
- Provide comprehensive knowledge and skills to secure IT infrastructure.
- Train students in deploying and managing virtualized environments and automating IT tasks.
- Prepare students for designing, implementing, and managing cloud infrastructure.

### **Module 1: Networking**

#### **Lab: Setting up a basic network, IP Address, VLAN and Routing Configurations**

- Introduction to OSI and TCP/IP models, IP addressing.
- Subnetting and IP configuration exercises.
- Introduction to VLANs and Routing Protocols (OSPF, BGP).
- Network Performance tools and introduction to QoS.
- Fundamentals of SDN and network troubleshooting.

### **Module 2: Server and Storage**

#### **Lab: Hands-on installation of server operating systems, Server configuration exercises Including Setting up Storages.**

- Server architectures and installation of server OS (Windows and Linux).
- Configuration and management of Windows and Linux servers.
- Introduction to Data Storage Technologies (DAS, NAS, SAN).
- Understanding RAID levels and implementation.
- Exploring advanced storage solutions (Storage virtualization and flash storage).

### **Module 3: Security**

#### **Lab: Configuring Firewalls, Penetration Techniques and Tools, Security Audit and Compliance Checks**

- Basics of encryption, firewalls, and VPNs.
- Setting up and managing IDS/IPS.
- Ethical hacking basics and security auditing.
- Advanced security practices and compliance.
- Incident response and introduction to digital forensics.

### **Module 4: Virtualization & Automation**

#### **Lab: Creating Virtual Machines, Managing Containers, Ansible Playbook and CICD Pipelines Using Jenkin.**

- Introduction to virtualization technologies and setting up VMs.
- Containerization with Docker and Kubernetes basics.
- Managing containers.

- Introduction to automation with Ansible and PowerShell.
- Implementing CI/CD pipelines and Infrastructure as Code.

### **Module 5: Cloud Computing**

#### **Labs: AWS or Azure Cloud – Services Deployment, AI and Machine Learnings on Cloud**

- Cloud service models and initial setup in AWS, Azure, or Google Cloud.
- Cloud architecture and scalable systems design.
- Multi-cloud and hybrid cloud strategies.
- Serverless computing and cloud-native technologies.
- AI and machine learning integration in cloud environments.



## eSEMESTER V

| S. NO.       | COURSE CODE | COURSE TITLE                         | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|--------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JMA2501     | Optimization Techniques              | T         | BS       | 4               | 2         | 2        | 0         | 3         |
| 2            | JAL2501     | Machine Learning                     | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JAL2521     | Time Series Analysis and Forecasting | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 4            | JCS2501     | Computer Networks                    | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 5            | -           | Professional Elective 2              | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 6            | -           | Open Elective 2                      | T         | OE       | 3               | 3         | 0        | 0         | 3         |
| 7            | JPT2042     | Technical Skills and Aptitude        | P         | EEC      | 2               | 0         | 0        | 2         | *         |
| 8            | JAL2511     | Machine Learning Laboratory          | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 9            | JGE2542     | MERN Stack Development Laboratory    | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                      |           |          | <b>31</b>       | <b>17</b> | <b>2</b> | <b>12</b> | <b>23</b> |

**\*Only internal assessment**

## SEMESTER V

|                |                                |          |          |          |          |
|----------------|--------------------------------|----------|----------|----------|----------|
| <b>JMA2501</b> | <b>OPTIMIZATION TECHNIQUES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                | <b>2</b> | <b>2</b> | <b>0</b> | <b>3</b> |

### COURSE OBJECTIVES:

- To enable students understand linear programming problems.
- To impart knowledge of duality in linear programming problems and build concepts in transportation and assignment problems.
- To outline various methods for solving non-linear programming problems.
- To introduce problem solving using dynamic programming and game theory.
- To familiarize students in Markovian and Non Markovian queue models

### **UNIT-I      LINEAR PROGRAMMING      9+3**

Formulation – Types of Solutions of an LPP – Graphical solution – Simplex method – Big M method – Two phase method.

### **UNIT-II      ADVANCED LINEAR PROGRAMMING      9+3**

Duality in linear programming problems – Dual Simplex method – Transportation and Assignment problems.

### **UNIT-III      NON-LINEAR PROGRAMMING      9+3**

Lagrangian method – Kuhn-Tucker conditions – Wolfe's method – Beale's method.

### **UNIT-IV      DYNAMIC PROGRAMMING AND GAME THEORY      9+3**

Bellman's principle of optimality – Forward and Backward recursion – Capital budgeting problem – Reliability improvement problem – Cargo loading problem.

Game Theory – Two person Zero sum games – Saddle point – Dominance Rule – Method of matrices – Graphical solution.

### **UNIT-V      QUEUEING MODELS      9+3**

Markovian queues (without proof) – Single and multiple server, Infinite and finite queueing models – Little's formula.

Non-Markovian queues – M/G/1 queue – Pollaczek Khinchine formula (without proof) – M/D/1 model.

**TOTAL: 60 PERIODS**

### COURSE OUTCOMES:

**At the end of the course, students will be able**

- Solve linear programming problems through simplex and other methods.
- Demonstrate efficient use of duality in linear programming problems and solve transportation and assignment problems.
- Solve non-linear programming problems through standard methods.
- Conceptualize dynamic programming and game theory and use it in real-time problems.
- Apply Little's formula for finding standard parameters of Markovian and Non Markovian queue problems.

**TEXT BOOKS:**

1. Paneerselvam R., "Operations Research", Prentice Hall of India, Fourth Print, 2016.
2. Hamdy A Taha "Introduction to Operations Research", Prentice Hall India, 10<sup>th</sup> Edition, 2019.
3. Gross D., and Harris C.M., "Fundamentals of Queueing Theory", Wiley Student 4<sup>th</sup> Edition, 2014.

**REFERENCES:**

1. G. Srinivasan., "Operations Research – Principles and Applications", 2<sup>nd</sup> Edition, PHI, 2010.
2. Bernard. W. Taylor., "Introduction to Management Science", Pearson Publications, 12<sup>th</sup> Edition, 2016.

**WEB REFERENCES:**

- <https://nptel.ac.in/courses/111104027/>
- <https://nptel.ac.in/courses/110105082/>
- <https://nptel.ac.in/courses/111105100/>
- <https://nptel.ac.in/courses/110101133/>
- <https://nptel.ac.in/courses/111103159/>

**CO-PO MAPPING**

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

|                |                         |          |          |          |          |
|----------------|-------------------------|----------|----------|----------|----------|
| <b>JAL2501</b> | <b>MACHINE LEARNING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                         | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To familiarize the basic concepts of machine learning.
- To enable building supervised learning models.
- To enable building unsupervised learning models.
- To inculcate knowledge on neural networks.
- To evaluate the machine learning algorithms.

## **UNIT I INTRODUCTION TO MACHINE LEARNING**

**9**

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik - Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

## **UNIT II SUPERVISED LEARNING**

**9**

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function - Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

## **UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**

**9**

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

## **UNIT IV NEURAL NETWORKS**

**9**

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks – Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

## **UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS**

**9**

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms –  $t$  test, McNemar's test, K-fold CV paired  $t$  test.

**TOTAL 45 PERIODS**

## COURSE OUTCOMES

On completion of the course, the students will be able to:

- Explain the basic concepts of machine learning.
- Implement supervised learning models.
- Implement unsupervised learning algorithms.
- Apply neural networks to make intelligent decisions.
- Evaluate and analyze machine learning algorithms.

## TEXT BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Second Edition, CRC Press, 2014.

## REFERENCES

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3<sup>rd</sup> Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
5. Sebastain Raschka, Vahid Mirjalili, "Python Machine Learning", Packt publishing 3<sup>rd</sup> Edition, 2019.

## WEBSITE REFERENCES

1. <https://mitsloan.mit.edu/ideas-made-to-matter/machine-learning-explained>
2. <https://www.simplilearn.com/tutorials/machine-learning-tutorial/supervised-and-unsupervised-learning>
3. <https://www.investopedia.com/terms/n/neuralnetwork.asp>
4. <https://towardsdatascience.com/a-quick-guide-to-managing-machine-learning-experiments-af84da6b060b>

## CO-PO MAPPING

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| C01 | 1   | 2   | 1   | 1   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 2    | 2    |
| C02 | 3   | 2   | 3   | 2   | 3   | -   | -   | -   | -   | -    | -    | 1    | 2    | 2    | 2    |
| C03 | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | 1   | -    | 1    | 2    | 2    | 2    | 2    |
| C04 | 3   | 3   | 3   | 2   | 3   | -   | -   | -   | 1   | -    | 1    | 2    | 2    | 2    | 2    |
| C05 | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | 3   | 3    | 1    | 1    | 2    | 2    | 2    |

|                |                                                 |          |          |          |          |
|----------------|-------------------------------------------------|----------|----------|----------|----------|
| <b>JAL2521</b> | <b>TIME SERIES ANALYSIS AND<br/>FORECASTING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                 | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

### **COURSE OBJECTIVES:**

- To understand the basic concepts of time series analysis.
- To familiarize the basic statistical methods to modeling, analyzing, and forecasting time series data.
- To learn the application of regression models for forecasting.
- To explore Autoregressive Integrated Moving Average (ARIMA) Models.
- To introduce multivariate time series and forecasting models.

### **UNIT I INTRODUCTION TO TIME SERIES AND FORECASTING 9**

Introduction to Time Series: Different types of data - Internal structures of time series - Models for time series analysis - Autocorrelation and Partial Autocorrelation – Introduction to forecasting: The nature and uses of forecasting – Examples of Time series - The Forecasting Process - Data for forecasting – Resources for forecasting.

### **UNIT II STATISTICS BACKGROUND FOR FORECASTING 9**

Graphical Displays - Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments - General Approach to Time Series Modelling and Forecasting - Evaluating and Monitoring Forecasting Model Performance.

### **UNIT III REGRESSION ANALYSIS AND FORECASTING 9**

Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression - Prediction of New Observations - Model Adequacy Checking - Variable Selection Methods in Regression - Generalized and Weighted Least Squares-Regression Models for General Time Series Data.

### **UNIT IV EXPONENTIAL SMOOTHING METHODS AND ARIMA MODELS 9**

First-order exponential smoothing - Modeling time series data - Linear models for stationary time series - Finite order moving average processes - Finite order autoregressive processes - Mixed autoregressive–moving average Processes – Non stationary processes - Time series model building - Forecasting ARIMA processes - Seasonal processes.

### **UNIT V MULTIVARIATE TIME SERIES MODELS AND FORECASTING METHODS 9**

Multivariate Time Series Models and Forecasting - Combining forecasts to improve prediction performance - Neural Networks and Forecasting - Spectral Analysis – Bayesian Methods in Forecasting.

## **LAB EXERCISES**

1. Plotting and Visualizing Time Series Data – Create line plots, seasonal plots, and perform time series decomposition on a real-world dataset (e.g., stock prices, temperature, or sales data).
2. Autocorrelation and Partial Autocorrelation Analysis – Compute and interpret ACF and PACF plots to identify patterns and determine suitable lag values.
3. First-Order Exponential Smoothing – Implement and apply single exponential smoothing to forecast short-term trends in time series data.
4. Linear Regression and Transformations for Time Series – Apply linear regression, logarithmic transformations, differencing, and moving averages to model and forecast time series data. Plot and compare predictions with actual values.
5. ARIMA Model for Forecasting – Identify appropriate ARIMA parameters, build the model, and generate forecasts for non-seasonal time series.
6. Seasonal ARIMA (SARIMA) Modeling – Build and evaluate SARIMA models for seasonal datasets (e.g., monthly or quarterly data), and assess forecast accuracy.
7. Multivariate Time Series Forecasting with VAR – Use Vector AutoRegression (VAR) to analyze relationships between multiple time series and make multivariate forecasts.
8. Comparison of Forecasting Methods – Implement and compare naïve, mean, and exponential smoothing forecasting techniques. Evaluate model performance using RMSE and MAE.

## **LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

**HARDWARE:** Stand-alone desktops 30 Nos. (or) Server supporting 30 terminals or more with internet connection

**SOFTWARE:** Python 3.8 or above with packages pandas, numpy, matplotlib, seaborn, statsmodels, scikit-learn, pmdarima, Jupyter Notebook / VS Code / Google Colab, MySQL

**TOTAL 60 PERIODS**

## **COURSE OUTCOMES:**

**On completion of the course, the students will be able to:**

- Analyze any time series data using various statistical approaches.
- Know basic concepts of univariate time series analysis; build appropriate econometric time series models
- Know basic concepts of multivariate time series analysis; build appropriate econometric time series models
- Distinguish the ARIMA modelling of stationary and non-stationary time series.
- Compare different forecasting methods for applications.

**TEXT BOOK(S):**

1. Douglas C. Montgomery, Cheryl L. Jen, "Introduction To Time Series Analysis and Forecasting", 2nd Edition, Wiley Series in Probability and Statistics (2015).
2. Dr. Avishek Pal, Dr. Pks Prakash - Master Time Series Data Processing, Visualization and Modeling Using Python (2017).

**REFERENCE BOOKS**

1. Soren Bisgaard Murat Kulahci - Time Series Analysis and Forecasting by Example, Technical University of Denmark, Copyright c2011 By John Wiley & Sons, Inc.
2. Peter J. Brockwell Richard A. Davis Introduction to Time Series and Forecasting Third Edition. (2016).
3. William W.S. - Multivariate Time Series Analysis and Applications Wei Department of Statistical Science Temple University, Philadelphia, PA, SA 2019 John Wiley & Sons Ltd 2019.

**WEBSITE REFERENCES**

1. <https://online.stat.psu.edu/stat510>
2. <https://otexts.com/fpp3/>
3. <https://towardsdatascience.com/tagged/time-series>
4. <https://www.itl.nist.gov/div898/handbook/>
5. <https://www.analyticsvidhya.com/blog/category/time-series/>
6. <https://www.coursera.org/learn/practical-time-series-analysis>

**CO-PO MAPPING:**

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



|                |                          |          |          |          |          |
|----------------|--------------------------|----------|----------|----------|----------|
| <b>JCS2501</b> | <b>COMPUTER NETWORKS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                          | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To learn the basic concepts of layered approach in Computer Networks and different transmission media of physical layer.
- To know functions of Data link layer and Media access layer.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of Transport layer.
- To familiarize the application layer services.

### **Prerequisite : Digital Principles and Computer Organization**

#### **UNIT-I INTRODUCTION AND PHYSICAL LAYER 9**

Building a network-Layered Network Protocol Architectures- Telecommunications and Cellular Networks overview- Design issues- OSI Model- TCP/IP protocol suite- Physical layer- Basics of communications- Transmission Media-Performance.

#### **UNIT-II DATA-LINK LAYER & MEDIA ACCESS 9**

Link layer Services - Framing - Error control - Flow control - Media access control (TDMA, FDMA, CSMA, CSMA/CD)- Ethernet IEEE 802.3 - Wireless LAN IEEE 802.11 -Bluetooth - Performance analysis: related protocols such as ICMP, NAT, ARP and RARP.

#### **UNIT-III NETWORK LAYER 9**

Network layer – Hierarchical network architecture-IPv4 and IPv6 addressing- Routing protocols: Distance-vector and Link-state approaches (RIP, OSPF, BGP) – Multicast Addressing– Multicast routing protocols (DVMRP, PIM).

#### **UNIT-IV TRANSPORT LAYER 9**

Overview of Transport layer-Reliable end- to- end transmission protocols- UDP, TCP- Connection management-Flow control- Retransmission-TCP Congestion control-Congestion avoidance(DEC bit, RED)-QoS.

#### **UNIT-V APPLICATION LAYER 9**

Socket Interface and Socket programming, Example protocols: DNS, SMTP, FTP, HTTP- Electronic Mail (POP3, IMAP, MIME)-HTTP-web services

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

#### **At the end of the course, students will be able**

- Evaluate the functions and performance of a network
- Comprehend the data flow and control between nodes in the network
- Analyze and design routing algorithms

[illegible]

|                |                                      |          |          |          |          |
|----------------|--------------------------------------|----------|----------|----------|----------|
| <b>JPT2042</b> | <b>TECHNICAL SKILLS AND APTITUDE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                      | <b>0</b> | <b>0</b> | <b>2</b> | <b>*</b> |

### **COURSE OBJECTIVES:**

- To make students analyze and solve problem in technical as well as aptitude. Enhance the Technical skills and basics of programming language.
- To make the students understand how to apply the practical knowledge with real time applications.
- To make the students think and draw a conclusion from different scenarios.
- To help the students understand OOPS and python programming concepts.
- To help the students understand concepts and problems in OOPS and python.

### **UNIT – 1: FUNDAMENTALS OF C++**

**6**

Introduction to C++ - Data Types and Operators - Control Structures - Functions in C++ - Arrays and Strings - Structures and Unions - File Handling.

### **UNIT – 2: OBJECT-ORIENTED PROGRAMMING (OOP) & ADVANCED C++**

**6**

Object-Oriented Programming (OOP) - Inheritance & Polymorphism - Operator Overloading - Templates and Exception Handling - Standard Template Library (STL) - Multi-threading & advanced topics.

### **UNIT- 3: PYTHON BASICS & FUNDAMENTALS**

**6**

Introduction to Python - Data Types & Variables - Operators & Expressions - Control Flow Statements - Functions & Modules - File Handling - Exception Handling.

### **UNIT- IV: QUANTITATIVE APTITUDE**

**6**

Time and work – Pipes and Cistern – Time and Distance – Problems on Trains – Boats and streams – Arithmetic and Geometric progression.

### **UNIT - V: LOGICAL REASONING**

**6**

Syllogism: Statement and Conclusion – Clocks - Inequalities – Non Verbal Reasoning – Logical Sequence, Inferred Meaning

**TOTAL: 30 PERIODS**

### **COURSE OUTCOMES:**

**At the end of the course, students will be able**

CO1: To enhance their knowledge in OOPS concepts

CO2: To enhance knowledge in PYTHON programming

CO3: To gain knowledge in Coding the concepts of python programming.

CO4: To solve the complex Arithmetic problems practically with real time application problems

CO5: To think logically in solving problems enhance their decision making for difficult situations.

**TEXT BOOKS:**

1. Dr.E. Balagurusamy ,”Programming in C++” complete reference 8th Edition.
2. “THE COMPLETE REFERENCE PYTHON”, Herbert schildt., McGraw Hill Education, 2011.
3. Python: The Complete Reference by Martin Brown and Martin C.Brown Published in 2014.
4. Python in a nutshell by Alex Martelli Revised in March 2013.
5. Dr. R.S Agrawal, “Quantitative Aptitude” and Non Verbal Reasoning published in 2000

**WEB REFERENCES:**

- <https://www.indiabix.com/aptitude/questions-and-answers/>
- <https://m4maths.com/placement-puzzles.php>
- [www.freshers world.com](http://www.freshersworld.com)
- [www.careerride.com](http://www.careerride.com)
- [www.youtube.com/watch/python](http://www.youtube.com/watch/python)
- [www.youtube.com/watch/concepts of python](http://www.youtube.com/watch/concepts%20of%20python)
- <https://stackoverflow.com/>
- <https://www.w3schools.com/>
- <https://www.geeksforgeeks.org/>

|                |                                    |          |          |          |          |
|----------------|------------------------------------|----------|----------|----------|----------|
| <b>JAL2511</b> | <b>MACHINE LEARNING LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                    | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES:**

- To enable the students make use of data sets in implementing the machine learning algorithms.
- To demonstrate implementation of the machine learning concepts and algorithms.

### **LIST OF EXERCISES**

1. Perform the following operations on matrices:
  - a. Matrix addition
  - b. Matrix subtraction
  - c. Matrix multiplication
  - d. Matrix inversion
  - e. Transpose of a Matrix
2. Perform the following basic operations on a matrix.
  - a. Find the minimum and maximum element of the matrix.
  - b. Find the minimum and maximum element of each row and column in the matrix.
  - c. Find trace and rank of the given matrix.
  - d. Find eigenvalues and eigenvectors of the given matrix.
3. Create a data frame with columns for at least 5 observations.
  - a. Retrieve a particular column from the DataFrame.
  - b. Summarize the data frame and observe the statistics of the DataFrame created.
  - c. Observe the mean and standard deviation of the data frame and print the values.
4. Programs to implement prediction algorithms.
  - a. Implement the Linear Regression for a sample training data set stored as a .CSV file. Compute Mean Square Error by considering few test data sets.
  - b. Implement the Non-linear Regression for a sample training data set stored as a .CSV file. Compute Mean Square Error by considering few test data sets.
  - c. Evaluate the performance of Linear Regression and Non-linear Regression based prediction models for heart disease diagnosis.
5. Programs to implement classification algorithms.
  - a. Implement the Logistic Regression for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier.
  - b. Implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy with a few test data sets.
  - c. Implement Support Vector Machine algorithm to classify the iris data set. Print both correct and wrong predictions.
  - d. Evaluate the performance of the above classifier models for heart disease diagnosis.
6. Implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions
7. Implement k-Means algorithm to cluster a set of data stored in a .CSV file.
8. Develop an application using machine learning algorithms for one of the following:
  - a. Economic data analysis
  - b. Video indexing
  - c. Heart disease diagnosis
  - d. Human Resource Management
  - e. Lung disease diagnosis
  - f. Anomaly Detection & Recommendation

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

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

- Understand the basic operations of Linear Algebra in Machine Learning.
- Use various Supervised and Unsupervised Learning techniques.
- Apply Statistical approaches for multiple learning techniques.
- Construct models for classification.
- Evaluate the performance of different models.

**TEXTBOOKS:**

1. Vijayvargia, Abhishek, “Machine Learning with Python: An Approach to Applied Machine Learning”, BPB Publications, 1st edition, 2018.
2. Aurelien Geron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, Oreilly, March 2017.
3. Dr. M Gopal, “Applied Machine Learning”, 1st Edition, McGraw-Hill, 2018.

**WEBSITE REFERENCES:**

1. <https://machinelearningmastery.com/>
2. <https://towardsdatascience.com/>
3. <https://www.kaggle.com/datasets>
4. <https://www.nvidia.com/en-us/glossary/scikit-learn/>

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:****HARDWARE:**

Stand-alone desktops 30 Nos. (or) Server supporting 30 terminals or more

**SOFTWARE:**

Programming language: Python

Libraries: Numpy, Pandas, Matplotlib, seaborn, scikit-learn.

**CO-PO MAPPING**

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

|                |                                              |          |          |          |          |
|----------------|----------------------------------------------|----------|----------|----------|----------|
| <b>JGE2542</b> | <b>MERN STACK DEVELOPMENT<br/>LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                              | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES:**

- To understand the concepts of automata Full Stack Development.
- To learn and execute NoSQL Databases and MongoDB
- To learn and setup Express.js and Node.js.
- To learn React.js Development and to build Interactive User Interfaces.
- To learn about Integrating MERN Stack Applications

### **UNIT-I INTRODUCTION TO FULL STACK DEVELOPMENT 12**

Understanding Web Development Architecture - Overview of Frontend, Backend, and Database Systems - Introduction to MERN Stack.

### **UNIT-II MONGODB ESSENTIALS 12**

Introduction to NoSQL Databases - CRUD Operations with MongoDB - Designing Data Models and Schemas.

### **UNIT-III EXPRESS.JS AND NODE.JS FUNDAMENTALS 12**

Setting up Node.js Environment - Building RESTful APIs with Express.js - Middleware and Routing Concepts.

### **UNIT-IV REACT.JS DEVELOPMENT 12**

Introduction to React Framework - Components, Props, and State Management - Building Interactive User Interfaces.

### **UNIT-V INTEGRATING MERN STACK APPLICATIONS 12**

Connecting Frontend to Backend APIs - Managing Authentication and Authorisation (JWT) - Deployment and Hosting Best Practices.

### **COURSE OUTCOMES:**

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

- Complete understanding on Web Development Architecture.
- Implement CRUD Operations with MongoDB .
- Understand the steps in Setting up Node.js Environment and Building RESTful APIs with Express.js
- Understand and Building Interactive User Interfaces
- Integrating various MERN Stack Applications

## SEMESTER VI

| S. NO.       | COURSE CODE | COURSE TITLE                                 | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P         | C         |
|--------------|-------------|----------------------------------------------|-----------|----------|-----------------|-----------|----------|-----------|-----------|
| 1            | JAL2601     | Neural Networks and Deep Learning            | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 2            | JAL2602     | Natural Language Processing                  | T         | PC       | 3               | 3         | 0        | 0         | 3         |
| 3            | JAL2621     | Robotic Process Automation                   | I         | PC       | 5               | 3         | 0        | 2         | 4         |
| 4            | -           | Professional Elective 3                      | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 5            | -           | Professional Elective 4                      | T         | PE       | 3               | 3         | 0        | 0         | 3         |
| 6            | -           | Open Elective 3                              | T         | OE       | 3               | 3         | 0        | 0         | 3         |
| 7            | JPT2042     | Technical Skills and Aptitude                | P         | EEC      | 2               | 0         | 0        | 2         | 1         |
| 8            | JHS2541     | Professional Communication                   | P         | HS       | 2               | 0         | 0        | 2         | 1         |
| 9            | JAL2611     | Neural Networks and Deep Learning Laboratory | P         | PC       | 4               | 0         | 0        | 4         | 2         |
| 10           | JGE2642     | Computational Intelligence Laboratory        | P         | EEC      | 4               | 0         | 0        | 4         | 2         |
| <b>TOTAL</b> |             |                                              |           |          | <b>32</b>       | <b>18</b> | <b>0</b> | <b>14</b> | <b>25</b> |



## SEMESTER VI

|                |                                          |          |          |          |          |
|----------------|------------------------------------------|----------|----------|----------|----------|
| <b>JAL2601</b> | <b>NEURAL NETWORKS AND DEEP LEARNING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                          | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### COURSE OBJECTIVES:

- To introduce major deep neural network frameworks and issues in basic neural networks.
- To solve real world applications using Deep learning.
- To make students understand key concepts applied in building, training, and fine-tuning models for improved performance and generalization.
- To impart knowledge about the basics of Convolution Neural Networks and RNN.
- To equip students with a comprehensive understanding in advanced neural network architectures and deep learning techniques, Recursive Neural Networks and Transfer Learning.

### UNIT I NEURAL NETWORKS 9

Introduction of Artificial Neural Networks (ANN) - Functions in ANN – Activation function, Loss function - L1, L2 - Function approximation, classification / clustering problems – Applications.

### UNIT II LEARNING IN DEEP NETWORKS 9

Back propagation training, Learning the weights, Chain rule, Stochastic gradient descent, Sigmoid units and vanishing gradient, Rectified Linear Unit (ReLU) and its variants - Cross entropy for classification and activation, Batch learning.

### UNIT III IMPROVING DEEP NEURAL NETWORKS 9

Hyper-parameter tuning, Regularization - Dropouts, Minibatch gradient descent, Data Augmentation, Stratification, Generalization Gap – Under-fitting Vs Over-fitting - Optimization – Momentum, Learning rate schedules, AdaGrad, RMSProp and Adam optimization, Internal Co-variant and Batch Normalization, Initialization – weights, Bias.

### UNIT IV CONVOLUTION NEURAL NETWORKS AND RECURRENT NETWORKS 9

CNN Operations, Pooling, Basic architecture, Variants of the Basic Convolution Model – Advanced architectures: AlexNet, ResNet and others. Recurrent Neural Networks - Bidirectional RNNs, Encoder, Decoder, Sequence-to-Sequence Architectures, Deep Recurrent Networks, Auto encoders.

### UNIT V RECURSIVE NEURAL NETWORKS AND TRANSFER LEARNING 9

The Challenge of Long-Term Dependencies, Echo State Networks, Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory, Transfer Learning strategy, GAN and their variants, R-CNN, YOLO and SSD.

**TOTAL: 45 PERIODS**

## COURSE OUTCOMES:

On completion of the course, the students will be able to:

- Understand the basics of Artificial Neural Networks, activation and loss functions, and their use in solving classification and clustering problems.
- Explain backpropagation, gradient descent methods, and activation functions used in training deep neural networks.
- Apply techniques like regularization, optimization, and hyperparameter tuning to improve deep learning model performance.
- Describe the architecture of CNNs and RNNs and understand their use in image and sequence data processing.
- Understand long-term dependencies, gated RNNs, and advanced models for transfer learning and object detection.

## TEXT BOOK(S)

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville – “Deep Learning”, MIT Press, 2017.
2. Michael Nielsen – “Neural Networks and Deep Learning”, Determination Press.

## REFERENCE BOOKS

1. N D Lewis – “Deep Learning Step by Step with Python”, 2016.
2. Josh Patterson, Adam Gibson – “Deep Learning: A Practitioner's Approach”, O'Reilly Media, 2017.
3. Umberto Michelucci – “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks”, Apress, 2018.
4. Deep Learning with TensorFlow: Explore neural networks with Python, Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy, Packt Publisher, 2017.
5. Deep Learning with Keras, Antonio Gulli, Sujit Pal, Packt Publishers, 2017.
6. Deep Learning with Python", Francois Chollet, Manning Publications, 2017.

## WEBSITE REFERENCES

1. <https://www.techtarget.com/searchenterpriseai/definition/neural-network>
2. <https://www.kibin.com/essay-examples/the-objectives-of-deep-learning-KCApMkQ5>
3. <https://www.telusinternational.com/insights/ai-data/article/difference-between-cnn-and-rnn>
4. <https://datascience.stackexchange.com/questions/70333/recursive-transfer-learning>

## CO-PO MAPPING:

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

|                |                                        |          |          |          |          |
|----------------|----------------------------------------|----------|----------|----------|----------|
| <b>JAL2602</b> | <b>NATURAL LANGUAGE<br/>PROCESSING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To tag a given text with basic language processing features, design an innovative application using NLP components.
- Implement a rule based system to tackle morphology/syntax of a language.
- Design a tag set to be used for statistical processing keeping an application in mind.
- Design a Statistical technique for a new application.
- Compare and contrast use of different statistical approaches for different types of applications.

### **UNIT I BASICS OF LANGUAGE PROCESSING**

**9**

Regular Expressions - Finite State Automata - Morphology – Finite state transducers - Probabilistic models - N-grams models.

### **UNIT II SYNTAX ANALYSIS**

**9**

Word classes and Part-of-Speech - Context Free Grammars for English – parsing with context free grammar- Syntax-Features and Unification- Lexicalized and Probabilistic Parsing- Language and Complexity.

### **UNIT III SEMANTIC ANALYSIS**

**9**

Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus - Representing Linguistically Relevant Concepts - Syntax-Driven Semantic Analysis - Semantic Attachments - Syntax-Driven Analyzer - Robust Analysis - Lexemes and their Senses - Internal Structure - Word Sense Disambiguation - Information Retrieval.

### **UNIT IV – PRAGMATICS**

**9**

Discourse - Reference Resolution - Text Coherence - Discourse Structure - Dialog and Conversational Agents - Natural Language Generation - Machine Translation - Transfer Metaphor – Interlingual – Statistical Approaches.

### **UNIT V – INFORMATION EXTRACTION**

**9**

Entity recognition - relation detection - temporal expression analysis and template – filling - Question Answering and Summarization: Information retrieval - factoid question answering, single document summarization - generic multiple document summarization - query - focused summarization.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

**On completion of the course, the students should be able to:**

- Understand and apply foundational language processing techniques using regular expressions, automata, morphological analysis, and n-gram probabilistic models.
- Analyze the syntactic structure of language using context-free grammars, parsing techniques, and part-of-speech tagging.

- Represent and interpret the meaning of natural language using formal semantic models and techniques like word sense disambiguation.
- Examine language use in context through discourse analysis, reference resolution, and natural language generation techniques.
- Extract and summarize relevant information from text using entity recognition, relation detection, and question-answering systems.

### TEXT BOOKS

1. Daniel Jurafsky and James, H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing Computational Linguistics, and Speech Recognition”, 2nd Edition Prentice-Hall, 2009.
2. Tanveer Siddiqui and U. S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. James Allen, “Natural Language Understanding”, Benjamin / Cummings Publishing Co., 1995.

### REFERENCES

1. Gros, Jones and Webber, “Readings in Natural Language Processing”, Morgan Konfmann Publishers, 1986.
2. Popov, “Talking with computers in Natural Language”- Springer – Verlag – 1986.
3. E. Reiter and Robert Date, “Building Natural Language Generation Systems, Cambridge University Press, 2000.

### WEBSITE REFERENCES

1. <https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-natural-language-processing-nlp>
2. [https://www.tutorialspoint.com/natural\\_language\\_processing/natural\\_language\\_processing\\_syntactic\\_analysis.htm](https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_syntactic_analysis.htm)
3. <https://www.scaler.com/topics/nlp/elements-of-semantic-analysis/>
4. <https://www.codingninjas.com/codestudio/library/pragmatics-in-nlp>
5. <https://nanonets.com/blog/information-extraction/>

### CO-PO MAPPING:

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

|                |                                       |          |          |          |          |
|----------------|---------------------------------------|----------|----------|----------|----------|
| <b>JAL2621</b> | <b>ROBOTIC PROCESS<br/>AUTOMATION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                       | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

### **COURSE OBJECTIVES**

- To learn the basic concepts of Robotic Process Automation and understand the UiPath tools.
- To understand the control flow and automation system components.
- To develop familiarity on data manipulation techniques.
- To familiarize on advanced automation concepts and techniques.
- To provide foundational knowledge on deploying and maintaining Chatbots.

**PRE-REQUISITES:** Artificial Intelligence

### **UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9**

Introduction - History of RPA - Scope and techniques of automation Robotic Process Automation - Benefits of RPA - Components of RPA - Components of UiPath - UiPath stack - Downloading and installing UiPath Studio - Future of RPA.

### **UNIT II AUTOMATION SYSTEM COMPONENTS 9**

The user interface - Task recorder - Input and output methods - Sequencing the workflow - Control flow and its types - Sequence and Flowchart - Emptying trash in Gmail - Emptying recycle bin.

### **UNIT III DATA MANIPULATION AND AUTOMATION 9**

Variables and scope - Collections - Arguments - Data tables - File operation - Data manipulation with CSV/Excel - Exception Handling - Logging - Debugging techniques - Collecting crash dumps - Error reporting.

### **UNIT IV ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES 9**

Mouse and Keyboard activities - Basic recording - Desktop recording - Web recording - Citrix - Screen Scraping - OCR and types of OCR - Java plugin - Mail plugin - PDF plugin - Assistant bots - Monitoring system event triggers - Launching an assistant bot.

### **UNIT V DEPLOYING AND MAINTAINING THE BOT 9**

Launching an assistant bot on a keyboard event - Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.

### **LAB EXERCISES**

1. Download, Install and Activate Ui-Path Studio. Learn all the basics of RPA(Variables, arguments and Control flow etc.)
2. Algorithmic approach - control structures.
3. (i) Empty the trash folder in Gmail  
(ii) Empty the Recycle Bin
4. Create a simple calculator using a separate workflow and arguments.
5. (i) Build a data table (Static)  
(ii) Build a data table using data scraping (Dynamically)
6. File operations:  
(i) Read cell

- (ii) Write cell
- (iii) Read range
- (iv) Write range
- (v) Append range
- 7. (i) Screen scraping using OCR.
- (ii) Extracting data from pdf.
- 8. Development of a household automation system.
- 9. Design and launch a Chabot for any domain.

## **LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

**HARDWARE:** Stand-alone desktops 30 Nos with Intel i5/i7 processor and internet.

**SOFTWARE:** Python 3 or above, UiPath Studio, MySQL.

**TOTAL 60 PERIODS**

## **COURSE OUTCOMES**

**On completion of the course, the students will be able to:**

- Understand the RPA and the ability and use UiPath for basic automation tasks.
- Design and implement control flow structures and identify key automation components in an RPA workflow.
- Perform data manipulation and handle exceptions for troubleshooting within RPA tools.
- Model the workflow of different scrapping methodologies and Text and Data Tables Automation.
- Experiment with workflow in a manner to get the optimized output from a Bot.

## **TEXT BOOKS**

1. Alok Mani Tripathi - Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool – UiPath, Packt Publishing Ltd., 2018.
2. Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1<sup>st</sup> ed., Packt Publishing Ltd, 2018.

## **REFERENCES**

1. Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere, Nandan Mullakara, Arun Kumar Asokan, Packt Publishing Ltd., 2020.
2. Tom Tauli, “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems” 1<sup>st</sup> Edition, 2020.
3. Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant Paperback, 2018.
4. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots with the leading RPA tool – UiPath Kindle Edition.

## WEBSITE REFERENCES

1. <https://www.bterrell.com/robotic-process-automation-rpa/basics-rpa>
2. <https://www.soais.com/variables-and-arguments/>
3. <https://docs.uipath.com/studio/docs/control-flow-activities>
4. <https://www.uipath.com/learning/video-tutorials/data-manipulation-with-studio>
5. <https://www.uipath.com/rpa/robotic-process-automation>
6. <https://www.academy.uipath.com>

## CO-PO MAPPING:

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

|                |                                      |          |          |          |          |
|----------------|--------------------------------------|----------|----------|----------|----------|
| <b>JPT2042</b> | <b>TECHNICAL SKILLS AND APTITUDE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                      | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

### **COURSE OBJECTIVES:**

- To make students analyze and solve problem in technical as well as aptitude. Enhance the technical skills and basics of programming language
- To make the students understand how to apply the practical knowledge with real time applications.
- To make the students think and draw a conclusion from different scenarios.
- To help the students understand JAVA programming concepts
- To help the students understand concepts and develop new Applications in JAVA.

### **UNIT - 1: OBJECT-ORIENTED & ADVANCED PYTHON**

**6**

Object-Oriented Programming (OOP) - Advanced Data Structures & Algorithms - Decorators & Closures - Regular Expressions & String Manipulation - Multi-threading & Multiprocessing.

### **UNIT - 2: JAVA FUNDAMENTALS**

**6**

Introduction to Java - Data Types & Variables - Operators & Control Statements - Functions & Methods - Arrays & Strings.

### **UNIT-3: OBJECT-ORIENTED PROGRAMMING (OOP) & ADVANCED JAVA**

**6**

Object-Oriented Programming (OOP) Basics - Exception Handling - Inheritance & Polymorphism - Collections Framework - File Handling & Serialization.

### **UNIT- IV: QUANTITATIVE APTITUDE**

**6**

Permutation and combination: Letter, Number and circular permutation – Probability – Logarithm – Mensuration – Data sufficiency.

### **UNIT V: LOGICAL REASONING**

**6**

Calendar – Visual Reasoning – Mirror Image and Water Image – Picture analogy – Pattern completion – Data Interpretation – Selection decision table.

**TOTAL: 30 PERIODS**

### **COURSE OUTCOMES**

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

CO1: To enhance their knowledge in JAVA concepts.

CO2: To enhance knowledge in JAVA programming.

CO3: To gain knowledge in Coding the concepts of JAVA programming.

CO4: To solve the complex Arithmetic problems practically with real time application problems.

CO5: To think logically in solving problems enhance their decision making for difficult situations.



CO6: To enhance their employability skills and well prepared to face the MNCs Campus interviews.

**TEXTBOOKS:**

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary Cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.
3. Dr. R.S Agrawal, “Quantitative Aptitude” and Non Verbal Reasoning published in 2000.
4. S. Chand – A Modern Approach to Logical Reasoning Published in 2000.

**WEBSITES:**

- <https://www.indiabix.com/aptitude/questions-and-answers/>
- <https://m4maths.com/placement-puzzles.php>
- [www.freshers world.com](http://www.freshersworld.com)
- [www.careerride.com](http://www.careerride.com)
- [www.youtube.com/watch/python](http://www.youtube.com/watch/python)
- [www.youtube.com/watch/concepts of python](http://www.youtube.com/watch/concepts%20of%20python)
- <https://stackoverflow.com/>
- <https://www.w3schools.com/>
- <https://www.geeksforgeeks.org/>

|         |                               |   |   |   |   |
|---------|-------------------------------|---|---|---|---|
| JHS2541 | PROFESSIONAL<br>COMMUNICATION | L | T | P | C |
|         |                               | 0 | 0 | 2 | 1 |

### **COURSE OBJECTIVES:**

- To enhance reading comprehension and oral communication through self-reflection and peer feedback.
- To improve listening and speaking skills through exposure to diverse accents and group discussions.
- To develop professional writing and critical thinking through email composition and career-related tasks.
- To refine presentation skills and job application writing for effective workplace communication.
- To build interview confidence and problem-solving abilities through simulations and case analysis.

### **LIST OF EXPERIMENTS AND ACTIVITIES:**

#### **1. Reading: 21st Century Skills**

**Activity:** Read an article or infographic on 21st-century skills, summarize key skills and conduct a quiz.

#### **2. Speaking: Self-introduction**

**Activity:** Deliver a 2 to 3-minute self-introduction or elevator pitch and receive peer feedback on content and delivery.

#### **3. Listening: Accents in English**

**Activity:** Listen to English audio clips in British, American, and Indian accents and answer comprehension questions based on the content.

#### **4. Speaking: Group Discussion Dynamics**

**Activity:** Participate in a formal group discussion on a current or technical topic and observe turn-taking, assertiveness, and relevance.

#### **5. Writing: Working in Virtual Teams**

**Activity:** Conduct a virtual team-based design challenge, simulate and record a remote meeting, and complete a reflective report on communication effectiveness.

#### **6. Reading: Career Planning and Research Proposals**

**Activity:** Read and analyse a sample career plan or research proposal, extract key points and compare effectiveness.

#### **7. Speaking: Presentation Skills**

**Activity:** Prepare and deliver a 4 to 5-minute oral or PPT presentation on a technical or career-related topic and receive peer and instructor feedback.

#### **8. Writing: Job Application and Resume Writing**

**Activity:** Prepare a tailored cover letter and resume—both by mail and email—for a specific job description, emphasizing clarity, proper formatting, and relevance.

#### **9. Speaking: Interview Skills**

**Activity:** Participate in mock interviews in pairs or with instructors, practice behavioural questions and receive structured feedback.

## **10. Listening: Professional Challenges**

**Activity:** Listen to workplace case studies based on real-life experiences shared by friends or relatives, identify challenges and discuss possible solutions and ethical considerations.

**TOTAL: 30 PERIODS**

### **COURSE OUTCOMES:**

**At the end of the course, the students should be able:**

- To demonstrate improved reading and speaking through summarization and structured self-introductions
- To apply listening and discussion strategies by interpreting diverse accents and engaging in collaborative dialogues
- To produce professional emails and analyse career-related documents with clarity
- To deliver concise presentations and craft effective job applications tailoring to contexts
- To show interview readiness and ethical awareness by engaging in mock interviews and analysing workplace challenges.

### **TEXT BOOKS:**

1. Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice Oxford University Press, 2022.
2. Pushp Lata & Sanjay Kumar, Communication Skills, Oxford University Press, 2011.

### **REFERENCES:**

1. Alex, K, 2019, Soft Skills: Know Yourself and Know the World, New Delhi: S. Chand & Company Limited.
2. Butterfield, Jeff, 2015, Soft Skills for Everyone. New Delhi: Cengage Learning.
3. Dhawan, Erica. (2021). Digital Body Language: How to Build Trust and Connection, No Matter the Distance. New York: St. Martin's Press.
4. Gallo, Carmine. (2014). Talk Like TED: The 9 Public-Speaking Secrets of the World's Top Minds. New York: St. Martin's Press.
5. Interact English Lab Manual for Undergraduate Students, 2016, Hyderabad: Orient BlackSwan.
6. Mitra, Barun K, 2016, Personality Development and Soft Skills, New Delhi: Oxford University Press.
7. Raman, Meenakshi and Sangeeta Sharma, 2022, Professional Communication, Oxford: Oxford University Press.
8. Rizvi, Ashraf, M, 2018, Effective Technical Communication, Chennai: McGraw-Hill Education.

### **WEB LINKS:**

1. <https://www.coursera.org/learn/english-for-career-development>
2. <https://owl.purdue.edu/>
3. <https://www.mindtools.com/>
4. <https://www.toastmasters.org/resources/public-speaking-tips>
5. <https://www.ted.com/topics/communication>

6. <https://learnenglish.britishcouncil.org/skills>
7. <https://www.indeed.com/career-advice/resumes-cover-letters>
8. <https://www.skillsyouneed.com/>

**CO-PO MAPPING:**

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

|                |                                                         |          |          |          |          |
|----------------|---------------------------------------------------------|----------|----------|----------|----------|
| <b>JAL2611</b> | <b>NEURAL NETWORKS AND DEEP<br/>LEARNING LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                         | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES:**

- To enable the students apply CNN and its variants for image processing.
- To motivate towards developing applications using auto encoders and generative models.
- To impart practical exposure on learning models.

### **LIST OF EXERCISES**

1. Implement simple vector addition in Tensor Flow.
2. Implement a regression model in Keras.
3. Implement a perception in Tensor Flow / Keras environment.
4. Implement a feed forward network in Tensor Flow / Keras environment.
5. Implement an image classifier using CNN in Tensor Flow / Keras environment.
6. Improve the deep learning model by fine tuning hyper parameters.
7. Implement a transfer learning concept in image classification.
8. Perform sentimental analysis using RNN.
9. Implement an LSTM based auto encoding in Tensor Flow / Keras environment.
10. Implement object detection using CNN.
11. Design a recommendation system from sales data.
12. Design a simple deep learning application.

**TOTAL: 60 PERIODS**

### **COURSE OUTCOMES:**

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

- Apply CNN for image processing.
- Understand the basics of associative memory and unsupervised learning networks.
- Apply CNN and its variants for suitable applications.
- Analyse the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
- Apply auto encoders and generative models for suitable applications.

### **LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

**HARDWARE:** Stand-alone desktops 30 Nos. (or) Server supporting 30 terminals or more

**SOFTWARE: Tools:** Java, Python, Jupyter Notebook with packages TensorFlow, Keras,

### **REFERENCES:**

1. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), "Deep Learning Applications", Volume 3, Springer Publications 2022.
2. Stone, James. (2019), " Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning", Sebtel Press, United States, 2019.

### **WEBSITE REFERENCES:**

- [https://www.tutorialspoint.com/tensorflow/tensorflow\\_keras.htm](https://www.tutorialspoint.com/tensorflow/tensorflow_keras.htm)
- <https://www.tensorflow.org/guide/keras>
- <https://blog.keras.io/building-autoencoders-in-keras.html>

- <https://vitalflux.com/feed-forward-neural-network-python-example/>
- <https://data-flair.training/blogs/applications-of-deep-learning-with-python/>

#### CO-PO MAPPING:

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



**Tools:**

- Kali Linux, Metasploit, Burp Suite, Wireshark
- Unity3D, Vuforia/ARCore/ARKit, Oculus SDK or Cardboard SDK
- Jupyter, TensorFlow/Keras, Scikit-learn, Google Colab

**LAB REQUIREMENTS****Hardware:**

- PCs with minimum 8GB RAM, i5 processor, GPU recommended for DL module
- Android devices/AR-capable phones or VR headsets (Oculus Rift/Quest or Google Cardboard)

**Software:**

- VirtualBox/Vagrant (for cybersecurity labs)
- Unity3D (latest version)
- Python (3.10+), Anaconda
- TensorFlow, Scikit-learn, OpenCV
- GitHub Classroom or GitLab for submissions



## SEMESTER VII

| S. NO.       | COURSE CODE | COURSE TITLE                        | T / P / I | CATEGORY | CONTACT PERIODS | L         | T        | P        | C         |
|--------------|-------------|-------------------------------------|-----------|----------|-----------------|-----------|----------|----------|-----------|
| 1            | -           | Professional Elective 5             | T         | PE       | 3               | 3         | 0        | 0        | 3         |
| 2            | -           | Professional Elective 6             | T         | PE       | 3               | 3         | 0        | 0        | 3         |
| 3            | -           | Open Elective 4                     | T         | OE       | 3               | 3         | 0        | 0        | 3         |
| 4            | -           | Non-Credit Mandatory Course 2       | T         | NCM      | 3               | 3         | 0        | 0        | -         |
| 5            | JHS2741     | Universal Human Values              | I         | HS       | 3               | 1         | 0        | 2        | 2         |
| 6            | JGE2751     | Entrepreneurship Development        | I         | EEC      | 4               | 2         | 0        | 2        | 3         |
| 7            | JAL2741     | Comprehension and Technical Seminar | P         | EEC      | 2               | 0         | 0        | 2        | 1         |
| 8            | JAL2742     | Internship                          | P         | EEC      | -               | -         | -        | 4**      | 2         |
| <b>TOTAL</b> |             |                                     |           |          | <b>21</b>       | <b>15</b> | <b>0</b> | <b>4</b> | <b>17</b> |

**\*\*Internship of 1 month must be undertaken in industry through semester 4, 5 and 6 leading to 1 credit in semester 7**

## SEMESTER VII

|         |                        |   |   |   |   |
|---------|------------------------|---|---|---|---|
| JHS2741 | UNIVERSAL HUMAN VALUES | L | T | P | C |
|         |                        | 1 | 0 | 2 | 2 |

### COURSE OBJECTIVES:

**The objective of the course is four-fold:**

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

### MODULE I: INTRODUCTION

(3L, 6P)

Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration– Its content and process; ‘Natural acceptance’ and Experiential Validation- as the process for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

**Practical Session:** Include sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

### MODULE II: HARMONY IN THE HUMAN BEING

(3L, 6P)

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’, Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility, Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer), Understanding the characteristics and activities of ‘I’ and harmony in ‘I’, Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.

**Practical Session:** Include sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

### MODULE III: HARMONY IN THE FAMILY AND SOCIETY

(3L, 6P)

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention

and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

**Practical Session:** *Include sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives*

#### **MODULE IV: HARMONY IN THE NATURE AND EXISTENCE (3L, 6P)**

Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence.

**Practical Session:** *Include sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.*

#### **MODULE V: IMPLICATIONS OF HARMONY ON PROFESSIONAL ETHICS (3L, 6P)**

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Sum up.

**Practical Session:** *Include Exercises and Case Studies will be taken up in Sessions E.g. To discuss the conduct as an engineer or scientist etc.*

**TOTAL: 45 (15 Lectures + 30 Practicals) PERIODS**

#### **COURSE OUTCOMES:**

**At the end of the course, students will be able**

By the end of the course, the students will be able to:

- CO1: Become more aware of themselves, and their surroundings (family, society, nature);
- CO2: Have more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- CO3: Have better critical ability.
- CO4: Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- CO5: Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**REFERENCES:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 3rd revised edition, 2023.
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews.
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj – Pandit Sunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

**WEB REFERENCES:**

1. Class preparations: <https://fdp-si.aicte-india.org/UHV-II%20Class%20Note.php>
2. Lecture presentations: [https://fdp-si.aicte-india.org/UHV-II\\_Lectures\\_PPTs.php](https://fdp-si.aicte-india.org/UHV-II_Lectures_PPTs.php)
3. Practice and Tutorial Sessions: <https://fdp-si.aicte-india.org/UHV-II%20Practice%20Sessions.php>

**CO-PO MAPPING**

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

| JGE2751 | ENTREPRENEURSHIP DEVELOPMENT | L | T | P | C |
|---------|------------------------------|---|---|---|---|
|         |                              | 2 | 0 | 2 | 3 |

## COURSE OBJECTIVES

- Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship.
- Apply process of problem - opportunity identification and validation through human-centered approach to design thinking in building solutions as part of engineering projects.
- Analyse market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a minimum viable product.
- Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise.
- Prepare and present an investible pitch deck of their practice venture to attract stakeholders.

### MODULE – I: ENTREPRENEURIAL MINDSET

**4L, 8P**

Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economics – Developing and Understanding an Entrepreneurial Mindset – Importance of Technology Entrepreneurship – Benefits to the Society.

Case Analysis: Study cases of successful & failed engineering entrepreneurs - Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks.

### MODULE – II: OPPORTUNITIES

**4L, 8P**

Problems and Opportunities – Ideas and Opportunities – Identifying problems in society – Creation of opportunities – Exploring Market Types – Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities

Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation - Analyse feedback to refine the opportunity.

### MODULE – III: PROTOTYPING & ITERATION

**4L, 8P**

Prototyping – Importance in entrepreneurial process – Types of Prototypes - Different methods – Tools & Techniques.

Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.

### MODULE – IV: BUSINESS MODELS & PITCHING

**4L, 8P**

Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest assumptions to Business Models – Using Business Model Canvas as a Tool – Pitching Techniques: Importance of pitching - Types of pitches - crafting a compelling pitch – pitch presentation skills - using storytelling to gain investor/customer attention.

Activity Session: Develop a business model canvas for the prototype; present and receive feedback

from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback.

## **MODULE – V: ENTREPRENEURIAL ECOSYSTEM**

**4L, 8P**

Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models – equity, debt, crowdfunding, etc, Support from the government and corporates. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network.

Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or makerspace or interact with startup founders).

**TOTAL 60 PERIODS**

## **COURSE OUTCOMES**

**On completion of the course, the students will be able to:**

- CO1: Develop an Entrepreneurial Mind-set and Understand the Entrepreneurial Ecosystem Components and Funding types
- CO2: Comprehend the process of opportunity identification through design thinking, identify market potential and customers
- CO3: Generate and develop creative ideas through ideation techniques
- CO4: Create prototypes to materialize design concepts and conduct testing to gather feedback and refine prototypes to build a validated MVP
- CO5: Analyse and refine business models to ensure sustainability and profitability Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders.

## **REFERENCES**

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business
3. Blank, S. G., & Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch
4. Roy, R. (2017). Indian Entrepreneurship: Theory and Practice. New Delhi: Oxford University Press
5. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons

## **CO-PO MAPPING**

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

|                |                                            |          |          |          |          |
|----------------|--------------------------------------------|----------|----------|----------|----------|
| <b>JAL2741</b> | <b>COMPREHENSION AND TECHNICAL SEMINAR</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                            | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

#### **COURSE OBJECTIVES:**

- To revamp the knowledge gained in the semester and prepare the students to face interview both at the academic and the industrial sector.
- To encourage the students to study about the recent developments in the field.
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as power point presentation and demonstrative models.

#### **METHOD OF EVALUATION:**

##### **COMPREHENSION:**

One period is allotted for comprehension. During this period, a test with objective type questions from competitive exams is conducted in identified technical courses. The evaluation is purely internal. Average of all the test marks shall be calculated, a weightage of 50 marks is awarded to the comprehension component.

##### **TECHNICAL SEMINAR:**

Three periods are allotted for the technical seminar. During the seminar session each student is expected to prepare and present a technical topic for duration of 10 minutes.

Each student is expected to make presentation at least twice during the semester and the student is evaluated based on various parameters such as topic chosen, content delivery, communication skills and presentation. A faculty guide is allotted who shall guide and monitor the progress and attendance of all the students. Equal weightage is considered for the two seminar sessions for a total weightage of 50 marks.

The total mark awarded for the course shall be the sum of marks scored out of 50 each for the two components. Evaluation is purely internal.

#### **EVALUATION:**

| <b>Technical Seminar<br/>(50)</b> | <b>Comprehension<br/>(50)</b> | <b>Total<br/>(100)</b> | <b>Internal Marks<br/>(50)</b> | <b>Internal Marks<br/>(100)</b> |
|-----------------------------------|-------------------------------|------------------------|--------------------------------|---------------------------------|
|-----------------------------------|-------------------------------|------------------------|--------------------------------|---------------------------------|

**TOTAL: 30 PERIODS**

#### **COURSE OUTCOMES:**

**On completion of the course, the students will be able to:**

- Consolidate all the engineering concepts acquired in the course of study.
- Enrich their technical knowledge.
- Prepare and present technological developments.
- Communicate effectively the concepts related to the various topics.
- Face the interviews with confidence during the placement drives.

### CO-PO MAPPING:

[illegible]



|                |                   |          |          |          |          |
|----------------|-------------------|----------|----------|----------|----------|
| <b>JAL2742</b> | <b>INTERNSHIP</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                   | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

### **COURSE OBJECTIVES:**

To enable the students to

- Get connected with reputed industry/ laboratory/academia / research institute
- Get practical knowledge on Product Development / Software Design and Development / Testing / Analytics/ research/ startups/ professionalism / business processes and insights / domain knowledge/ Industry Practices/ and other related aspects and develop skills to solve related problems
- Develop technical, soft, team skills to cater to the needs of the industry / academia / businesses / research / organizations in the core aspects of Automation, Digitalization

The students may undergo Industrial training for a period as specified in the Curriculum during summer/winter vacation. In this case the training has to be undergone continuously for the entire period.

In lieu of Industrial training, students may undergo Internship at Industry / Research organizations / University (after due approval from Head of the Department) during the IV,V or VI semester breaks for a continuous period of 30 days to an Industry / Organization / University and two credit is allotted in the Seventh semester based on a viva voce examination. The Industrial / Practical Training, Summer Project, Internship, shall carry 100 marks and shall be evaluated through internal assessment only.

At the end of Industrial/Practical Training/Internship/ Summer Project, the student shall submit an attendance certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a viva-voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution consisting of the course coordinator and two experts from the Department. The certificates (issued by the organization) submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examinations.

### **EVALUATION :**

|                               |                          |                       |                          |
|-------------------------------|--------------------------|-----------------------|--------------------------|
| <b>Internship Report (40)</b> | <b>Presentation (30)</b> | <b>Viva Voce (30)</b> | <b>Total Marks (100)</b> |
|-------------------------------|--------------------------|-----------------------|--------------------------|

**Number of days : 30**

### **COURSE OUTCOMES:**

On completion of the course, the student will know about

CO1: Industry Practices, Processes, Techniques, technology, automation and other core aspects of software industry

CO2: Analyze, Design solutions to complex business problems

CO3: Build and deploy solutions for target platform

CO4: Preparation of Technical reports and presentation.

CO5: Ability to acknowledge the value of continuing education for oneself and to stay up with technology advancements.

**CO-PO MAPPING:**

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

## SEMESTER VIII

| S. NO.       | COURSE CODE | COURSE TITLE | T / P / I | CATEGORY | CONTACT PERIODS | L        | T        | P         | C         |
|--------------|-------------|--------------|-----------|----------|-----------------|----------|----------|-----------|-----------|
| 1            | JAL2831     | Project Work | P         | PC       | 20              | 0        | 0        | 20        | 10        |
| <b>TOTAL</b> |             |              |           |          | <b>20</b>       | <b>0</b> | <b>0</b> | <b>20</b> | <b>10</b> |

|                |                     |          |          |           |           |
|----------------|---------------------|----------|----------|-----------|-----------|
| <b>JAL2831</b> | <b>PROJECT WORK</b> | <b>L</b> | <b>T</b> | <b>P</b>  | <b>C</b>  |
|                |                     | <b>0</b> | <b>0</b> | <b>20</b> | <b>10</b> |

### COURSE OBJECTIVES:

- To develop the ability to solve a specific problem related to their subject expertise.
- To develop the methodology to solve the identified problem.
- To design, analyze and implement the chosen problem using the hardware components.
- To validate the simulation, hardware results with the theoretical results.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

### METHOD OF EVALUATION:

The students in a group of 3 to 4 work on a topic approved by the Head of the Department under the guidance of a faculty member, prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee is constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report, jointly by external and internal examiners.

## PROJECT EVALUATION

### ZEROTH REVIEW

|                                                     |                           |                     |               |                                 |           |            |                |
|-----------------------------------------------------|---------------------------|---------------------|---------------|---------------------------------|-----------|------------|----------------|
| Novelty/Problem Identification & Objectives<br>(20) | Literature survey<br>(30) | Methodology<br>(10) | Guide<br>(20) | PowerPoint Presentation<br>(20) |           |            | Total<br>(100) |
|                                                     |                           |                     |               | BL<br>(5)                       | CS<br>(5) | CP<br>(10) |                |

### FIRST REVIEW

|                                       |                                                    |                    |               |                                  |           |            |                |
|---------------------------------------|----------------------------------------------------|--------------------|---------------|----------------------------------|-----------|------------|----------------|
| Implementation of Methodology<br>(20) | Design/ Analysis/ Testing/ Algorithm/Model<br>(30) | Inferences<br>(10) | Guide<br>(20) | Power Point Presentation<br>(20) |           |            | Total<br>(100) |
|                                       |                                                    |                    |               | BL<br>(5)                        | CS<br>(5) | CP<br>(10) |                |

### SECOND REVIEW

|                  |                 |                                         |               |                                  |           |            |                |
|------------------|-----------------|-----------------------------------------|---------------|----------------------------------|-----------|------------|----------------|
| Progress<br>(20) | Results<br>(30) | Preparation of Conference Paper<br>(10) | Guide<br>(20) | Power Point Presentation<br>(20) |           |            | Total<br>(100) |
|                  |                 |                                         |               | BL<br>(5)                        | CS<br>(5) | CP<br>(10) |                |

### THIRD REVIEW

|                               |                     |                      |               |                                  |           |             |                |
|-------------------------------|---------------------|----------------------|---------------|----------------------------------|-----------|-------------|----------------|
| Results & Discussions<br>(30) | Conclusions<br>(20) | Publications<br>(10) | Guide<br>(20) | Power Point Presentation<br>(20) |           |             | Total<br>(100) |
|                               |                     |                      |               | BL<br>(5)                        | CS<br>(5) | CPS<br>(10) |                |

BL - Body Language, CS-Communication Skills, CP-Content of Presentation

**TOTAL: 300 PERIODS**

### END SEMESTER EXAM

|                                           |                              |          |                                  |          |                                 |                |
|-------------------------------------------|------------------------------|----------|----------------------------------|----------|---------------------------------|----------------|
| Project report<br>(External Only)<br>(30) | Result/Demonstration<br>(30) |          | Power Point Presentation<br>(20) |          | Viva<br>(External Only)<br>(20) | Total<br>(100) |
|                                           | Internal                     | External | Internal                         | External |                                 |                |

### COURSE OUTCOMES:

**On completion of the course, the students will be able to:**

- Apply the technical knowledge acquired for solving real world problems.
- Develop skills such as self-learning, critical thinking, problem solving, project management and finance.
- Apply modern tools and techniques for implementing the project.
- Work with team mates and collectively work towards the success of the project.
- Communicate effectively to present the outcomes of the project both in written and oral forms.

## **SYLLABUS FOR PROFESSIONAL ELECTIVES**

### **VERTICAL – I DATA SCIENCE**

| <b>S.No.</b> | <b>COURSE CODE</b> | <b>COURSE TITLE</b>                | <b>CATEGORY</b> | <b>CONTACT PERIODS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------|--------------------|------------------------------------|-----------------|------------------------|----------|----------|----------|----------|
| 1            | JCS2001            | Foundation of Data Science         | PE              | 3                      | 3        | 0        | 0        | 3        |
| 2            | JCS2002            | Big Data Analytics                 | PE              | 3                      | 3        | 0        | 0        | 3        |
| 3            | JCS2003            | Recommender Systems                | PE              | 3                      | 3        | 0        | 0        | 3        |
| 4            | JCS2004            | Web and Speech Analysis            | PE              | 3                      | 3        | 0        | 0        | 3        |
| 5            | JCS2005            | Social Media Analytics             | PE              | 3                      | 3        | 0        | 0        | 3        |
| 6            | JCS2006            | Data Exploration and Visualization | PE              | 3                      | 3        | 0        | 0        | 3        |
| 7            | JCS2007            | Health Care Analytics              | PE              | 3                      | 3        | 0        | 0        | 3        |
| 8            | JCS2008            | Image and Video Analytics          | PE              | 3                      | 3        | 0        | 0        | 3        |

|                |                                   |          |          |          |          |
|----------------|-----------------------------------|----------|----------|----------|----------|
| <b>JCS2001</b> | <b>FOUNDATION OF DATA SCIENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To understand the data science process and the different roles involved in data science.
- To understand the concept of correlation and regression.
- To develop skills in creating line plots, scatter plots, density plots, contour plots, and histograms.
- To learn data manipulation techniques using Numpy and Pandas.
- To learn techniques for visualizing segmentations and representing trees as sets of rules.

### **PREREQUISITE: Database Management System**

### **UNIT I INTRODUCTION TO DATA SCIENCE PROCESS AND R PROGRAMMING 9**

Data science process, roles, stages in data science project, working with data from files, working with relational databases, exploring data, managing data, cleaning and sampling for modeling Introduction to R: Introduction to various data types, numeric, character, date, data frame, array, matrix etc., reading and writing datasets, working with different file types .txt, .csv, outliers, R functions and loops.

### **UNIT II DESCRIBING RELATIONSHIPS 9**

Correlation – Scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – Regression – regression line – least squares regression line – Standard error of estimate – interpretation of  $r^2$  – multiple regression equations – regression towards the mean.

### **UNIT III DATA VISUALIZATIONS 9**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

### **UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING 9**

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 V PREDICTIVE MODELING 9**

Models, Induction, and Prediction - Visualizing Segmentations - Trees as Sets of Rules – Probability Estimation - Fitting a Model to Data: Classification via Mathematical Functions - Regression via Mathematical Functions - Class Probability Estimation and Logistic Regression.

**TOTAL: 45 PERIODS**

## COURSE OUTCOMES:

At the end of the course, students will be able to

- Gain a comprehensive understanding of the data science process, including its stages and key roles.
- Develop a clear understanding of correlation and regression and its significance in analyzing relationships between variables.
- Learn how to create line plots, scatter plots, density plots, contour plots, and histograms using appropriate tools and libraries.
- Learn how to perform data indexing, selection, and operations on datasets
- Understand how to visualize segmentations in data using appropriate techniques.

## TEXTBOOKS:

1. Foster Provost & Tom Fawcett, "Data Science for Business", Published by O'Reilly Media, 2013.
2. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2018
3. Robert Kabacoff, "R in Action: Data Analysis and Graphics with R", Manning Publications, 2015.

## REFERENCES:

1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016
2. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.
4. Tania Moulik, "Applied Data Visualization with R and ggplot2", September 2018.
5. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

## WEBSITE REFERENCES:

1. <https://rdrr.io/cran/IPSUR/f/inst/doc/IPSUR.pdf>
2. <https://www.oreilly.com/library/view/applied-data-visualization>
3. <https://www.oreilly.com/library/view/doing-data-science/9781449363871/>
4. <https://pg-p.ctme.caltech.edu/data-science-course-certification>
5. <https://www.mygreatlearning.com/srm-mtech-data-science>

## CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | -   | -   | -   | -   | -   | -   | 3   | -    | 2    | 3    |
| CO2 | 3   | 3   | 2   | 3   | -   | -   | -   | -   | 3   | -    | 2    | 3    |
| CO3 | 3   | -   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | 3    |
| CO4 | 3   | 3   | -   | 3   | -   | -   | -   | -   | 3   | -    | 2    | -    |
| CO5 | 3   | 2   | -   | -   | 2   | -   | -   | -   | 3   | -    | 3    | -    |
| AVG | 3   | 2.7 | 2.5 | 3   | 2   | -   | -   | -   | 3   | -    | 2.2  | 3    |

|                |                           |          |          |          |          |
|----------------|---------------------------|----------|----------|----------|----------|
| <b>JCS2002</b> | <b>BIG DATA ANALYTICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To know the fundamental concepts of bigdata and analytics.
- To explore tools and practices for working with bigdata.
- To analyse about association and recommendation rules.
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

## **UNIT-I INTRODUCTION TO BIGDATA**

**9**

Evolution of Bigdata-Best Practices for Bigdata Analytics-Bigdata characteristics– Validating the Promotion of the Value of Big Data - Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value-Understanding BigData Storage.

## **UNIT-II CLUSTERING AND CLASSIFICATION**

**9**

Overview of Clustering - K-means - Use Cases -Overview of the Method- Determining the Number of Clusters - Classification: Decision Trees - Overview - Algorithms-Evaluation-Naïve Bayes-Bayes' Theorem – Naïve Bayes Classifier.

## **UNIT-III ASSOCIATION AND RECOMMENDATION SYSTEM**

**9**

Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association & finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation.

## **UNIT-IV HADOOP FILE SYSTEM AND MAP-REDUCE**

**9**

Hadoop Architecture, Internals of Hadoop File Systems. Map-Reduce Programming: Developing Distributed Programs and issues, Developing Map-Reduce programs in Java, Reduce works on HDFS, Examples: Running simple word count Map-Reduce program on the cluster, analyze call data records.

## **UNIT-V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION**

**9**

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 – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs Review of Basic Data Analytic Methods using R.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES**

**Upon completion of the course, the students will be able to:**

- Work with big data tools and its analysis techniques.
- Analyzed at a by utilizing clustering and classification algorithms.



- Apply different mining algorithms and recommendation systems for large volumes of data.
- Perform on Hadoop and Map reduce programming.
- Explore NoSQL databases and management.

### TEXT BOOKS

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph ", Morgan Kaufmann/El sevier Publishers, 2013.
2. Sridhar Alla, "Big Data Analytics with Hadoop 3", Packt Publications, May 2018.
3. Adam Shook, Donald Miner, "Map Reduce Design Patterns", O'Reilly Media, Inc., 2012.
4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publisher, 2015.

### REFERENCES

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
2. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
3. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers "CRC Press, 2015.
4. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

### WEBSITE REFERENCES

1. <https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics>
2. <https://www.studocu.com/in/document/tata-institute-of-social-sciences/big-dataanalysis/unit-4-unit-4-notes/11465883>
3. <https://www.analyticssteps.com/blogs/what-big-data-analytics-definition-advantagesand-types>

### CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 3   | 3   | 3   | 1   | -   | 1   | -   | -    | -    | 1    |
| CO2 | 3   | 3   | 3   | 3   | 3   | -   | 1   | -   | -   | -    | -    | -    |
| CO3 | 3   | 3   | -   | 3   | 2   | -   | -   | -   | -   | -    | -    | -    |
| CO4 | 3   | 3   | -   | 3   | 3   | 1   | -   | -   | -   | -    | -    | -    |
| CO5 | 3   | -   | -   | 3   | 3   | -   | -   | -   | -   | -    | -    | -    |
| AVG | 3   | 3   | 3   | 3   | 2.8 | 1   | 1   | 1   | -   | -    | -    | 1    |

|                |                            |          |          |          |          |
|----------------|----------------------------|----------|----------|----------|----------|
| <b>JCS2003</b> | <b>RECOMMENDER SYSTEMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To understand the foundations of the recommender system.
- To learn the significance of content-based Recommender systems.
- To learn about collaborative filtering.
- To make students learn about attacks in recommender system.
- To learn on Evaluation techniques for Recommender systems.

### **PREREQUISITE: Database Management System**

#### **UNIT I INTRODUCTION TO RECOMMENDER SYSTEMS 9**

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 9**

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 9**

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 9**

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 9**

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand the basic concepts of recommender systems.
- Implement content-based recommender systems for various data sets.
- Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
- Design and implement attack-resistant simple recommender system.
- Learn about evaluation of recommender system.

**TEXTBOOKS:**

1. Charu C. Aggarwal, “Recommender Systems: The Textbook”, Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, “Recommender Systems: An Introduction”, Cambridge University Press, 2011.

**REFERENCES:**

1. Francesco Ricci, Lior Rokach, Bracha Shapira, “Recommender Systems Handbook”, Springer, 2011.
2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, “Mining of massive datasets”, 3<sup>rd</sup> edition, Cambridge University Press, 2020.

**WEBSITE REFERENCES:**

1. <https://www.coursera.org/specializations/recommender-systems>
2. <https://towardsdatascience.com/introduction-to-recommender-systems-c66cf15ada?gi=4c414b90d766>
3. <https://builtin.com/data-science/recommender-systems>

**CO-PO MAPPING:**

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

|                |                                |          |          |          |          |
|----------------|--------------------------------|----------|----------|----------|----------|
| <b>JCS2004</b> | <b>WEB AND SPEECH ANALYSIS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To recall the basics of www and textual data in web.
- To familiarize the processing of textual data such as tokenization, phrase recognition, document matching.
- To apply relevant models for contextual information retrieval.
- To understand speech recognition process.
- To explain the processes involved in information extraction using sentimental analysis.

### **PREREQUISITE: Python Programming, Web Technology**

#### **UNIT I INTRODUCTION TO WEB 9**

History of Web and Internet, Web analysis, Text analysis, Types of problems solved using text analysis, Document classification and information retrieval, Clustering and organizing documents, Information extraction, Prediction and Evaluation.

#### **UNIT II NLP BASED PREDICTION 9**

A Document Tokenization- Lemmatization, Vector Generation and Prediction, Boundary determination, Phrase Recognition, Parsing, Feature generation -Term-Document Matrices (TDMs) from the Corpus, Problem specific novel patterns finding CO2 C Keyword search, Nearest Neighbor Methods, Similarity measures, Web based document search, Document matching,

#### **UNIT III TEXT INFORMATION RETRIEVAL 9**

Introduction to Text information retrieval - A Clustering methods for similarity Cluster Label Mean-Patterns and Entities-Co-reference and relationship extraction- Template Filling - Applications: Information retrieval - commercial extraction systems-criminal justice- Intelligence.

#### **UNIT IV SPEECH RECOGNITION 9**

Introduction to speech recognition - Speech representation and feature extraction - Hidden Markov Models (HMM) for speech recognition - Building a basic speech recognition system-Introduction to speech sentiment analysis - Pre-processing speech data for sentiment analysis - Feature extraction for speech sentiment analysis - Developing a basic speech sentiment analysis system.

#### **UNIT V SPEECH SENTIMENT ANALYSIS 9**

Speech Analysis: Rhetorical Devices and Persuasive Strategies-Introduction to speech analysis and its relevance- Identifying and analyzing rhetorical devices- Understanding persuasive strategies – Speech Analysis: Delivery Techniques and Nonverbal Communication-Analyzing delivery styles – Assessing nonverbal communication cues and their impact-Case studies of speeches with effective delivery techniques.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- To discuss the basics of www and textual data in web.
- To analyse tokenization, phrase recognition, Document matching in text data processing.
- To build relevant models for contextual information retrieval.
- To explain speech recognition process.
- To discuss the basic concepts involved in information extraction using sentimental analysis.

**TEXTBOOKS:**

1. Gregory C. Burdea & Philippe Coiffet, John, "Virtual Reality Technology" 2nd Edition, Wiley & Sons, 2013
2. D. Yu and L. Deng, "Automatic Speech Recognition: A Deep Learning Approach", Springer, 2015.

**REFERENCES:**

1. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data", Springer, 2011.

**WEBSITE REFERENCES:**

1. <https://www.futurelearn.com/info/blog/virtual-reality-education-immersive-learning>
2. <https://immersionvr.co.uk/about-360vr/vr-for-education/>
3. <https://online.lsu.edu/newsroom/articles/how-virtual-reality-changing-education/>
4. <https://www.analyticssteps.com/blogs/5-applications-virtual-reality-education>

**CO-PO MAPPING:**

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

|                |                               |          |          |          |          |
|----------------|-------------------------------|----------|----------|----------|----------|
| <b>JCS2005</b> | <b>SOCIAL MEDIA ANALYTICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To understand basics of social media related simple applications.
- To understand data structures in social media analysis
- To recall the basics of social networks
- To explain the data extraction and mining of social networks
- To describe the processing and visualization in web analytics

### **PREREQUISITE: Computer Networks**

#### **UNIT I INTRODUCTION TO SOCIAL MEDIA ANALYTICS 9**

Introduction, History of Social media Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Types of social networks: friend, user-generated, content, affiliation, etc., Sociograms, Sociometric studies Basics of Social Media and Business Models, Basics of Web Search Engines and Digital Advertising., Application of SMA in different areas.

#### **UNIT II GRAPH AND MATRICES 9**

The Adjacency Matrix, Paths and Connectivity, Distance and Breadth-First Search, Network Datasets: An Overview Nodes, ties and influencers, Making connections: Link analysis. Paths Random graphs and network evolution. telephone call graph, Weighted Networks, Hypergraph.

#### **UNIT III NETWORK FUNDAMENTALS 9**

Network structures: equivalence, homophile, clustering, Snowball Sampling, Contact Tracing, And Random Walks, Ego-centered network, dominance hierarchies, Third-Party Records, affiliation network, Citation Networks, Peer-To- Peer Networks, Recommender Networks, Biological Networks, Genetic Regulatory Networks, Neural Networks.

#### **UNIT IV SOCIAL NETWORK AND MODELING 9**

Social contexts: Affiliation and identity. social capital, structural holes, Structural balance, Predictive modeling, Descriptive modeling: community/anomaly detection Diffusion in Networks : information cascades, social ,influence, market experiments, Geospatial social data mining, Privacy in a Networked World, Predicting the future with social media Facebook Analytics: Introduction, parameters, demographics. Analysing page audience. Reach and Engagement analysis. Google analytics.

#### **UNIT V PROCESSING, VISUALIZATION AND WEB ANALYTICS 9**

Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics, Collecting and analysing social media data; visualization and exploration, Social network and web data and methods, Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis, Trend: social influences on judgments, opinion spread, sentiment.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- Develop simple social media related simple applications.
- Explain the data structures in Social Networking.
- Discuss the basics of networking.
- Explain the data extraction and mining of social networks.
- Discuss the processing and visualization in web analytics.

**TEXTBOOKS:**

1. Peter Mika, “Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Application, Springer, 2010.
3. David Easley, Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning about a Highly Connected World, First Edition, Cambridge University Press, 2010.

**REFERENCES:**

1. Easley D. Kleinberg J., “Networks, Crowds, and Markets – Reasoning about a Highly Connected World, Cambridge University Press, 2010.
2. Jackson, Matthew O., “Social and Economic Networks”, Princeton University Press, 2008.
3. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.

**WEBSITE REFERENCES:**

1. <https://www.coursera.org/learn/social-media-analytics-introduction>
2. [https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fcarey.jhu.edu%2Fuploads%2Fdocuments%2F450.765\\_AY19-20.docx&wdOrigin=BROWSELINK](https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fcarey.jhu.edu%2Fuploads%2Fdocuments%2F450.765_AY19-20.docx&wdOrigin=BROWSELINK)
3. <https://blog.hootsuite.com/what-is-social-media-analytic/>

**CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2   | 1   | -   | 1   | -   | 1   | -   | 2   | -   | -    | 1    | 3    |
| CO2 | 3   | 1   | 3   | 2   | 1   | 1   | -   | -   | 2   | 3    | 2    | 3    |
| CO3 | 2   | 3   | 2   | 3   | 3   | 2   | 3   | -   | 2   | -    | 2    | 1    |
| CO4 | 1   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 2    | 3    | 2    |
| CO5 | 2   | 3   | 2   | 3   | 3   | 3   | 3   | 2   | -   | 2    | 3    | 1    |
| AVG | 2   | 2.2 | 2.5 | 2.4 | 2.5 | 2   | 3   | 2.3 | 2.3 | 2.3  | 2.2  | 2    |

|                |                                               |          |          |          |          |
|----------------|-----------------------------------------------|----------|----------|----------|----------|
| <b>JCS2006</b> | <b>DATA EXPLORATION AND<br/>VISUALIZATION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

### **PREREQUISITE: Probability and Statistics**

### **UNIT I EXPLORATORY DATA ANALYSIS 9**

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - 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**

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors– density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

### **UNIT III UNIVARIATE ANALYSIS 9**

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**

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**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand the fundamentals of exploratory data analysis.
- Implement the data visualization using Matplotlib.
- Perform univariate data exploration and analysis.



- Apply bivariate data exploration and analysis.
- Use Data exploration and visualization techniques for multivariate and time series data.

#### TEXTBOOKS:

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

#### REFERENCES:

1. Eric Pimpler, “Data Visualization and Exploration with R”, GeoSpatial Training service, 2017.
2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

#### WEBSITE REFERENCES:

1. Data Analysis and Visualization Foundations | Coursera
2. Data Analysis and Visualization Foundations Specialization (IBM) | Coursera
3. Data Analysis and Visualization – Shaheed Sukhdev College of Business Studies (du.ac.in)
4. Data Analysis and Visualization Syllabus - BCA Tribhuvan University(TU) - Bench Partner

#### CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9  | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | 3   | 1   | 3   | 3   | -   | -   | -   | -   | 2    | 3    | 3    | 3    |
| CO2 | 2   | 2   | 2   | 1   | 1   | -   | -   | -   | 3    | 2    | 3    | 1    |
| CO3 | 2   | 1   | 2   | 1   | 1   | -   | -   | -   | -    | 1    | 2    | 1    |
| CO4 | 2   | 2   | 2   | 1   | -   | -   | -   | -   | 1    | 2    | 1    | 3    |
| CO5 | 3   | 1   | 1   | 2   | 1   | -   | -   | -   | 3    | 2    | 1    | 2    |
| AVG | 2.4 | 1.4 | 2   | 1.6 | 1   | -   | -   | -   | 2.25 | 2    | 2    | 2    |

|                |                              |          |          |          |          |
|----------------|------------------------------|----------|----------|----------|----------|
| <b>JCS2007</b> | <b>HEALTH CARE ANALYTICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

#### **COURSE OBJECTIVES:**

- Understand the health data formats, health care policy and standards.
- Learn the significance and need of data analysis and data visualization.
- Understand the health data management frameworks.
- Learn the use of machine learning and deep learning algorithms in healthcare.
- Apply healthcare analytics for critical care applications.

#### **PREREQUISITE: Database Management System and Artificial Intelligence**

#### **UNIT I INTRODUCTION TO HEALTH CARE ANALYSIS 9**

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**

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**

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**

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**

Predicting Mortality for cardiology Practice –Smart Ambulance System using IoT Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- Use machine learning and deep learning algorithms for health data analysis.
- Apply the data management techniques for healthcare data.
- Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications.
- Design health data analytics for real time applications.
- Design emergency care system using health data analysis.

**TEXTBOOKS:**

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.

**REFERENCES:**

1. Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
2. Hui Jang, Eva K.Lee, "HealthCare Analysis: From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
3. Kulkarni, Siarry, Singh, Abraham, Zhang, Zomaya, Baki, "Big Data Analytics in HealthCare", Springer, 2020.

**WEBSITE REFERENCES:**

1. <https://cpe.ucdavis.edu/sites/g/files/dgvnsk4886/files/2021-04/Intro%20to%20Healthcare%20Analytics%20Syllabus%20-%20HCA200>
2. <https://www.coursera.org/learn/healthcare-analytics-essentials>
3. <https://www.coursera.org/lecture/hi-five-clinical/introduction-to-healthcare-dataanalytics-overview-NAv03>
4. <https://www.business.rutgers.edu/masters-healthcare-analyticsintelligence/curriculum>

**CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 3   | 1   | 3   | -   | -   | -   | 3   | 2    | 1    | 1    |
| CO2 | 3   | 1   | 1   | 3   | 1   | -   | -   | -   | 3   | 2    | 3    | 1    |
| CO3 | 2   | 1   | 2   | 1   | 2   | -   | -   | -   | 2   | 2    | 1    | 3    |
| CO4 | 2   | 2   | 3   | 3   | 1   | -   | -   | -   | 2   | 3    | 1    | 2    |
| CO5 | 1   | 2   | 2   | 1   | 1   | -   | -   | -   | 1   | 3    | 3    | 2    |
| AVG | 2.2 | 1.8 | 2.2 | 1.8 | 1.6 | -   | -   | -   | 2.2 | 2.4  | 1.8  | 1.8  |

|                |                                  |          |          |          |          |
|----------------|----------------------------------|----------|----------|----------|----------|
| <b>JCS2008</b> | <b>IMAGE AND VIDEO ANALYTICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                  | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

### **PREREQUISITE: Python Programming and Computer Graphics**

### **UNIT I INTRODUCTION 9**

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 9**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models – Local pre- processing in the frequency domain - Line detection by local pre- processing operators - Image restoration.

### **UNIT III OBJECT DETECTION USING MACHINE LEARNING 9**

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 9**

Face Recognition-Introduction - Applications of Face Recognition - Process of Face Recognition - Deep Face solution by Facebook - FaceNet for Face Recognition - Implementation using FaceNet - Gesture Recognition.

### **UNIT V VIDEO ANALYTICS 9**

Video Processing – use cases of video analytics - Vanishing Gradient and exploding gradient problem - RestNet architecture - RestNet and skip connections - Inception Network – GoogleNet architecture - Improvement in Inception v2 - Video analytics - RestNet and Inception v3.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Discuss the basics of image processing techniques for computer vision and video analysis.
- Analyse the techniques used for image pre-processing.
- Develop various object detection techniques.

- Make use of various face recognition mechanisms for multiple applications.
- Elaborate on deep learning-based video analytics.

#### TEXTBOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhav,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

#### REFERENCES:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited, 2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
3. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
4. E. R. Davies, (2012), “Computer & Machine Vision”, 4<sup>th</sup> Edition, Academic Press.

#### WEBSITE REFERENCES:

1. <https://www.analyticsvidhya.com/blog/2018/09/deep-learning-video-classification-python/>
2. <https://www.toptal.com/machine-learning/machine-learning-video-analysis>
3. <https://tryolabs.com/guides/video-analytics-guide>
4. <https://www.simplilearn.com/image-processing-article>
5. <https://www.v7labs.com/blog/video-recognition-overview-and-tutorial>

#### CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 1   | 2   | 2   | 2   | -   | -   | -   | 3   | 3    | 2    | 1    |
| CO2 | 1   | 2   | 3   | 3   | 3   | -   | -   | -   | 3   | 2    | 1    | 1    |
| CO3 | 1   | 2   | 2   | 2   | 3   | -   | -   | -   | 1   | 2    | 1    | 1    |
| CO4 | 1   | 2   | 3   | 2   | 3   | -   | -   | -   | 2   | 2    | 2    | 1    |
| CO5 | 3   | 2   | 1   | 3   | 2   | -   | -   | -   | 2   | 1    | 1    | 1    |
| AVG | 2   | 1.8 | 2.2 | 2.4 | 2.6 | -   | -   | -   | 2.2 | 2    | 1.4  | 1    |

**VERTICAL – II**  
**FULL STACK DEVELOPMENT**

| <b>S.No.</b> | <b>COURSE CODE</b> | <b>COURSE TITLE</b>             | <b>CATEGORY</b> | <b>CONTACT PERIODS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------|--------------------|---------------------------------|-----------------|------------------------|----------|----------|----------|----------|
| 1            | JIT2001            | App Development                 | PE              | 3                      | 3        | 0        | 0        | 3        |
| 2            | JIT2002            | Cloud Services Management       | PE              | 3                      | 3        | 0        | 0        | 3        |
| 3            | JIT2003            | UI and UX Design                | PE              | 3                      | 3        | 0        | 0        | 3        |
| 4            | JIT2004            | DevOps                          | PE              | 3                      | 3        | 0        | 0        | 3        |
| 5            | JIT2005            | Web Security and Privacy        | PE              | 3                      | 3        | 0        | 0        | 3        |
| 6            | JIT2006            | MERN Stack Development          | PE              | 3                      | 3        | 0        | 0        | 3        |
| 7            | JIT2007            | Software Testing and Automation | PE              | 3                      | 3        | 0        | 0        | 3        |
| 8            | JIT2008            | NoSQL Database                  | PE              | 3                      | 3        | 0        | 0        | 3        |

|                |                        |          |          |          |          |
|----------------|------------------------|----------|----------|----------|----------|
| <b>JIT2001</b> | <b>APP DEVELOPMENT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To learn development of web applications with basic GUI Components.
- To develop cross-platform applications with event handling.
- To develop applications with location and data storage capabilities.
- To develop web applications with database access.
- To learn non-functional characteristics of app frameworks.

## **UNIT I FUNDAMENTALS OF MOBILE AND WEB APPLICATION DEVELOPMENT 9**

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design.

## **UNIT II APP DEVELOPMENT USING JAVA 9**

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS.

## **UNIT III HYBRID APP DEVELOPMENT 9**

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks.

## **UNIT IV CROSS-PLATFORM APP DEVELOPMENT 9**

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross-platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native and Native Components.

## **UNIT-V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9**

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES**

**Upon completion of the course, the students will be able to:**

- Develop native applications with GUI Components.
- Develop hybrid applications with basic event handling.
- Implement cross-platform applications with location and data storage capabilities.
- Implement cross platform applications with basic GUI and event handling.
- Develop web applications with cloud database access.

## TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition, 2015.
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015.
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing.

## REFERENCES

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition, 2018.
2. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, International Edition, Matt Triff, Pawan Lingras, Rucha Lingras , CENGAGE Learning, 2016.
3. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

## WEBSITE REFERENCES

1. <https://www.geeksforgeeks.org/web-development/>
2. <https://www.startechup.com/blog/app-development-with-java/>
3. <https://www.turing.com/resources/hybrid-mobile-app-development>
4. <https://www.browserstack.com/guide/build-cross-platform-mobile-apps>
5. <https://www.geeksforgeeks.org/non-functional-requirements-in-software-engineering/>

## CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 1   | 1   | 1   | -   | -   | -   | 2   | 1    | 3    | 2    |
| CO2 | 3   | 1   | 2   | 3   | 2   | -   | -   | -   | 1   | 2    | 3    | 1    |
| CO3 | 1   | 1   | 3   | 1   | 3   | -   | -   | -   | 3   | 3    | 1    | 1    |
| CO4 | 1   | 1   | 1   | 2   | 3   | -   | -   | -   | 2   | 3    | 3    | 1    |
| CO5 | 1   | 3   | 3   | 2   | 2   | -   | -   | -   | 1   | 3    | 1    | 2    |
| AVG | 1.8 | 1.8 | 2   | 1.8 | 2.2 | -   | -   | -   | 1.8 | 2.4  | 2.2  | 1.4  |



|                |                                  |          |          |          |          |
|----------------|----------------------------------|----------|----------|----------|----------|
| <b>JIT2002</b> | <b>CLOUD SERVICES MANAGEMENT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                  | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To introduce Cloud Service Management terminology, definition & concepts.
- To compare and contrast cloud service management with traditional IT service management.
- To identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- To select appropriate structures for designing, deploying and running cloud-based services in a business environment.
- To illustrate the benefits and drive the adoption of cloud-based services to solve real world problems.

### **UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS**

**9**

Cloud Ecosystem - the Essential Characteristics - Basics of Information Technology Service Management and Cloud Service Management - Service Perspectives - Cloud Service Models - Cloud Service Deployment Models.

### **UNIT II CLOUD SERVICES STRATEGY**

**9**

Cloud Strategy Fundamentals - 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**

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 - Cloud Service Deployment and Migration - Cloud Marketplace - Cloud Service Operations Management.

### **UNIT IV CLOUD SERVICE ECONOMICS**

**9**

Pricing models for Cloud Services - Freemium - Pay Per Reservation - Pay per User - Subscription based Charging - Procurement of Cloud-based Services - Capex vs Opex Shift - Cloud service Charging - Cloud Cost Models.

### **UNIT V CLOUD SERVICE GOVERNANCE AND VALUE**

**9**

IT Governance Definition - Cloud Governance Definition - Cloud Governance Framework - Cloud Governance Structure - Cloud Governance Considerations - Cloud Service Model Risk Matrix - Understanding Value of Cloud Services - Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

**At the end of the course - students will be able to**

- Exhibit cloud-design skills to build and manage business solutions using cloud technologies.
- Possess strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.
- Solve the real world problems using Cloud services and technologies.
- Analyse the cloud service economics Cloud Cost Models.
- Explain the various cloud service governance and its values

#### **TEXTBOOKS:**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque - Enel Publications.
2. Cloud Computing: Concepts - Technology & Architecture by Thomas Erl - Ricardo Puttini - Zaigham Mohammad 2013.
3. Cloud Computing Design Patterns by Thomas Erl - Robert Cope - Amin Naserpour.

#### **REFERENCES:**

1. Economics of Cloud Computing by Praveen Ayyappa - LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya - Christian Vechhiola - S. Thamarai Selvi.

#### **WEBSITE REFERENCES:**

1. <https://cloud.google.com/learn/what-is-cloud-management>
2. <https://learn.microsoft.com/en-us/azure/cloud-adoption-framework/organize/cloud-strategy>
3. <https://www.geeksforgeeks.org/economics-of-cloud-computing/>
4. <https://www.isaca.org/resources/news-and-trends/newsletters/atisaca/2021/volume-3/building-cloud-governance-from-the-basics>

#### **CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 1   | 1   | 1   | -   | -   | -   | 2   | 1    | 3    | 2    |
| CO2 | 3   | 1   | 2   | 3   | 2   | -   | -   | -   | 1   | 2    | 3    | 1    |
| CO3 | 1   | 1   | 3   | 1   | 3   | -   | -   | -   | 3   | 3    | 1    | 1    |
| CO4 | 1   | 1   | 1   | 2   | 3   | -   | -   | -   | 2   | 3    | 3    | 1    |
| CO5 | 1   | 3   | 3   | 2   | 2   | -   | -   | -   | 1   | 3    | 1    | 2    |
| AVG | 1.8 | 1.8 | 2   | 1.8 | 2.2 | -   | -   | -   | 1.8 | 2.4  | 2.2  | 1.4  |

|                |                         |          |          |          |          |
|----------------|-------------------------|----------|----------|----------|----------|
| <b>JIT2003</b> | <b>UI AND UX DESIGN</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                         | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To provide a sound knowledge in UI & UX.
- To understand the need for UI and UX.
- To understand the various Research Methods used in Design.
- To explore the various Tools used in UI & UX.
- Creating a wireframe and prototype.

### **UNIT I FOUNDATIONS OF DESIGN**

**9**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

### **UNIT II FOUNDATIONS OF UI DESIGN**

**9**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

### **UNIT III FOUNDATIONS OF UX DESIGN**

**9**

Introduction to User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

### **UNIT IV WIREFRAMING, PROTOTYPING AND TESTING**

**9**

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing – Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Synthesizing Test Findings – Prototype Iteration.

### **UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE**

**9**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios – Flow Diagrams - Flow Mapping - Information Architecture.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

**On completion of the course, the students will be able to:**

- Build UI for user applications.
- Evaluate UX design of any product or application.
- Demonstrate UX Skills in product development.
- Implement sketching principles.

- Create wireframe and prototype.

## TEXT BOOKS

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022.
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021.

## REFERENCES

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd Edition, O’Reilly 2020.
2. Steve Schoger, Adam Wathan “Refactoring UI”, 2018.
3. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile”, Third Edition, 2015.

## WEBSITE REFERENCES

1. <https://www.nngroup.com/articles/>
2. <https://www.interaction-design.org/literature>.

## CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 1   | 1   | 3   | 1   | -   | -   | -   | 3   | 3    | 2    | 1    |
| CO2 | 2   | 3   | 1   | 3   | 2   | -   | -   | -   | 1   | 2    | 2    | 2    |
| CO3 | 1   | 3   | 3   | 2   | 2   | -   | -   | -   | 2   | 3    | 1    | 2    |
| CO4 | 1   | 2   | 3   | 3   | 1   | -   | -   | -   | 3   | 2    | 1    | 3    |
| CO5 | 1   | 2   | 3   | 2   | 1   | -   | -   | -   | 1   | 1    | 1    | 1    |
| AVG | 1.6 | 2.2 | 2.2 | 2.6 | 1.4 | -   | -   | -   | 2.2 | 2.2  | 1.4  | 1.8  |

|                |               |          |          |          |          |
|----------------|---------------|----------|----------|----------|----------|
| <b>JIT2004</b> | <b>DEVOPS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To introduce DevOps terminology, definition & concepts.
- To understand the different Version control tools.
- To understand the concepts of Continuous Integration and Testing.
- To understand Configuration management using Ansible.
- Illustrate the benefits and drive the adoption of cloud-based Dev ops tools to solve real world problems.

### **UNIT I INTRODUCTION TO DEVOPS**

**9**

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github.

### **UNIT II COMPILE AND BUILD USING MAVEN & GRADLE**

**9**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle.

### **UNIT III CONTINUOUS INTEGRATION USING JENKINS**

**9**

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

### **UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE**

**9**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in Ansible.

### **UNIT V BUILDING DEVOPS PIPELINES USING AZURE**

**9**

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines. yaml file.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Understand different actions performed through Version control tools like Git.
- Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
- Ability to Perform Automated Continuous Deployment

- Ability to do configuration management using Ansible
- Understand to leverage Cloud-based DevOps tools using Azure DevOps

## TEXT BOOKS

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014.

## REFERENCES

1. Hands-On Azure Devops: Cidc Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.

## WEBSITE REFERENCES

1. <https://www.jenkins.io/user-handbook.pdf>
2. <https://maven.apache.org/guides/getting-started/>

## CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 1   | 1   | 3   | 1   | -   | -   | -   | 3   | 3    | 2    | 1    |
| CO2 | 2   | 3   | 1   | 3   | 2   | -   | -   | -   | 1   | 2    | 2    | 2    |
| CO3 | 1   | 3   | 3   | 2   | 2   | -   | -   | -   | 2   | 3    | 1    | 2    |
| CO4 | 1   | 2   | 3   | 3   | 1   | -   | -   | -   | 3   | 2    | 1    | 3    |
| CO5 | 1   | 2   | 3   | 2   | 1   | -   | -   | -   | 1   | 1    | 1    | 1    |
| AVG | 1.6 | 2.2 | 2.2 | 2.6 | 1.4 | -   | -   | -   | 2.2 | 2.2  | 1.4  | 1.8  |

|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JIT2005</b> | <b>WEB SECURITY AND PRIVACY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To familiarize the fundamentals of web application security.
- To help students understand the wide aspects of secure development and deployment of web applications.
- To explain how to build secure APIs.
- To make understand the basics of vulnerability assessment and penetration testing.
- To explain about Hacking techniques and Tools.

## **UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 9**

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation.

## **UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 9**

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

## **UNIT III SECURE API DEVELOPMENT 9**

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys, OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

## **UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9**

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.

## **UNIT V HACKING TECHNIQUES AND TOOLS 9**

Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

**TOTAL : 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Discuss the basic concepts of web application security and the need for it

- Explain the process for secure development and deployment of web applications
- Make use of the skill to design and develop Secure Web Applications that use Secure APIs
- Analyze the problem and carry out vulnerability assessment and penetration testing
- Acquire the skill to think like a hacker and to use hackers tool sets for ethical hacking.

#### TEXT BOOKS:

1. Andrew Hoffman, “ Web Application Security: Exploitation and Counter measures for Modern Web Applications”, First Edition, O’Reilly Media, Inc. 2020,
2. Bryan Sullivan, Vincent Liu, “Web Application Security: A Beginners Guide”, The McGraw-Hill Companies, 2012.

#### REFERENCES:

1. Ravi Das and Greg Johnson, “ Testing and Securing Web Applications”, Taylor & Francis Group, LLC, 2021,
2. Prabath Siriwardena, “Advanced API Security”, Apress Media LLC, USA, 2020.
3. Malcom McDonald, “Web Security for Developers”, No Starch Press, Inc.2020,
4. Neil Madden, “API Security in Action”, Manning Publications Co., NY, USA, 2020.

#### WEBSITE REFERENCES:

1. <https://www.rapid7.com/fundamentals/web-application-security/>
2. [https://owasp.org/www-community/api\\_security\\_tools](https://owasp.org/www-community/api_security_tools)
3. <https://owasp.org/>
4. <https://www.veracode.com/security/vulnerability-assessment-and-penetration-testing>
5. <https://www.guru99.com/learn-everything-about-ethical-hacking-tools-and-skills.html>

#### CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO2 | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO3 | 3   | 2   | 3   | 3   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO4 | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO5 | 3   | 1   | 3   | 3   | 3   | 1   | -   | 2   | 2   | 2    | -    | 3    |
| AVG | 3   | 2.4 | 3   | 3   | 2.2 | 1   | -   | 2   | 2   | 2    | -    | 3    |



|                |                               |          |          |          |          |
|----------------|-------------------------------|----------|----------|----------|----------|
| <b>JIT2006</b> | <b>MERN STACK DEVELOPMENT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVE**

- To introduce the basics of JavaScript and importance of MERN stack.
- To identify the role of React in designing front-end components.
- To familiarize the design issues in the development of backend components using Node.js and Express.
- To illustrate the significance of using MongoDB as a database system.
- To make understand the advanced features of full stack development.

## **UNIT I JAVASCRIPT AND BASICS OF MERN STACK 9**

JavaScript Fundamentals -Modules -DOM tree -Node properties -browser events -Events - Forms, controls -Document and resource loading -Mutation observer -Event loop –MERN Components.

## **UNIT II REACT 9**

React ES6 -React Render HTML -React JSX -Components -React Classes –Composing Components -Passing Data -Dynamic Composition -React state -setting State -Async State Initialization - Event Handling -Stateless Components -Designing components-React Forms - React CSS -React SaaS.

## **UNIT III NODE.JS AND EXPRESS 9**

Node.js basics - Node Package Manager - Node.js web server - Node.js File system - Node Inspector -Node.js Event Emitter -Frameworks for Node.js -Express.js Web App -Node.js Data Access - Express REST APIs -REST -Resource Based -HTTP Methods as Actions -JSON-Express - Routing -Handler Function -Middleware -List and Create API -Automatic Server Restart –Error Handling - Template Engine.

## **UNIT IV MONGODB 9**

MongoDB -MongoDB Basics -Documents -Collections -Query Language -Installation- The mongo Shell -MongoDB Node.js Driver -Reading from MongoDB -Writing to MongoDB - CRUD operations -projections -Indexing -Aggregaton -Replication -Sharding -Creating backup – Deployment.

## **UNIT V ADVANCED FEATURES 9**

Modularization and Webpack -Routing with React Router -Forms -More Filters in the List API - UI Components -React-Bootstrap -Table and Panel -Forms -Alerts -Modals -Server Rendering - Basic Server Rendering -Handling State -MongoDB Aggregate -Pagination -Higher Order Components - Search Bar -Google Sign-In -Session Handling.

**TOTAL : 45 PERIODS**

## COURSE OUTCOME:

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

- Discuss the basic concepts of javascript and MERN.
- Build programs and applications using REACT.
- Create applications using Node.Js and Express.
- Apply MongoDB for database access.
- Explain what future enhancements are available for MERN stack.

## TEXT BOOKS

1. Vasan Subramanian , “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node” , APress Publisher, 2019.
2. Eric Bush, “Node.Js, Mongodb, React, React Native Full-Stack Fundamentals and Beyond”, Blue Sky Productions Incorporated, 2018.

## REFERENCES

1. Manu Sharma , “Full Stack Development with MongoDB”, BPB publication, 2022.
2. Greg Lim , “Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App” , Independent publication, 2021.
3. Chris Northwood , “The Full Stack Developer Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer”, APress Publisher 2018.

## WEBSITE REFERENCES

1. <https://www.tutorialsteacher.com/javascript>
2. <https://reactjs.org/>
3. <https://nodejs.org>
4. [www.Expressjs.com](http://www.Expressjs.com)
5. [www.mongodb.com](http://www.mongodb.com)

## CO-PO MAPPING:

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

|                |                                            |          |          |          |          |
|----------------|--------------------------------------------|----------|----------|----------|----------|
| <b>JIT2007</b> | <b>SOFTWARE TESTING AND<br/>AUTOMATION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To understand the basics of software testing.
- To learn how to do the testing and planning effectively.
- To build test cases and execute them.
- To focus on wide aspects of testing and understanding multiple facets of testing.
- To get an insight about test automation and the tools used for test automation.

## **UNIT I FOUNDATIONS OF SOFTWARE TESTING**

**9**

Why do we test Software?, Software Testing Life Cycle, V-model of Software Testing, Software Testing Principles, The Tester's Role in a Software Development Organization – Basic definitions- Failures, Errors and Faults, Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design.

## **UNIT II TEST CASE DESIGN STRATEGIES**

**9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Using White Box Approach to Test design– static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Paths – code complexity testing.

## **UNIT III LEVELS OF TESTING**

**9**

The need for Levels of Testing – Unit Test – Unit Test Planning – The Test Harness – Integration tests – Designing Integration Tests – Integration Test Planning, System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Usability and Accessibility testing.

## **UNIT IV TEST PLANNING & TEST AUTOMATION**

**9**

The Goal of Test Planning- High Level Expectations- Intergroup Responsibilities - Test Phases, Test Strategy- Software test automation – skills needed for automation – scope of automation – design and architecture for automation – challenges in automation.

## **UNIT V TEST AUTOMATION TOOLS**

**9**

Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

**TOTAL : 45 PERIODS**

## COURSE OUTCOMES

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

- Understand the basic concepts of software testing and the need for software testing.
- Design Test planning and different activities involved in test planning.
- Design effective test cases that can uncover critical defects in the application.
- Carry out advanced types of testing.
- Automate the software testing using Selenium and TestNG.

## TEXTBOOKS

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012.
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018.

## REFERENCES

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing.
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiario, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing.

## WEBSITE REFERENCES

1. <https://www.geeksforgeeks.org/software-testing-test-plan/>
2. [https://www.tutorialspoint.com/software\\_testing\\_dictionary/test\\_execution.htm](https://www.tutorialspoint.com/software_testing_dictionary/test_execution.htm)
3. <https://www.javatpoint.com/automation-testing-tool>
4. <https://www.guru99.com/automated-testing-tools.html>

## CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 2   | 1   | 2   | -   | -   | -   | 1   | 1    | 3    | 2    |
| CO2 | 2   | 3   | 1   | 1   | 1   | -   | -   | -   | 2   | 2    | 1    | 2    |
| CO3 | 2   | 2   | 1   | 3   | 1   | -   | -   | -   | 1   | 3    | 1    | 2    |
| CO4 | 2   | 1   | 3   | 2   | 1   | -   | -   | -   | 1   | 1    | 1    | 2    |
| CO5 | 2   | 2   | 1   | 3   | 1   | -   | -   | -   | 1   | 3    | 2    | 1    |
| AVG | 2.2 | 2.2 | 1.6 | 2   | 1.2 | -   | -   | -   | 1.2 | 2    | 1.6  | 1.8  |

|                |                       |          |          |          |          |
|----------------|-----------------------|----------|----------|----------|----------|
| <b>JIT2008</b> | <b>NOSQL DATABASE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                       | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To describe the basics of NoSQL
- To make understand the features of RDBMS and NoSQL
- To familiarize the concept of Document oriented NoSQL Database.
- To help the students understand how store and access data column oriented databases
- To explain the usage of key value pair NoSQL database.

## **UNIT I BASICS OF NOSQL**

**9**

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

## **UNIT II RDBMS AND NOSQL**

**9**

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding,

## **UNIT III DOCUMENT ORIENTED NOSQL DB**

**9**

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

## **UNIT IV COLUMN ORIENTED NOSQL DB**

**9**

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

## **UNIT V KEY VALUE PAIR NOSQL DB**

**9**

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Database. Features, Suitable Use Cases.

**TOTAL : 45 PERIODS**

**COURSE OUTCOME:**

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

- Discuss basic concepts of NoSQL databases.
- Explain the similarities and contrasts of RDBMS with different NoSQL databases.
- Explain the detailed architecture and performance tune of Document-oriented NoSQL databases.
- Analyze problems and use column oriented databases when necessary.
- Build efficient Key-Value Pair NoSQL databases.

**TEXT BOOKS**

1. Martin Fowler , Pramod Sadalage, “ NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications”, 1st Edition ,2014.
2. Dan Sullivan Sullivan , “NoSQL for Mere Mortals”, Wesley Publication ,1st Edition, 2015.

**REFERENCES**

1. Adam Fowler, “NoSQL For Dummies” , For dummies publication , 2015.
2. Shashank Tiwari , “Professional NoSQL”, Wiley publication 2011.
3. Gaurav Vaish, “Getting Started with NoSQL” , Packet publishing Limited, 2013.
4. Olivier Pivert , “NoSQL Data Models: Trends and Challenges” , Wiley publication, 2018
5. Dan McCreary, Ann Kelly, “Making Sense of NoSQL: A guide for managers and the rest of us”, Manning Publications, 2013.

**WEBSITE REFERENCES:**

1. <https://www.ibm.com/cloud/learn/nosql-databases>
2. <https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp>
3. <https://www.geeksforgeeks.org/introduction-to-nosql/>
4. <https://www.javatpoint.com/nosql-database>
5. <https://www.couchbase.com/resources/why-nosql/>

**CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 1   | 1   | 1   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO2 | 3   | 1   | 3   | 1   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO3 | 3   | 1   | 3   | 1   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO4 | 3   | 1   | 3   | 1   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| CO5 | 3   | 1   | 3   | 1   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |
| AVG | 3   | 1   | 2.6 | 1   | 2   | -   | -   | -   | 2   | 2    | -    | 3    |

**VERTICAL – III**  
**CLOUD COMPUTING**

| <b>S.No.</b> | <b>COURSE CODE</b> | <b>COURSE TITLE</b>            | <b>CATEGORY</b> | <b>CONTACT PERIODS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------|--------------------|--------------------------------|-----------------|------------------------|----------|----------|----------|----------|
| 1            | JAL2005            | Foundations of Cloud Computing | PE              | 3                      | 3        | 0        | 0        | 3        |
| 2            | JIT2002            | Cloud Services Management      | PE              | 3                      | 3        | 0        | 0        | 3        |
| 3            | JAL2006            | Agile Software Development     | PE              | 3                      | 3        | 0        | 0        | 3        |
| 4            | JAL2007            | Storage Technologies           | PE              | 3                      | 3        | 0        | 0        | 3        |
| 5            | JAL2008            | Distributed Computing          | PE              | 3                      | 3        | 0        | 0        | 3        |
| 6            | JAL2009            | IOT and Cloud Computing        | PE              | 3                      | 3        | 0        | 0        | 3        |
| 7            | JAD2007            | Cloud Computing Tools          | PE              | 3                      | 3        | 0        | 0        | 3        |
| 8            | JAL2010            | Security and Privacy in Cloud  | PE              | 3                      | 3        | 0        | 0        | 3        |

|                |                                           |          |          |          |          |
|----------------|-------------------------------------------|----------|----------|----------|----------|
| <b>JAL2005</b> | <b>FOUNDATIONS OF CLOUD<br/>COMPUTING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To provide insights into the software environments used in distributed and cloud computing.
- To enable understand the management of virtual clusters and the role of virtualization in data-center automation.
- To explain different cloud computing infrastructure virtualization and Docker.
- To enable understand programming paradigms applicable to the cloud and Framework.
- To analyze the security challenges in the real time environment.

### **UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9**

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.

### **UNIT II VIRTUALIZATION 9**

Virtual Machine Basics- Hypervisor- Implementation levels of Virtualization – Virtualization Structures /Tools and Mechanisms – Virtualization of CPU, Memory and I/O devices – Virtual Clusters and Resource Management – Virtualization for Data-Center Automation.

### **UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9**

Desktop Virtualization – Network Virtualization – Storage Virtualization –Server Virtualization – Operating system Virtualization – Containers vs. Virtual Machines – Introduction to Docker – Docker architecture – Process of Container Orchestration - Container Orchestration Tools.

### **UNIT IV CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENTS 9**

Cloud and Grid Platforms – Programming Support: Google App Engine –Amazon AWS – Microsoft Azure – Cloud Frameworks: Eucalyptus – Nimbus – Open Nebula – Sector – Sphere – OpenStack.

### **UNIT V CLOUD SECURITY 9**

Virtualization System - Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Analyse and evaluate software environments used in distributed and cloud computing.
- Utilize appropriate tools and mechanisms for virtualizing computational resources.
- Design robust data-centre architectures and interconnection networks.
- Apply programming paradigms to real-world cloud applications.
- Analyze the security challenges in the cloud environment.



**TEXTBOOKS:**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010.

**REFERENCES:**

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

**WEBSITE REFERENCES:**

1. <https://www.nist.gov/topics/cloud-computing>
2. <https://cloudsecurityalliance.org/>
3. <https://docs.microsoft.com/en-us/azure/cloud-concepts/>
4. <https://www.checkpoint.com/cyber-hub/cloud-security/what-is-cloud-security/>
5. <https://www.sciencedirect.com/topics/computer-science/cloud-deployment-model>

**CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 2   | 1   | 1   | 2   | -   | -   | -   | 2   | 3    | 1    | 3    |
| CO2 | 3   | 1   | 2   | 2   | 2   | -   | -   | -   | 1   | 2    | 1    | 3    |
| CO3 | 2   | 3   | 2   | 3   | 1   | -   | -   | -   | 3   | 1    | 1    | 3    |
| CO4 | 1   | 2   | 3   | 3   | 3   | -   | -   | -   | 3   | 3    | 1    | 2    |
| CO5 | 2   | 3   | 3   | 1   | 3   | -   | -   | -   | 2   | 2    | 1    | 2    |
| AVG | 2.2 | 2.2 | 2.2 | 2   | 2.2 | -   | -   | -   | 2.2 | 2.2  | 1    | 2.6  |

|                |                                  |          |          |          |          |
|----------------|----------------------------------|----------|----------|----------|----------|
| <b>JIT2002</b> | <b>CLOUD SERVICES MANAGEMENT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                  | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To introduce Cloud Service Management terminology, definition & concepts.
- To compare and contrast cloud service management with traditional IT service management.
- To identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- To select appropriate structures for designing, deploying and running cloud-based services in a business environment.
- To illustrate the benefits and drive the adoption of cloud-based services to solve real world problems.

### **UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9**

Cloud Ecosystem - the Essential Characteristics - Basics of Information Technology Service Management and Cloud Service Management - Service Perspectives - Cloud Service Models - Cloud Service Deployment Models.

### **UNIT II CLOUD SERVICES STRATEGY 9**

Cloud Strategy Fundamentals - 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**

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 - Cloud Service Deployment and Migration - Cloud Marketplace - Cloud Service Operations Management.

### **UNIT IV CLOUD SERVICE ECONOMICS 9**

Pricing models for Cloud Services - Freemium - Pay Per Reservation - Pay per User - Subscription based Charging - Procurement of Cloud-based Services - Capex vs Opex Shift - Cloud service Charging - Cloud Cost Models.

### **UNIT V CLOUD SERVICE GOVERNANCE AND VALUE 9**

IT Governance Definition - Cloud Governance Definition - Cloud Governance Framework - Cloud Governance Structure - Cloud Governance Considerations - Cloud Service Model Risk Matrix - Understanding Value of Cloud Services - Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

### **At the end of the course - students will be able to**

- Exhibit cloud-design skills to build and manage business solutions using cloud technologies.
- Possess strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.
- Solve the real world problems using Cloud services and technologies.
- Analyse the cloud service economics Cloud Cost Models
- Explain the various cloud service governance and its values.

## **TEXTBOOKS:**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque - Enel Publications.
2. Cloud Computing: Concepts - Technology & Architecture by Thomas Erl - Ricardo Puttini - Zaigham Mohammad 2013.
3. Cloud Computing Design Patterns by Thomas Erl - Robert Cope - Amin Naserpour.

## **REFERENCES:**

1. Economics of Cloud Computing by Praveen Ayyappa - LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya - Christian Vechhiola - S. Thamarai Selvi.

## **WEBSITE REFERENCES:**

1. <https://cloud.google.com/learn/what-is-cloud-management>
2. <https://learn.microsoft.com/en-us/azure/cloud-adoption-framework/organize/cloud-strategy>
3. <https://www.geeksforgeeks.org/economics-of-cloud-computing/>
4. <https://www.isaca.org/resources/news-and-trends/newsletters/atisaca> /2021/ volume-3/building-cloud-governance-from-the-basics

## **CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 1   | 1   | 1   | -   | -   | -   | 2   | 1    | 3    | 2    |
| CO2 | 3   | 1   | 2   | 3   | 2   | -   | -   | -   | 1   | 2    | 3    | 1    |
| CO3 | 1   | 1   | 3   | 1   | 3   | -   | -   | -   | 3   | 3    | 1    | 1    |
| CO4 | 1   | 1   | 1   | 2   | 3   | -   | -   | -   | 2   | 3    | 3    | 1    |
| CO5 | 1   | 3   | 3   | 2   | 2   | -   | -   | -   | 1   | 3    | 1    | 2    |
| AVG | 1.8 | 1.8 | 2   | 1.8 | 2.2 | -   | -   | -   | 1.8 | 2.4  | 2.2  | 1.4  |

|                |                                   |          |          |          |          |
|----------------|-----------------------------------|----------|----------|----------|----------|
| <b>JAL2006</b> | <b>AGILE SOFTWARE DEVELOPMENT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To understand the basics of agile process.
- To study the various phases in planning agile projects.
- To understand the basics of scum framework.
- To facilitate the understanding of the concepts in Extreme Programming.
- To inculcate the process in designing and developing agile software.

## **UNIT I FUNDAMENTALS OF AGILE PROCESS**

**9**

Introduction and background, Agile Manifesto and Principles, Stakeholders and Challenges, Overview of Agile Development Models: Scrum, Extreme Programming, Feature Driven Development, Crystal, Kanban, and Lean Software Development.

## **UNIT II AGILE PROJECTS**

**9**

Planning for Agile Teams: Scrum Teams, XP Teams, General Agile Teams, Team Distribution; Agile Project Lifecycles: Typical Agile Project Lifecycles, Phase Activities, Product Vision, Release Planning: Creating the Product Backlog, User Stories, Prioritizing and Estimating, Creating the Release Plan; Monitoring and Adapting: Managing Risks and Issues, Retrospectives.

## **UNIT III INTRODUCTION TO SCRUM**

**9**

Agile Scrum Framework, Scrum Artifacts, Meetings, Activities and Roles, Scrum Team Simulation, Scrum Planning Principles, Product and Release Planning, Sprinting: Planning, Execution, Review and Retrospective; User story definition and Characteristics, Acceptance tests and Verifying stories, Burn down chart, Daily scrum, Scrum Case Study.

## **UNIT IV INTRODUCTION TO EXTREME PROGRAMMING (XP)**

**9**

XP Lifecycle, The XP Team, XP Concepts: Refactoring, Technical Debt, Timeboxing, Stories, Velocity; Adopting XP: Pre-requisites, Challenges; Applying XP: Thinking- Pair Programming, Collaborating, Release, Planning, Development; XP Case Study.

## **UNIT V AGILE SOFTWARE DESIGN AND DEVELOPMENT**

**9**

Agile design practices, Role of design Principles, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control; Agility and Quality Assurance: Agile Interaction Design, Agile approach to Quality Assurance, Test Driven Development, Pair programming: Issues and Challenges.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

### **At the end of the course - students will be able to**

- Describe the fundamental principles and practices associated with each of the agile development methods.
- Compare agile software development model with traditional development models and identify the benefits and pitfalls.
- Use techniques and skills to establish and mentor Agile Teams for effective software development.
- Apply core values and principles of Agile Methods in software development.

## **TEXTBOOKS:**

1. Robert C. Martin, Agile Software Development- Principles, Patterns and Practices, Prentice Hall, 2013.
2. Kenneth S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison Wesley, 2012.
3. James Shore and Shane Warden, The Art of Agile Development, O'Reilly Media, 2007.
4. Craig Larman, - Agile and Iterative Development: A manager's Guide, Addison-Wesley, 2004.

## **REFERENCES:**

1. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson, 2001.
2. Cohn, Mike, Agile Estimating and Planning, Pearson Education, 2006.
3. Cohn, Mike, User Stories Applied: For Agile Software Development Addison Wisley, 2004.

## **WEBSITE REFERENCES:**

1. <https://www.wrike.com/project-management-guide/agile-methodology-basics/>
2. <https://www.simplilearn.com/tutorials/project-management-tutorial/what-is-agile-project-management>
3. <https://www.atlassian.com/agile/scrum>
4. <https://www.ntaskmanager.com/blog/extreme-programming-in-agile-a-practical-guide-for-project-managers-and-ntaskers/>
5. <https://www.visual-paradigm.com/scrum/what-is-agile-software-development/>

## **CO-PO MAPPING**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 1   | 2   | 1   | 3   | 3   | -   | -   | -   | 1   | 1    | 1    | 3    |
| CO2 | 2   | 2   | 2   | 3   | 3   | -   | -   | -   | 3   | 2    | 3    | 2    |
| CO3 | 2   | 1   | 3   | 2   | 2   | -   | -   | -   | 2   | 2    | 1    | 1    |
| CO4 | 3   | 1   | 2   | 3   | 2   | -   | -   | -   | 1   | 1    | 3    | 1    |
| CO5 | 1   | 3   | 2   | 1   | 2   | -   | -   | -   | 2   | 3    | 2    | 1    |
| AVG | 1.8 | 1.8 | 2   | 2.4 | 2.8 | -   | -   | -   | 1.8 | 1.8  | 2    | 1.6  |

|                |                             |          |          |          |          |
|----------------|-----------------------------|----------|----------|----------|----------|
| <b>JAL2007</b> | <b>STORAGE TECHNOLOGIES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                             | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To characterize the functionalities of logical and physical components of storage.
- To describe various storage networking technologies.
- To make students identify different storage virtualization technologies.
- To facilitate discussion on the different backup and recovery strategies.
- To make the students understand common storage management activities and solutions.

### **UNIT I STORAGE SYSTEMS**

**9**

Introduction to Information Storage: Digital data and its types - Information storage - Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics - Cloud services and cloud deployment models - Big data analytics - Social networking and mobile computing - Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center - Compute systems and compute virtualization and Software-defined data center.

### **UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID**

**9**

Components of an intelligent storage system - Components - addressing - and performance of hard disk drives and solid-state drives - RAID - Types of intelligent storage systems - Scale-up and scale-out storage Architecture.

### **UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION**

**9**

Block-Based Storage System - File-Based Storage System - Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking - FC SAN components and architecture - FC SAN topologies - link aggregation - and zoning - Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol - network components - and connectivity - Link aggregation - switch aggregation - and VLAN - FCIP protocol - connectivity - and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN - FCoE SAN connectivity - Converged Enhanced Ethernet - FCoE architecture.

### **UNIT IV BACKUP - ARCHIVE AND REPLICATION**

**9**

Introduction to Business Continuity - Backup architecture - Backup targets and methods - Data deduplication - Cloud-based and mobile device backup - Data archive - Uses of replication and its characteristics - Compute based - storage-based - and network-based replication - Data migration - Disaster Recovery as a Service (DRaaS).

## UNIT V SECURING STORAGE INFRASTRUCTURE

9

Information security goals - Storage security domains - Threats to a storage infrastructure - Security controls to protect a storage infrastructure - Governance - risk - and compliance - Storage infrastructure management functions - Storage infrastructure management processes.

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

**At the end of the course - students will be able to**

- Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
- Illustrate the usage of advanced intelligent storage systems and RAID.
- Interpret various storage networking architectures - SAN - including storage subsystems and Virtualization.
- Examine the different role in providing disaster recovery and remote replication technologies.
- Infer the security needs and security measures to be employed in information storage management.

### TEXTBOOKS:

1. EMC Corporation - Information Storage and Management - Wiley - India.
2. Jon Tate - Pall Beck - Hector Hugo Ibarra - Shanmuganathan Kumaravel and Libor Miklas - Introduction to Storage Area Networks - Ninth Edition - IBM - Redbooks - December 2017.

### REFERENCES:

1. Ulf Troppens - Rainer Erkens - Wolfgang Mueller-Friedt - Rainer Wolafka - Nils Haustein - Storage Networks Explained - Second Edition - Wiley - 2009.

### WEBSITE REFERENCES:

1. <https://www.delltechnologies.com/en-us/storage/index.htm>
2. <https://www.netapp.com/storage-systems/>
3. <https://www.redhat.com/en/topics/storage>
4. <https://www.veritas.com/>
5. <https://www.snia.org/education/what-is-storage-security>

### CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 1   | 2   | 1   | 3   | 5   | -   | -   | -   | 1   | 1    | 1    | 3    |
| CO2 | 3   | 1   | 2   | 3   | 3   | -   | -   | -   | 3   | 2    | 3    | 2    |
| CO3 | 1   | 1   | 3   | 2   | 2   | -   | -   | -   | 3   | 1    | 1    | 2    |
| CO4 | 3   | 2   | 1   | 2   | 2   | -   | -   | -   | 1   | 1    | 3    | 1    |
| CO5 | 1   | 3   | 2   | 1   | 2   | -   | -   | -   | 1   | 2    | 3    | 1    |
| AVG | 1.8 | 1.8 | 1.8 | 2.2 | 2.4 | -   | -   | -   | 1.8 | 1.4  | 2.2  | 1.8  |

|                |                              |          |          |          |          |
|----------------|------------------------------|----------|----------|----------|----------|
| <b>JAL2008</b> | <b>DISTRIBUTED COMPUTING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To introduce the computation and communication models of distributed systems.
- To illustrate the issues of synchronization and collection of information in distributed systems
- To describe distributed mutual exclusion and distributed deadlock detection techniques
- To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
- To explain the cloud computing models and the underlying concepts

### **UNIT I INTRODUCTION TO DISTRIBUTED COMPUTATIONS 9**

Introduction: Definition - Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

### **UNIT II LOGICAL TIME AND GLOBAL STATE 9**

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

### **UNIT III DISTRIBUTED MUTEX AND DEADLOCK 9**

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport’s algorithm – Ricart-Agrawala’s Algorithm — Token-Based Algorithms – Suzuki-Kasami’s Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

### **UNIT IV CONSENSUS AND RECOVERY 9**

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm - Algorithm for Asynchronous Checkpointing and Recovery

### **UNIT V CLOUD COMPUTING 9**

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services.



**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**At the end of the course - students will be able to**

- Explain the foundations of distributed systems.
- Solve synchronization and state consistency problems.
- Use resource sharing techniques in distributed systems.
- Apply working model of consensus and reliability of distributed systems.
- Explore the fundamentals of cloud computing.

**TEXTBOOKS:**

1. Kshemkalyani Ajay D - Mukesh Singhal - “Distributed Computing: Principles - Algorithms and Systems” - Cambridge Press - 2011.
2. Mukesh Singhal - Niranjana G Shivaratri - “Advanced Concepts in Operating systems” - McGraw Hill Publishers - 1994.

**REFERENCES:**

1. George Coulouris - Jean Dollimore - Time Kindberg - “Distributed Systems Concepts and Design” - Fifth Edition - Pearson Education - 2012.
2. Pradeep L Sinha - “Distributed Operating Systems: Concepts and Design” - Prentice Hall of India - 2007.
3. Tanenbaum A S - Van Steen M - “Distributed Systems: Principles and Paradigms” - Pearson Education - 2007.
4. Liu M L - “Distributed Computing: Principles and Applications” - Pearson Education - 2004.
5. Nancy A Lynch - “Distributed Algorithms” - Morgan Kaufman Publishers - 2003.
6. Arshdeep Bagga - Vijay Madisetti - “Cloud Computing: A Hands-On Approach” - Universities Press - 2014.

**WEBSITE REFERENCES:**

1. [https://www.tutorialspoint.com/distributed\\_systems/index.htm](https://www.tutorialspoint.com/distributed_systems/index.htm)
2. <https://www.cs.cmu.edu/~dga/15-440/F12/>
3. <https://www.distributed-systems.net/logical-time/>
4. <https://www.geeksforgeeks.org/distributed-mutual-exclusion/>
5. <http://www.digimat.in/nptel/courses/video/106106168/L11.html>

**CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2   | 2   | 3   | 3   | 1   | -   | -   | -   | 2   | 1    | 3    | 3    |
| CO2 | 1   | 3   | 2   | 1   | 2   | -   | -   | -   | 2   | 2    | 2    | 2    |
| CO3 | 2   | 2   | 1   | 3   | 3   | -   | -   | -   | 3   | 2    | 1    | 1    |
| CO4 | 1   | 2   | 2   | 3   | 1   | -   | -   | -   | 3   | 3    | 2    | 1    |
| CO5 | 3   | 3   | 1   | 2   | 3   | -   | -   | -   | 3   | 3    | 3    | 1    |
| AVG | 1.8 | 2.4 | 1.8 | 2.4 | 2   | -   | -   | -   | 2.6 | 2.2  | 2.2  | 1.6  |

|                |                                |          |          |          |          |
|----------------|--------------------------------|----------|----------|----------|----------|
| <b>JAL2009</b> | <b>IOT AND CLOUD COMPUTING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To familiarize the fundamentals of Internet of Things.
- To make students analyze and design a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To impart the concept of Internet of Things in the real world scenario.
- To teach the usage of physical and cloud storage.
- To demonstrate the application of cloud technologies to the world of IoT.

### **UNIT I FUNDAMENTALS OF IOT**

**9**

Introduction – Characteristics - Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoTvs M2M

### **UNIT II IOT DESIGN METHODOLOGY**

**9**

IoT systems management – IoT Design Methodology –Specifications Integration and Application Development.

### **UNIT III IOT PHYSICAL DEVICES AND ENDPOINTS**

**9**

What is an IoT Device - Basic building blocks of an IoT Device Exemplary Device: Raspberry Pi - About the Board Linux on Raspberry Pi Raspberry Pi Interfaces -Serial SPI - I2C - Programming Raspberry Pi with Python - Controlling LED with Raspberry Pi - Interfacing an LED and Switch with Raspberry Pi - Interfacing a Light Sensor (LDR) with Raspberry Pi Other IoT Devices - BeagleBone Black

### **UNIT IV IOT PHYSICAL SERVERS & CLOUD OFFERINGS**

**9**

Designing a RESTful Web API - Amazon Web Services for IoT-Amazon EC2 - Amazon AutoScaling - Amazon S3 - Amazon RDS - Amazon DynamoDB - Amazon Kinesis - Amazon SQS - Amazon EMR - SkyNetIoT Messaging Platform.

### **UNIT V CASE STUDIES- IOT DESIGN AND CLOUD INCORPORATION**

**9**

Introduction to IOT Design - Home Automation - Smart Lighting - Home Intrusion Detection - Cities - Smart Parking - Environment - Weather Monitoring System - Weather Reporting Bot - Air Pollution Monitoring - Forest Fire Detection - Agriculture - Smart Irrigation - Productivity Applications - IoT Printer.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

**At the end of the course - students will be able to**

- Interpret the essentials of IOT
- Design a portable IoT using Arduino/ equivalent boards using relevant protocols

- Describe the concept of web services to access/control IoT devices
- Identify physical devices required to deploy an IoT application and connect to the cloud for real time scenarios.

#### TEXTBOOKS:

1. Arshdeep Bahga - Vijay Madisetti - “Internet of Things – A hands-on approach” - Universities Press - 2015 - ISBN: 978-81-7371-954-7.
2. Rajkumar Buyya - James Broberg - Andrzej Goscinski: Cloud Computing Principles and Paradigms - Willey 2014.

#### REFERENCES:

1. Honbo Zhou - “The Internet of Things in the Cloud: A Middleware Perspective” - CRC Press 2013 - ISBN: 978-1-4398-9299-2.
2. Soyata - Tolga - “Enabling Real-Time Mobile Cloud Computing through Emerging Technologies” - IGI Global - 2015 - ISBN: 978-1-4666-8662-5.

#### WEBSITE REFERENCES

1. <https://www.iotforall.com/>
2. <https://iot-analytics.com/>
3. <https://www.allaboutcircuits.com/technical-articles/category/iot/>
4. <https://www.cisco.com/c/en/us/solutions/internet-of-things/overview.html>
5. <https://kainjan1.files.wordpress.com/2019/02/iot-physical-servers-cloud-offereings-iot-case-studies-2.pdf>

#### CO-PO MAPPING

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 2   | 2   | 2   | 5   | -   | -   | -   | 1   | 1    | 1    | 3    |
| CO2 | 3   | 3   | 2   | 3   | 3   | -   | -   | -   | 3   | 2    | 2    | 2    |
| CO3 | 2   | 1   | 3   | 2   | 2   | -   | -   | -   | 2   | 2    | 1    | 1    |
| CO4 | 3   | 3   | 2   | 2   | 3   | -   | -   | -   | 3   | 3    | 3    | 1    |
| CO5 | 1   | 3   | 2   | 1   | 2   | -   | -   | -   | 2   | 3    | 2    | 1    |
| AVG | 2.4 | 2.4 | 2.2 | 2   | 3   | -   | -   | -   | 2.2 | 2.2  | 1.8  | 1.6  |

|                |                              |          |          |          |          |
|----------------|------------------------------|----------|----------|----------|----------|
| <b>JAD2007</b> | <b>CLOUD COMPUTING TOOLS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment

**PREREQUISITES:** Computer Networks, Cloud computing

### **UNIT I CLOUD COMPUTING OVERVIEW 9**

Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

### **UNIT II CLOUD INSIGHTS 9**

Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability, simplicity, vendors, security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.

### **UNIT III CLOUD ARCHITECTURE- LAYERS AND MODELS 9**

Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service ( PaaS ), features of PaaS and benefits, Infrastructure as a Service ( IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

### **UNIT IV CLOUD SIMULATORS- CLOUDSIM AND GREENCLOUD 9**

Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud.

### **UNIT V INTRODUCTION TO VMWARE SIMULATOR 9**

Basics of VMWare, advantages of VMware virtualization, using VMware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand the design challenges in the cloud.

- Apply the concept of virtualization and its types.
- Experiment with virtualization of hardware resources and Docker.
- Develop and deploy services on the cloud and set up a cloud environment.
- Explain security challenges in the cloud environment.

#### TEXT BOOKS:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
4. James Turnbull, “The Docker Book”, O’Reilly Publishers, 2014

#### REFERENCES:

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
4. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

#### WEBSITE REFERENCES :

1. <https://www.cloudzero.com/blog/cloud-computing-tools>
2. [https://www.ibm.com/cloud/free?utm\\_content=SRCWW&p1=Search&p4=43700075080984306&p5=p&gclid=Cj0KCQjw7aqkBhDPArisAKGa0oJ5hTJCgy9JVMAbDqxKyh0KbBCmHrqfm80UeIe4YAojIAJiw2ifDKEaAvkZEALw\\_wcB&gclsrc=aw.ds](https://www.ibm.com/cloud/free?utm_content=SRCWW&p1=Search&p4=43700075080984306&p5=p&gclid=Cj0KCQjw7aqkBhDPArisAKGa0oJ5hTJCgy9JVMAbDqxKyh0KbBCmHrqfm80UeIe4YAojIAJiw2ifDKEaAvkZEALw_wcB&gclsrc=aw.ds)
3. <https://www.knowledgehut.com/blog/cloud-computing/cloud-computing-tools>
4. <https://mindmajix.com/cloud-computing-tools>
5. <https://www.analyticssteps.com/blogs/top-cloud-computing-tools-market>

#### CO-PO MAPPING

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9  | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | 3   | 1   | 3   | 3   | -   | -   | -   | -   | 2    | 3    | 3    | 3    |
| CO2 | 2   | 2   | 2   | 1   | 1   | -   | -   | -   | 3    | 2    | 3    | 1    |
| CO3 | 2   | 1   | 2   | 1   | 1   | -   | -   | -   | -    | 1    | 2    | 1    |
| CO4 | 2   | 2   | 2   | 1   | -   | -   | -   | -   | 1    | 2    | 1    | 3    |
| CO5 | 3   | 1   | 1   | 2   | 1   | -   | -   | -   | 3    | 2    | 1    | 2    |
| AVG | 2.4 | 1.4 | 2   | 1.6 | 1   | -   | -   | -   | 2.25 | 2    | 2    | 2    |

|                |                                      |          |          |          |          |
|----------------|--------------------------------------|----------|----------|----------|----------|
| <b>JAL2010</b> | <b>SECURITY AND PRIVACY IN CLOUD</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                      | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To Introduce Cloud Computing terminology - definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity - Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

### **UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9**

Overview of cloud security- Security Services - Confidentiality - Integrity - Authentication - Nonrepudiation - Access Control - Basic of cryptography - Conventional and public-key cryptography - hash functions - authentication - and digital signatures.

### **UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9**

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies – Data Protection strategies: Data retention - deletion and archiving procedures for tenant data - Encryption - Data Redaction - Tokenization - Obfuscation - PKI and Key.

### **UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 9**

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on - Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

### **UNIT IV CLOUD SECURITY DESIGN PATTERNS 9**

Introduction to Design Patterns - Cloud bursting - Geo-tagging - Secure Cloud Interfaces - Cloud Resource Access Control - Secure On-Premise Internet Access - Secure External Cloud.

### **UNIT V MONITORING - AUDITING AND MANAGEMENT 9**

Proactive activity monitoring - Incident Response - Monitoring for unauthorized access - malicious traffic - abuse of system privileges - Events and alerts - Auditing – Record generation - Reporting and Management - Tamper-proofing audit logs - Quality of Services - Secure Management - User management - Identity management - Security Information and Event Management.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

**At the end of the course - students will be able to**

- Understand the cloud concepts and fundamentals.
- Explain the security challenges in the cloud.
- Define cloud policy and Identity and Access Management.

- Understand various risks and audit and monitoring mechanisms in the cloud.
- Define the various architectural and design considerations for security in the cloud

#### TEXTBOOKS:

1. Raj Kumar Buyya - James Broberg – Andrzej Goscinski - “Cloud Computing:‡ - Wiley 2013.
2. Dave shackelford - “Virtualization Security‡ - SYBEX a wiley Brand 2013.
3. Mather - Kumaraswamy and Latif - “Cloud Security and Privacy‡ - OREILLY 2011.

#### REFERENCES:

1. Mark C. Chu-Carroll “Code in the Cloud,CRC Press - 2011.
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya - Christian Vechhiola - S. ThamaraiSelvi.

#### WEBSITE REFERENCES:

1. <https://stefanini.com/en/insights/news/7-fundamentals-of-cloud-security-tips-to-future-proof-your-busin>
2. <https://www.guidepointsecurity.com/education-center/cloud-security-architecture/>
3. <https://www.ibm.com/topics/identity-access-management>
4. <https://docs.microsoft.com/en-us/azure/architecture/patterns/>
5. <https://www.netguru.com/blog/cloud-audit-guide>

#### CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 3   | 3   | 1   | 2   | -   | -   | -   | 1   | 1    | 1    | 3    |
| CO2 | 1   | 3   | 2   | 3   | 1   | -   | -   | -   | 2   | 2    | 3    | 2    |
| CO3 | 3   | 2   | 2   | 3   | 2   | -   | -   | -   | 3   | 1    | 1    | 2    |
| CO4 | 2   | 1   | 2   | 3   | 3   | -   | -   | -   | 3   | 2    | 3    | 3    |
| CO5 | 1   | 3   | 3   | 1   | 1   | -   | -   | -   | 2   | 3    | 3    | 2    |
| AVG | 2   | 2.4 | 2.4 | 2.2 | 1.8 | -   | -   | -   | 2.2 | 1.8  | 2.2  | 2.4  |

**VERTICAL – IV**  
**CYBER SECURITY**

| <b>S. No.</b> | <b>COURSE CODE</b> | <b>COURSE TITLE</b>                       | <b>CATEGORY</b> | <b>CONTACT PERIODS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|---------------|--------------------|-------------------------------------------|-----------------|------------------------|----------|----------|----------|----------|
| 1             | JCB2001            | Cyber Security Fundamentals and Practices | PE              | 3                      | 3        | 0        | 0        | 3        |
| 2             | JCB2002            | Cryptography and Cryptanalysis            | PE              | 3                      | 3        | 0        | 0        | 3        |
| 3             | JCB2003            | Cyber Forensics                           | PE              | 3                      | 3        | 0        | 0        | 3        |
| 4             | JCB2004            | Intrusion Detection and Prevention        | PE              | 3                      | 3        | 0        | 0        | 3        |
| 5             | JCB2005            | Hardware Security                         | PE              | 3                      | 3        | 0        | 0        | 3        |
| 6             | JCB2006            | Cloud Security                            | PE              | 3                      | 3        | 0        | 0        | 3        |
| 7             | JCB2007            | Ethical Hacking                           | PE              | 3                      | 3        | 0        | 0        | 3        |
| 8             | JCB2008            | Web Application Security                  | PE              | 3                      | 3        | 0        | 0        | 3        |



|                |                                                      |          |          |          |          |
|----------------|------------------------------------------------------|----------|----------|----------|----------|
| <b>JCB2001</b> | <b>CYBER SECURITY FUNDAMENTALS<br/>AND PRACTICES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                      | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To understand the difference between threat, risk, attack, and vulnerability.
- To learn about security in operating system and networks.
- To analyze the different security available in databases.
- To understand the concept of privacy and security in emerging technologies.
- To learn about management and risks in different technologies.

## **PREREQUISITE: Computer Programming, Computer Networks**

### **UNIT-I INTRODUCTION TO CYBER SECURITY**

**9**

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authentication - Access Control and Cryptography –Web-User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks

### **UNIT-II SECURITY IN OPERATING SYSTEM & NETWORKS**

**9**

Security in Operating Systems - Security in the Design of Operating Systems – Root kit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

### **UNIT-III DEFENCES SECURITY COUNTER MEASURES**

**9**

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

### **UNIT-IV PRIVACY IN CYBERSPACE**

**9**

Privacy concepts –privacy principles and policies -authentication and privacy-Data mining – privacy on the Web - email Security - privacy Impacts of Emerging Technologies - where the Field Is Headed.

### **UNIT-V MANAGEMENT AND INCIDENTS**

**9**

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Classify various types of attacks and learn the tools to launch the attacks
- Apply various tools to perform information gathering
- Analyze intrusion techniques to detect intrusion

- Apply intrusion prevention techniques to prevent intrusion
- Explain the basics of cyber security, cybercrime and cyber law.

#### TEXT BOOKS:

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5<sup>th</sup> Edition, Pearson Education, 2015.
2. David Kim & Michael G. Solomon, “FOUNDATIONS” and Custom Edition 1 Jan 1, 2014.

#### REFERENCES:

1. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
2. MarttiLehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015.
3. Nelson Phillips and Enfinger Steuart, —Computer Forensics and Investigationsl, Cengage Learning, New Delhi, 2009.

#### WEB REFERENCES:

- [https://onlinecourses.nptel.ac.in/noc23\\_cs62/preview](https://onlinecourses.nptel.ac.in/noc23_cs62/preview)
- [https://onlinecourses.nptel.ac.in/noc23\\_cs44/preview](https://onlinecourses.nptel.ac.in/noc23_cs44/preview)
- <https://www.javatpoint.com/cyber-security-tutorial>
- <https://www.edureka.co/blog/cybersecurity-fundamentals-introduction-to-cybersecurity/>
- [https://cnitarot.github.io/courses/fc\\_Fall\\_2022/2550\\_intro\\_history\\_pub\\_cnr.pdf](https://cnitarot.github.io/courses/fc_Fall_2022/2550_intro_history_pub_cnr.pdf)

#### CO-PO MAPPING:

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

|                |                                       |          |          |          |          |
|----------------|---------------------------------------|----------|----------|----------|----------|
| <b>JCB2002</b> | <b>CRYPTOGRAPHY AND CRYPTANALYSIS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                       | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES**

- To study about the fundamentals of Cryptography
- To analyze Key Management techniques and importance of number Theory
- To understand the concept of Message Authentication Codes and Hash Functions
- To design a security solution for a given application
- To understand about cybercrimes and the different security practice.

### **PREREQUISITE: Fundamentals of Mathematics**

#### **UNIT-I INTRODUCTION TO CRYPTOGRAPHY**

**9**

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields-Symmetric Key Ciphers- SDES – Block Ciphers – DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

#### **UNIT-II ASYMMETRIC CRYPTOGRAPHY**

**9**

Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm-Asymmetric Key Ciphers - RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography.

#### **UNIT-III MESSAGE AUTHENTICATION AND HASH FUNCTION**

**9**

Authentication Requirements - Authentication Function- Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs- Secure Hash Algorithm - Whirlpool, HMAC, CMAC -Digital Signatures - Authentication Protocol - Digital Signature Standard- Authentication Applications- Kerberos -X.509 Authentication Service - Public-key infrastructure

#### **UNIT-IV FIREWALLS AND CRYPTANALYSIS**

**9**

Intruder – Intrusion detection system - Password Management - Virus and related threats - Countermeasures - Firewall design principles- Trusted systems - Practical implementation of cryptography and security.

#### **UNIT-V CYBER CRIMES AND SECURITY**

**9**

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand the fundamentals of networks security
- Demonstrate the different cryptographic operations of symmetric cryptographic algorithms
- Develop the different cryptographic operations of public key cryptography.
- Explain the various Authentication schemes to simulate different applications.
- Understand various cyber-crimes and cyber security.

#### TEXT BOOKS:

1. Forouzan Mukhopadhyay “Cryptography and Network Security” McGraw Hill, 2nd Edition
2. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
3. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber-crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

#### REFERENCES:

1. Behrouz A. Forouzan, DebdeepMukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

#### WEB REFERENCES:

1. <https://www.w3.org/TR/WebCryptoAPI/>
2. <https://ukdiss.com/examples/web-based-crypto-analysis-learning-application.php>
3. [https://developer.mozilla.org/en-US/docs/Web/API/Web\\_Crypto\\_API](https://developer.mozilla.org/en-US/docs/Web/API/Web_Crypto_API)
4. <https://www.garykessler.net/library/crypto.html>
5. <https://www.cryptomathic.com/news-events/blog/summary-of-cryptographic-algorithms-according-to-nist>

#### CO-PO MAPPING:

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

|                |                        |          |          |          |          |
|----------------|------------------------|----------|----------|----------|----------|
| <b>JCB2003</b> | <b>CYBER FORENSICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To understand the process of Digital Cyber Forensics.
- To be aware of the Cyber forensics Environments and standards.
- To study the data and evidence collection activities.
- To understand how to investigate digital evidence.
- To Explore advanced techniques in Cyber Forensics.

## **PREREQUISITE: Cryptography and Cryptanalysis**

### **UNIT-I DIGITAL FORENSICS PROCESS**

**9**

Computer forensic fundamentals - Applying forensic science to computers - Computer forensic services - Benefits of professional forensic methodology -Steps taken by computer forensic specialists, Forensic science, Digital forensics, Digital evidence, Digital forensics process – Identification, Collection, Examination, Analysis, Presentation Phases, Cyber Crime Law.

### **UNIT-II FORENSICS ENVIRONMENTS & STANDARDS**

**9**

Hardware and software environments – Storage devices - Operating system - File Systems – Metadata - Locating evidence in file systems - Password security – Encryption - Hidden files - Digital evidence.

### **UNIT-III DATA AND EVIDENCE COLLECTION**

**9**

Identification of Data: timekeeping - Forensic identification - Analysis of technical surveillance devices - Reconstructing past events - Useable file formats - Unusable file formats - Converting files - Investigating network intrusions - Cybercrime - Network forensics - Investigating logs - Network.

### **UNIT-IV INVESTIGATING DIGITAL EVIDENCE**

**9**

Applying forensic Science to computers – Preparation – Survey – Documentation – Preservation – examination – Reconstruction - Analyzing digital evidence - Locating digital evidence, Categorizing files - Eliminating superfluous files - Event analysis tool - Cloud analysis tool - Lead analysis tool - Volume shadow copy analysis tools.

### **UNIT-V ADVANCED CYBER FORENSICS**

**9**

Windows forensics evidence collection in linux - Network forensics packet capture using wire shark, t shark and tcp dump - Memory forensics virtual machine- Forensics use – Implementation -Virtual machines in forensic analysis- Cloud forensics analysis -Cloud storage - Data remnants.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Identify the need for cybercrime forensics.
- Examine the hardware, software components and standards responsible for seeking

evidence.

- Apply techniques for collecting data and evidences.
- Analyze the methods for investigating digital evidences
- Examine advanced techniques for Cyber Forensics.

#### TEXT BOOKS:

1. Richard Boddingtons, Practical Digital Forensics, PACKT publishing, First Edition, 2016.
2. Marjie T.Britz, Computer Forensics and Cyber Crime: An Introduction, Third Edition, Prentice Hall, 2013.

#### REFERENCES:

1. Richard E.Smith, “Internet Cryptography”, Third Edition, Pearson Education, 2008
2. Angus M.Marshall, “Digital forensics: Digital evidence in criminal investigation”, John – Wiley and Sons, 2008.
3. John R.Vacca, “Computer Forensic”s, Second Edition, Cengage Learning, 2005.
4. John R. Vacca, Charles River Media “Computer Forensics: Computer Crime Scene Investigation”, 2nd Edition, , 2005

#### WEB REFERENCES:

- <https://annamalaiuniversity.ac.in/studport/download/engg/it/resources/Cyber%20Forensics.pdf>
- <https://www.stannescet.ac.in/cms/staff/qbank/CSE/Notes/CS6004-CYBER%20FORENSICS-1800235714-CS6004%20UNIT%203.pdf>
- <https://www.geeksforgeeks.org/cyber-forensics/>
- <https://www.studocu.com/in/document/dr-babasaheb-ambedkar-marathwada-university/cyber-forensic/cyber-forensics-lecture-notes/34989994>
- <https://www.studocu.com/in/document/kannur-university/network-forensics/cyber-forensics-unit1/17233533>

#### CO-PO MAPPING:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 2   | -   | 1   | 3   | -   | 2   | 1   | 3   | -   | 3    | 1    | 3    |
| CO-2  | 1   | 1   | 1   | -   | 2   | -   | 2   | -   | 2   | -    | 2    | -    |
| CO-3  | -   | 2   | 1   | 1   | 3   | -   | 1   | 2   | 3   | 2    | -    | 2    |
| CO-4  | 2   | 1   | 2   | 2   | 2   | -   | 1   | 2   | 1   | -    | 3    | -    |
| CO-5  | 2   | 1   | 2   | 2   | 3   | 3   | 1   | 3   | 1   | -    | 2    | -    |

|                |                                               |          |          |          |          |
|----------------|-----------------------------------------------|----------|----------|----------|----------|
| <b>JCB2004</b> | <b>INTRUSION DETECTION AND<br/>PREVENTION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES**

- To understand basic concepts of intrusion detection system.
- To learn about Intrusion Prevention Systems, Network IDs protocol and model for intrusion analysis.
- To analyze intrusion detection alerts and logs to distinguish attack types from false alarms
- To understand Intrusion Prevention Systems, Network IDs protocol and model for intrusion analysis.
- To learn agent development for intrusion detection and architectural models of IDs and IPs.

### **PREREQUISITE: Foundations of Cyber Security**

#### **UNIT-I INTRODUCTION TO INTRUSION DETECTION 9**

History of intrusion detection, Audit, Concept and definition, Internal and external threats to data, Attacks, Need and types of IDS, Information sources, Host based information sources, Network based information sources.

#### **UNIT-II THEORITICAL FOUNDATION OF DETECTION 9**

Intrusion prevention systems, Network Ids protocol based Ids, Hybrid Ids, Analysis schemes, Thinking about intrusion, Model for intrusion analysis, Techniques responses, Requirement of responses, Types of responses, Mapping responses to policy vulnerability analysis, Credential analysis, Non credential analysis.

#### **UNIT-III ARCHITECTURE AND IMPLEMENTATION 9**

Introduction to snort, Snort installation scenarios, Installing snort, Running snort on multiple network interfaces, Snort command line options, Step-by-step procedure to compile, Install snort location of snort files, Snort modes snort alert modes.

#### **UNIT-IV SNORT CONCEPTS 9**

Working with snort rules, Rule headers, Rule options, Snort configuration file, Plugins, Preprocessors and output modules, Using snort with mysql.

#### **UNIT-V CASE STUDY 9**

Using ACID and snort snarf with snort, Agent development for intrusion detection, Architecture models of Ids and Ips.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand the basic concepts of intrusion detection system.
- Explain about Intrusion Prevention Systems, Network IDs protocol and model for intrusion

analysis.

- Analyze when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
- Understand the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
- Explain about agent development for intrusion detection and architectural models of IDs and IPs.

#### TEXT BOOKS:

1. T. Fahringer, R. Prodan, “A Text book on Grid Application Development and Computing Environment”. 6<sup>th</sup> Edition, Khanna Publishers, 2012.
2. Rafeeq Rehman : “ Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID,” 1<sup>st</sup> Edition, Prentice Hall , 2003.

#### REFERENCES:

1. Christopher Kruegel, Fredrik Valeur, Giovanni Vigna: “Intrusion Detection and Correlation Challenges and Solutions”, 1st Edition, Springer, 2005.
2. Carl Endorf, Eugene Schultz and Jim Mellander, “Intrusion Detection & Prevention”, 1<sup>st</sup> Edition, Tata McGraw-Hill, 2004.
3. Stephen Northcutt, Judy Novak: “Network Intrusion Detection”, 3rd Edition, New Riders Publishing, 2002.

#### WEB REFERENCES:

- <https://www.geeksforgeeks.org/intrusion-detection-system-ids/>
- <https://www.knowledgehut.com/blog/security/intrusion-detection-system>
- <https://www.helixstorm.com/blog/types-of-intrusion-detection-systems/>
- <https://usemynotes.com/what-is-intrusion-detection-system/>
- <https://www.cs.colostate.edu/~massey/Teaching/cs356/RestrictedAccess/Slides/356lecture18.pdf>

#### CO-PO MAPPING:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 1   | 2   | -   | 3   | -   | 1   | -   | 1   | -   | -    | -    | 1    |
| CO-2  | 3   | 2   | -   | 2   | 3   | 2   | -   | -   | 1   | 2    | -    | 2    |
| CO-3  | 3   | 1   | -   | 1   | 2   | 1   | -   | -   | 2   | 1    | -    | 1    |
| CO-4  | 2   | 2   | 3   | 2   | 3   | -   | -   | -   | -   | 2    | 2    | -    |
| CO-5  | 1   | 2   | 2   | 2   | 2   | 2   | 1   | 1   | 2   | 1    | 2    | 1    |



|                |                          |          |          |          |          |
|----------------|--------------------------|----------|----------|----------|----------|
| <b>JCB2005</b> | <b>HARDWARE SECURITY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                          | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES**

- To know basic components and fundamentals of hardware security.
- To develop an application using various services in security.
- To understand about different attacks and testing.
- To learn the basic and important concepts of hardware design.
- To understand the issues and solutions for hardware security and monitoring.

### **PREREQUISITE: Cryptography and Cryptanalysis**

#### **UNIT-I INTRODUCTION**

**9**

Hardware security-Key threats-Security practices-Types-Fault attacks and countermeasures-Hardware design cycle-Measuring hardware security-Secure platforms-Ciphers: historical; block (AES/DES), Stream, (Trivium) Public Key Ciphers (RSA, ECC), Hash Functions (SHA-1).

#### **UNIT-II PRINCIPLES AND APPLICATIONS**

**9**

Physical unclonable functions:-Design-Principles and applications- Hardware random- Number generators: design-Principles and applications-Design and evaluate pufs - Random number generators on an FPGA

#### **UNIT-III ATTACKS AND TESTING**

**9**

Side channels – Overview - Fault attacks and countermeasures Power attacks and countermeasures - Designing Fault attack - Evaluate a counter measure - VLSI testing: attacks and countermeasures, Scan attack on FPGA implementation of DES.

#### **UNIT-IV HARDWARE ARCHITECTURE**

**9**

Hardware trojans-Overview-Attacks and defenses-Malicious 8051 Processor design-IP piracy - Logic encryption-FPGA logic encryption of combinational logic-Reverse engineering: ic layout camouflaging, Gate level reversing, ESL reversing.

#### **UNIT-V CASE STUDY**

**9**

Analysis of notable hardware security breaches - Study of hardware security vulnerabilities in commercial systems-Emerging hardware security technologies – Approaches - Ethical considerations - Hardware security research - Practice- Internet of Things (IoT) Security challenges- Hardware security - Autonomous systems.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Demonstrate the main concepts of security, its characteristics, advantages, key technologies.

- Develop and design an application using various tools in hardware environment.
- Understand the basic and important design concepts and issues of attacks and testing.
- Explain about the concept, characteristics and the architecture of hardware.
- Analyze the issue of security and understand the applications of hardware security in various field.

#### TEXT BOOKS:

1. S. Bhunia and M. Tehranipoor, “Hardware Security: A Hand-on Training Approach, Morgan Kauffman”, 2018
2. M. Tehranipoor and C. Wang (Eds.), Introduction to Hardware Security and Trust, Springer, 2011

#### REFERENCES:

1. Debdeep Mukhopadhyay, “Hardware Security: Design, Threats, and Safeguards”, 1st edition, 2015.
2. Mohammad Tehranipoor and Cliff Wang, “Introduction to Hardware Security and Trust, by”, kindle edition, 2012.

#### WEB REFERENCES:

1. <https://www.amazon.in/Introduction-Hardware-Security-Mohammad-Tehranipoor-ebook/dp/B00F5U36X8>
2. [https://books.google.com/books/about/Introduction\\_to\\_Hardware\\_Security\\_and\\_Tr.html?id=bNiw9448FeIC](https://books.google.com/books/about/Introduction_to_Hardware_Security_and_Tr.html?id=bNiw9448FeIC)
3. <https://tehranipoor.ece.ufl.edu/wp-content/uploads/2021/07/01-Intro-to-HW-Security.pdf>
4. [https://catalog.library.vanderbilt.edu/discovery/fulldisplay/alma991043664639603276/01VAN\\_INST:vanui](https://catalog.library.vanderbilt.edu/discovery/fulldisplay/alma991043664639603276/01VAN_INST:vanui)

#### CO-PO MAPPING:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 3   | -   | 2   | 1   | 2   | -   | -   | -   | -   | -    | 1    | 1    |
| CO-2  | 1   | 2   | 1   | -   | 1   | -   | -   | -   | -   | 1    | 1    | 1    |
| CO-3  | 1   | 2   | 1   | 1   | 1   | 1   | -   | -   | -   | 1    | 2    | -    |
| CO-4  | 3   | 2   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 2    |
| CO-5  | 2   | 3   | -   | 1   | 3   | 1   | -   | -   | -   | 2    | 1    | -    |

|                |                       |          |          |          |          |
|----------------|-----------------------|----------|----------|----------|----------|
| <b>JCB2006</b> | <b>CLOUD SECURITY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                       | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To know basic components and fundamentals of cloud computing.
- To develop an application using various services in cloud.
- To understand how to design the web application development in cloud.
- To understand the issues and solutions for cloud security and cloud monitoring.
- To learn the basic and important concepts of python to implement in an application.

**PREREQUISITE: Data Communication and Networking, Foundations of Cyber Security**

## **UNIT-I INTRODUCTION**

**9**

Cloud fundamentals - Cloud service components - Cloud service, Deployment models - Cloud components - Guiding principle - Utilization, Security, Pricing - Application of cloud computing. Case Study: Open stack and AWS.

## **UNIT-II CLOUD BASED APPLICATIONS DEVELOPMENT**

**9**

Application architectures - Monolithic-Distributed, Micro Service fundamental - Cloud native applications - 12 factors app - Application integration process - APIfication process- API fundamental-Micro service - API management- Spring boot fundamental - Design of micro service - API tools.

## **UNIT-III WEB DEVELOPMENT TECHNIQUES**

**9**

Devops fundamentals - Devops role – responsibility - Tools - Containerization process and application-Evolution of app deployment- Docker fundamentals – architecture – Commands – Orchestration – Kubernetes - Docker container.

## **UNIT-IV CLOUD SECURITY AND MONITORING TOOL**

**9**

Cloud security - Shared responsibility architecture - Security by design principles-Identity - Access management - Cloud security layers illustration - Cloud network - Host - Data security concepts - Security operations - Major cloud service provider tools - Security compliance and regulations - Cloud monitoring - Benefits of cloud monitoring.

## **UNIT-V BUILDING AN APPLICATION USING PYTHON**

**9**

Developing - Deploying an application in the cloud- Building a python project based on design - Development testing - Deployment of an application using a development framework - Deployment Platform - Case study: python use case and python framework.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Demonstrate the main concepts of cloud, its characteristics, advantages, key technologies and

its various delivery and deployment models.

- Develop and design an application using various tools in cloud environment.
- Acquire the basic and important design concepts and issues of web application development techniques in cloud.
- Structure simple python program for developing an application in cloud.
- Analyze the issue of cloud such as security, energy efficiency and interoperability, and provide an insight into future prospects of computing in the cloud monitoring.

#### TEXT BOOKS:

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", Prentice Hall, 2013.
2. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting Applications on the Cloud", IBM Press, 2012.

#### REFERENCES:

1. Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", 1st Edition, Wiley, 2014.
2. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2011.

#### WEB REFERENCES:

1. [https://www.tutorialspoint.com/cloud\\_computing/cloud\\_computing\\_security.htm](https://www.tutorialspoint.com/cloud_computing/cloud_computing_security.htm)
2. <https://www.javatpoint.com/what-is-cloud-security>
3. <https://www.ibm.com/topics/cloud-security>
4. <https://www.box.com/resources/what-is-cloud-security>
5. <https://cloud.google.com/learn/what-is-cloud-security>

#### CO-PO MAPPING:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 3   | 3   | -   | 2   | 3   | 1   | -   | 1   | -   | -    | 1    | 1    |
| CO-2  | 2   | 1   | 2   | -   | -   | -   | -   | -   | -   | 1    | 1    | 1    |
| CO-3  | -   | 1   | 3   | 2   | 1   | -   | -   | -   | 1   | -    | -    | -    |
| CO-4  | 3   | 3   | 3   | 3   | 1   | 2   | 1   | 1   | 1   | 2    | 1    | -    |
| CO-5  | 1   | 2   | 2   | 3   | -   | -   | 1   | 1   | 2   | 1    | -    | 1    |

|                |                        |          |          |          |          |
|----------------|------------------------|----------|----------|----------|----------|
| <b>JCB2007</b> | <b>ETHICAL HACKING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To study about the fundamentals of hacking.
- To learn different types of hacking in web.
- To understand attacks in networking.
- To learn about wireless hacking, attacks and various agents in hacking.
- To understand about automation and authentication.

## **PREREQUISITE: Cryptography and Cryptanalysis**

### **UNIT-I INTRODUCTION TO HACKING**

**9**

Introduction to hacking – Terminologies – Penetration test – Vulnerability assessments versus penetration test – Pre-engagement – Rules of engagement -Penetration testing methodologies – OSSTMM – Categories of penetration test – Types of penetration tests – Vulnerability assessment summary - Reports.

### **UNIT-II ETHICAL HACKING IN WEB**

**9**

Introduction to ethical hacking – Foot printing - Reconnaissance - Scanning networks - Enumeration - System hacking - Malware Threats – Sniffing- Social engineering - Denial of service - Session hijacking - Hacking web servers - Web applications – SQL Injection - Hacking wireless networks - Mobile platforms.

### **UNIT-III NETWORK ATTACKS**

**9**

Vulnerability data resources – Exploit databases –Promiscuous versus non promiscuous mode – MITM attacks – ARP attacks –SSL strip: stripping https traffic -DNS spoofing – ARP spoofing– DHCP Spoofing -Remote exploitation – Attacking network remote services – Overview of brute force attacks.

### **UNIT-IV WIRELESS HACKING**

**9**

Wireless hacking – Air crack- Cracking WEP – WPA/WPA2 wireless network using air crack – Evil twin attack –Log-in protection mechanisms – Captcha validation flaw – Captcha RESET flaw – Manipulating user-Agents to bypass captcha.

### **UNIT-V CASE STUDY**

**9**

Authentication bypass attacks – Testing for vulnerability – Automating with burp suite – Session attacks – SQL injection attacks – XSS (Cross-Site Scripting) - Types of cross-Site scripting – Cross-site request forgery (CSRF) – SSRF attacks.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- Understand the fundamentals of hacking and different methodologies in testing.
- Demonstrate the different types of hacking and various applications in web.
- Explain about different attacks, testing, and authentication in networking.
- Understand about wireless hacking, cracking and protection mechanisms.
- Explain the various Authentication schemes to simulate different applications.

**TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

**REFERENCES:**

1. Marjie T.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3rd Edition, Prentice Hall, 2013.
2. Kenneth C.Brancik, “Insider Computer Fraud”, Auerbach Publications Taylor & Francis Group–2008.
3. AnkitFadia, “Ethical Hacking”, Second Edition, Macmillan India Ltd, 2006.
4. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005.

**WEB REFERENCES:**

1. <https://www.geeksforgeeks.org/introduction-to-ethical-hacking/>
2. [https://www.hackittech.com/Resources%20pdf/hacking\\_resources/HackitTech\\_20210523130501.pdf](https://www.hackittech.com/Resources%20pdf/hacking_resources/HackitTech_20210523130501.pdf)
3. <https://www.javatpoint.com/ethical-hacking>
4. <https://www.synopsys.com/glossary/what-is-ethical-hacking.html>
5. <https://www.knowledgehut.com/blog/security/introduction-to-ethical-hacking>

**CO-PO MAPPING:**

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 2   | 2   | 1   | 1   | 2   | -   | 1   | 1   | 1   | -    | 2    | -    |
| CO-2  | 1   | 1   | 2   | 1   | -   | 1   | 1   | -   | -   | 1    | -    | 1    |
| CO-3  | -   | 2   | 1   | -   | 1   | -   | -   | 2   | 2   | -    | 1    | 2    |
| CO-4  | 2   | 2   | -   | 2   | 1   | 1   | -   | 1   | 2   | -    | -    | -    |
| CO-5  | 1   | 1   | 1   | 2   | 1   | -   | 3   | 1   | -   | 2    | -    | -    |

|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JCB2008</b> | <b>WEB APPLICATION SECURITY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To reveal the underlying in web application.
- To identify and aid in fixing any security vulnerabilities during the web development process.
- To understand the security principles in developing a reliable web application.
- To learn about different industry tools in web security.
- To understand about various testing and security.

## **PREREQUISITE: Web Technology**

### **UNIT-I INTRODUCTION TO WEB APPLICATIONS 9**

History of web applications interface -Web application Vs Cloud application -Security fundamentals- Input validation - Attack surface reduction rules of thumb- Classifying and prioritizing threats.

### **UNIT-II WEB APPLICATION SECURITY FUNDAMENTALS 9**

Origin policy - Exceptions to the same- Cross-site scripting and cross-site request forgery – Reflected XSS - HTML injection.

### **UNIT-III WEB APPLICATION VULNERABILITIES 9**

Vulnerabilities in traditional client server application and web applications- Client state manipulation-Cookie based attacks,-SQL injection, Cross domain attack (XSS/XSRF/XSSI)- Http header injection - SSL vulnerabilities and testing - Proper encryption use in web application- Session vulnerabilities and testing - Cross-site request forgery.

### **UNIT-IV WEB APPLICATION MITIGATIONS 9**

Http request - Http response, rendering and events - Html image tags - Image tag security – Issue - Java script on error – Java script timing - Port scanning - Remote scripting - Running remote code - frame and iframe - Browser sandbox - policy goals, same origin policy - Library import - Domain relaxation.

### **UNIT-V SECURE WEBSITE DESIGN 9**

Introduction- Architecture and Design Issues for Web Applications - Deployment Considerations Input Validation – Authentication – Authorization - Configuration Management - Sensitive Data - Session Management – Cryptography - Parameter Manipulation - Exception Management.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Identify the vulnerabilities in the web applications.
- Identify the various types of threats and mitigation measures of web applications.
- Apply the security principles in developing a reliable web application.

- Use industry standard tools for web application security.
- Apply Penetration testing to improve the security of web application

#### TEXT BOOKS:

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

#### REFERENCES:

1. Behrouz A. Ferouzan, DebdeepMukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

#### WEB REFERENCES:

1. [Web Application Security \[Book\] \(oreilly.com\)](#)
2. [Web Application Security: Exploitation and Countermeasures for Modern Web ... - Andrew Hoffman - Google Books amazon.com/Web-Application-Security-Beginners-Guide/dp/0071776168 https://www.garykessler.net/library/crypto.html](#)
3. <https://www.cryptomathic.com/news-events/blog/summary-of-cryptographic-algorithms-according-to-nist>

#### CO-PO MAPPINGS:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 2   | -   | 2   | 2   | -   | -   | 1   | -   | -   | 1    | 2    | 1    |
| CO-2  | 2   | 2   | 2   | 2   | 2   | -   | -   | -   | -   | 2    | 1    | 1    |
| CO-3  | 2   | 2   | 2   | 2   | 1   | -   | 2   | -   | -   | -    | -    | 2    |
| CO-4  | 2   | -   | -   | 2   | -   | -   | 1   | -   | -   | 1    | 2    | 1    |
| CO-5  | 2   | 1   | 2   | 2   | 2   | -   | 2   | -   | -   | 1    | 1    | 2    |



**VERTICAL – V**  
**INTERNET OF THINGS**

| S.No. | COURSE CODE | COURSE TITLE                                                | CATEGORY | CONTACT PERIODS | L | T | P | C |
|-------|-------------|-------------------------------------------------------------|----------|-----------------|---|---|---|---|
| 1     | JIT2009     | Internet of Things: Architecture Protocols and Applications | PE       | 3               | 3 | 0 | 0 | 3 |
| 2     | JIT2010     | Programming for IoT Boards                                  | PE       | 3               | 3 | 0 | 0 | 3 |
| 3     | JIT2011     | Industrial IoT 4.0                                          | PE       | 3               | 3 | 0 | 0 | 3 |
| 4     | JIT2012     | IoT in Healthcare                                           | PE       | 3               | 3 | 0 | 0 | 3 |
| 5     | JIT2013     | Robotics in IOT                                             | PE       | 3               | 3 | 0 | 0 | 3 |
| 6     | JIT2014     | Mobile Application Development for IoT                      | PE       | 3               | 3 | 0 | 0 | 3 |
| 7     | JIT2015     | Cognitive IoT                                               | PE       | 3               | 3 | 0 | 0 | 3 |
| 8     | JIT2016     | Privacy Security for IOT                                    | PE       | 3               | 3 | 0 | 0 | 3 |

**PREREQUISITES: Python Programming, Computer Networks, Mobile Computing, Internet of Things**

|                |                                                                        |          |          |          |          |
|----------------|------------------------------------------------------------------------|----------|----------|----------|----------|
| <b>JIT2009</b> | <b>INTERNET OF THINGS: ARCHITECTURE<br/>PROTOCOLS AND APPLICATIONS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES**

4. To understand the Architectural Overview of IoT
5. To understand the IoT Reference Architecture and RealWorld Design Constraints
6. To understand the various IoT Protocols.
7. To understand various IoT transport & session layer protocols.
8. To understand various IoT service layer protocols and security

### **PREREQUISITE: Web Technology**

#### **UNIT-I OVERVIEW**

**9**

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

#### **UNIT-II REFERENCE ARCHITECTURE**

**9**

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

#### **UNIT-III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS**

**9**

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN,6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.

#### **UNIT-IV TRANSPORT & SESSION LAYER PROTOCOLS**

**9**

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT.

#### **UNIT-V SERVICE LAYER PROTOCOLS & SECURITY**

**9**

Service Layer – one M2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Describe the basic concept and architecture of IOT systems
- Understand key skills employed in the IIoT &IoRT space building applications.
- Analyze various IoT Comprehend IOT protocols.
- Analyze various IoT Comprehend IOT protocols.
- Analyze various IoTservice layer protocols and security.

## **TEXT BOOKS:**

1. JanHoller, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a NewAge of Intelligence”, 1st Edition, Academic Press, 2014.
2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

## **REFERENCES:**

1. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
2. Vijay Madiseti and ArshdeepBahga, “Internet of Things (A Hands-on Approach)”,1stEdition, VPT, 2014.

## **WEB REFERENCES:**

1. [http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot\\_prot/index.html](http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html)
2. <https://www.hindawi.com/journals/jece/2017/9324035>
3. <https://www.sciencedirect.com/science/article/pii/B9780128205815000134>

## **CO-PO MAPPINGS:**

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 3   | 3   | 3   | 3   | -   | 1   | 1   | -   | -   | -    | -    | -    |
| CO-2  | 3   | 2   | 3   | 3   | -   | 1   | 1   | -   | -   | -    | -    | -    |
| CO-3  | 3   | 3   | 2   | 3   | -   | 2   | 2   | -   | -   | -    | -    | -    |
| CO-4  | 3   | 3   | 3   | 2   | -   | 2   | 2   | -   | -   | -    | -    | -    |
| CO-5  | 3   | 2   | 2   | 2   | -   | 2   | 2   | -   | -   | -    | -    | -    |
| AVG   | 3   | 3   | 3   | 3   | -   | 2   | 2   | -   | -   | -    | -    | -    |

|                |                                   |          |          |          |          |
|----------------|-----------------------------------|----------|----------|----------|----------|
| <b>JIT2010</b> | <b>PROGRAMMING FOR IOT BOARDS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To introduce Internet of Things (IoT) environment and its technologies for designing smart systems.
- To explore open-source computer hardware/software platform, development and debugging environment, programming constructs and necessary libraries.
- To learn embedded programming constructs and real time systems.
- To understand various options in programming languages.
- To test, debug, and deploy and to solve real world problems.

## **UNIT-I INTRODUCTION TO IOT BOARDS 9**

IoT- Introduction and Characteristics, Things, Architecture, Enabling Technologies, Challenges, Levels - Environment -board, IDE, shields; Programming - syntax, variables, types, operators, constructs and functions; sketch - skeleton, compile and upload, accessing pins; debugging - UART communication protocol and serial library.

## **UNIT-II INTERFACING WITH IOT BOARDS 9**

Circuits - design, wiring, passive components; sensors and actuators, interfacing, read and write; software libraries to handle complicated hardware; shields, interfacing and libraries

## **UNIT-III SINGLE BOARD COMPUTERS AND PYTHON INTERFACING 9**

Board schematic, setup, configure and use, OS implications; linux - basics, file system and processes, shell CLI, GUI; python - basics, API's RPi.GPIO, PWM library to access pins, Tkinter Networking - Internet Connectivity, Standard Internet Protocols, MQTT, CoAP, Networking Socket Interface; Cloud - Public APIs and SDK's for accessing cloud services, Twitter API using Twython package; Interfacing - sensors and actuators, Pi Camera, Servo, A/D, D/A

## **UNIT-IV EMBEDDED PROGRAMMING AND RTOS 9**

MCU - GPIO, WDT, timers/counters, IO, A/D, D/A, PWM, Interrupts, Memory, serial Communication UART, I2C, SPI, Peripheral Interfacing OS - basics, types, tasks, process, threads (POSIX Threads), thread preemption, Preemptive Task Scheduling Policies, Priority Inversion, Task communication, Task Synchronization issues - racing and deadlock, binary and counting semaphores (Mutex example), choosing RTOS.

## **UNIT-V REAL WORLD PROJECTS 9**

IoT Integrated Primary Health Care, Large Scale Face Detection by AI Powered Street Lights, Cloud IoT Systems for Smart Agriculture, Smart Home Gadgets, Autonomous Car Features – speed and horn intensity control.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- Understand basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world.
- Program SBC for practical IoT devices using Python.
- Explore protocols, data conversion process, Api and expansion boards for real world interaction.
- Learn embedded programming constructs and constraints real time systems.
- Illustrate IoT prototyping for real world socio-economic problems.

**TEXT BOOKS:**

1. Yamanoor, Sai, and Srihari Yamanoor. Python Programming with Raspberry Pi, 1st edition, Packt Publishing Ltd, 2017.
2. Donald Norris, The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black, 1st edition, McGraw Hill Education, 2015

**REFERENCES:**

1. Marco Schwartz, Home Automation with Arduino, 3rd edition, Open Home Automation 2014.
2. Schwartz, Marco. Internet of things with arduino cookbook, 1st edition, Packt Publishing Ltd, 2016.
3. Kooijman, Matthijs. Building Wireless Sensor Networks Using Arduino, 1st edition, Packt Publishing Ltd, 2015.

**WEB REFERENCES:**

1. <https://elearn.nptel.ac.in/shop/iit-workshops/completed/lab-workshop-on-internet-of-thingsiot/>
2. <https://ict.iitk.ac.in/courses/learn-iot-through-arduino-and-raspberry-pi/>
3. [https://onlinecourses.swayam2.ac.in/arp20\\_ap03/preview](https://onlinecourses.swayam2.ac.in/arp20_ap03/preview)

**CO-PO MAPPINGS:**

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 2   | -   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    |
| CO-2  | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    |
| CO-3  | 3   | -   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | -    |
| CO-4  | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    |
| CO-5  | -   | 3   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    |
| AVG   | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -    | -    | -    |

|                |                           |          |          |          |          |
|----------------|---------------------------|----------|----------|----------|----------|
| <b>JIT2011</b> | <b>INDUSTRIAL IoT 4.0</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To develop knowledge in Industrial Internet of Things (IIoT) fundamentals.
- To understand the architecture, IOT and its protocols.
- To understand the various data analytics techniques.
- To understand the CPS for Industry 4.0.
- To provide students with a good depth of knowledge of Designing Industrial IOT Systems for various applications.

### **UNIT – I INDUSTRIAL IOT INTRODUCTION**

**9**

Introduction to IOT, IOT Vs. IIOT, History of IIOT, Components of IIOT - Sensors and Actuators for Industrial Processes, Role of IIOT in Manufacturing Processes. Challenges & Benefits in implementing IIOT.

### **UNIT II IIOT ARCHITECTURE**

**9**

Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.

### **UNIT III IIOT ANALYTICS**

**9**

Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop.

### **UNIT IV INDUSTRIAL IOT: CYBER PHYSICAL SYSTEM**

**9**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS- Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Case study: Application of CPS in health care domain.

### **UNIT V INDUSTRIAL IOT- APPLICATION DOMAINS**

**9**

Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- To understand the basics of industrial IoT (IIoT).
- To develop various applications using IIOT architectures.
- Recognize the uses of cloud computing and data analytics.
- Analyze privacy and security measures for industry standard solutions.
- Design and implement IOT applications that manage various technology.

**TEXT BOOKS:**

1. Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd, 2018.
2. Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress, 2017

### REFERENCES:

1. Alasdair Gilchrist, *Industry 4.0: The Industrial Internet of Things*, 1st Edition, Apress, 2017.
2. Aboul Ella Hassanien, Nilanjan Dey and Sureeka Boara, *Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications*, 1st edition, CRC Press, 2019.

### WEB REFERENCES:

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs52/preview](https://onlinecourses.nptel.ac.in/noc22_cs52/preview)
2. <https://www.coursera.org/specializations/developing-industrial-iot#courses>
3. <https://www.coursera.org/learn/industrial-internet-of-things>.
4. <https://www.coursera.org/learn/internet-of-things-sensing-actuation>

### CO-PO MAPPING:

[illegible]

|                |                          |          |          |          |          |
|----------------|--------------------------|----------|----------|----------|----------|
| <b>JIT2012</b> | <b>IOT IN HEALTHCARE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                          | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To design products related to IoT based Health care applications
- To understand and design multidisciplinary approach for design, development,
- To simulate, and implement IoT health care systems.
- To apply the monitored health parameter sensor output data for further computing, analyzation and visualization.
- To identify and summarize remote health monitoring and Tele-health.

### **UNIT I INTRODUCTION TO IOT BASED HEALTH CARE 9**

Introduction to IoT applications in smart healthcare and their distinctive advantages - Patient Health Monitoring System (PHMS), Tele-Health, TeleMedicine, Tele-Monitoring, Mobile Health Things (m-health).

### **UNIT II IOT SMART SENSING HEATH CARE AND POWER CHALLENGE 9**

Concept of Generic Biomedical sensors, Smart Sensors: Monitor health parameters, Wearable ECG sensors, IoT Data Acquisition System, Energy harvesting, Battery based systems, Power management.

### **UNIT III INTERNET OF MEDICAL THINGS 9**

Data Confidentially, Data Integrity, Data Protection, Security awareness, Emergent threats: Autonomous, IoT heterogeneity and ubiquity, Physical environment.

### **UNIT IV SECURITY AND PRIVACY 9**

Security, Privacy and Ethical Issues Smart Health and well-being Applications Risk Analysis Cyber-Physical-Social Systems, Machine Ethics, Physical Safety Software Quality, IT Security, Privacy, Risk of Technology Misuse.

### **UNIT V WEARABLE TECHNOLOGIES – CASE STUDIES 9**

Soft Skin simulation for Wearable Haptic Rendering, Design Challenges for real wearable computers, Collaboration with wearable computers. IoT Based Contactless Body Temperature Monitor.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Understand and design multidisciplinary approach for design, development, simulation, and implementation of IoT health care systems.
- Apply the monitored health parameter sensor output data for further computing, analyzation and visualization.
- Identify and summarize remote health monitoring and Tele-health
- Elaborate security, privacy and ethical issues in smart sensor health and well-being



- Learn about the requirement's to design Frameworks for Wearable Computing

1. Dac-Nhuong Le,” Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0,” Wiley, 2019.
2. S. Misra, A. Mukherjee, and A. Roy “Introduction to IoT”. Cambridge University Press, 2017.

1. Qusay F. Hassan “Internet of Things A to Z Technologies and Applications.
2. Intelligent Data Sensing and Processing for Health and Well-being Applications, Miguel Antonio Wister Ovando, Pablo Pancardo Garcia, Francisco Diego Acosta Escalante, Jose Adan Hernandez Nolasco.
3. Vankamamidi S. Naresh<sup>1</sup>,Suryateja S. Pericherla, PillaSita Rama Murty, Sivaranjani Reddi, “Internet of Things in Healthcare: Architecture, Applications, Challenges, and Solutions”, International Journal of Computer Systems Science &Engineering, Vol. 35 no 6 November 2020.

1. <https://www.udemy.com/course/iot-based-emergency-health-care-system>
2. <https://skill-lync.com/medical-technology-courses/iot-healthcare>

[illegible]

|                |                        |          |          |          |          |
|----------------|------------------------|----------|----------|----------|----------|
| <b>JIT2013</b> | <b>ROBOTICS IN IOT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES**

- To learn basics of Internet of Things (IoT), and its execution using multiple robotic sensors.
- To understand Internet of Robotic Things (IoRT) and its various implementations in industry and automation.
- To implement IoT and Robotics application in autonomous driving and health care.
- To learn the design and analysis of Industry 4.0 systems for Energy and smart vehicular applications.
- To understand the Cloud Robotics and Industrial Automation.

### **UNIT I INTRODUCTION TO IOT AND VISION SYSTEMS 9**

History and evolution of IoT, AI, ML, Machine Vision, optoelectronic sensors, 3D & 2D machine vision technologies, robot navigation, control schemes, motion controllers, intelligent algorithms and vision systems.

### **UNIT II ROBOTIC SENSORS 9**

Optical sensors and actuators; Mechanical sensors and actuators; Acoustic sensors and actuators; Performance characteristics of sensors and actuators.

### **UNIT III INTERNET OF ROBOTIC THINGS 9**

Communication architecture for IoRT; Decentralized and automated IoT infrastructure using Blockchain; IoRT Platforms Architecture, IoRT applications.

### **UNIT IV AUTONOMOUS VEHICLE SYSTEMS 9**

Introduction to Autonomous Driving; Perception in Autonomous Driving; Robot Operating System (ROS) Overview - Client Systems for Autonomous Driving - Decision planning and control in autonomous vehicle systems - Cloud Platform for Autonomous Driving.

### **UNIT V CLOUD ROBOTICS AND INDUSTRIAL AUTOMATION 9**

IoMT and Robotics in Healthcare IoMT Driven connected healthcare, Efficient design for IoMT based healthcare design, Robotics in healthcare, Components of Cloud Robotics; Limitations and challenges of Cloud Robotics; Applications: Autonomous mobile robots, Cloud medical robots, Industrial robots.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand IoT ecosystem in robotic paradigm.
- Analyze IoT infrastructure and develop IoRT applications.
- Apply IoT in robotics over different platforms.
- Implement Cloud robotics in automations.

- Implement automated applications using multiple robotic sensors.

#### TEXT BOOKS:

1. Vermesan, Ovidiu, and Joël Bacquet, eds., Cognitive Hyperconnected Digital Transformation: Internet of Things Intelligence Evolution, 1st edition, River Publishers, 2017.
2. A.K.Gupta, S.K.Arora, and J.Riescher, Industrial Automation and Robotics, 1st edition, Mercury Learning and Information LLC, 2017.

#### REFERENCES:

1. A.K Dubey, A.Kumar, and S.R Kumar., AI and IoT-based Intelligent Automation in Robotics, 1st edition. Wiley, 2020
2. A.E.Hassanien, N.Dey, and S.Borra, Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications, 1st edition, Taylor & Francis Group, 2019.
3. S.Liu, L.Li and J.Tang, Creating Autonomous Vehicle Systems, Synthesis Lectures on Computer Science, 1st edition, Morgan & Claypool, 2018.
4. Nathan Ida, Sensors, Actuators, and Their Interfaces: A multidisciplinary introduction, 2nd edition The Institution of Engineering and Technology, 2017.

#### WEB REFERENCES:

1. <https://www.udemy.com/course/iot-robotics-hacking-nodemcu/>

#### CO-PO MAPPINGS:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 3   | 3   | 3   | 3   | -   | 2   | 2   | 2   | -   | -    | -    | -    |
| CO-2  | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | -    |
| CO-3  | 3   | 3   | 3   | 3   | -   | 1   | 1   | 1   | -   | -    | -    | -    |
| CO-4  | 3   | 3   | 3   | 3   | -   | 1   | 1   | 1   | -   | -    | -    | -    |
| CO-5  | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | -    |
| AVG   | 3   | 3   | 3   | 3   | -   | 2   | 2   | 2   | -   | -    | -    | -    |

|                |                                                   |          |          |          |          |
|----------------|---------------------------------------------------|----------|----------|----------|----------|
| <b>JIT2014</b> | <b>MOBILE APPLICATION DEVELOPMENT<br/>FOR IOT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                                   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES**

- To understand the mobile application development for Internet of Things (IoT) devices.
- To deploy various components of mobile devices and essential sensors for various application.
- To understand architectures and models used in Mobile.
- To understand analytics and security aspects of mobile applications in IoT platforms.
- To apply the technologies for low power wireless devices.

### **UNIT I INTRODUCTION TO IOT ECOSYSTEM 9**

IoT ecosystem; Industry 4.0; Application development platforms for IoT; IoT Data sources.

### **UNIT II SENSOR FOR MOBILE AND HANDHELD DEVICES 9**

Temperature sensors, Proximity sensor, IR sensors, Image sensors, Motion detection sensors, Accelerometer sensors, Gyroscope sensors, Optical sensors.

### **UNIT III SENSOR DATA PROCESSING 9**

Sensor Data-Gathering and Data-Dissemination Mechanisms; Sensor Database system architecture; Sensor data-fusion mechanisms; Data-fusion Architectures and models.

### **UNIT IV PROGRAMMING FRAMEWORKS FOR INTERNET OF THINGS 9**

IoT Programming Approaches: Node-Centric Programming - Database approach – Model Driven Development - IoT Programming Frameworks: Android Things – Thing Speak - IoTivity - Node-RED - DeviceHive - Contiki and Cooja – Zetta.

### **UNIT V COMMUNICATION TECHNOLOGIES FOR LOW POWER WIRELESS INTERACTIONS 9**

Wireless communications in product development – Bluetooth LE - Near Field Communications (NFC) – WiFi; Prototyping Bluetooth LE with Arduino Nano; Power management strategies and practices Case Study.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Outline a fundamental full stack architecture for IoT.
- Describe various development technologies in each IoT layer.
- Develop IoT applications using standardized hardware and software platforms.
- Create prototype using low power communication technologies.
- Explain IoT solution development from Product management perspective.

**TEXT BOOKS:**

1. Kale, Vivek. Parallel Computing Architectures and APIs: IoT Big Data Stream Processing 1st edition, CRC Press, 2019.
2. Lea, Perry. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, 1st edition, Packt Publishing Ltd, 2018.

**REFERENCES:**

1. Fadi Al-Turjman, Intelligence in IoT-enabled Smart Cities, 1st edition, CRC Press, 2019
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packt Publishing, 2018.

**WEB REFERENCES:**

1. <https://www.silabs.com/support/training/app-103-mobile-app-development-for-iot>
2. <https://www.classcentral.com/course/mobile-development-in-iot-73972>

**CO-PO MAPPINGS:**

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 3   | 3   | 3   | 3   | -   | 2   | 2   | 2   | 3   | 3    | 3    | 3    |
| CO-2  | 3   | 3   | 3   | 3   | -   | -   | -   | -   | 3   | 3    | 3    | 3    |
| CO-3  | 3   | 3   | 3   | 3   | -   | 1   | 1   | 1   | 3   | 3    | 3    | 3    |
| CO-4  | 3   | 3   | 3   | 3   | -   | 1   | 1   | 1   | 3   | 3    | 3    | 3    |
| CO-5  | 3   | 3   | 3   | 3   | -   | -   | -   | -   | 3   | 3    | 3    | 3    |
| AVG   | 3   | 3   | 3   | 3   | -   | 2   | 2   | 2   | 3   | 3    | 3    | 3    |

|                |                      |          |          |          |          |
|----------------|----------------------|----------|----------|----------|----------|
| <b>JIT2015</b> | <b>COGNITIVE IOT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                      | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

- To Introduce cloud computing and enabling technologies.
- To Explore the need for fog and edge computation.
- To Impart the knowledge to log the sensor data and to perform further data analytics.
- Impart the knowledge to log the sensor data and to perform further data analytics.
- Make the students to apply Internet of Things (IoT) data for business solution in various domain in secured manner.

## **UNIT I COGNITIVE IOT – INTRODUCTION**

**9**

Cognitive IoT, Need for Cognitive IoT, Current and Future trends of IoT, Cognitive computing and applications. Data Analytics for IoT Regression, Data Analytics for IoT ANN Classification, Data Analytics for IoT Modern DNN's.

## **UNIT II SECURE FOG-CLOUD OF THINGS**

**9**

Secure Fog-Cloud of Things: Architectures, Opportunities & Challenges IoT Architecture and Core IoT, Collaborative and Integrated Edge Security Architecture, A connected ecosystem, Threat and security in IoT.

## **UNIT III GPU ARCHITECTURE**

**9**

Introduction to GPU's Parallel programming for GPU, Parallel programming in CUDA, CNN Inference in GPU, CNN Training in GPU. FPGA for Internet of Things Benefits of FPGA, Interfacing FPGAs with IoT-based edge devices, IoT-FPGA based applications, Microsemi's SmartFusion2 SoC FPGA.

## **UNIT IV IOT ENABLING TECHNOLOGIES AND DEVICES**

**9**

Big data, Digital twin, Cloud Computing, Sensors, Communications, Analytical software, Edge Devices.

## **UNIT V SECURITY IN COGNITIVE IOT**

**9**

Security in Cognitive IoT, Security Issues in IoT, A hardware assisted approach for security, Architectural level overview for providing security, Security threats. IoT and Edge Security, Physical and hardware security, Shell security, Cryptography, Software-Defined Perimeter, Blockchains and cryptocurrencies in IoT, Government regulations and intervention.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Integrate the aspects of human cognitive processes in the system design.
- Comprehend the underlying cognitive process can have many abstractions of a cognitive cycle such as 'Sense', 'Understand', 'Decide' and 'Act'.

- Detect any failures of system components and re-configure itself which provides a graceful degradation through self-healing.
- Accomplish knowledge about the application, system architecture, resources, system state and behavior.
- Analyze security issues in IoT applications.

#### TEXT BOOKS:

1. Matin, Mohammad Abdul, ed. Towards Cognitive IoT Networks, 1st edition, Springer International Publishing, 2020.
2. “IoT and Edge Computing for Architects” Perry Lea,”-second edition, Packt, March,2020.
3. “Secure EdgeComputing: Applications, Techniques and Challenges”, Mohiuddin Ahmed (Editor), Paul Haskell-Dowland (Editor), CRC press, first edition, August 2021.

#### REFERENCES:

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange and Stefan Meissner, Enabling things to talk –Designing IoT solutions with the IoT Architecture Reference Model, 1st edition, Springer Open, 2016.
2. John Mutumba Bilay, Peter Gutsche, Mandy Krimmel and Volker Stiehl, SAP Cloud Platform Integration: The Comprehensive Guide, 2nd edition, Rheinwerk publishing. 2019.
3. Mahalle, Parikshit Narendra, and Poonam N. Railkar, Identity management for internet of things, 1st edition, River Publishers, 2015.

#### WEB REFERENCES:

1. <https://learn.microsoft.com/en-us/training/modules/run-cognitive-services-iot-edge/>

#### CO-PO MAPPINGS:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 3   | 3   | 3   | 3   | -   | 2   | 2   | 2   | -   | -    | -    | -    |
| CO-2  | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | -    |
| CO-3  | 3   | 3   | 3   | 3   | -   | 1   | 1   | 1   | -   | -    | -    | -    |
| CO-4  | 3   | 3   | 3   | 3   | -   | 1   | 1   | 1   | -   | -    | -    | -    |
| CO-5  | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | -    |
| AVG   | 3   | 3   | 3   | 3   | -   | 2   | 2   | 2   | -   | -    | -    | -    |

|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JIT2016</b> | <b>PRIVACY SECURITY FOR IoT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

## **COURSE OBJECTIVES**

6. To realize IoT security requirements and management tools.
7. To know the state-of-the-art methodologies in Cyber Physical system.
8. To impart knowledge on Model threats and countermeasures.
9. To explore the Privacy Preservation and Trust Models in Internet of Things (IoT).
10. To apply the concept of Internet of Things Security in the real world scenarios.

## **UNIT I INTRODUCTION: SECURING THE INTERNET OF THINGS 9**

Introduction – Security Requirements in IoT architectures – Security in Enabling Technologies – IoT Security Life Cycle – Cryptographic Fundamentals for IoT Security Engineering - Security Concerns in IoT Applications – Basic Security Practices.

## **UNIT II SECURITY ARCHITECTURE IN THE INTERNET OF THINGS 9**

Introduction – Security Requirements in IoT – Insufficient Authentication/Authorization – Insecure Access Control – Threads to Access Control, Privacy, and Availability – Attacks Specific to IoT – Malware Propagation and Control in Internet of Things.

## **UNIT III PRIVACY PRESERVATION 9**

Privacy Preservation Data Dissemination - Privacy Preservation for IoT used in Smart Building – Exploiting Mobility Social Features for Location Privacy Enhancement in Internet of Vehicles – Lightweight and Robust Schemes for Privacy Protection in Key personal IOT Applications: Mobile WBSN and Participatory Sensing.

## **UNIT IV TRUST, AUTHENTICATION AND DATA SECURITY 9**

Trust and Trust Models for IoT – Emerging Architecture Model for IoT Security and Privacy – preventing Unauthorized Access to Sensor Data – Authentication in IoT – Computational Security for the IoT – Secure Path Generation Scheme for real-Time Green IoT – Security Protocols for IoT Access Networks.

## **UNIT V SOCIAL AWARENESS AND CASE STUDIES 9**

User Centric Decentralized Governance Framework for Privacy and Trust in IoT – Policy Based Approach for Informed Consent in IoT - Security and Impact of the IoT on Mobile Networks – Security Concerns in Social IoT – Security for IoT Based Healthcare – Smart cities.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

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

- Describe the basics of securing Internet of Things.
- Explain architecture and threats in IoT.
- Analyze various privacy schemes related to IoT.



- Describe the authentication mechanisms for IoT security and privacy.
- Explain security issues for various applications using case studies.

#### TEXT BOOKS:

1. Shancang Li, Li Da Xu, "Securing the Internet of Things," Syngress (Elsevier) publication, 2017, ISBN: 978-0-12-804458-2.
2. Fei Hu, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations," CRC Press (Taylor & Francis Group), 2016, ISBN:978-1-4987- 23190.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands-on approach," VPT Publishers, 2014, ISBN: 978-0996025515.

#### REFERENCES:

1. Alasdair Gilchris, "Iot Security Issues," Walter de Gruyter GmbH & Co, 2017.
2. Sridipta Misra, Muthucumaru Maheswaran, Salman Hashmi, "Security Challenges and Approaches in Internet of Things," Springer, 2016. 6. Brian Russell, Drew Van Duren, "Practical Internet of Things Security," Packet Publishing Ltd, 2016.

#### WEB REFERENCES:

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs23/preview](https://onlinecourses.nptel.ac.in/noc22_cs23/preview)
2. <https://www.coursera.org/lecture/m2m-iot-interface-design-embedded-systems/iot-ecurity/>

#### CO-PO MAPPING:

| CO\PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO-1  | 3   | 3   | 2   | 2   | 2   | -   | 3   | 1   | -   | -    | 2    | 2    |
| CO-2  | 3   | 3   | 3   | 2   | 2   | -   | -   | 1   | 1   | 2    | 3    | 2    |
| CO-3  | 3   | 3   | 2   | 3   | 1   | -   | -   | 1   | -   | 1    | 2    | 2    |
| CO-4  | 3   | 3   | 3   | 2   | 2   | -   | -   | 1   | 1   | 2    | 3    | 2    |
| CO-5  | 3   | 3   | 3   | 3   | 2   | -   | 1   | 2   | -   | 2    | 2    | 2    |
| AVG   | 3   | 3   | 3   | 2   | 2   | -   | 2   | 1   | 1   | 2    | 2    | 2    |

**SYLLABUS FOR OPEN ELECTIVES**  
**OPEN ELECTIVE - I**  
**SEMESTER – IV**

|                |                                          |          |          |          |          |
|----------------|------------------------------------------|----------|----------|----------|----------|
| <b>JAL9201</b> | <b>BASICS OF ARTIFICIAL INTELLIGENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                          | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

- To teach the fundamental concepts of Artificial Intelligence and its applications.
- To explain different problem solving methods.
- To familiarize the basics of knowledge representation and reasoning.
- To introduce about software agents.
- To outline the fundamental issues and challenges in AI.

**UNIT I INTRODUCTION TO AI 9**

Introduction – Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents – Typical Intelligent Agents – Problem Solving Approach to typical AI Problems.

**UNIT II PROBLEM SOLVING METHODS 9**

Problem Solving Methods – Search Strategies – Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games.

**UNIT III KNOWLEDGE REPRESENTATION 9**

Knowledge Representation – First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining – Backward – Chaining – Resolution – Knowledge Representation – Ontological Engineering – Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information.

**UNIT IV SOFTWARE AGENTS 9**

Software Agents – Architecture for Intelligent Agents – Agent Communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent Systems.

**UNIT V AI APPLICATIONS 9**

AI Applications – Language Models – Information Retrieval – Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning - Moving.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- Understand the fundamental concepts of Artificial Intelligence and its applications.
- Apply different problem solving methods.
- Discuss the basics of knowledge representation and reasoning.
- Discuss about software agents.
- Develop solutions for fundamental issues and challenges in AI.

**TEXTBOOKS:**

1. Stuart Russel and Peter Norvig, "Artificial Intelligence – A modern approach", 2nd Edition, Prentice Hall, 2009.
2. I. Bratko, "Prolog: Programming for Artificial Intelligence", 4th Edition, Addison-Wesley Educational Publishers Inc., 2011.

**REFERENCES:**

1. Prachi Joshi, and Parag Kulkarni, "Artificial Intelligence: Building Intelligent Systems", 2nd Edition, MIT Press, 2012.
2. Elaine Rich, Kevin Knight and Shiva Shankar B Nair, (2010), "Artificial Intelligence", 3rd Edition, TMH, 2010.

**WEBSITE REFERENCES:**

1. <https://www.red-gate.com/simple-talk/development/data-science-development/introduction-to-artificial-intelligence/>
2. <http://redwood.cs.ttu.edu/~rahewett/teach/ai16/2prob-solving.pdf>
3. <https://www.edureka.co/blog/knowledge-representation-in-ai/>
4. <https://www.techopedia.com/definition/24595/software-agent>
5. <https://www.shiksha.com/online-courses/articles/top-real-world-artificial-intelligence-applications/>

**CO-PO MAPPING:**

|     | 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    |
| AVG | 1.8 | 1.8 | 1.8 | 2   | 2.4 | -   | -   | -   | 1.4 | 2    | 2.2  | 1.8  |

|                |                                           |          |          |          |          |
|----------------|-------------------------------------------|----------|----------|----------|----------|
| <b>JAL9202</b> | <b>ETHICS AND ARTIFICIAL INTELLIGENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To introduce the ethics of AI.
- To familiarize the framework and different models of human rights.
- To discuss about the concepts and issues with AI.
- To outline the different perspectives of AI.
- To give an overview of the various applications of AI.

### **UNIT I INTRODUCTION TO ETHICS OF AI 9**

Role of Artificial Intelligence in human life - Understanding ethics - Why Ethics in AI? - Ethical Considerations of AI - Current Initiatives in AI and Ethics - Ethical Issues with our relationship with artificial Entities.

### **UNIT II FRAMEWORK AND MODELS 9**

AI governance by human-right centered design - Normative models - Role of professional norms - Teaching machines to be moral.

### **UNIT III CONCEPTS AND ISSUES 9**

Accountability in computer systems – Transparency - Responsibility and AI - Race and gender - AI as a moral right-holder.

### **UNIT IV PERSPECTIVES AND APPROACHES 9**

Perspectives on ethics of AI - Integrating ethical values and economic value - Automating origination - AI a binary approach - Machine learning values - Artificial moral agents.

### **UNIT V CASES AND APPLICATIONS 9**

Ethics of Artificial Intelligence in transport - Ethical AI in military, biomedical research, patient care, public health, robot teaching, pedagogy, policy, smart city ethics.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Explain about the ethics of AI.
- Describe the framework and different models of human rights.
- Discuss about the concepts and issues with AI.
- Apply the different perspectives of AI while designing real time applications.
- Design ethical AI applications.

### **TEXTBOOKS:**

1. Paula Boddington, “Towards a Code of Ethics for Artificial Intelligence”, Springer, 2017.
2. Markus D. Dubber, Frank Pasquale, Sunit Das, “The Oxford Handbook of Ethics of AI”, Oxford University Press Edited book, 2020.
3. S. Matthew Liao, “Ethics of Artificial Intelligence”, Oxford University Press Edited Book, 2020.

**REFERENCES:**

1. Wallach, W., & Allen, C, “Moral Machines: Teaching Robots Right From Wrong”, Oxford University Press, 2008.
2. N. Bostrom and E. Yudkowsky. “The ethics of artificial intelligence”, W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, Cambridge, 2014.

**WEBSITE REFERENCES:**

1. <https://intelligence.org/files/EthicsofAI.pdf>
2. <https://www.coursera.org/learn/ethics-of-artificial-intelligence>
3. <https://www.ibm.com/watson/assets/duo/pdf/everydayethics.pdf>

**CO-PO MAPPING:**

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

**OPEN ELECTIVE - II**  
**SEMESTER – V**

|                |                                   |          |          |          |          |
|----------------|-----------------------------------|----------|----------|----------|----------|
| <b>JAL9203</b> | <b>HUMAN COMPUTER INTERACTION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

- To learn the user's need of the interaction system.
- To understand and apply various interaction design techniques.
- To introduce implementation and evaluation techniques of human computer interaction and user support.
- To understand the cognitive aspects of human - machine interaction.
- To familiarize the various sectors that require human - machine interaction.

**UNIT - I INTRODUCTION TO HUMAN COMPUTER INTERACTION 9**

Foundation – Human – Computer – Interaction – Paradigms – Definition of HCI – Components – Cognitive Framework – Perception and Representation – Attention and Memory Constraint – Knowledge and Mental Model – Interface Metaphors – Input – Output.

**UNIT - II DESIGN PROCESS 9**

Interaction Styles – Interaction Design Basics – HCI in the Software Process – Design Rules - Designing Windowing Systems - User Support and On-Line Information - Designing For Collaborative Work and Virtual Environments - Principles and User - Centered Design - Methods for User-Centered Design.

**UNIT - III IMPLEMENTATION AND EVALUATION PROCESS 9**

Introduction - Elements of windowing system - programming the application - Implementation issues – Implementation Support - Goals of Evaluations – Evaluation techniques – Evaluation through experts - Evaluation through user participation - Universal Design – User Support.

**UNIT - IV MODELS 9**

Cognitive models – Linguistic models - Physical and device models – Cognitive architectures - Communication & collaboration models: Face to Face communication - Text based communication - Models of the system – Modeling Rich Interaction.

**UNIT - V APPLICATIONS 9**

Socio – Organization issues and stakeholder requirements - Ubiquitous Computing - Context – Aware User Interfaces - Hypertext - Multimedia - World Wide Web - Virtual reality- Augmented reality - Decision support systems.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- Understand the basic concepts for HCI.
- Analyze the user's needs and methods in interaction system.
- Emphasis on elements, goals and universal design process.
- Evaluate the usability and effectiveness of various models.
- Apply the interaction techniques to build efficient systems.

**TEXTBOOKS:**

1. Dix, Finlay, Abowd and Beale. (2004), "Human – Computer Interaction", (3<sup>rd</sup> Edn.), Prentice Hall.
2. J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey. (2000), "Human – Computer Interaction", (1<sup>st</sup> Edn.), Addison Wesley.

**REFERENCES**

1. Frank Adelstein, Sandeep KS Gupta, Golden Richard, (2005)," Fundamentals of Mobile and Pervasive Computing", TMH.
2. Debashis Saha, (2002),"Networking Infrastructure for Pervasive Computing: Enabling Technologies", (1<sup>st</sup> Edn.), Kluwer Academic Publisher, Springer.

**WEBSITE REFERENCES**

1. <https://www.interaction-design.org/literature/topics/human-computer-interaction>
2. <https://www.figma.com/resource-library/interaction-design/>
3. <https://www.scratchapixel.com/lessons/3d-basic-rendering/windowing/windows-intro.html>
4. <https://www.frontiersin.org/journals/computer-science/articles/10.3389/fcomp.2024.1384252/full>
5. <https://link.springer.com/article/10.1007/s11042-021-10971-4>

**CO-PO MAPPING:**

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

|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>JAL9204</b> | <b>DEEP LEARNING PRINCIPLES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                 | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To introduce the basics of deep learning.
- To explain the different aspects of deep learning models.
- To familiarize the concepts of convolution neural network.
- To describe the concepts of recurrent neural network.
- To give an introduction on reinforcement learning concept.

### **UNIT I INTRODUCTION TO DEEP LEARNING**

**9**

The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons - Soft max output layers.

### **UNIT II DEEP LEARNING MODELS**

**9**

Tensorflow – Variables – Operations – Placeholders – Sessions – Sharing Variables - Graphs – Visualization.

### **UNIT III CONVOLUTION NEURAL NETWORK**

**9**

Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer – Applications.

### **UNIT IV RECURRENT NEURAL NETWORK**

**9**

Recurrent Neural Network – Memory cells – Sequence analysis – Word 2vec – LSTM – Memory augmented Neural Networks – NTM – Applications.

### **UNIT V REINFORCEMENT LEARNING**

**9**

Reinforcement Learning – MDP – Q Learning – Applications.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand the basics of deep learning.
- Apply deep learning models to solve real time problems.
- Discuss the concepts of CNN.
- Recall the different concepts of RNN.
- Get familiarized with reinforcement learning.

### **TEXTBOOKS:**

1. Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms”, O'Reilly Media, 2017.

### **REFERENCES:**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning series”, MIT Press, 2017.



**WEBSITE REFERENCES:**

1. <https://www.simplilearn.com/tutorials/deep-learning-tutorial/introduction-to-deep-learning>
2. <https://g.co/kgs/W8N35XH>
3. <https://www.datacamp.com/tutorial/introduction-to-convolutional-neural-networks-cnns>
4. <https://machinelearningmastery.com/an-introduction-to-recurrent-neural-networks-and-the-math-that-powers-them/>
5. <https://www.ibm.com/topics/reinforcement-learning>

**CO-PO MAPPING:**

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

**OPEN ELECTIVE - III**  
**SEMESTER – VI**

|                |                                  |          |          |          |          |
|----------------|----------------------------------|----------|----------|----------|----------|
| <b>JAL9205</b> | <b>NATURE INSPIRED COMPUTING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                                  | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

- To explain concepts of natural systems and its applications.
- To teach new basic natural systems functions (operations).
- To introduce fundamentals of nature inspired techniques which influence computing.
- To integrate hardware and software in natural applications.
- To familiarize natural design considerations.

**UNIT I INTRODUCTION**

**9**

Introduction - Overview of Philosophy - Nature to Nature Computing - A Brief Overview of Three Branches - Computing Inspired by nature - Simulation and Emulation of Nature in Computers - Computing with Natural Materials - Nature Inspired Computing Approaches.

**UNIT II CONCEPTUALIZATION**

**9**

Natural Phenomena - Models and metaphors - Nature to computing and back again - Individuals, Entities and agents - Parallelism and Distributivity Interactivity – Adaptation – Feedback - Self-Organization -Complexity – Emergence - Bottom-up Vs Top-Down Approach – Determination - Chaos and Fractals.

**UNIT III EVOLUTIONARY COMPUTING**

**9**

Hill Climbing - Simulated Annealing - Simulated Annealing - Genetics Principles - Standard Evolutionary Algorithm - Genetic Algorithms – Reproduction - Crossover Mutation - Evolutionary Programming - Genetic Programming.

**UNIT IV NEUROCOMPUTING**

**9**

The Nervous System - Levels of Organization in the Nervous System - Networks Layers and Maps - Basis of learning and Memory - Artificial Neural Networks - Network Architectures - Learning Approaches - ANNs and Learning Algorithms - Hebbian Learning - Single Layer Perceptron - Multilayer Perceptron - Case Study: Bank loan approval using ANN.

**UNIT V SWARM INTELLIGENCE**

**9**

Introduction - Ant Colony Optimization - Ant Foraging Behaviour - Ant Colony Optimization - SACO algorithm - Ant Colony Algorithm (ACA) - Scope of ACO algorithms - Swarm Robotics - Social Adaptation of Knowledge - Particle Swarm Optimization - Case Study: Swarm Intelligence in Bio Inspired Computing Problem.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- To discuss concepts of Natural systems and its applications.
- To understand new basic natural systems functions.
- To manage the scope changes of nature inspired techniques which influence computing.
- To examine the principle of Immune computing techniques.

- To illustrate the basic concepts of Swarm Intelligence processes.

#### TEXTBOOKS:

1. Dario Floreano, Claudio Mattiuss, "Bio-Inspired Artificial Intelligence Theories, Methods, and Technologies", MIT Press, Cambridge, 2023.
2. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", CRC Press, 2006.

#### REFERENCES:

1. Kazumi Nakamatsu, Srikanta Patnaik, Xin-She Yang, "Nature-Inspired Computing and Optimization Theory and Applications", Springer, 2018
2. Atulya K. Nagar, Kusum Deep, Shishir K. Shandilya, Smita Shandilya, "Handbook of Research on Soft Computing and Nature-Inspired Algorithms", IGI
3. Marco Dorigo, Thomas Stutzle, "Ant Colony Optimization", PHI, 2005.
4. Information Resources Management Association - "Nature-Inspired Computing Concepts, Methodologies, Tools, and Applications", IGI Global, 2016.

#### WEBSITE REFERENCES:

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4675795/>
2. <https://www.sciencedirect.com/topics/computer-science/bio-inspired-computing>
3. <https://www.computersciencedegreehub.com/faq/what-is-nature-inspired-computing/>
4. <https://www.tandfonline.com/doi/full/10.1080/09540091.2015.1092499>
5. [http://www.scholarpedia.org/article/Swarm\\_intelligence](http://www.scholarpedia.org/article/Swarm_intelligence)

#### CO-PO MAPPING:

|     | 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    |
| AVG | 1.8 | 1.8 | 1.8 | 2   | 2.4 | -   | -   | -   | 1.4 | 2    | 2.2  | 1.8  |

|                |                              |          |          |          |          |
|----------------|------------------------------|----------|----------|----------|----------|
| <b>JAL9206</b> | <b>BUSINESS INTELLIGENCE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To understand business analytics and its related technology
- To understand the competitive advantages of business analytics
- To provide information about estimation, regression and testing of hypothesis
- To learn data mining methods
- To gain knowledge about business intelligence tools

### **UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9**

Introduction - Types of Digital Data - OLAP & OLTP - Business View of Information Technology Application - Descriptive Analytics - Prescriptive Analytics - Application of Analytics.

### **UNIT II BUSINESS INTELLIGENCE 9**

Introduction - BI Definition and Concepts - Data Integration - Multidimensional Data Modeling.

### **UNIT III UNDERSTANDING PROBABILITY AND STATISTICS 9**

Probability - Sampling and Estimation - Confidence Intervals - Hypothesis Testing - Analysis of Variance - Correlation Analysis - Understanding Statistics.

### **UNIT IV DATA MINING ALGORITHMS 9**

Simple Linear Regression - Multiple Linear Regression - Logistic Regression - Decision Tree - Forecasting Techniques - Clustering - Mining Frequent Patterns – Associations and Correlations – Mining Methods – Pattern Evaluation Method.

### **UNIT V BUSINESS ANALYTICS TOOLS 9**

SAP Business Intelligence - Zoho Analytics - Microsoft Power BI - Tableau - Oracle BI - IBM Cognos Analytics.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Explain various types of business analytics.
- Apply business intelligence concepts for data modelling.
- Apply statistical tests in testing hypothesis on data.
- Analyse data by utilizing various data mining approaches.
- Build applications using business analytics tools.

### **TEXTBOOKS:**

1. R N Prasad, Seema Acharya, “Fundamentals of Business Analytics”, 2<sup>nd</sup> Edition, Wiley Publications, 2016.
2. U Dinesh Kumar, “Business Analytics: The Science of Data-Driven Decision Making”, Wiley Publications, 2017.

**REFERENCES:**

1. Philipp K. Janert, “Data Analysis with Open Source Tools”, O’Reilley, 2010.
2. Wes McKinney, “Python for Data Analysis”, O’Reilley, 2012.
3. Robert Nisbelt, John Elder, and Gary Miner, “Handbook of Statistical Analysis and Data Mining Applications”, Academic Press, 2009.
4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Businesses”, Wiley, 2013.
5. David Ruppert, “Statistics and Data Analysis for Financial Engineering”, Springer, 2011.

**WEBSITE REFERENCES:**

1. <https://learn.microsoft.com/en-us/azure/architecture/data-guide/relational-data/online-analytical-processing>
2. <https://www.techtarget.com/searchbusinessanalytics/definition/business-intelligence-BI>
3. <https://online.stat.psu.edu/stat200/book/export/html/121>
4. <https://www.devteam.space/blog/top-10-data-mining-algorithms/>
5. <https://www.simplilearn.com/types-of-business-analytics-tools-examples-jobs-article>

**CO-PO MAPPING:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 1   | 2   | 2   | 2   | -   | -   | -   | 3   | 3    | 1    | 1    |
| CO2 | 2   | 2   | 3   | 3   | 3   | -   | -   | -   | 3   | 2    | 1    | 1    |
| CO3 | 2   | 2   | 2   | 2   | 3   | -   | -   | -   | 1   | 2    | 1    | 2    |
| CO4 | 1   | 2   | 3   | 2   | 3   | -   | -   | -   | 2   | 2    | 1    | 2    |
| CO5 | 3   | 2   | 1   | 3   | 2   | -   | -   | -   | 2   | 1    | 1    | 3    |
| AVG | 2   | 1.8 | 2.2 | 2.4 | 2.6 | -   | -   | -   | 2.2 | 2    | 1    | 1.8  |

|                |                            |          |          |          |          |
|----------------|----------------------------|----------|----------|----------|----------|
| <b>JAL9207</b> | <b>TEXT AND WEB MINING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                |                            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

### **COURSE OBJECTIVES:**

- To explain the numerous methods of text extraction process.
- To differentiate clustering techniques on text.
- To differentiate classification techniques on text.
- To explain the basics of web content mining.
- To enable development of a web recommendation systems for social networking.

### **UNIT I TEXT EXTRACTION**

**9**

Text Extraction: Introduction - Rapid automatic keyword extraction – Candidate keywords - Keyword scores - Adjoining keywords - Extracted keywords - Benchmark evaluation - Precision and recall - Efficiency - Stop-list generation - Evaluation on new articles.

### **UNIT II CLUSTERING**

**9**

Introduction to Clustering: Multilingual document clustering - Multilingual LSA - Tucker1 method - PARAFAC2 method - LSA with term alignments - LMSA – LMSA with term alignments.

### **UNIT III CLASSIFICATION**

**9**

Introduction to Classification: Content-based spam email classification using machine-learning algorithms-Utilizing non-negative matrix factorization for email classification problems-Constrained clustering with k-means type algorithms.

### **UNIT IV INFORMATION RETRIEVAL AND WEB MINING**

**9**

Introduction to Information retrieval - Basic Concepts of Information Retrieval - Information Retrieval Methods – Text and Web Page Preprocessing - Web crawling - Text indexing- scoring and ranking - Information extraction and integration – Web Mining Algorithms - Online opinion mining sentiment analysis - Review spam detection.

### **UNIT V SOCIAL NETWORK ANALYSIS**

**9**

Link analysis - Social network mining algorithms - Online social media analysis and modelling - Co-Citation and Bibliographic Coupling - Page Rank Algorithm – HITS Algorithm - Community Discovery - Problem Definition - Bipartite Core Communities - Maximum Flow Communities - Email Communities – Web Recommendation System.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOMES:**

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

- Understand the various text extraction techniques.
- Understand the clustering techniques.
- Apply the classification techniques among textual document.
- Implement the various web mining algorithms.
- Develop a web recommendation systems for social networking.

### TEXT BOOKS

1. Michael W. Berry & Jacob Kogan, (2011)"Text Mining Applications and Theory", 1st edition, Wiley publications.
2. Prabhakar Raghavan, HinrichSchitze, Christopher D. Manning (2008), "Introduction to Information Retrieval", (2nd Edn.), Cambridge University Press.

### REFERENCES

1. Aggarwal, Charu C., and Cheng Xiang Zhai, (2012),"Mining text data", 1st edition, Springer Science & Business Media.
2. Srivastava, Ashok N., and Mehran Sahami, (2009),"Text mining: classification, clustering, and applications." 2nd edition, Chapman and Hall/CRC.

### WEBSITE REFERENCES

1. <https://egyankosh.ac.in/bitstream/123456789/89138/3/Unit-12.pdf>
2. <https://www.sciencedirect.com/topics/computer-science/text-clustering>
3. <https://www.upgrad.com/blog/information-retrieval-system-explained/>
4. <https://www.igi-global.com/chapter/web-mining-social-network-analysis/48398>

### CO-PO MAPPING:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3   | 2   | 3   | 1   | 3   | -   | -   | -   | 1   | 2    | 1    | 2    |
| CO2 | 3   | 1   | 2   | 1   | 3   | -   | -   | -   | 2   | 2    | 1    | 3    |
| CO3 | 2   | 2   | 1   | 3   | 1   | -   | -   | -   | 3   | 3    | 1    | 2    |
| CO4 | 2   | 1   | 1   | 1   | 2   | -   | -   | -   | 2   | 1    | 2    | 2    |
| CO5 | 1   | 3   | 2   | 2   | 1   | -   | -   | -   | 3   | 2    | 1    | 1    |
| AVG | 2.2 | 1.8 | 1.8 | 1.6 | 2   | -   | -   | -   | 2.2 | 2    | 1.2  | 2    |





**TEXTBOOKS:**

1. Kaliraj, P., & Devi, T. (Eds.), “Artificial Intelligence Theory, Models, and Applications”, 1st ed., 2021, CRC Press, Taylor & Francis Group, Boca Raton.

**REFERENCES:**

1. Zoltán Somogyi, “The Application of Artificial Intelligence”, 2021, Springer International Publishing.
2. Ilias G. Maglogiannis (Ed.), “Emerging Artificial Intelligence Applications in Computer Engineering Real World AI Systems with Applications in EHealth, HCI, Information Retrieval and Pervasive Technologies”, 2007, IOS Press.
3. Terje Solsvik Kristensen, “Artificial Intelligence: Models, Algorithms and Applications”, 2021, Bentham Science Publishers.

**WEBSITE REFERENCES:**

1. <https://www.accenture.com/cz-en/insights/artificial-intelligence-summary-index>
2. [https://www.sas.com/en\\_in/insights/articles/big-data/artificial-intelligence-machine-learning-deep-learning-and-beyond.html](https://www.sas.com/en_in/insights/articles/big-data/artificial-intelligence-machine-learning-deep-learning-and-beyond.html)
3. <https://www.foreseemed.com/artificial-intelligence-in-healthcare>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7546651/>
5. <https://intellias.com/artificial-intelligence-in-agriculture/>

**CO-PO MAPPING:**

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