# SRI SHAKTHI

**INSTITUTE OF ENGINEERING AND TECHNOLOGY, (AUTONOMOUS)**

**L&T BYPASS ROAD, COIMBATORE - 62**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**



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

**REGULATION 2019**

# VISION OF THE INSTITUTE

To make the institution one of our nation's great engineering schools recognized nationally and internationally for excellence in teaching, research and public service. We seek to be the preferred destination for students, practitioners seeking an engineering education, employers hiring engineering graduates and organizations seeking engineering knowledge.

# MISSION OF THE INSTITUTE

To provide an encouraging environment to develop the intellectual capacity, critical thinking, creativity and problem solving ability of the students.

# VISION OF THE DEPARTMENT

To produce outstanding Computer Science and Engineering professionals at par with the nation's top engineering schools and to make the department as a hub for contemporary Research and development activities and industrial linkages.

# MISSION OF THE DEPARTMENT

| M1 | To ensure perpetual academic excellence |
|----|------------------------------------------|
| M2 | To practice a well-defined teaching learning process. |
| M3 | To empower the students with analytical skills, exposure on latest technologies, research activities and industry practices. |
| M4 | To produce successful graduates with professional and leadership qualities to serve the needs of society. |

| PEO No | Program Educational Objectives Statements |
|--------|-------------------------------------------|
| PEO 1 | To ensure that the graduates will be proficient in utilizing the fundamental knowledge of basic sciences, mathematics and computer science for the applications relevant to various streams of Engineering and Technology. |
| PEO 2 | To enrich graduates with the core competencies necessary for applying knowledge of computers and modern tools to develop hardware and software systems by understanding the importance of social, business and environmental needs in the human context. |
| PEO 3 | To enable graduates to think logically, act ethically, pursue lifelong learning and to have the capacity to understand technical issues related to computing systems and to design optimal solutions. |
| PEO 4 | To enable graduates to gain ability and attitude to adapt with emerging technological changes. |
| PEO 5 | To enable graduates to establish themselves as technocrats or entrepreneurs by applying their technical skills to solve real world problems to meet the needs of industry, academia and research. |

## PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

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

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.

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.

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.

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.

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.

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.

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

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## PROGRAMME SPECIFIC OUTCOMES:

**PSO1**: Ability to understand the core principles of the theory of computing, programming and data organization and to make use of them in designing, developing and testing software systems with assured quality.

**PSO2:** The ability to use software engineering practices and tools in developing complete software based solutions for identified real world problems with the help of acquired knowledge in computer networking and World Wide Web.

**PSO3:** The ability to learn new technologies and acquire new skill sets to adapt to the changing requirements in the career and to pursue entrepreneurship.

| Sem | Course name | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Matrices and Calculus for CSE and IT | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| | Applied Chemistry | ✓ | ✓ | | | | | | | | | | |
| | Communicative English | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| | Computational Thinking and Problem Solving | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ |
| | Front End Technologies | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ |
| | Language - Tamil, Malayalam,Foundation English | | | | | | | | | | ✓ | | |
| | Engineering Exploration I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Applied Chemistry Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| | Communicative English Laboratory | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| | Computational Thinking and Problem Solving Laboratory | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | ✓ |
| | Front End Technologies Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ |
| | Crop Production Laboratory - I | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | |
| 2 | Advanced Calculus and Set Algebra | ✓ | ✓ | ✓ | | ✓ | | | | | | | ✓ |
| | Physics For Information Science | ✓ | ✓ | | | | | | | | | | |
| | English for Engineers | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| | C Programming | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| | Computer Architecture | ✓ | ✓ | ✓ | | | | | | | | | ✓ |
| | Digital principles and system design | | | | | | | | | | | | |
| | Engineering Exploration-II | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Physics For Information Science Laboratory | ✓ | ✓ | | | | | | | | | | |
| | English for Engineers Laboratory | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| | C Programming Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| | Digital principles and system design Laboratory | | | | | | | | | | | | |
| 3 | Discrete Mathematics | ✓ | ✓ | ✓ | | ✓ | | | | | | | ✓ |
| | Operating Systems | ✓ | ✓ | ✓ | | | | | | | | | |
| | Data Structures | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ |
| | Database Management Systems | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ |
| | Object oriented | ✓ | ✓ | ✓ | ✓ | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programming | | | | | | | | | | | | |
| | Microprocessor and Microcontroller | ✓ | ✓ | | | | | | | | | | |
| | <mark>Engineering Exploration – III</mark> | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Operating Systems Laboratory | ✓ | ✓ | ✓ | | | | | | | | | |
| | Data Structures Laboratory | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ |
| | Database Management Systems Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ |
| | Object oriented Programming Laboratory | ✓ | ✓ | ✓ | | ✓ | | | | | | | |
| | Microprocessor and Microcontroller Laboratory | ✓ | ✓ | | | | | | | | | | |
| | Career Enhancement Program - I | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 4 | Probability, Statistics and Queueing Theory | ✓ | ✓ | ✓ | | ✓ | | | | | | | ✓ |
| | Environmental Science and Engineering | ✓ | | | | | ✓ | ✓ | | | | | |
| | Advanced Databases | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| | Internet Programming | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ |
| | Design and Analysis of Algorithms | ✓ | ✓ | ✓ | | | | | | | | | |
| | Advanced Java Programming | | ✓ | ✓ | | ✓ | | | | | | ✓ | |
| | <mark>Engineering Exploration -IV</mark> | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Advanced Java Programming Laboratory | | ✓ | ✓ | | ✓ | | | | | | ✓ | |
| | Internet Programming Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ |
| | Design and Analysis of Algorithms Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ |
| | Advanced Databases Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| | Career Enhancement Program - II | | ✓ | ✓ | | | ✓ | ✓ | | | ✓ | ✓ | |
| 5 | Compiler Design | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| | Object Oriented Analysis and Design | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ |
| | Data Science and Analytics | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ |
| | Computer Networks | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ |
| | Professional Elective I | | | | | | | | | | | | |
| | <mark>Engineering Exploration – V</mark> | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Compiler Design Laboratory | ✓ | ✓ | | | ✓ | | | | | | | |
| | Object Oriented Analysis and Design | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ |

| Sem | Course | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Laboratory |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Data Science and Analytics Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  |  | ✓ |
|  | Computer Networks Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |
|  | Web development Laboratory | ✓ | ✓ | ✓ |  | ✓ |  |  | ✓ | ✓ | ✓ |  | ✓ |
|  | Career Enhancement Program - III |  | ✓ | ✓ |  |  |  | ✓ | ✓ |  | ✓ | ✓ |  |
| 6 | Software Engineering | ✓ | ✓ | ✓ | ✓ |  |  | ✓ |  |  | ✓ | ✓ |  |
|  | Mobile Computing | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |  |  |
|  | Cloud Computing | ✓ | ✓ | ✓ | ✓ | ✓ |  |  | ✓ | ✓ | ✓ | ✓ | ✓ |
|  | Professional Elective II |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Professional Elective III |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Mini project | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|  | Software Engineering Laboratory | ✓ | ✓ | ✓ | ✓ |  |  | ✓ |  |  | ✓ | ✓ |  |
|  | Mobile Application Development Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |
|  | Cloud Computing Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |
|  | Career Enhancement Program IV |  | ✓ | ✓ |  |  |  | ✓ | ✓ |  | ✓ | ✓ |  |
| 7 | Cryptography and Network Security | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |  |
|  | Principles of Management and Professional Ethics | ✓ | ✓ |  |  |  | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|  | Professional Elective IV |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Open elective I |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Professional Elective V |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Security Laboratory | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |  |
|  | Project Phase I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 8 | Open elective II |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Project Phase II | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

# B.E. COMPUTER SCIENCE AND ENGINEERING

## REGULATION 2019- CHOICE BASED CREDIT SYSTEM

### SEMESTER I

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| | | Induction Program | - | - | - | - | - | - |
| 1 | U19ENTL101T | Communicative English | HS | 3 | 2 | 0 | 2 | 2 |
| 2 | U19MATH105 | Matrices and Calculus for CSE and IT | BS | 4 | 3 | 1 | 0 | 4 |
| 3 | U19CHTL101T | Applied Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 4 | U19CSTL101T | Computational Thinking and Problem Solving | ES | 3 | 3 | 0 | 0 | 3 |
| 5 | U19CSTL102T | Front End Technologies | ES | 5 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 6 | U19ENTL101L | Communicative English Laboratory | HS | 2 | 0 | 0 | 2 | 1 |
| 7 | U19CHTL101L | Applied Chemistry Laboratory | BS | 3 | 0 | 0 | 2 | 1 |
| 8 | U19CSTL101L | Computational Thinking and Problem-Solving Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 9 | U19CSTL102L | Front End Technologies Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 10 | U19CCEX101 | Engineering Exploration I | EEC | 3 | 1 | 0 | 2 | 2 |
| 11 | U19AEPC101 | Crop Production Laboratory - I | BS | 3 | 0 | 0 | 4 | 2 |
| 12 | U19LATH101 U19LATH102 U19LAEN101 | Language - Tamil Language - Malayalam Foundation English | HS | 2 | 2 | 0 | 0 | 2 |
| **TOTAL** | | | | | | | | 25 |

### SEMESTER II

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | U19ENTL202T | English for Engineers | HS | 3 | 2 | 0 | 0 | 2 |
| 2 | U19MATH214 | Advanced Calculus and Set Algebra | BS | 4 | 3 | 0 | 0 | 3 |
| 3 | U19PHTL205T | Physics For Information Science | BS | 3 | 2 | 0 | 0 | 2 |
| 4 | U19ITTH201 | Computer Architecture | PC | 4 | 3 | 0 | 0 | 3 |
| 5 | U19CSTL203T | C Programming | ES | 4 | 3 | 0 | 0 | 3 |
| 6 | U19ECTL204T | Digital principles and system design | ES | 3 | 2 | 0 | 0 | 2 |
| **PRACTICALS** | | | | | | | | |
| 7 | U19CCEX202 | Engineering Exploration-II | EEC | 2 | 1 | 0 | 2 | 2 |
| 8 | U19PHTL205L | Physics For Information Science Laboratory | BS | 3 | 0 | 0 | 2 | 1 |
| 9 | U19CSTL203L | C Programming Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 10 | U19ECTL204L | Digital principles and system design Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 11 | U19ENTL202L | English for Engineers Laboratory | HS | 3 | 0 | 0 | 2 | 1 |
| **TOTAL** | | | | | | | | 21 |

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | U19MATH322 | Discrete Mathematics | BS | 5 | 3 | 1 | 0 | 4 |
| 2 | U19CSTL304T | Operating Systems | PC | 4 | 3 | 0 | 0 | 3 |
| 3 | U19CSTL307T | Object oriented Programming | PC | 4 | 3 | 0 | 0 | 3 |
| 4 | U19CSTL305T | Data Structures | PC | 4 | 3 | 0 | 0 | 3 |
| 5 | U19ECTL513T | Microprocessor and Microcontroller | ES | 3 | 2 | 0 | 0 | 2 |
| 6 | U19CSTL306T | Database Management Systems | PC | 4 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7 | U19CCEX303 | Engineering Exploration – III | EEC | 4 | 0 | 0 | 2 | 1 |
| 8 | U19CSTL304L | Operating Systems Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 9 | U19CSTL307L | Object oriented Programming Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 10 | U19CSTL305L | Data Structures Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 11 | U19ECTL513L | Microprocessor and Microcontroller Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 12 | U19CSTL306L | Database Management Systems Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 13 | U19CCLC301 | Career Enhancement Program - I | EEC | 3 | 1 | 1 | 0 | 1 |
| **TOTAL** | | | | | | | | **25** |

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | U19MATH429 | Probability, Statistics and Queueing Theory | BS | 4 | 3 | 1 | 0 | 4 |
| 2 | U19CSTL408T | Advanced Databases | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | U19CSTL409T | Internet Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | U19CSTL410T | Design and Analysis of Algorithms | PC | 4 | 3 | 0 | 0 | 3 |
| 5 | U19ITTL405T | Advanced Java Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 6 | U19CHTH401 | Environmental Science and Engineering | HS | 4 | 2 | 0 | 0 | 2 |
| **PRACTICALS** | | | | | | | | |
| 7 | U19CSTL408L | Advanced Databases Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 8 | U19CSTL409L | Internet Programming Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 9 | U19CSTL410L | Design and Analysis of Algorithms Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 10 | U19ITTL405L | Advanced Java Programming Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 11 | U19CCEX404 | Engineering Exploration -IV | EEC | 3 | 0 | 0 | 2 | 1 |
| 12 | U19CCLC402 | Career Enhancement Program - II | EEC | 3 | 1 | 1 | 0 | 1 |
| **TOTAL** | | | | | | | | **24** |

**SEMESTER V**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | U19CSTL512T | Object Oriented Analysis and Design | PC | 4 | 3 | 0 | 0 | 3 |
| 2 | U19CSTL511T | Compiler Design | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | U19CSTL513T | Data Science and Analytics | PC | 4 | 3 | 0 | 0 | 3 |
| 4 | U19ITTL506T | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective I | PE | 3 | 2 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 6 | U19CSTL512L | Object Oriented Analysis and Design Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 7 | U19CSTL511L | Compiler Design Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 8 | U19CSTL513L | Data Science and Analytics Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 9 | U19ITTL506L | Computer Networks Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 10 | U19CCEX505 | Engineering Exploration – V | EEC | 3 | 0 | 0 | 2 | 1 |
| 11 | U19CCLC503 | Career Enhancement Program - III | EEC | 3 | 1 | 1 | 0 | 1 |
| 12 | U19CSLC501 | Web development Laboratory | PC | 3 | 0 | 0 | 4 | 2 |
| | | **TOTAL** | | | | | | **23** |

**SEMESTER VI**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | U19CSTL615T | Mobile Computing | PC | 4 | 3 | 0 | 0 | 3 |
| 2 | U19CSTL614T | Software Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | U19ITTL608T | Cloud Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective II | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective III | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 6 | U19CSTL615L | Mobile Application Development Laboratory | PC | 2 | 0 | 0 | 4 | 2 |
| 7 | U19CSTL614L | Software Engineering Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 8 | U19ITTL608L | Cloud Computing Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 9 | U19CSPR601 | Mini project | EEC | 3 | 0 | 0 | 4 | 2 |
| 10 | U19CCLC604 | Career Enhancement Program IV | EEC | 2 | 1 | 0 | 0 | 1 |
| | | **TOTAL** | | | | | | **22** |

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | U19METH707 | Principles of Management and Professional Ethics | HS | 3 | 3 | 0 | 0 | 3 |
| 2 | U19CSTL716T | Cryptography and Network Security | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | | Professional Elective IV | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | | Open Elective I | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 5 | U19CSPR703 | Professional Readiness for Innovation, Employability and Entrepreneurship | EEC | 6 | 0 | 0 | 6 | 3 |
| 6 | U19CSTL716L | Security Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 7 | U19CSPR702 | Project Phase I | EEC | 6 | 0 | 0 | 4 | 2 |
| | | **TOTAL** | | | | | | **18** |

**SEMESTER VIII**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | | Open Elective II | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 2 | U19CSPR803 | Project Phase II | EEC | 16 | 0 | 0 | 12 | 6 |
| | | **TOTAL** | | | | | | **9** |

**Total Number of Credits: 167**

| S.No. | Course Category | Credits per Semester | | | | | | | | Credits | Credit % |
|-------|-----------------|---|---|---|---|---|---|---|---|---------|----------|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| | | | | | | | | | | | |
| | **SUMMARY** | | | | | | | | | | |
| 1 | HS | 5 | 3 | - | 2 | - | - | 3 | - | 13 | 7.78 |
| 2 | BS | 10 | 6 | 4 | 4 | - | - | - | - | 24 | 14.37 |
| 3 | ES | 8 | 7 | 3 | - | - | - | - | - | 18 | 10.78 |
| 4 | PC | - | 3 | 16 | 16 | 18 | 13 | 4 | - | 70 | 41.92 |
| 5 | PE | - | - | - | - | 3 | 6 | 3 | - | 12 | 7.19 |
| 6 | OE | - | - | - | - | - | - | 3 | 3 | 6 | 3.59 |
| 7 | EEC | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 6 | 24 | 14.37 |
| | **Total** | 25 | 21 | 25 | 24 | 23 | 22 | 18 | 9 | 167 | 100% |

## HUMANITIES AND SOCIAL SCIENCES (HS)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1 | U19ENTL101T | Communicative English | HS | 3 | 2 | 0 | 2 | 2 |
| 2 | U19ENTL101L | Communicative English Laboratory | HS | 2 | 0 | 0 | 2 | 1 |
| 3 | U19LATH101 U19LATH102 U19LAEN101 | Language - Tamil Language – alayalam Foundation English | HS | 2 | 2 | 0 | 0 | 2 |
| 4 | U19ENTL202T | English for Engineers | HS | 3 | 2 | 0 | 0 | 2 |
| 5 | U19ENTL202L | English for Engineers Laboratory | HS | 2 | 0 | 0 | 2 | 1 |
| 6 | U19CHTH401 | Environmental Science and Engineering | HS | 4 | 2 | 0 | 0 | 2 |
| 7 | U19METH707 | Principles of Management and Professional Ethics | HS | 3 | 3 | 0 | 0 | 3 |

## BASIC SCIENCES (BS)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1 | U19MATH105 | Matrices and Calculus for CSE and IT | BS | 4 | 3 | 1 | 0 | 4 |
| 2 | U19CHTL101T | Applied Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 3 | U19AEPC101 | Crop Production Laboratory – I | BS | 3 | 0 | 0 | 4 | 2 |
| 4 | U19CHTL101L | Applied Chemistry Laboratory | BS | 3 | 0 | 0 | 2 | 1 |
| 5 | U19MATH214 | Advanced Calculus and Set Algebra | BS | 4 | 3 | 0 | 0 | 3 |
| 6 | U19PHTL205T | Physics For Information Science | BS | 3 | 2 | 0 | 0 | 2 |
| 7 | U19PHTL205L | Physics For Information Science Laboratory | BS | 3 | 0 | 0 | 2 | 1 |
| 8 | U19MATH322 | Discrete Mathematics | BS | 5 | 3 | 1 | 0 | 4 |
| 9 | U19MATH429 | Probability, Statistics and Queuing Theory | BS | 4 | 3 | 1 | 0 | 4 |

## ENGINEERING SCIENCES (BS)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1 | U19CSTL101T | Computational Thinking and Problem Solving | ES | 3 | 3 | 0 | 0 | 3 |
| 2 | U19CSTL102T | Front End Technologies | ES | 5 | 3 | 0 | 0 | 3 |
| 3 | U19CSTL101L | Computational Thinking and Problem Solving Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 4 | U19CSTL102L | Front End Technologies Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 5 | U19CSTL203T | C Programming | ES | 4 | 3 | 0 | 0 | 3 |
| 6 | U19ECTL204T | Digital principles and system Design | ES | 3 | 2 | 0 | 0 | 2 |
| 7 | U19CSTL203L | C Programming Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 8 | U19ECTL204L | Digital principles and system design Laboratory | ES | 3 | 0 | 0 | 2 | 1 |
| 9 | U19ECTL513T | Microprocessor and Microcontroller | ES | 3 | 2 | 0 | 0 | 2 |
| 10 | U19ECTL513L | Microprocessor and Microcontroller Laboratory | ES | 3 | 0 | 0 | 2 | 1 |

## PROFESSIONAL CORE (PC)

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1 | U19ITTH201 | Computer Architecture | PC | 4 | 3 | 0 | 0 | 3 |
| 2 | U19CSTL304T | Operating Systems | PC | 4 | 3 | 0 | 0 | 3 |
| 3 | U19CSTL307T | Object oriented Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | U19CSTL305T | Data Structures | PC | 4 | 3 | 0 | 0 | 3 |
| 5 | U19CSTL306T | Database Management Systems | PC | 4 | 3 | 0 | 0 | 3 |
| 6 | U19CSTL304L | Operating Systems Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 7 | U19CSTL307L | Object oriented Programming Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 8 | U19CSTL305L | Data Structures Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 9 | U19CSTL306L | Database Management Systems Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 10 | U19CSTL408T | Advanced Databases | PC | 3 | 3 | 0 | 0 | 3 |
| 11 | U19CSTL409T | Internet Programming | PC | 3 | 3 | 0 | 0 | 3 |

| 12 | U19CSTL410T | Design and Analysis of Algorithms | PC | 4 | 3 | 0 | 0 | 3 |
|----|-------------|-----------------------------------|----|---|---|---|---|---|
| 13 | U19ITTL405T | Advanced Java Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 14 | U19CSTL408L | Advanced Databases Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 15 | U19CSTL409L | Internet Programming Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 16 | U19CSTL410L | Design and Analysis of Algorithms Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 17 | U19ITTL405L | Advanced Java Programming Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 18 | U19CSTL512T | Object Oriented Analysis and Design | PC | 4 | 3 | 0 | 0 | 3 |
| 19 | U19CSTL511T | Compiler Design | PC | 3 | 3 | 0 | 0 | 3 |
| 20 | U19CSTL513T | Data Science and Analytics | PC | 4 | 3 | 0 | 0 | 3 |
| 21 | U19ITTL506T | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 22 | U19CSTL512L | Object Oriented Analysis and Design Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 23 | U19CSTL511L | Compiler Design Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 24 | U19CSTL513L | Data Science and Analytics Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 25 | U19ITTL506L | Computer Networks Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 26 | U19CSLC501 | Web development Laboratory | PC | 3 | 0 | 0 | 4 | 2 |
| 27 | U19CSTL615T | Mobile  Computing | PC | 4 | 3 | 0 | 0 | 3 |
| 28 | U19CSTL614T | Software Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 29 | U19ITTL608T | Cloud Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 30 | U19CSTL615L | Mobile  Application Development Laboratory | PC | 3 | 0 | 0 | 4 | 2 |
| 31 | U19CSTL614L | Software Engineering Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 32 | U19ITTL608L | Cloud Computing Laboratory | PC | 3 | 0 | 0 | 2 | 1 |
| 33 | U19CSTL716T | Cryptography and  Network Security | PC | 3 | 3 | 0 | 0 | 3 |
| 34 | U19CSTL716L | Security Laboratory | PC | 3 | 0 | 0 | 2 | 1 |

**PROFESSIONAL ELECTIVES (PE)**

| S.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1 | U19CSPE001 | Machine Learning | PE | 3 | 3 | 0 | 0 | 3 |
| 2 | U19CSPE002 | Advanced Machine Learning | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | U19ITPE008 | Big Data Analytics | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | U19ITPE009 | Advanced Big Data and its Ecosystem | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | U19CSPE003 | Data Visualization Techniques | PE | 3 | 3 | 0 | 0 | 3 |

| 6 | U19CSPE004 | Software Testing | PE | 3 | 3 | 0 | 0 | 3 |
|---|------------|------------------|-----|---|---|---|---|---|
| 7 | U19CSPE005 | Software Test Automation | PE | 3 | 3 | 0 | 0 | 3 |
| 8 | U19ITPE015 | Software Project Management | PE | 3 | 3 | 0 | 0 | 3 |
| 9 | U19ITPE003 | Agile Technologies | PE | 3 | 3 | 0 | 0 | 3 |
| 10 | U19ECTL614T | Internet of Things | PE | 3 | 3 | 0 | 0 | 3 |
| 11 | U19CSPE006 | Social Network Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 12 | U19ITPE013 | Artificial Intelligence | PE | 3 | 3 | 0 | 0 | 3 |
| 13 | U19CSPE007 | Software Defined Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 14 | U19CSPE008 | Information Retrieval Techniques | PE | 3 | 3 | 0 | 0 | 3 |
| 15 | U19ITPE012 | MERN STACK – Web Application Development | PE | 3 | 3 | 0 | 0 | 3 |
| 16 | U19CSPE009 | Full Stack Web Development | PE | 3 | 3 | 0 | 0 | 3 |
| 17 | U19ITPE004 | C# and .Net Programming | PE | 3 | 3 | 0 | 0 | 3 |
| 18 | U19CSPE010 | Augmented Reality | PE | 3 | 3 | 0 | 0 | 3 |
| 19 | U19CSPE011 | Game Programming | PE | 3 | 3 | 0 | 0 | 3 |
| 20 | U19CSPE012 | Blockchain Technologies | PE | 3 | 3 | 0 | 0 | 3 |
| 21 | U19ITPE014 | Digital Image Processing | PE | 3 | 3 | 0 | 0 | 3 |
| 22 | U19ITPE005 | Computer Graphics & Multimedia | PE | 3 | 3 | 0 | 0 | 3 |
| 23 | U19CSPE013 | Graph Theory and applications | PE | 3 | 3 | 0 | 0 | 3 |
| 24 | U19CSPE014 | Ad Hoc and Sensor Networks | PE | 3 | 3 | 0 | 0 | 3 |

**OPEN ELECTIVES (OE)**

| S.No | Dept | Course Code | Course Title | Contact Periods | L | T | P | C |
|------|------|-------------|--------------|-----------------|---|---|---|---|
| 1 | AGRI | U19AEOE001 | Agricultural Waste Management | 3 | 3 | 0 | 0 | 3 |
| 2 | AGRI | U19AEOE002 | Farm Management | 3 | 3 | 0 | 0 | 3 |
| 3 | BT | U19BTOE001 | Basics of Bioinformatics | 3 | 3 | 0 | 0 | 3 |
| 4 | BT | U19BTOE002 | Introduction to Bioenergy and Biofuels | 3 | 3 | 0 | 0 | 3 |
| 5 | BME | U19BMOE001 | Bio Healthcare and Telemedicine | 3 | 3 | 0 | 0 | 3 |
| 6 | BME | U19BMOE002 | Embedded Systems in Medical Devices | 3 | 3 | 0 | 0 | 3 |
| 7 | CIVIL | U19CEOE001 | Green buildings | 3 | 3 | 0 | 0 | 3 |
| 8 | CIVIL | U19CEOE002 | Disaster Preparedness and Management | 3 | 3 | 0 | 0 | 3 |
| 9 | CSE | U19CSOE001 | Software Engineering | 3 | 3 | 0 | 0 | 3 |
| 10 | CSE | U19CSOE002 | Database Management systems | 3 | 3 | 0 | 0 | 3 |
| 11 | ECE | U19ECOE003 | Consumer Electronics | 3 | 3 | 0 | 0 | 3 |
| 12 | ECE | U19ECOE006 | Medical Electronics | 3 | 3 | 0 | 0 | 3 |
| 13 | EEE | U19EEOE001 | Renewable Energy Resources | 3 | 3 | 0 | 0 | 3 |
| 14 | EEE | U19EEOE002 | Introduction to Control Systems | 3 | 3 | 0 | 0 | 3 |

| 15 | FT | U19FTOE001 | Food Science and Nutrition | 3 | 3 | 0 | 0 | 3 |
|----|------|------------|---------------------------|---|---|---|---|---|
| 16 | FT | U19FTOE002 | Food Preservation Techniques | 3 | 3 | 0 | 0 | 3 |
| 17 | IT | U19ITOE001 | UX/UI Design | 3 | 3 | 0 | 0 | 3 |
| 18 | IT | U19ITOE002 | Multimedia Systems | 3 | 3 | 0 | 0 | 3 |
| 19 | MECH | U19MEOE001 | Engineering Drawing | 3 | 3 | 0 | 0 | 3 |
| 20 | MECH | U19MEOE002 | Modern Manufacturing Techniques | 3 | 3 | 0 | 0 | 3 |
| 21 | PHY | U19PHOE001 | Nanotechnology and Engineering Applications | 3 | 3 | 0 | 0 | 3 |
| 22 | ENG | U19ENOE001 | English For Competitive Exams | 3 | 3 | 0 | 0 | 3 |
| 23 | AGRI | U19AEOE003 | Introduction to Bio-Energy | 3 | 3 | 0 | 0 | 3 |
| 24 | AGRI | U19AEOE004 | Robotics in Agriculture | 3 | 3 | 0 | 0 | 3 |
| 25 | BT | U19BTOE003 | Analytical methods and Instrumentation | 3 | 3 | 0 | 0 | 3 |
| 26 | BT | U19BTOE004 | Industrial Waste management | 3 | 3 | 0 | 0 | 3 |
| 27 | BME | U19BMOE003 | Hospital Management system | 3 | 3 | 0 | 0 | 3 |
| 28 | BME | U19BMOE004 | Biomedical Instrumentation | 3 | 3 | 0 | 0 | 3 |
| 29 | CIVIL | U19CEOE003 | Remote Sensing and GIS | 3 | 3 | 0 | 0 | 3 |
| 30 | CIVIL | U19CEOE004 | Air Pollution And Control Engineering | 3 | 3 | 0 | 0 | 3 |
| 31 | CSE | U19CSOE003 | Data Structures and Algorithms | 3 | 3 | 0 | 0 | 3 |
| 32 | ECE | U19ECOE001 | Soft Computing | 3 | 3 | 0 | 0 | 3 |
| 33 | ECE | U19ECOE004 | Advanced Mobile Communication | 3 | 3 | 0 | 0 | 3 |
| 34 | EEE | U19EEOE003 | Sensors and Transducers | 3 | 3 | 0 | 0 | 3 |
| 35 | EEE | U19EEOE004 | Energy Technology | 3 | 3 | 0 | 0 | 3 |
| 36 | FT | U19FTOE003 | Beverage Technology | 3 | 3 | 0 | 0 | 3 |
| 37 | FT | U19FTOE004 | Processing of Food Materials | 3 | 3 | 0 | 0 | 3 |
| 38 | IT | U19ITOE003 | Foundations of Information Technology | 3 | 3 | 0 | 0 | 3 |
| 39 | IT | U19ITOE004 | Web Design and Management | 3 | 3 | 0 | 0 | 3 |
| 40 | MECH | U19MEOE003 | Automobile Technology | 3 | 3 | 0 | 0 | 3 |
| 41 | MECH | U19MEOE004 | CAD/CAM | 3 | 3 | 0 | 0 | 3 |
| 42 | PHY | U19PHOE002 | Thin film Technology and Applications | 3 | 3 | 0 | 0 | 3 |
| 43 | CHE | U19CHOE001 | Environmental Sciences | 3 | 3 | 0 | 0 | 3 |
| 44 | ENG | U19ENOE002 | English for Employability Skills | 3 | 3 | 0 | 0 | 3 |
| 45 | EDC | U19EDOE001 | Intellectual Property rights | 3 | 3 | 0 | 0 | 3 |

## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1 | U19CCEX101 | Engineering Exploration I | EEC | 3 | 1 | 0 | 2 | 2 |
| 2 | U19CCEX202 | Engineering Exploration-II | EEC | 2 | 1 | 0 | 2 | 2 |
| 3 | U19CCEX303 | Engineering Exploration – III | EEC | 4 | 0 | 0 | 2 | 1 |
| 4 | U19CCLC301 | Career Enhancement Program - I | EEC | 3 | 1 | 1 | 0 | 1 |
| 5 | U19CCEX404 | Engineering Exploration -IV | EEC | 3 | 0 | 0 | 2 | 1 |
| 6 | U19CCLC402 | Career Enhancement Program - II | EEC | 3 | 1 | 1 | 0 | 1 |
| 7 | U19CCEX505 | Engineering Exploration – V | EEC | 3 | 0 | 0 | 2 | 1 |
| 8 | U19CCLC503 | Career Enhancement Program - III | EEC | 3 | 1 | 1 | 0 | 1 |
| 9 | U19CSPR601 | Mini project | EEC | 3 | 0 | 0 | 4 | 2 |
| 10 | U19CCLC604 | Career Enhancement Program IV | EEC | 2 | 1 | 0 | 0 | 1 |
| 11 | U19CSPR703 | Professional Readiness for Innovation, Employability and Entrepreneurship | EEC | 6 | 0 | 0 | 6 | 3 |
| 12 | U19CSPR702 | Project Phase I | EEC | 6 | 0 | 0 | 4 | 2 |
| 13 | U19CSPR803 | Project Phase II | EEC | 16 | 0 | 0 | 12 | 6 |

| | | | | | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **U19MATH105** | | **MATRICES AND CALCULUS FOR CSE AND IT** | | | 3 | 1 | 0 | 4 |

**COURSE OBJECTIVES**

Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of Matrix Theory, Differential Calculus, Integral Calculus and Ordinary Differential Equations which are being widely used in Information Sciences.

**PREREQUISITES**

- Basic concepts of Matrices
- System of linear equations
- Limits and Continuity
- Basic concepts of Differentiation
- Basic concepts of Integration

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | | 2 | 2 | 2 | 3 | | 2 | | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 2 | | | 2 |
| CO3 | | | | | | 2 | | 2 | 3 | 3 | | 2 | | | 2 |
| CO4 | | | | | | | 3 | 2 | 1 | 3 | | 3 | | | 3 |
| CO5 | | | | | | 3 | 3 | 3 | 3 | 3 | | 3 | | | 3 |

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

Consistency of linear system of equations – Rouche's theorem– Linear transformations – Vectors – Linear dependence – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (excluding proof) – Applications of Matrices in CSE and IT.

**UNIT II**  **DIAGONALIZATION OF A REAL SYMMETRIC MATRICES**  **8+3**

Cayley - Hamilton theorem (excluding proof) – Orthogonal matrix – Diagonalization of matrices– Reduction of Quadratic form to Canonical form by orthogonal transformation – Applications of  Diagonalization of a  real symmetric matrices in CSE and IT.

**UNIT III**  **DIFFERENTIAL CALCULUS AND ITS GEOMETRICAL**  **APPLICATIONS**  **9+3**

Derivatives – Curvature –Radius of curvature in Cartesian and Parametric forms   – Simple problems – Centre of curvature – Circle of curvature – Involutes and Evolutes of Parabola – Applications of Differential Calculus in CSE and IT.

**UNIT IV**  **INTEGRAL CALCULUS AND MULTIPLE INTEGRALS**  **9+4**

Definite and Indefinite integrals **–** Substitution rule **–** Integration by parts **–** Double integrals – Area enclosed by plane curves **–**  Triple integrals in Cartesian coordinates **–** Applications of  Integrals in CSE and IT.

**UNIT V**           **ORDINARY DIFFERENTIAL EQUATIONS**           **9+3**

Higher order linear differential equations with constant coefficients – Cauchy's linear equations – Simultaneous first order linear equations with constant coefficients **–** Applications of Ordinary Differential Equations in CSE and IT.

**Total: 60 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Calculate the rank of a matrix, Eigen values, Eigen vectors and solutions of system of Linear equations.

**CO2:** Use the applicability of Cayley-Hamilton theorem to find the inverse of a matrix and diagonalization of matrices which are frequently used in representing data in Computer and Scientific applications.

**CO3:** Gain knowledge to find the radius of curvature and torsion of a curve, which are used for Analyzing the output data.

**CO4:** Gain knowledge to determine values of definite integrals exactly and apply to regions under and between curves.

**CO5:** Gain knowledge to solve differential equations arising in Information Sciences.

**TEXT BOOKS:**

**T1:** Grewal. B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.
James Stewart., "Calculus: Early Transcendentals", Cengage Learning, 7th Edition,New Delhi, 2015.

**T2:** [For Unit IV-Sections 5.2,5.4(excluding net change  Theorem),  5.5 and 7.1]

**REFERENCE BOOKS:**

**R1:** Kreyszig E., "Advanced Engineering Mathematics", 10$^{th}$ Edition, John Wiley and   sons, 2011.

**R2:** Peter V. O. Neil., "Advanced Engineering Mathematics", 7$^{th}$ Edition  Cengage  learning, India pvt., Ltd, New Delhi. 2011.

**R3:** Veerarajan T., "Engineering Mathematics", Tata McGraw Hill Publishing  Company,  New Delhi (2008).

**R4:** Weir.  M. D and Joel Hass., "Thomas Calculus", 14$^{th}$ Edition, Pearson India, 2017.

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**U19CHTL101T**                    **APPLIED CHEMISTRY**                    

**COURSE OBJECTIVES**

The course aims to provide the students

- To make the students understand the principles of electrochemical reactions, corrosion.
- To gain the knowledge on electrochemical processing and the methods for prevention and protection of corrosion.
- To understand the principles and fabrication of batteries and fuel cells.
- To gain knowledge on the principles of polymer chemistry and its engineering application.
- To know the properties and applications of important Nanomaterials.

**PREREQUISITES :Nil**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | | | | |
| CO3 | 3 | 3 | | | | | | | | | | | | | |
| CO4 | 3 | 3 | | | | | | | | | | | | | |
| CO5 | 3 | 3 | | | | | | | | | | | | | |

**UNIT I**          **ELECTROCHEMISTRY & CORROSION**          **9**

Electrochemical cells – Reversible and irreversible cells – EMF – Electrochemical series - Significance – Single electrode potential – Nernst equation –Chemical corrosion: oxidation corrosion - Pilling–Bedworth rule – Electrochemical corrosion – Types (Galvanic corrosion, Differential aeration corrosion) – Factors influencing corrosion.

**UNIT II**          **ELECTROCHEMICAL PROCESSES & METAL FINISHING**          **9**

Corrosion control – Modifying metal - Cathodic protection (Sacrificial anode, Impressed current method) – Corrosion inhibitors; Protective coatings – Electroplating (Cu and Ni only), Electroless plating of Ni & Cu – Anodizing & Chromating – applications; Electropolishing, Electrochemical machining.

**UNIT III**          **BATTERIES & FUEL CELLS**          **8**

Batteries - Types – characteristics - fabrication and working of batteries (alkaline battery, lead – acid battery, Ni-Cd battery and lithium ion batteries) - super capacitors; Fuel cells - principle, working and applications of hydrogen - oxygen, solid oxide, direct methanol and proton exchange membrane fuel cells.

**UNIT IV**          **POLYMERS**          **10**

Polymers - Functionality - Degree of polymerization; Polymerization: Types –Glass transition temperature; Plastics - Thermo plastics (Teflon and PMMA)thermosets (Bakelite and Urea formaldehyde resin) – Preparation and applications of polymers(Nylon66 and Epoxy resins); Fabrication: Compression moulding - Injection moulding - Blow moulding.

**UNIT V**          **NANOMATERIALS**          **9**

Nanomaterials - Types (Nanoparticles, Nanoclusters, Nanowires, Nanrods and Nanotubes) – Properties – Synthesis & Applications; Role of bottom up and top down approaches in nano technology – solgel process, CVD  and Laser ablation – Nano dynamics - Carbon Nanotubes & Graphene -  Applications;

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Understand the cells, potentials, types of corrosion and factors influencing it.

**CO2:** Know the corrosion control techniques and metal finishing techniques

**CO3:** Learn about various types of batteries, fuel cells and its applications.

**CO4:** Gain knowledge on the properties of polymers and manufacturing methods.

**CO5:** Understand the importance of nanomaterials and concepts.

**TEXT BOOKS:**

**T1:** P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publications Pvt. Ltd, New Delhi, 16th Edition, 2017.

**T2:** S. S. Dara and S.S. Umare, "Textbook of Engineering Chemistry", S. Chand & Company Ltd, New Delhi, 2017.

**REFERENCE BOOKS:**

**R1:** PrasantaRath, "Engineering Chemistry", Cengage Learning India Pvt. Ltd, 2013.

**R2:** O.G. Palanna, "Engineering Chemistry", Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2017.

**R3:** Sunita Rattan, "A Textbook of Engineering Chemistry", S.K. Kataria & Sons, New Delhi, 2013.

**R4:** S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry', Wiley India Pvt. Ltd, New Delhi, 2nd Edition 2014.

**R5:** Daniel P Bovet and Marco Cesati, —Understanding the Linux kernel‖, 3rd edition, O'Reilly, 2005

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**COMMUNICATIVE ENGLISH**

(Common to all Programmes)

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

**COURSE OBJECTIVES**

The course aims to provide the students

- To enhance learners' listening skills so as to help them to comprehend conversations and lectures in diverse contexts.
- To develop the speaking skills of learners with fluency and appropriacy in order to express their ideas, views and opinions in varied formal and informal contexts and social situations.
- To inculcate the habit of reading using different types of reading strategies for understanding contextual situations.
- To develop the learners to write various writing forms effectively and coherently in an appropriate style.
- To develop linguistic competence and performance to express ideas effectively and appropriately in different contexts

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | | 2 | 2 | 2 | 3 | | 2 | | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 2 | | | 2 |
| CO3 | | | | | | 2 | | 2 | 3 | 3 | | 2 | | | 2 |
| CO4 | | | | | | | 3 | 2 | 1 | 3 | | 3 | | | 3 |
| CO5 | | | | | | 3 | 3 | 3 | 3 | 3 | | 3 | | | 3 |

**UNIT I          INTRODUCTION TO BUSINESS COMMUNICATION                    6**

Parts of Speech -  Jumbled words - Making mild Suggestions / offers / invitations - Discourse Markers - Letter writing (Request / Complaint / Thanking)

**UNIT II          EXTENDED WRITING                                                6**

Seeking advice / Information politely - Root words - Present Tense  -  Reading Comprehension (MCQ) - Paragraph writing

**UNIT III          READING COMPREHENSION                                        6**

Past Tense - Phrasal Verbs  - Jargon - Making polite requests - Reading and comprehending  newspaper articles - Hints Development

**UNIT IV          EXTENDED GRAMMAR CONCEPTS                                6**

Future Tense  - Determiners - Making enquiries / requests indirectly and politely -  Indicating Preference - Reading Comprehension (Short questions) - Constructing conversations  (Formal and Informal)

**UNIT V          TECHNICAL COMMUNICATION                                    6**

Pointing out mistakes and unpleasant things politely - Asking yes or no type questions  and  wh-questions indirectly and politely - Misspelled words -  Cloze reading -  Picture Description – Jumbled sentences

**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Listen and comprehend technical and non-technical spoken experts critically and functionally.

**CO2:** Write different forms of writing effectively and apparently and create advance level of writing in English.

**CO3:** Read different genres of text, analyzing and interpreting it by guessing the meaning from the context and employ it for new ideas, to learn and present.

**CO4:** Speak fluently using the appropriate vocabulary, modulation, articulation and pronunciation.

**CO5:** Familiarize the soft skills needed for the employability and gaining functional understanding of the language.

**TEXT BOOKS:**

**T1:** Means,L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning ,USA: 2007

**T2:** Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book). Cambridge University Press, New Delhi: 2005

**REFERENCE BOOKS:**

**R1:** Carter, R., & McCarthy, M. (2006). Cambridge grammar of English: A comprehensive guide: spoken and written English grammar and usage. Cambridge University Press.

**R2:** Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011

**R3:** Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press. 2018

**WEB RESOURCES**

**W1:** http://www.bbc.co.uk/worldservice/learningenglish/language/

**W2** http://www.bbc.co.uk/learningenglish/english/features/pronunciation/introduction

**W3:** http://toefl.uobabylon.edu.iq/papers/itp_2015_1817487.pdf

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| | | | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| **U19CSTL101T** | | **COMPUTATIONAL THINKING AND PROBLEM SOLVING** | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- The course aims to provide the students,
- To understand the various general steps in problem solving.
- To analyze the efficiency of the algorithms.
- To learn to solve problems using C.
- To understand the concept of arrays and strings.
- To learn C functions and storage classes.

**PREREQUISITES :Nil**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | | 3 | | 1 | | | | | | | | 3 | 3 | |
| CO2 | 3 | | | | | | | | | | | | | 2 | |
| CO3 | | 2 | 3 | | | | | | | | | | | 2 | |
| CO4 | 3 | | 3 | | 3 | | | | | | | | 3 | 2 | 2 |
| CO5 | 3 | 2 | | 2 | | | | | 2 | | 2 | 2 | 1 | 2 | 2 |
| CO6 | 3 | 2 | 3 | 2 | | | | | 2 | | 2 | 2 | 2 | 3 | 3 |

**UNIT I        INTRODUCTION TO COMPUTER PROBLEM SOLVING        9**

Computers - Introduction, CPU - ALU, Memory – RAM/ROM, Input/Output, hard disk, storage.

The problem solving Aspect, Top-Down Design, Implementation of Algorithms, Program Verification, Introduction, Information and data, Data encoding, number systems. Logic: Boolean logic.

**UNIT II        PROBLEM SOLVING TECHNIQUES AND ALGORITHMIC THINKING        9**

Problem definition, logical reasoning, problem decomposition, abstraction. Flowchart: Name binding, Selection, Repetition, Modularization. Data Organization: List and Arrays. Simple algorithms, Factoring and recursion techniques.

**UNIT III        C PROGRAMMING FUNDAMENTALS        9**

Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic, Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions. If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do While and Examples. Continue Break and Goto statements.

**UNIT IV        ARRAYS & STRINGS        9**

Arrays - Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear Search.Strings - Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions.

**UNIT V        FUNCTIONS        9**

Function Basics, User-defined Functions, Calls, Standard Functions, and Methods of Parameter Passing. Recursion- Recursive Functions. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**      Understand the various general steps in problem solving.

**CO2:**      Analyze the efficiency of the algorithms.

**CO3:**      Learn to solve problems using C.

**CO4:**      Understand the concept of arrays and strings.

**CO5:**      Learn C functions and storage classes.

**TEXT BOOKS:**

**T1:**       David Riley and Kenny Hunt, "Computational Thinking for Modern Solver", Chapman & Hall/CRC 2014

**T2**        R.G.Dromey, "How to Solve it by Computer", PHI, 2008

**REFERENCE BOOKS:**

**R1:**       Seyed H Roosta,"Foundations of programming languages design & implementation", Cengage Learning. 2009.

**R2:**       Karl Beecher, "Computational Thinking: A beginner's guide to problem-solving and programming", BCS, The Chartered Institute for IT; 1 edition, 2017.

**R3:**       Wladston Ferreira Filho, "Computer Science Distilled: Learn the Art of Solving Computational Problems", Code Energy LLC, 2017.

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| U19CSTL102T | FRONT END TECHNOLOGIES | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand how world wide web works and inculcate the user experience-based design thinking
- To develop a basic proficiency with HTML
- To develop different layouts and style the web applications.
- To learn client side scripting
- To develop responsive websites

**PREREQUISITES :Nil**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | | | | | | | 3 | 3 | 2 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | | | | | | | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 3 | | | | | | | 3 | 3 | 3 | 3 |

**UNIT I          BASICS OF INTERNET AND USER EXPERIENCE          9**

How the web works-Internet Protocols-The client server model-Internet-Domain Name System-Uniform Resource Locators-HTTP-Webservers

**UNIT II          HTML          9**

Basic Structure of HTML-HTML syntax-Elements and attributes-Semantic Markup- HTML Documents –Head and body-HTML Elements- Headings-Paragraphs -Divisions –Links-URL Relative Referencing -Inline Text Elements –Images-Character Entities-Lists-Meta Tags- External Link Tags-Semantic Structure –Tables-Styling Tables-Forms-Form Control Elements- Table and Form Accessibility

**UNIT III          CSS          9**

CSS-CSS Syntax-Location of styles-Selectors-The Cascade: How Styles Interact- Box Model- CSS Text Styling- Advanced CSS-Positioning Elements- Floating Elements-Constructing Multicolumn Layouts- Approaches to CSS Layout- Responsive Design-CSS Frameworks.

**UNIT IV          CLIENT SIDE SCRIPTING          9**

Client- Side Programming: The JavaScript Language- Design Principles- Syntax- Variables-Loops-Functions-Objects - The Document Object Model (DOM)- JavaScript Events- Forms

**UNIT V          BOOTSTRAP FRAMEWORK          9**

Responsive Design - Introduction to Bootstrap- framework-Container- Class- Jumbotron – Tables – Images - Grid – Buttons - Alerts – Glyphicons – Dropdowns –Tables – Carousel

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Use, adopt design process and guidelines for UI/UX design.

**CO2:** Develop a basic proficiency with HTML.

**CO3:** Develop different layouts and style the web applications

**CO4:** Use the JavaScript to do client side scripting.

**CO5:** Develop Responsive website using Bootstrap

**TEXT BOOKS:**

**T1:** Randy Connolly, "Fundamentals of Web Development", Pearson Education, Inc,2015.

**T2** Jennifer Kyrnin, "Sam's Teach Yourself Bootstrap in 24 Hours", Pearson Education, 2016

**REFERENCE BOOKS:**

**R1:** Thomas A., Powell, "HTML and CSS –The complete reference" Fifth Edition, McGraw Hill Publication,2010

**R2:** Don Norman, "Design of Everyday Things", Revised and Expanded Edition, Basic Books,

**R3:** Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

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**U19CHTL101L**

| | L | T | P | C |
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**APPLIED CHEMISTRY LABORATORY**

0  0  2  1

**COURSE OBJECTIVES**

The course aims to provide the students

- To make the students understand the principles of electrochemical reactions, corrosion.
- To gain the knowledge on electrochemical processing and the methods for prevention and protection of corrosion.
- To understand the principles and fabrication of batteries and fuel cells.
- To gain knowledge on the principles of polymer chemistry and its engineering application.
- To know the properties and applications of important Nanomaterials.

**Course Outcomes**

At the end of the course, learners will be able to

- C01: Estimate the amount of substance present in the given solution using potentiometer and conductivity meter.
- C02: Examine the total hardness and chemical oxygen demand in the given solution by volumetric analysis method
- C03: Apply the use of internal and external indicators and their comparison for redox titrations and mechanisms of iodometric titrations and use of double indicator method in a single titration.
- C04: Learn about instrumental analysis and chemical components.
- C05:Gain knowledge of mechanism chemical reaction.
- C06: They would learn about electroplating techniques.

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | 2 | 1 | | 1 | 2 | 2 | 1 | 1 |
| CO2 | 2 | 1 | 1 | | | | | 1 | | | 1 | 2 | 2 | 1 | 1 |
| CO3 | 1 | 1 | 2 | 1 | | | | 2 | 1 | | 1 | 1 | 1 | 1 | 2 |
| CO4 | 1 | 2 | 1 | | | | | 2 | 1 | | 1 | 2 | 1 | 2 | 1 |
| CO5 | 2 | 3 | 2 | | | | | 2 | 1 | | 1 | 2 | 2 | 3 | 2 |
| CO6 | 1 | 2 | | | 2 | 2 | | | | | 1 | 1 | 1 | 2 | |

**LAB COMPONENTS**

1. Testing the conductivity of various types of water (municipal water, distilled water, saltwater, waste water).
2. Construction of voltaic cells & batteries.
3. Determination of strength of HCl using pH meter.
4. Determination of strength of HCl using Conductivity meter.
5. Determination of Dissolved Oxygen content of water sample by Winkler's method.
6. Determination of corrosion rate of steel in acid media by weight loss method.
7. Electro-deposition of Copper for corrosion control.
8. Electroplating of Nickel for corrosion control.
9. Redox reactions – Finding emf of Fe in sample by Potentiometry.
10. Determination of molecular weight by Viscometry.
11. Synthesis of conductive polymers & its electrochemical characterization.
12. Synthesis of silver nanoparticles & its electrochemical characterization.

**Total: 30 Hours**

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| | | | L | T | P | C |
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| **U19ENTL101L** | **COMMUNICATIVE ENGLISH LABORATORY** | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To enhance learners' listening skills so as to help them to comprehend conversations and lectures in diverse contexts.
- To develop the speaking skills of learners with fluency and appropriacy in order to express their ideas, views and opinions in varied formal and informal contexts and social situations.
- To inculcate the habit of reading using different types of reading strategies for understanding contextual situations.
- To develop the learners to write various writing forms effectively and coherently in an appropriate style.
- To develop linguistic competence and performance to express ideas effectively and appropriately in Different contexts.

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | | 2 | 2 | 2 | 3 | | 2 | | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 2 | | | 2 |
| CO3 | | | | | | 2 | | 2 | 3 | 3 | | 2 | | | 2 |
| CO4 | | | | | | | 3 | 2 | 1 | 3 | | 3 | | | 3 |
| CO5 | | | | | | | 3 | 3 | 3 | 3 | 3 | | 3 | | | 3 |

**LAB COMPONENTS**

1. Organs of Speech
2. Pronunciation – Vowels
3. Pronunciation – Diphthongs
4. Pronunciation – Consonants
5. Word Transcription
6. Pronunciation tips
7. Word stress
8. Intonation
9. News/ Video clips
10. Conversation
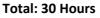11. Self-introduction (Video Recording)
12. Ted Talks (comprehension and questions)

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**Total: 30 Hours**

| | | L | T | P | C |
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| **U19CSTL101L** | **COMPUTATIONAL THINKING AND PROBLEM SOLVING LABORATORY** | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the various general steps in problem solving.
- To analyze the efficiency of the algorithms.
- To learn to solve problems using C.
- To understand the concept of arrays and strings.
- To learn C functions and storage classes

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | | | | | | | | | | 2 | | |
| CO2 | 3 | 2 | 3 | | | | | | | | | 2 | 2 | | |
| CO3 | 3 | 2 | 2 | 2 | | | | | 2 | 2 | | | 2 | | |
| CO4 | 3 | 3 | 2 | 2 | | | | | | | | | 2 | 2 | 2 |
| CO5 | 3 | 2 | 3 | 2 | | | | | | | | | | 2 | |
| CO6 | 3 | 2 | 3 | 2 | | | | | 2 | 2 | | 2 | | 2 | 2 |

**LAB COMPONENTS**

1. Design an Algorithm, Flow chart for various problems.
2. Design an algorithm, a flowchart using sequence
3. Algorithm using selection.
4. Algorithm using Boolean logic and number systems.
5. Design an algorithm, a flowchart using Repetition.
6. Construct an algorithm using List
7. Design an algorithm for encoding and decoding.
8. Demonstrate various algorithms using Factoring Techniques.
9. Demonstrate various Searching Techniques.
10. Demonstrate various sorting techniques.
11. Design various algorithms for Recursive problems.
12. Construct an algorithm for Text processing.

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**Total: 30 Hours**

| | | | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| **U19CSTL102L** | | **FRONT END TECHNOLOGIES LABORATORY** | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand how world wide web works and inculcate the user experience
- based design thinking
- To develop a basic proficiency with HTML
- To develop different layouts and style the web applications.
- To learn client side scripting
- To develop responsive websites

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | | | | | | | 3 | 3 | 2 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | | | | | | | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 3 | | | | | | | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 2 | 3 | | | | | | | 3 | 3 | 2 | 3 |

**LAB COMPONENTS**

1 Simple Webpage Creation Using HTML
2 Product Catalogue using HTML and Form Elements
3 Adding CSS to a simple webpage
4 CSS – Navigation Bars, Image Gallery
5 CSS – Multicolumn layouts
6 Java Script functions and events
7 Java Script DOM
8 Bootstrap – basics
9 Designing Single Page Applications using Bootstrap
13. Designing a personal website using bootstrap

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**Total: 30 Hours**

| U19AEPC101 | CROP PRODUCTION-I LABORATORY-I | L T P C |
|---|---|---|
| | | 0 0 4 2 |

**Course Objectives**

- To introduce the students to principles of field crops production and to introduce the production practices of crops.
- To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.
- To equip the students with necessary theoretical and practical knowhow on basic principles of cropping and acquaint them with the cultivation practice of few important crops of Tamil Nadu..

**Course Outcomes**

At the end of the course, learners will be able to

CO1 : Knowledge on crop selection, production and management.

CO2 : Able to understand the importance of crop water management

C03 :Understand the cultivation practices for some of the important crops in Tamil Nadu

C04: Good knowledge in the field preparation of crops including systems of tillage

C05: Sound understanding of the production practices of vegetable crops

C06: Students will gain good knowledge in the production of agricultural and horticultural crops

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | | | | 2 | | | | | | | 2 | 2 | |
| CO2 | 3 | 3 | | 2 | | 2 | 2 | | | | | | 2 | 2 | |
| CO3 | 3 | 3 | | 2 | 2 | 2 | 1 | | | | | | 2 | 2 | |
| CO4 | 3 | 3 | | 1 | 2 | 2 | 2 | | | | | | 2 | 2 | |
| CO5 | 3 | 3 | | | | 2 | 2 | | | | | | 2 | 2 | |
| CO6 | 3 | 3 | | 2 | | 2 | | | | | | | 2 | 2 | |

List of Components

- To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.
- Identification of different crops in local region
- Visit to meteorological observatory
- Visit to wetlands and irrigate dry lands to learn important cropping systems and Hi Tec nursery
- Seed selection and seed treatment procedures

- Seed bed and nursery preparation
- Sowing / Transplanting
- Biometric observation for crops
- Nutrient management studies
- Water management and irrigation scheduling
- Weed management studies
- Integrated Pest Management studies
- Harvesting
- Post harvesting

**TOTAL: 30 HOURS**

**TEXT BOOKS**
- Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and
- Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2015.
- Hand Book of Agriculture. 2009 (6th revised edition), Indian Council of Agricultural Resarch (ICAR), New Delhi
- Balasubramanian P and Palaniappan SP. 2001. Principles and practices of Agronomy. Agrobios Publishers, Ludhiana

**REFERENCES**
- Ramasamy S and Siddeswran K 2018. Agriculture and crop production. Sri Shakthi Institute of Engineering and Technology, Coimbatore
- Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2005

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**U19LATH101**                      **LANGUAGE - TAMIL**                                      **L T P C**
                                                                                              **2 0 0 2**

**Course Objectives**

The students should be made

- To enhance listening skill of the learners and practicing it for a better professional as well as moral skills
- To read different text without barriers using reading strategies

|      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| **CO1** |     |     |     |     |     |     |     |     | 3   | 3    | 2    | 2    | 1    |      |
| **CO2** |     |     |     |     |     |     |     |     | 3   | 3    | 2    | 2    | 1    |      |
| **CO3** |     |     |     |     |     |     |     |     | 3   | 3    | 2    | 1    | 1    |      |
| **CO4** |     |     |     |     |     |     |     |     | 3   |      | 2    | 1    | 1    |      |
| **CO5** |     |     |     |     |     |     |     |     | 3   | 3    | 2    | 3    | 1    |      |
| **CO6** |     |     |     |     |     |     |     |     | 3   | 3    | 2    | 2    | 1    |      |

**UNIT I**                    **அலகு – 1**                                                              **5**

சங்ககாலம்- மூன்றுசங்கங்கள்- முதற்சங்கம் (கடல்கொண்டதென்மதுரை)- இடைச்சங்கம் (கபாடபுரம்)-கடைச்சங்கம்(மதுரை)-சங்க இலக்கியங்கள்- பதினெண்மேற்க்கணக்கு நூல்கள்: எட்டுத்தொகைநூல்கள் (ஐங்குறுநூறு, குறுந்தொகை,கலித்தொகை, நற்றிணை, அகநானூறு, புறநானூறு, பதிற்றுப்பத்து, பரிபாடல்)- பத்துப்பாட்டு நூல்கள் (சிறுபாணாற்றுப்படை, பெரும்பாணாற்றுப்படை, திருமுருகாற்றுப்படை, பொருநராற்றுப்படை, மலைபடுகடாம், குறிஞ்சிப்பாட்டு, முல்லைப்பாட்டு, பட்டினப்பாலை, நெடுநல்வாடை, மதுரைக்காஞ்சி.)- சங்கம்மருவியகாலம்- பதினெண்கீ ழ்க்கணக்கு நூல்கள் (திருக்குறள், நாலடியார், நான்மணிக்கடிகை, இன்னாநாற்பது, இனியவைநாற்பது, திரிகடுகம், ஆசாரக்கோவை, பழமொழி, சிறுபஞ்சமூலம், முதுமொழிக்காஞ்சி, ஏலாதி, கார்நாற்பது, களவழிநாற்பது, ஐந்திணைஜம்பது, திணைமொழிஜம்பது, ஐந்திணைஎழுபது, திணைமாலை நூற்றைம்பது, கைந்நிலை)- காப்பியங்கள்- ஐம்பெருங்காப்பியங்கள்- (சிலப்பதிகாரம், மணிமேகலை, சீவகசிந்தாமணி, வளையாபதி, குண்டலகேசி)- ஐஞ்சிறுகாப்பியங்கள் (நாககுமாரகாவியம், உதயணகுமாரகாவியம், யசோதரகாவியம், சூளாமணி, நீலகேசி)- இலக்கணம் - எழுத்து, சொல், பொருள், யாப்பு, அணி - தமிழ் எழுத்துக்கள்- உயிரெழுத்துக்கள், மெய்யெழுத்துக்கள், உயிர்மெய் எழுத்துக்கள், ஆய்தஎழுத்து- வகைகள்- குறில், நெடில், வல்லினம், மெல்லினம், இடையினம், குற்றியலுகரம், குற்றியலிகரம்.

**UNIT II**                    **அலகு - 2**                                                              **5**

மயங்கொலிப்பிழைகள் - ர, ற-ஒலிவேறுபாடுகள-ல, ள, ழஒலிவேறுபாடுகள்-ந, ன, ண-

ஒலி வேறுபாடுகள்- சொல் இலக்கணம்- திணை, பால், எண், இடம், காலம் - பேச்சுவழக்கு– எழுத்துவழக்கு- இழிவழக்குச்சொற்கள்-வழுவுச்சொற்கள் - இணைச்சொற்கள்- தொகைச்சொற்கள்-நிறுத்தற்குறியீடுகள்- உவமைத்தொடர்கள்- மரபுத்தொடர்கள்- வாக்கியத்தில் அமைத்தல்-மரபுப்பிழை திருத்தம் -ஐந்திணை- பலபொருள்ஒருசொல்-ஒருசொல்பலபொருள்

**UNIT III**  அலகு – 3  **5**

அணி இலக்கணம் – இயல்புநவிற்சி அணி, உயர்வுநவிற்சி அணி, உவமை அணி- எடுத்துக்காட்டுஉவமை அணி, உருவக அணி, ஏகதேச உருவக அணி, சொற்பொருள் பின்வருநிலைஅணி, தற்குறிப்பேற்ற அணி, வேற்றுமை அணி, வஞ்சப்புகழ்ச்சி அணி, மடக்கணி. பொருந்திய சரியான சொல்லைத் தேர்ந்தெடுத்தல் செய்யுள் பொருளுணர்திறன்.

**UNIT IV**  அலகு – 4  **5**

திருக்குறள்- 50 குறள்கள்- ஆத்திச்சூடி- கவிதைகள்- பாரதியார் (மனதில் உறுதி வேண்டும்)- பாரதிதாசன் (கனியிடை ஏறியசுளையும்)- வைரமுத்து (ஆதலால்மனிதா…) பெய்யெனப் பெய்யும் மழை கவிதைத்தொகுப்பு-காசி ஆனந்தன் (மாடியிலிருந்து…)- நறுக்குகள் கவிதைத் தொகுப்பு- பழமொழிகள்-விடுகதைகள்

**UNIT V**  அலகு – 5  **5**

சிறுகதைகள் – ஜெயமோகன், ஜெயகாந்தன், கி.ராஜநாராயணன், பிரபஞ்சன் நீதிக்கதைகள், மொழிபெயர்ப்பு- மூன்றில் ஒருபங்காகச் சுருக்குதல் வினாவிற்கேற்ற விடைகள்- கடிதங்கள்-தலைவர்கள் மற்றும் அறிஞர்கள் பற்றிய கட்டுரைகள்

**UNIT VI**  அலகு – 6  **5**

படைப்பாற்றல்பயிற்சி – பேச்சுப்பயிற்சி (கதைசொல்லுதல், விவாதித்தல், கவியரங்கம், பட்டிமன்றம்)-எழுத்துப்பயிற்சி (கவிதை, கட்டுரை, சிறுகதை, கடிதங்கள்)

**TOTAL: 30 HOURS**

**Course Outcomes**

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

**CO1**  Learn the language literature concepts

**CO2**  Speak fluently using the proper vocabulary.

**CO3**  Familiarize the functional understanding of the language grammar

**CO4**  Understand the concepts of new era tamil literature works

**CO5**  To develop the reading skills of tamil novels and stories

**CO6**  To enhance the features of story telling, conversation and creative skills of writing in students

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**U19LATH102**                    **MALAYALAM**

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

**Course Objectives**
- To Write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.
- To develop an interest in the Mother tongue through the study of literature and other contemporary forms of culture.
- To be proficient in speaking and listening and assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning
- To enhance reading and writing skills for a better understanding of the main contextual ideas
- To use their mother tongue in the formal setup to express their views and ideas using the appropriate vocabulary and phrases.

**Course Outcomes**

At the end of the course, learners will be able to

**CO1 :** Students should be familiar with literary and cultural texts within a significant number of historical, geographical, and cultural contexts.

**CO2 :** Students should be able to apply critical and theoretical approaches to the reading and analysis of literary and cultural texts in multiple genres.

**CO3 :** Students should be able to ethically gather, understand, evaluate, and synthesize Information from a variety of written and electronic sources from different genres.

**CO4 :** Students should be able to write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

**CO5 :** Students should be able to understand the process of communicating and interpreting human experiences through literary representation using historical contexts and disciplinary methodologies.

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | | 3 | 1 | 2 | 3 | | 2 | | | 2 |
| CO2 | | | | | | | | 2 | | 3 | | 2 | | | 2 |
| CO3 | | | | | | | 3 | | 3 | 3 | | 2 | | | 3 |
| CO4 | | | | | | | 1 | | 2 | 3 | | 3 | | | 3 |
| CO5 | | | | | | | | 1 | 3 | 3 | | 3 | | | 3 |
| CO6 | | | | | | | 3 | 1 | 2 | 3 | | 2 | | | 2 |

**THEORY COMPONENT CONTENTS**

| | | |
|---|---|---|
| **UNIT I** | **GRAMMAR AND LANGUAGE DEVELOPMENT** | **6** |

**Writing**- letters, **Error-free Malayalam**: 1. Language; 2. Clarity of expression; 3. Punctuation.

| | | |
|---|---|---|
| **UNIT II** | **LETTER WRITING** | **6** |

Letter writing: Formal (applications, letter to editor of a Newspaper, commercial correspondence, complaints) and informal letters.

| | | |
|---|---|---|
| **UNIT III** | **READING COMPREHENSION** | **6** |

Reading section: Comprehension of unseen prose passages and Short stories

| | | |
|---|---|---|
| **UNIT IV** | **EXTENDED SPEAKING** | **6** |

Expansion of ideas: Proverbs, poems and philosophical statements.

| | | |
|---|---|---|
| **UNIT V** | **INTRODUCTION TO MALAYALAM LITERATURE** | **6** |

Critical appreciation of literary works  :(Books and Films). Literary & Cultural figures of Kerala and about their literary contributions.

**TOTAL: 30 HOURS**

**TEXT BOOKS**

1. John D Kunnathu, Lissy J Kunnathu, Learn Basic Malayalam In Six Weeks: With Daily Worksheets & Answer Key; CreateSpace Independent Publishing Platform (June 22, 2015)

2. Vidvan C. L. Meenakshi Amma. Learn Malayalam, manuals_contributions; manuals; additional_collections, 1975

3. Learn Basic Malayalam in Six Weeks: With Daily Worksheets & Answer Key, by John D. Kunnathu (Author), Lissy J. Kunnathu (Author), Kindle Edition

4. A Grammar of the Malayalam Language by Rev H.Gundert, Basel Mission Press, 2002

5. Malayalam Grammar Book Paperback, Kindle Edition, 2018

**REFERENCE BOOKS**

1. Malayalam: A University Course and Reference Grammar. - Fourth Edition, The Center for Asian Studies at The University of Texas at Austin, 2018

2. An Intensive Course in Malayalam (An Old and Rare Book) by B.Shyamala Kumari, Central Institute of Indian Languages, Mysore, 1999

**WEB RESOURCES**

1. https://e-resources.saraswatihouse.com

2. https://www.alllanguageresources.com/malayalam/

3. Learning Malayalam: A Complete Self-Study Guide -

   https://www.alllanguageresources.com › Malayalam

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| | | L | T | P | C |
|---|---|---|---|---|---|
| | **FOUNDATION ENGLISH** | | | | |
| **U19LAEN101** | | 2 | 0 | 0 | 2 |

**COURSE OBJECTIVES**

- Educate students in both the artistry and utility of the English language through the study of literature and other contemporary forms of culture.
- Provide students with the critical faculties necessary in an academic environment, on the job, and in an increasingly complex, interdependent world.
- Graduate students who are capable of performing research, analysis, and developing content from different genres.
- Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning.
- Write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

**PRE-REQUISITES: Nil**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | | 3 | 1 | 2 | 3 | | 2 | | | 2 |
| CO2 | | | | | | | | 2 | | 3 | | 2 | | | 2 |
| CO3 | | | | | | | 3 | | 3 | 3 | | 2 | | | 3 |
| CO4 | | | | | | | 1 | | 2 | 3 | | 3 | | | 3 |
| CO5 | | | | | | | | 1 | 3 | 3 | | 3 | | | 3 |
| CO6 | | | | | | | 3 | 1 | 2 | 3 | | 2 | | | 2 |

**UNIT I       INTRODUCTION TO ENGLISH LITERATURE**                                          **6**

Introduction to the English Language – Introduction to Indian writing in English - Palanquin Bearers by Sarojini Naidu – To me, fair friend, you never can be old, Sonnet 104 by Shakespeare

**UNIT II       APPRECIATION OF POEMS**                                                              **6**

Ode on a Grecian Urn by John Keats – Gitanjali by Rabindranath Tagore

**UNIT III      FOCUS ON SHORT STORIES**                                                           **6**

Short Stories: A Christmas Carol by Charles Dickens - The Open Window by Saki - The Interpreter of Maladies by Jhumpa Lahiri – Success Stories of inspirational leaders: Martin Luther King, Malala Yousafzai & Saalumarada Thimmakka, also known as Aalada Marada Timakka, an Indian environmentalist.

**UNIT IV      FOCUS ON NOVEL**                                                                       **6**

Novel: The Man-Eater of Malgudi by R.K.Narayan

**UNIT V**    **FOCUS ON DRAMA**        **6**

*A Doll's House* by Norwegian playwright <u>Henrik Ibsen</u>

**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course, students should be able to

**CO1 :**    Students should be familiar with literary and cultural texts within a significant number of historical, geographical, and cultural contexts.

**CO2 :**    Students should be able to apply critical and theoretical approaches to the reading and analysis of literary and cultural texts in multiple genres.

**CO3 :**    Students should be able to ethically gather, understand, evaluate, and synthesize Information from a variety of written and electronic sources from different genres.

**CO4 :**    Students should be able to write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

**CO5 :**    Students should be able to understand the process of communicating and interpreting human experiences through literary representation using historical contexts and disciplinary methodologies.

**TEXTBOOKS**

1.    Palanquin Bearers Paperback by Sarojini Naidu (Author), Indu Harikumar (Illustrator)
2.    Sonnet 104: To Me, Fair Friend, You Never Can Be Old

    Emma Abbate & Ashley Riches From the Album Mario Castelnuovo-Tedesco: Shakespeare Sonnets

3.    Ode On A Grecian Urn And Other Poems  (English, Paperback, Keats John), Publisher: Kessinger Publishing Co, Genre: Poetry, ISBN: 9781419137730

4.    Gitanjali by Rabindranath Tagore, Kindle edition

5.    The Man-eater of Malgudi by R.K. Narayan (Author), Repro Books

6.    A Doll's House by Henrik Ibsen, Maple Press, Genre: Fiction, ISBN: 9789350330685

**REFERENCE BOOKS**

1.    The Open Window and Other Short Stories, Kindle Edition

2.    Charles Dickens' Christmas Stories: A Classic Collection, 2019, Kindle Edition

**WEB RESOURCES**

1.    https://www.deccanchronicle.com/lifestyle/books-and-art/220418/saalumarada-thimmakka-the-green-legend-now-on-stage.html
2.    https://malala.org/malalas-story

3.      https://www.nobelprize.org/prizes/peace/1964/king/biographical/

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| ENGINEERING EXPLORATION I | L | T | P | C |
|---|---|---|---|---|
| U19CCEX101 | 1 | 0 | 2 | 2 |

**COURSE OBJECTIVES**
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

**PRE-REQUISITES**

Course Articulation Matrix : 3- High, 2- Medium, 3- Low

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 |  | 1 | 1 |  |  |  |  |  |  |  |  | 2 | 1 |  |  |
| CO2 | 3 | 3 | 3 | 2 |  |  |  |  |  |  |  |  | 3 | 3 |  |
| CO3 |  |  | 3 | 3 | 3 |  |  |  |  |  |  | 2 | 3 | 3 |  |
| CO4 |  |  |  |  |  | 3 | 3 | 3 |  |  |  |  |  | 3 | 3 |
| CO5 |  |  |  |  |  |  |  |  | 3 | 3 | 3 | 2 |  | 3 | 2 |
| CO6 |  |  |  |  |  |  |  |  | 3 | 3 | 3 | 2 |  | 2 | 2 |

**CONTENTS**

| S No | Topics | No of Hours |
|---|---|---|
| 1 | Introduction to Engineering | 3 |
| 2 | Platform-based development | 12 |
| 3 | Mechanisms | 9 |
| 4 | Requirements | 3 |
| 5 | Design |  |
| 6 | Ethics | 6 |
| 7 | Sustainability |  |
| 8 | Project Management Principles |  |
| 9 | Guided Project | 3 |
| 10 | Final Project | 9 |

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**COURSE OUTCOMES**
- Understand the role of an engineer as a problem solver

- Apply multi-disciplinary principles and build systems using engineering design process
- Use appropriate tools for designing and development of solutions.
- Analyze engineering solutions from ethical and sustainability perspectives
- Use basics of engineering project management skills while doing projects
- Communicate, Collaborate and work as a team

### GUIDELINES
- Practical based learning carrying credits.
- Multi-disciplinary/ Multi-focus group of 3-4 students.
- Groups can select to work on specific tasks, or projects related to real world problems.
- Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
- The students have to display their model at the end of semester.
- The progress of the course is evaluated based on class performance and final demonstration of prototype.

**Total:45 Hours**

| U19MATH214 | ADVANCED CALCULUS AND SET ALGEBRA | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

### COURSE OBJECTIVES
The course aims to provide the students
- Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems.
- It enables precise representation and communication of knowledge.
- The objective of the course is to expose students to understand the basics and importance of Vector Calculus, Complex Differentiation, Complex Integration, Sets and Relations and Functions which are being widely used in Information Sciences.

### PREREQUISITES
- Basic concepts of vectors and Trigonometric functions
- Basic concepts of Differentiation
- Basic concepts of Integration
- Basic concepts of Relations and Functions.

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 1 |
| CO3 | 3 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 1 |
| CO5 | 3 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |

**UNIT I**          **VECTOR CALCULUS**                                                                9

Gradient – Directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Vector Integration – Line Integrals – Applications of Vector calculus in CSE and IT.

**UNIT II**          **COMPLEX  DIFFERENTIATION**                                                9

Limit and derivative of a complex function – Analytic functions – Cauchy-Riemann equations –Harmonic functions – Orthogonal properties of analytic functions (excluding proof) – Construction of analytic functions by Milne - Thomson's Method – Conformal mappings: w = z + c, cz, 1/z and Bilinear transformation – Applications of complex differentiation in CSE and IT.

**UNIT III          COMPLEX INTEGRATION                                          9**

Complex integration – Statements of Cauchy's theorem and Cauchy's integral formula – Laurent's series– Singular points – Residues – Calculation of Residues – Cauchy's Residue theorem (excluding  proof) – Applications of complex integration in CSE and IT.

**UNIT IV          SETS AND RELATIONS                                           9**

Algebra of sets – The Power set – Ordered pairs and Cartesian products – Principle of inclusion and exclusion – Relations on sets – Types of relations and their properties – Relational matrix and the graph of relation – Equivalence relations – Operations on relations – Applications of sets and relations in CSE and IT.

**UNIT V          FUNCTIONS                                                    9**

Functions – Classification of functions –Types of functions – Injective, surjective and bijective functions – Composition of functions – Inverse functions – Characteristic function of a set – Applications of functions in CSE and IT.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

| CO1: | Perform vector calculus operations such as gradient, divergence and curl in vector and scalar fields |
|---|---|
| CO2: | Gain  knowledge to construct the analytic function and to find the image of given region under conformal mapping |
| CO3: | Gain  knowledge to solve the problems by using  complex integration |
| CO4: | Understand set algebra and relations which are widely used in theoretical   computer science |
| CO5: | Gain the knowledge of functions and inverse function which is used in computer graphics |

**TEXT BOOKS:**

T1:  Grewal.B.S,"Higher Engineering Mathematics", 44$^{th}$Edition, Khanna Publishers, New Delhi, 2017.

T2:  Tremblay J P and Manohar R, "Discrete Mathematical Structures withApplications to Computer Science", Tata McGraw Hill, New Delhi, 2017.

**REFERENCE BOOKS:**

R1:  Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9$^{th}$ Edition, Laxmi Publications Pvt Ltd., 2010.

R2:  Glyn James, "Advanced Modern Engineering Mathematics", 4$^{th}$Edition, Pearson Education, 2011.

R3:  Kenneth H Rosen, "Discrete Mathematics and its Applications", Tata McGraw Hill, New Delhi, 7$^{th}$ Edition, 2013.

R4:  Kreyszig E., "Advanced Engineering Mathematics", 10$^{th}$ Edition, John Wiley and sons, 2011.

R5:  Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited New Delhi, 2010.

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| | | | L | T | P | C |
|---|---|---|---|---|---|---|
| **U19PHTL205T** | | **PHYSICS FOR INFORMATION SCIENCE** | 2 | 0 | 0 | 2 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To gain the basic theory of electrical conductance in semiconducting and optical devices
- To get knowledge in the working principle of basic semiconducting and photo conducting devices

**PREREQUISITES**

As a prerequisite for this course on Engineering Physics    knowledge of physics like Mechanics, Optics, Waves and basic mathematics is essentially required.

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | | | | |
| CO3 | 3 | 3 | | | | | | | | | | | | | |
| CO4 | 3 | 3 | | | | | | | | | | | | | |
| CO5 | 3 | 3 | | | | | | | | | | | | | |
| CO6 | 3 | 3 | | | | | | | | | | | | | |

**UNIT I          FREE ELECTRON AND BAND THEROY OF SOLIDS                    6**

**Electronic Materials:** Classical free electron theory of metals (Drude Lorentz Theory)-Electrical and Thermal conductivity **–** Widemann Franz Law-Fermi energy and Fermi - Dirac distribution function –Density of states-Thermionic Emission. Band Theory of Solids-Electronic periodic potential- Bloch Theorem- Kronig Penny Model-Origin of Energy Bands - Bloch Theorem-Concepts of Effective mass-Brillouin Zones –Concept of Holes- Classification of solids into conductor, semiconductor- Insulator

**UNIT II          SEMICONDUCTOR FUNDAMENTALS                    6**

Energy band in solids – types of semiconductor – majority and minority carriers – Mobile charge carriers and immobile ions – drift current in intrinsic semiconductor – PN junction – Depletion layer – barrier voltage – Effect of temperature – forward biased and reverse biased pn junction – Zener breakdown – Avalanche breakdown – H parameters in CE and CB configuration.

**UNIT III          PHYSICS OF SEMICONDUCTOR DEVICES PHOTOCONDUCTING MATERIALS          6**

Open circuit P-N Junction diode-Energy diagram of PN Diode-Working of Diode-VI Characteristics of Diode- PN Diode as Rectifier- Diode equation – Tunnel Diode- Schottky diode- Metal Oxide Transistor. Classification of optical materials and their properties-Luminescence, Fluorescence and Phosphorescence- LED – LCD - Photo conducting materials - Photo detectors - Photonic crystals and applications - Elementary ideas of Non-linear optical materials and their applications

**UNIT IV          ELECTROMAGNETIC WAVES & INTERACTION WITH MATTER          6**

Electromagnetic waves in vacuum – Energy and momentum of EMW – EMW in matter – Propagation in linear media – Reflection and transmission at Normal incidence – Reflection and Transmission at Oblique incidence Implications: Laws of incidence and reflectance, snell's law, Brewster law – Fresnel's equations-wave guides- rectangular waveguide.

**UNIT V          APPLIED OPTICS          6**

Properties of laser radiation and their significance-wavelength, power, monochromaticity, coherence. Einstein Theory of stimulated emission-Types of lasers-working media and their radiation characteristics-Power, wavelength and operational modes of Nd-YAG, excimer, diode lasers. Optical fiber – principle and propagation of light in optical fibers – Numerical aperture and acceptance angle types of optical fibers – applications – fiber optic communication system – medicalendoscopy.

**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**  Illustrate the free electron theory of metals and to classify the conducting materials.

**CO2:**  Understand the fundamental concept of semiconducting physics and their applications.

**CO3:**  Describe the basic operating principles of diodes and photo conducting devices.

**CO4:**  Describe the idea behind electromagnetic theory.

**CO5:**  Describe the propagation and interaction of electromagnetic waves in different mediums

**CO6:**  Demonstrate the basics of LASER devices and optical fibres, as well as their significance in engineering and communication applications.

**TEXT BOOKS:**

**T1:**  S.J.Gupta, Sanjeev Gupta, Modern Engineering Physics, Dhanpatrai Publication, NeDelhi, 2015.

**T2:**  S.O.Kasap, Principle of Electronic Materials and Device, McGraw Hill Publications, 3$^{RD}$ Edition,2017.

**T3:**  H.Sathayaseelam, Laboratory Manual in Applied Physics, Second edition, -New age International Publication, 2015

**T4:**  V.Rajendran,Engineering Physics, Mc Graw Hill Education, tenthprint,2017

**REFERENCE BOOKS:**

**R1:**  Garcia, N. & Damask, A. —Physics for Computer Science Students‖. Springer-Verlag, 2012

**R2:** David Halliday, Robert Resnick and Jearl Walker, Fundamentals of Physics, John Wiley&Sons , New Delhi , 9th Edition , 2010

**R3:** Smith, F. Graham / King, Terry A. / Wilkins, Dan, Optics and Photonics, John Wiley&Sons, New Delhi , 2 Edition , 2007

**R4:** ShatendraSharama, Jyostsna Sharma, Engineering Physics, Pearson, Uttar Pradesh,2019.

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| U19ENTL202T | ENGLISH FOR ENGINEERS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**COURSE OBJECTIVES**

- To develop learners' ability to listen and comprehend talks for the application of language in various context.
- To develop the students' ability to use English accurately, appropriately and fluently in different social and professional situations.
- To comprehend advanced technical passages and to identify the author's purpose and tone.
- To enhance advanced level of writing by organizing ideas and achieving consistency in academic as well as workplace contexts.
- To enhance the technical components of English language for formulating effective and appropriate sentences.

**PREREQUISITES :**Nil

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | 1 | 2 | 1 | 1 | 3 | | 2 | | 2 | 1 |
| CO2 | | | | | | 2 | 2 | 2 | 2 | 3 | | 2 | | 2 | 2 |
| CO3 | | | | | | 3 | 3 | 1 | 2 | 3 | | 3 | | 2 | 3 |
| CO4 | | | | | | 1 | 1 | | 1 | 3 | | 1 | | 3 | 1 |
| CO5 | | | | | | 3 | 3 | 3 | 3 | 3 | | 3 | | 3 | 3 |

**UNIT I            BASICS OF GRAMMAR**

**6**

Use of the Gerund - Use of  the infinite -'Used to' for habitual actions - Degrees of Comparison – Reading

Comprehension passage and answering- Essay writing ((Narrative / Descriptive / Expository / Persuasive)- Letter Writing (Suggestions / Apology/ Acceptance)

**UNIT II               FOCUS ON LANGUAGE DEVELOPMENT                               6**

Modal verbs (Possibility, ability, Permission, Suggestions and obligations obligation) - Simple Past vs Present Perfect - Subject and verb agreement - Interpreting charts / Graphs / Tables - Instructions

**UNIT III               FUNCTIONAL GRAMMAR AND FORMAL WRITING                               6**

Relative Pronouns for people and things - Future with 'be going to' and 'will' - Personal and impersonal passive - Email writing - Memo writing - Expansion of a Proverb

**UNIT IV               EXTENDED WRITING                               6**

Fixed and Semi-fixed expressions - Wishes and hypotheses - Conditional clauses - Process Description- Notice / Agenda / Minutes of Meeting

**UNIT V               TECHNICAL COMMUNICATION                               6**

Idioms: guessing meaning based on the context - Question Tags - Reported speech - Technical Proposal – Report Writing (Project / Survey)

**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

CO1:     Communicate with one or many listeners using appropriate communicative strategies.

CO2:     Speak clearly, confidently and comprehensively using appropriate communicative strategies.

CO3:     Read different genres of texts adopting various reading strategies.

CO4:     Understand the form and function of the basic official correspondences and perform a range official support through formal and informal writings.

CO5:     Comprehend and apply the language learning strategies to read, comprehend, organize and retain written information.

**TEXT BOOKS:**

**T1:**     Richards, C. Jack. Interchange Students Book-2 New Delhi: CUP, 2015

**T2:**     Means,L. Thomas and Elaine Langlois. English and Communication For Colleges. Cengage Learning, USA: 2007

**REFERENCE BOOKS:**

**R1:**     Redston, Chris & Gillies Cunningham. Face2Face (Upper-intermediate Student's   Book). Cambridge University Press, New Delhi: 2005

**R2:**     Daise, Debra & Charl Norloff. Q:Skills for Success Reading and Writing (2nd   Edition). Oxford University Press. 2019

**R3:**     Sudharshana N Pand Savitha C. English for Technical Communication. Cambridge University Press. 2018

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| | L | T | P | C |
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| **U19CSTL203T**  **C PROGRAMMING** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- • Write modular programs consisting of structure, functions and pointer concepts.
- • Use structure variables for data storage and manipulation.
- • Develop an application using strings.
- • Gain knowledge about memory management in C.
- • To learn the files and perform file manipulations

**PREREQUISITES**

- • **U19CSTL101 -** Computational Thinking and Problem Solving

Course Articulation Matrix : 3- High, 2- Medium, 3- Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | 1 | | | | | | | | | 1 | | |
| CO2 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 2 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 1 | 2 | |
| CO4 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 2 | 2 | |
| CO5 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 2 | 3 | |
| CO6 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 1 | 2 | |

**UNIT I          INTRODUCTION: C PROGRAMMING          9**

Structure of C program, Comments, Data types, Variables, Tokens: Keyword, Identifier, Constants, Operators, Expression and evaluation, Input and Output statements, Decision making-statements, Iterative statements, Storage Classes: auto, register, static and extern, Preprocessor Directives.

**UNIT II**         **ARRAYS AND STRING**                                    **9**

Introduction to arrays: Declaration, Initialization. One dimensional array Multi dimensional arrays, Searching: Linear and Binary Search, Sorting: Bubble sort, Selection Sort. Introduction to string, Built in string functions, String manipulation with and without built in functions, Array of strings, Pattern matching application using strings.

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

Introduction to functions, Function prototype, Function definition, Function call, User defined functions and Standard functions (math function), Parameter passing: Call by value, Call by reference, Recursive functions, Passing arrays to functions, Command line arguments. Pointer in C, Importance of pointer, Types of pointer, Pointer expression and arithmetic, Pointer and array, String as pointer, Pointer to function, Dynamic Memory Allocation

**UNIT IV**         **USER DEFINED DATATYPES**                               **9**

Structure: Declaration, Accessing structure elements, Array of structure, Nested structure, Pointers to structure, Structure to function, typedef vs #define. Union: Declaration, Accessing union elements, Difference between structure and union, Enum and its uses

**UNIT V**          **FILE HANDLING**                                        **9**

Introduction to file, File Operations: Create, Open: File modes, Read, Write, Move, Close, File Processing: Sequential access and Random access.

                                                                    **Total: 45  Hours**

**COURSE OUTCOMES**
At the end of the course students should be able to
**CO1:**    Explain the syntax for C programming
**CO2:**    Associate the programs in 'C' for real world situation
**CO3:**    Apply the concepts of Arrays, Strings in 'C' language for user defined problems.
**CO4:**    Apply the concept of functions and pointers.
**CO5:**    Associate the programs with structure using 'C' language.
**CO6:**    Discuss to read and write data from/to files in 'C' Programs.

**TEXT BOOKS:**
**T1:**     Programming in C, Ashok N. Kamthane, 2nd Edition ,Pearson Education India, 2011

**T2:**     Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A Structures Programming Approach using C", Third Edition, Cengage Learning, 2006.

**REFERENCE BOOKS:**
**R1:**     A first book of ANSI C by Gray J.Brosin 3rd edition Cengage delmer Learning India P.Ltd
**R2:**     Pradip Dey, Manas Ghosh, "Programming in C", second edition, Oxford University Press, 2011.
**R3:**     Seyed H Roosta,"Foundations of programming languages design & implementation", Cengage Learning. 2009.

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| U19ITTH201 | COMPUTER ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- Data representation and organization of a computer system
- To write assembly language programs and download the machine code that will provide solutions to real-world control problems.
- Knowledge about pipelining, I/O and memory organization.
- 

**PREREQUISITES**

- Digital principles system design

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | | | | | | | | | | 1 | | | 2 |
| CO2 | 2 | 1 | 1 | | | | | | | | | 1 | | | 2 |
| CO3 | 3 | 1 | 2 | | | | | | | | | | 3 | 2 | |
| CO4 | 2 | 1 | 1 | | | | | | | | | 1 | | | 2 |
| CO5 | 3 | 2 | 3 | | | | | | | | | | 3 | 3 | 1 |
| CO6 | 3 | 2 | | | | | | | | | | | 3 | | |

**UNIT I**                     **BASIC STRUCTURE OF COMPUTERS**                                         **9**

Functional units - Basic operational concepts - Performance – Uniprocessors to multiprocessors – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

**UNIT II**                     **ARITHMETIC OPERATIONS**                     **9**

Addition and subtraction of signed numbers – Multiplication of positive numbers - Signed operand multiplication- fast multiplication – Integer division – Floating point numbers and operations

**UNIT III**                     **PROCESSOR AND PARALLELISM**                  **9**

Fundamental concepts – Execution of a complete instruction – Data path and control consideration for Instruction sets - Pipelining: Basic concepts – Data hazards – Instruction hazards – Control hazards.

**UNIT IV**                     **MEMORY SYSTEM**                             **9**

Basic Concepts - Memory Representation – Hierarchy - Memory Units: Semiconductor RAMs -ROM- Secondary Storage Devices: Magnetic Tape- Magnetic Disk and types-Optical Disk and types- USB: Pen drive-External Hard Disk- Cache Memory, Operations and performance considerations, Virtual Memory.

**UNIT V**                     **I/O ORGANIZATION**                             **9**

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB) – Case study: ARM interrupt structure and Multi core processor and its memory.

                                                  **Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**         Understand the basic structure of computer and addressing mode used in the processor.

**CO2:**         Design arithmetic and logic unit.

**CO3:**         Understand control unit and parallelism.

**CO4:**         Understand various memory systems.

**CO5:**         Understand different ways of communication with I/O devices.

CO6:         Understand interrupts and DMA data transfer strategy.

**TEXT BOOKS:**

**T1:**   Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", McGraw-Hill, 5th Edition 2011. (UNIT I, II, III, IV, V).

**T2:**   David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman/Elsevier, 4th edition, 2012. (UNIT- I, III, V)

**REFERENCE BOOKS:**

**R1:**   William Stallings, "Computer Organization and Architecture designing for Performance", Pearson Education 8th Edition, 2001

**R2:**   David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/ Software Interface", Morgan Kaufmann, 4th Edition, 2008, Publishers, 2012.

**R3:**   .John P. Hayes, "Computer Architecture and Organization", McGraw Hill, 3rd 59 Edition, 2002

**R4:**   M. Morris R. Mano "Computer System Architecture" 3rd Edition .

| U19ECTL204T | DIGITAL PRINCIPLES AND SYSTEM DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To introduce number systems and codes, basic hypothesizes of Boolean algebra and
  Relationship between Boolean expressions.
- To design and analyze combinational circuits and sequential circuits.
- To introduce the concept of memories and programmable logic devices.

**PREREQUISITES** Nil

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 3 | 2 | |
| **CO2** | 3 | 2 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 3 | 2 | |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 3 | 2 | |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 3 | 2 | |
| **CO5** | 3 | 2 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 3 | 2 | |
| **CO6** | 3 | 2 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 3 | 2 | |

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

Combinational Circuits – Analysis and Design Procedures – Binary Adder-Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – Introduction to HDL –

HDL Models of Combinational circuits

**UNIT II**         **COMBINATIONAL LOGIC**         **9**

Combinational Circuits – Analysis and Design Procedures – Binary Adder-Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – Introduction to HDL – HDL Models of Combinational circuits.

**UNIT III**         **SYNCHRONOUS SEQUENTIAL CIRCUITS**         **9**

Latches, Flip flops –SR, JK, T, D, Master/Slave FF –operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits –Design of Counters-Ripple Counters, Ring Counters, Shift registers.

**UNIT IV**         **ASYNCHRONOUS SEQUENTIAL CIRCUITS**         **9**

Analysis and design of clocked Asynchronous sequential circuits, cycles and races, Hazards, Design of Hazard free circuits.

**UNIT V**         **MEMORY DEVICES AND ITS APPLICATIONS**         **9**

Classification of memories – RAM-ROM - PROM – EPROM – EAPROM –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Implementation of combinational logic circuits using ROM, PLA, PAL

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

CO1:         Apply and Implement the Boolean functions using K map and logic gates

CO2:         Analyse and design the combinational logic circuits

CO3:         Analyse and design the sequential circuits

CO4:         Discuss the operation of various memory devices and their applications.

CO5:         Discuss the operation of various memory devices and their applications

CO6:         Describe the operation of programmable logic devices and implement combinational logic using PLDs

**TEXT BOOKS:**

**T1:**  M. Morris Mano, Michael D. Ciletti, 'Digital Design', 5th Edition, Pearson Education, New Delhi, 2012.

**REFERENCE BOOKS:**

**R1:**  Ronald J Tocci, Neal S Widmer, Gregory L Moss Digital Systems: Principles and Applications, 10th edition, Person , 2009

**R2:**  Thomas L.Floyd, Digital Fundamentals, Prentice Hall, 11th Edition, 2015

**R3:**  A.Anand Kumar, Fundamentals of Digital Electronics, 2nd Edition PHI Learning Private Limited, 2013

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**U19CCEX202**  ENGINEERING EXPLORATION II  L  T  P  C
  1  0  2  2

**COURSE OBJECTIVES**

- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | 1 | 1 | | | | | | | | | 2 | 1 | | |
| CO2 | 3 | 3 | 3 | 2 | | | | | | | | | 3 | 3 | |
| CO3 | | | 3 | 3 | 3 | | | | | | | 2 | 3 | 3 | |
| CO4 | | | | | | 3 | 3 | 3 | | | | | | 3 | 3 |
| CO5 | | | | | | | | | 3 | 3 | 3 | 2 | | 3 | 2 |
| CO6 | | | | | | | | | 3 | 3 | 3 | 2 | | 2 | 2 |

**CONTENTS**

| S No | Topics | No of Hours |
|---|---|---|
| 1 | Introduction to Engineering | 3 |
| 2 | Platform based development | 12 |

| 3 | Mechanisms | 9 |
|---|---|---|
| 4 | Requirements | 3 |
| 5 | Design | |
| 6 | Ethics | 6 |
| 7 | Sustainability | |
| 8 | Project Management Principles | 3 |
| 9 | Guided Project | |
| 10 | Final Project | 9 |

**COURSE OUTCOMES**

1. Understand the role of an engineer as a problem solver
2. Apply multi-disciplinary principles and build systems using engineering design process and tools
3. Analyze engineering solutions from ethical and sustainability perspectives
4. Use basics of engineering project management skills while doing projects
5. Communicate, Collaborate and work as a team

**GUIDELINES**

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model at the end of semester.
6. The progress of the course is evaluated based on class performance and final demonstration of prototype.

**Total:45 Hours**

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| | | | | L | T | P | C |
|---|---|---|---|---|---|---|---|
**U19PHTL205L** PHYSICS FOR INFORMATION SCIENCE LABORATORY     L T P C    0 0 2 1

**COURSE OBJECTIVES**

The course aims to provide the students

- To gain the basic theory of electrical conductance in semiconducting and optical devices

- To get knowledge in the working principle of basic semiconducting and photo conducting devices

## COURSE OUTCOME

At the end of the course students should be able to

**CO1**    Understand the functioning of various physics laboratory equipment.

**CO2**    Use graphical models to analyse laboratory data

**CO3**    Use mathematical models as a medium for quantitative reasoning and describing physical Reality

**CO4**    Access, process and analyse scientific information.

**CO5**    Solve problems individually and collaboratively.

**CO6**    Understand how to apply the physics concepts for the engineering applications

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | | | | |
| CO3 | 3 | 3 | | | | | | | | | | | | | |
| CO4 | 3 | 3 | | | | | | | | | | | | | |

| | PO1 | PO2 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO5 | 3 | 3 | | | | | | | | | | | | | | |
| CO6 | 3 | 3 | | | | | | | | | | | | | | |

**LAB COMPONENTS**

1. Determination of rigidity modulus of the material of a wire-Torsional Pendulum
2. Determination of Viscosity of a liquid – Poiseuille's method.
3. Uniform Bending - Determination of Young's Modulus.
4. Determination of thickness of a thin wire –Air Wedge
5. Determination of wavelength of mercury spectrum – spectrometer grating
6. Basic operation of Logic Gates
7. Laser (i) Determination of Wavelength and (ii) Determination of Particles size analysis
8. V-I characterization of PNP and NPN transistors
9. V-I characterization of Solar Cells
10. Determination of Energy band gap using p-n junction
11. Determination of thermal conductivity of a bad conductor by Lee's disc method
12. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.

**Total: 30 Hours**

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| **U19CSTL203L**     **C PROGRAMMING LABORATORY** | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- Write modular programs consisting of structure, functions and pointer concepts.
- Use structure variables for data storage and manipulation.
- Develop application using strings.
- Gain knowledge about memory management in C.
- To learn the files and perform file manipulations

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | 1 | | | | | | | | | 1 | | |
| CO2 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 2 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 1 | 2 | |
| CO4 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 2 | 2 | |
| CO5 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 2 | 3 | |
| CO6 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 1 | 2 | |

**LAB COMPONENTS**

1. Solve some mathematical and scientific problems using functions.
2. Solve problems using arrays.
3. Create a programs using recursive functions.
4. Demonstrate various Predefined String functions.
5. Manipulate string using user defined functions.)
6. Solve problems using pointers.
7. Develop a C program using Enum data type.
8. Design a C program using typedef.
9. Create programs using structures and unions.
10. Develop a C program using Dynamic Memory Allocation.
11 File handling in sequential access.
12. File handling in random access.

**Total: 30 Hours**

| U19ENTL202L | ENGLISH FOR ENGINEERS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

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## COURSE OBJECTIVES

The course aims to provide the students

- To develop learners' ability to listen and comprehend talks for the application of language in various context.
- To develop the students' ability to use English accurately, appropriately and fluently in different social and professional situations.
- To comprehend advanced technical passages and to identify the author's purpose and tone
- To enhance advanced level of writing by organizing ideas and achieving consistency in academic as well as workplace contexts.
- To enhance the technical components of English language for formulating effective and appropriate sentences.

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |     |     |     |     |     | 1   | 2   | 1   | 1   | 3    |      | 2    |      | 2    | 1    |
| CO2 |     |     |     |     |     | 2   | 2   | 2   | 2   | 3    |      | 2    |      | 2    | 2    |
| CO3 |     |     |     |     |     | 3   | 3   | 1   | 2   | 3    |      | 3    |      | 2    | 3    |
| CO4 |     |     |     |     |     | 1   | 1   |     | 1   | 3    |      | 1    |      | 3    | 1    |
| CO5 |     |     |     |     |     | 3   | 3   | 3   | 3   | 3    |      | 3    |      | 3    | 3    |

## LAB COMPONENTS

1. Telephone conversation
2. One Minute Talk (Prepared)
3. Describing a holiday / festivals / special events
4. BBC Hard Talk / NDTV Big Fight
5. Impromptu Speech
6. Story writing
7. Story telling
8. Open ended stories
9. Peacha Kucha
10. Book Review
11. Blog writing
12. TED Talk Presentation

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**Total: 30 Hours**

| | | | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| **U19ECTL204L** | **DIGITAL PRINCIPLES AND SYSTEM DESIGN LABORATORY** | | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To introduce number systems and codes, basic hypothesizes of Boolean algebra and relationship between Boolean expressions.
- To design and analyse combinational circuits and sequential circuits.
- To introduce the concept of memories and programmable logic devices.

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | 1 | | | | | | | | | 1 | | |
| CO2 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 2 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 1 | 2 | |
| CO4 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 2 | 2 | |
| CO5 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 2 | 3 | |
| CO6 | 2 | 1 | 1 | 1 | 2 | | | | | | | | 1 | 2 | |

**LAB COMPONENTS**

1. Study of Logic Gates.
2. Verification of Boolean Theorems using Digital Logic Gates.
3. Design and implementation of code converters using logic gates BCD to excess - 3 code.
4. Implementation of half adder and full adder, half sub tractor and full sub tractor.
5. Deign and implementation of 4 bit binary Adder/ Subtractor and BCD added using IC 7483.
6. Design and implementation of multiplexer and De-multiplexer using logic gate.
7. Construction and verification of 4 bit ripple counter and Mod- 10 Ripple counters.
8. Design and implementation of Shift Registers.
9. Design and Implementation of 3 bit Synchronous up/down counter.
10. Simulation of combinational and sequential circuits using Hardware and Description language (VHDL/Verilog HDL Software Required).

**Total: 30 Hours**

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| | | | | | | |
|---|---|---|---|---|---|---|
| **U19MATH322** | **DISCRETE MATHEMATICS** | | | **L** | **T** | **P** | **C** |

**COURSE OBJECTIVES**

The course aims to provide the students

- Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems.
- The objective of the course is to expose students to understand the basics and importance of Propositional and Predicate calculus, Combinatorics, Vector spaces, and Number Theory which are being widely used in information sciences.

**PREREQUISITES**

- Set theory
- Matrices

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO4 | 3 | 2 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |

**UNIT I        PROPOSITIONAL CALCULUS                                            12**

Propositional Logic – Propositional Equivalences – Normal Forms –   Principal Disjunctive Normal Forms  – Principal Conjunctive Normal Forms  – Rules of Inference –  Validity of arguments –  Applications of Propositional calculus in information sciences.

**UNIT II        PREDICATE CALCULUS                                              12**

Predicates – Statement function – Variables – Free and bound variables –  Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and  generalization – Validity of arguments – Applications of Propositional calculus in information sciences.

**UNIT III        COMBINATORICS                                                   12**

Permutations and Combinations – Generalized Permutations and Combinations – Recurrence Relations – Solving Linear Recurrence Relations using Characteristic Roots  and Generating functions – Applications of counting principle in information sciences.

**UNIT IV        VECTOR SPACES                                                   12**

General vector space – Real vector spaces – Subspaces – Linear dependence and Independence – Basis and Dimension of vector space –  Applications of Vector space in information sciences.

**UNIT V        NUMBER THEORY                                                   12**

Division algorithm – Base – b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic (statement only) – LCM – Congruence (definition only) – Chinese remainder theorem **–** Problems only – Applications of Number Theory in information sciences.

**Total: 60 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Apply the logical structure of proofs with connectives to produce logically valid arguments and construct direct and indirect proofs for appropriateness of each type in a particular setting.

**CO2:** Formulate and solve problems involving predicates.

**CO3:** Apply counting techniques and recursion theory including recursive and recursively enumerable sets of natural numbers in the problems of logic.

**CO4:** Solve problems using vector space concepts.

**CO5:** Apply number theory concepts for solving problems occur in Information sciences.

**TEXT BOOKS:**

**T1:** Kenneth H Rosen, "Discrete Mathematics and its Applications", Tata McGraw Hill, New Delhi, 7$^{th}$ Edition, 2016.

**T2:** Friedberg, A.H, Insel, A.J. and Spence, L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004.

**T3:** Koshy, T., "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2002.

**REFERENCE BOOKS:**

**R1:** Bernard Kolman, Robert C Busby and Sharon Cutler Ross, "Discrete Mathematical Structures", Prentice Hall, New Delhi, 6$^{th}$ Edition, 2007.

**R2:** Ralph P Grimaldi, "Discrete and Combinatorial Mathematics-An Applied Introduction", Addison Wesley, USA, 5$^{th}$ Edition, 2016.

**R3:** Richard Johnsonbaugh, "Discrete Mathematics", Pearson Education, New Delhi, 8$^{th}$ Edition, 2018.

**R4:** Tremblay J P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 2017.

**R5:** Kolman, B. Hill, D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.

**R6:** Strang, G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 3$^{rd}$ Edition, 2017.

**R7:** Niven, I., Zuckerman. H.S., and Montgomery, H.L., "An Introduction to Theory of Numbers", John Wiley and sons, Singapore, 2004.

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**U19CSTL304T**  **OPERATING SYSTEMS**  **L  T  P  C**

**COURSE OBJECTIVES**

The course aims to provide the students

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.
- Learn the basics of the Linux system and perform administrative tasks on Linux Servers.

**PREREQUISITES**

- Computational Thinking and Problem Solving

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
|       | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1   | 2   | 1   | 1   |     |     |     |     |     |     |      |      |      | 2    | 2    |      |
| CO2   | 2   | 1   | 1   |     |     |     |     |     |     |      |      |      | 2    | 2    |      |
| CO3   | 2   | 1   | 1   |     |     |     |     |     |     |      |      |      | 2    | 2    |      |
| CO4   | 2   | 1   | 1   |     |     |     |     |     |     |      |      |      | 2    | 2    |      |
| CO5   | 3   | 2   | 2   |     |     |     |     |     |     |      |      |      | 2    | 3    |      |
| CO6   | 3   | 2   | 2   |     |     |     |     |     |     |      |      |      | 2    | 2    |      |

**UNIT I**              **OPERATING SYSTEMS OVERVIEW**                                              **9**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization-Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

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

Processes-Process Concept, Process Scheduling, Operations on Processes, Inter process Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 – Thread and SMP Management. Process Synchronization – Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.

**UNIT III**              **STORAGE MANAGEMENT**                                              **9**

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV**              **I/O SYSTEMS**                                              **9**

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

**UNIT V**          **CASE STUDY**                                                                   **9**

Linux System -Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS –iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System..

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**      Explain the overall view of the computer system and operating system

**CO2:**      Identify various scheduling algorithm and deadlock prevention and avoidance algorithm

**CO3:**      Compare and contrast various memory management schemes and file system functionalities

**CO4:**      Discuss the performance of the various page replacement algorithms and interpret the file system implementation, sharing and protection mechanisms

**CO5:**      Demonstrate administrative tasks on Linux servers and to be familiar with the basics of Mobile OS

**CO6**       Make use of various algorithms to solve computing problems

**TEXT BOOKS:**

**T1:**   Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.

**REFERENCE BOOKS:**

**R1:**   William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

**R2:**   Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.

**R3:**   Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill  Education", 1996.

**R4:**   D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, Tata McGraw-Hill Education, 2007

**R5:**   Daniel P Bovet and Marco Cesati, —Understanding the Linux kernel, 3rd edition, O'Reilly, 2005

**R6:**   Neil Smyth, iPhone iOS 4 Development Essentials – Xcode, Fourth Edition, Payload media, 2011

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          **U19CSTL305T**                              **DATA STRUCTURES**                         **L    T    P    C**

**COURSE OBJECTIVES**

The course aims to provide the students

- Learn Sorting, Searching and Hashing Techniques
- Learn non-linear data structure - Tree
- Be exposed to graph algorithms
- Learn to apply tree and graph structures

**PREREQUISITES**

- C Programming

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | | | | | | | | | 2 | 1 | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 1 | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 1 | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 1 | | |
| CO5 | 3 | | | | | | | | | | | 2 | 1 | | |

**UNIT I                    SEARCHING AND SORTING                                               9**

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

**UNIT II                    TREES – I                                                                     9**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – Red Black Trees

**UNIT III                   TREES -  II                                                                   9**

Splay Tree - B-Tree - B+ Tree - Heap – Binomial Heap – Fibonacci Heap – Heap Sort - Applications of heap, Trie

**UNIT IV                   GRAPHS – I                                                                  9**

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Detecting Cycle in Directed and Undirected Graph

**UNIT V                    GRAPHS – II                                                                 9**

Minimum Spanning Trees  - Applications - Dijkstra's shortest path algorithm – Bellman Ford Algorithm – Floyd Warshall Algorithm - Disjoint Sets – Application of Disjoint Sets in Graph

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**    Apply Sorting, Searching Hashing Techniques for Problem Solving

**CO2:**    Apply Binary Trees for various applications

**CO3:**    Use M- Way Search trees, Heaps and Trie for solving problems

**CO4:**    Implement Graph and perform various operations on graph

**CO5:**    Use the different algorithms on graphs to solve problems.

**TEXT BOOKS:**

**T1:**    Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.

**T2:**    Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011

**T3:**    Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.

**REFERENCE BOOKS:**

**R1:**    Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.

**R2:**    Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education, 2004.

**R3:**    Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

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|  |  |  |  | L | T | P | C |
|---|---|---|---|---|---|---|---|
| **U19CSTL306T** | | **DATABASE MANAGEMENT SYSTEMS** | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- Provide a strong foundation in database concepts, technology, and practice.
- To study the physical and logical database designs, database modelling, relational, hierarchical, and network models.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database.
- Design and build database applications for real world problems.

**PREREQUISITES :N**IL

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 1 |  |  |  |  |  |  |  |  | 2 | 2 |  |  |
| CO2 | 2 | 1 | 2 | 1 | 3 |  |  |  |  |  |  | 1 | 3 |  |  |
| CO3 | 2 | 1 | 2 | 1 | 2 |  |  |  |  |  |  | 1 | 2 |  |  |
| CO4 | 2 | 3 |  |  | 1 |  |  |  |  |  |  | 2 | 3 |  |  |
| CO5 | 1 | 1 | 2 |  |  |  |  |  |  |  |  | 1 | 2 |  |  |

**UNIT I**          **INTRODUCTION**                                                                 **9**

Database System Applications - Database System Vs File System - Views of Data - Data Abstraction - Instance and Schema - Data Models - ER Model - Relational Model - Other Models - Database access for application programs - Database users and administrators - Transaction Management - Database System Structure - Storage Manager - Query Processor - Conceptual design for large enterprises.

**UNIT II**          **DATABASE DESIGN**                                                             **9**

**ER MODEL :** Database design and ER Diagrams - Beyond ER design entities, attributes and entity sets - Relationships and Relationship sets - additional features of ER Model - Concept design with the ER Model

**RELATIONAL MODEL:** Integrity Constraints over relations - enforcing integrity constraints - Querying relational data - Logical database design - Introduction to Views - destroying/altering tables and views. **RELATIONAL ALGEBRA :** Selection and Projection set operations - Renaming - Joins - Division - Examples of Algebra overviews

**UNIT III**          **WORKING WITH SQL AND PL/SQL**                                            **9**

**SQL :** Basic SQL Queries - Introduction to Nested Queries - Correlated Nested Query Set - Comparison operators - Conversion Functions - String and Date Functions - Aggregative operators - NULL Values - Comparison using NULL Values - Logical Connectivity's - SQL Constructs - Joins. **PL/SQL :** PL/SQL Basic Block - Functions and Stored Procedures - Triggers - Exception Handling - Cursors

**UNIT IV          SCHEMA REFINEMENT                                                    9**

Problem caused by Redundancy - Decomposition - Problem Related to Decomposition - Functional Dependencies - Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF - Dependency Preservation

**UNIT V          TRANSACTION CONCEPTS                                                 9**

Transaction state - ACID Properties of Transaction - Implementation of Isolation - Testing for serializability - Deadlock Handling - Failure Classification - Storage - Recovery and Atomicity – Recovery

**Total: 45  Hours**

## COURSE OUTCOMES

At the end of the course students should be able to

**CO1:**          Apply the basic concepts of DBMS in organisation.

**CO2:**          Design the database using ER and Relational model for the application.

**CO3:**          Create and execute SQL commands and perform PL/SQL concepts.

**CO4:**          Apply normalisation techniques for optimisation.

**CO5:**          Use deadlock avoidance mechanisms with ACID transaction properties.

## TEXT BOOKS:

**T1:**    Abraham Silberschatz, Henry F. Korth, S.Sudharshan - "Database System Concepts", 6$^{th}$ Edition, McGraw-Hill Education, 2018.

**T2**     Ramez Elmasri, Shamkant B.Navathe, "Fundamentals of Database System", 7$^{th}$ Edition, Pearson Education, 2016.

## REFERENCE BOOKS:

**R1:**    Raghu Ramakrishnan, Johannes Gehrke- "Database Management Systems", 3$^{rd}$ Edition, McGraw-Hill Education, 2002.

**R2:**    Coronel, Morris and Rob, "Database principles fundamentals of Design, Implementation and Management, 10$^{th}$ Edition, Cengage Learning, 2014.

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**U19CSTL307T**                    **OBJECT ORIENTED PROGRAMMING**                    **L      T      P      C**

3    0    0    3

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of creating basic Java classes and methods
- To know the principles of inheritance and interfaces and polymorphism
- To define exceptions and use I/O streams
- To develop a java application with threads and collections

**PREREQUISITES**

- NIL

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | | | | 3 |
| CO2 | 3 | | | | | | | | | | | | | | 3 |
| CO3 | 3 | 2 | 3 | | | | | | | | | | | 2 | 3 |
| CO4 | 3 | 3 | 3 | 2 | | | | | | | | | | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | | | | | 2 | 3 |
| CO6 | 3 | | | | | | | | | | | | | | 3 |

**UNIT I        INTRODUCTION TO OOP AND JAVA FUNDAMENTALS                9**

Object Oriented Programming  Abstraction – objects and classes  Encapsulation Inheritance  Polymorphism  OOP in Java – Characteristics of Java – The Java Environment  Java Source File Structure – Compilation. Fundamental Programming Structures in Java

**UNIT II        JAVA LANGUAGE BASICS                9**

Defining classes in Java – constructors and methods – defining real world entities using classes  Access specifiers  static members Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages – Java API documentation, Java Doc comments

**UNIT III        INHERITANCE AND INTERFACES                9**

Inheritance – Super classes sub classes –Protected members – constructors in sub classes The Object class – abstract classes and methods final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – polymorphism with inheritance – Strings

**UNIT IV        EXCEPTION HANDLING AND I/O                9**

Exceptions exception hierarchy throwing and catching exceptions – builtin exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

**UNIT V          MULTITHREADING AND COLLECTIONS          9**

Differences between multithreading and multitasking, thread life cycle, creating threads, Synchronizing threads, Interthread communication, daemon threads, inner classes, Array List  Basics of collections frameworks and Generics – Generic classes, Generic methods

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**     Explain the basic concepts of object oriented programming language and their representation.

**CO2:**     Illustrate dynamic memory allocation functions, access specifiers and the friend functions.

**CO3:**     Demonstrate the use of constructors, destructors and also the behaviour of inheritance and its implementation.

**CO4:**     Implement polymorphism and overloading of operators.

**CO5:**     Apply the I/O operations to handle backup system using files and to develop general purpose templates.

**CO6:**     Handle raised exception while implementing various object oriented concepts

**TEXT BOOKS:**

**T1:**   Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.

**T2**   Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

**REFERENCE BOOKS:**

**R1:**   Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015
**R2:**   Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
**R3**   . Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

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**U19ECTL513T          MICROPROCESSOR AND MICROCONTROLLER          L    T    P    C**

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

**PREREUISITES :** NIL

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 1 |
| CO2 | 2 | 1 |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 1 |
| CO3 | 2 | 1 |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 1 |
| CO4 | 2 | 1 |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 1 |
| CO5 | 2 | 1 |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 1 |
| CO6 | 3 | 2 |  |  |  |  |  |  |  |  |  |  | 2 | 3 | 2 |

**UNIT I          THE 8086 MICROPROCESSOR                                              9**

Introduction to 8086 – Microprocessor architecture – Addressing modes  Instruction set and assembler directives – Assembly language programming – Modular Programming  Linking and Relocation  Stacks Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II          8086 SYSTEM BUS STRUCTURE                                              9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III          I/O INTERFACING                                              9**

Memory Interfacing and I/O interfacing  Parallel communication interface – Serial communication interface – D/A and A/D Interface  Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV          MICROCONTROLLER                                              9**

Architecture of 8051 – Special Function Registers (SFRs)  I/O Pins Ports and Circuits  Instruction set  Addressing modes  Assembly language programming.

**UNIT V          INTERFACING MICROCONTROLLER                                              9**

Programming 8051 Timers  Serial Port Programming  Interrupts Programming – LCD & Keyboard Interfacing ADC, DAC & Sensor Interfacing  External Memory Interface Stepper Motor and Waveform generation Comparison of Microprocessor, Microcontroller, PIC and ARM processors

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Ability to design and implement programs on 8086 microprocessors

**CO2:** Ability to understand the basic configuration of bus structure

**CO3:** Ability to design memory interfacing circuits.

**CO4:** Ability to write application specific assembly level programming using Special Function Registers in 8051 Microcontrollers

**CO5:** Ability to should be able to design and interface external peripheral circuits with microcontroller.

**CO6:** Ability to learn the design aspects of IO, Memory, Communication and Bus interfacing circuits

**TEXT BOOKS:**

**T1:** YuCheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family  Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007. (UNIT I III)

**T2** Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition, Pearson education, 2011. (UNIT IVV)

**REFERENCE BOOKS:**

**R1:** Doughlas V.Hall, ―Microprocessors and Interfacing, Programming and Hardware‖,TMH,2012.

**R2:** A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata  McGrawHill, 2012

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| U19CSTL305L | DATA STRUCTURES  LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To write and execute programs to solve problems using data structures such as arrays, linked lists, stacks, queues.
- write and execute programs in to solve problems using data structures such as trees, graphs, hash tables and search trees.
- write and execute write programs to implement various sorting and searching methods

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | | | | | | | | | 2 | 1 | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 1 | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 1 | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 1 | | |

CO1    identify the appropriate data structure for given problem.

CO2    design programs for solving problems using different data structures.

CO3    solve problems using trees, graphs and hash tables addressing various issues.

CO4    Graduates will have ability to effectively use compilers includes library functions, debuggers and trouble shooting

**LAB COMPONENTS**

1    Array Implementation of List ADT
2    2. Operations on list ADT using singly, doubly, circularly linked list
3    3. Operations on stack and queue
4    4. Applications of linear data structures.
5    Operations of Binary Trees
6    Expression tree
7    Binary Search Trees – Operations and Applications
8    AVL Trees– Operations and Application
9    Graph representation and Traversal algorithms
10   Minimum Spanning Trees
11   Shortest Path Algorithm
12   Hashing and Collision Resolution Techniques.
13   Sorting &amp; Searching algorithms – implementation

**Total: 30  Hours**

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| | | | | | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **U19CSTL307L** | **OBJECT ORIENTED PROGRAMMING LABORATORY** | | | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, interfaces.
- To help the students understand the concept of  threads and integrate with the web application
- To develop applications using exception handling and packages**.**
- To make the students use Advanced Java concepts generic programming

**COURSE OUTCOMES**

CO1: Implement object oriented concepts such as objects, class abstraction and message passing.

CO2: Implement the friend function and function overloading.

CO3: Implement Operator overloading, Inheritance and method overriding.

CO4: Implement virtual function to achieve Run time polymorphism.

CO5: Implement the various functions on String.

CO6: Apply I/O operation to handle file system.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | | 2 | | | | | | | | | | |
| CO2 | 3 | | | | 2 | | | | | | | | | | |
| CO3 | 3 | | | | 2 | | | | | | | | | | |
| CO4 | 3 | 2 | 2 | | 2 | | | | | | | | 2 | 2 | |
| CO5 | 3 | 2 | | | 2 | | | | | | | | | | |
| CO6 | 3 | 2 | 2 | | 2 | | | | | | | | 2 | 2 | |

**LAB COMPONENTS**

1. Analyse a real world scenario (bank, college, department, etc.,) and an object oriented class hierarchy has to be created.
2. Analyse and understand the importance of inheritance in object oriented programming with practical examples.
3. Implement class hierarchy with interface to understand the need for a contract.
4. Dynamic polymorphism has to be implemented and understood with a real world scenario.
5. Multithreading  with the help of Java programs should be experimented to understand the capabilities of Java in various special occasions.
6. The synchronization has to be implemented among multiple threads for an useful real time activity such as producer consumer.
7. The unexpected scenarios of a program has to be handled with exception handling mechanism of java.

8. The steps to package java classes and interfaces and the benefits has to be practicallyimplemented and understood.
9. The hierarchy of java classes for input and output from java programs has to be implemented.
10. The collections framework has to be experimented for effective ways of storing java objects andhow they could be improved with Generics.

**Total: 30 Hours**

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**U19CSTL306L**        **DATABASE MANAGEMENT SYSTEMS LABORATORY**        **L**     **T**     **P**     **C**

**COURSE OBJECTIVES**

The course aims to provide the students

- To explain basic database concepts, applications, data models, schemas and instances.
- Describe the basics of SQL and construct queries using SQL.
- To emphasize the importance of normalization in databases.
- To familiarize issues of concurrency control and  transaction management.To be familiar with the use of a front end tool

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1  | 3   | 2   | 1   |     |     |     |     |     |     |      |      | 2    | 2    |      |      |
| CO2  | 2   | 1   | 2   | 1   | 3   |     |     |     |     |      |      | 1    | 3    |      |      |
| CO3  | 2   | 1   | 2   | 1   | 2   |     |     |     |     |      |      | 1    | 2    |      |      |
| CO4  | 2   | 3   |     |     | 1   |     |     |     |     |      |      | 2    | 3    |      |      |
| CO5  | 1   | 1   | 2   |     |     |     |     |     |     |      |      | 1    | 2    |      |      |

**LAB COMPONENTS**

1. Working with ER Diagrams and Normalization
2. Working with DDL, DML, DCL and Key constraints
3. Working with Queries, Nested Queries and Joins
4. Working with Queries using Aggregate operators and Views
5. Working with Conversion Functions, String Functions and Date Functions
6. Working with PL/SQL Blocks  Simple, Branching and Looping Statements
7. Working with Triggers using PL/SQL
8. Working with Functions and Stored Procedures
9. Working with Cursors (Implicit & Explicit)
10. Working with Exception Handling
11. A sample Database application with front end and back end connectivity

**Total: 30 Hours**

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| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19ECTL513L** | **MICROPROCESSOR AND MICROCONTROLLER LABORATORY** | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

CO1 Ability to design and implement programs on 8086 microprocessors

CO2 Ability to understand the basic configuration of bus structure

CO3 Ability to design memory interfacing circuits.

CO4 Ability to write application specific assembly level programming using Special Function Registers in 8051 Micro-controllers

CO5 Ability to should be able to design and interface external peripheral circuits with microcontroller.

CO6 Ability to learn the design aspects of IO, Memory, Communication and Bus interfacing circuits

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | 1 | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | 1 | | | | | | | | | | | | | |
| CO4 | 2 | 1 | | | | | | | | | | | | | |
| CO5 | 2 | 1 | | | | | | | | | | | | | |
| CO6 | 3 | 2 | | | | | | | | | | | 2 | | |

**LAB COMPONENTS**

**8086 Programs using kits and MASM**

1. Basic arithmetic and Logical operations

2. Move a data block without overlap

3. Code conversion, decimal arithmetic and Matrix operations.

4. Floating point operations, string manipulations, sorting and searching

5. Password checking, Print RAM size and system date

6. Counters and Time Delay

**Peripherals and Interfacing Experiments**

7. Traffic light control

8. Stepper motor control

9. Digital clock

10. Key board and Display

11. Printer status

12. Serial interface and Parallel interface

13. A/D and D/A interface and Waveform Generation

**8051 Experiments using kits and MASM**

14. Basic arithmetic and Logical operations

15. Square and Cube program, Find 2's complement of a number

16. Unpacked BCD to ASCII

**Total: 30  Hours**

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**COURSE OBJECTIVES**

The course aims to provide the students

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.
- Learn the basics of the Linux system and perform administrative tasks on Linux Servers.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | | | | | | 2 | 2 | |
| CO2 | 2 | 1 | 1 | | | | | | | | | | 2 | 2 | |
| CO3 | 2 | 1 | 1 | | | | | | | | | | 2 | 2 | |
| CO4 | 2 | 1 | 1 | | | | | | | | | | 2 | 2 | |
| CO5 | 3 | 2 | 2 | | | | | | | | | | 2 | 3 | |
| CO6 | 3 | 2 | 2 | | | | | | | | | | 2 | 2 | |

**LAB COMPONENTS**

1. Basics of UNIX commands.
2. Shell Programming.
3. Implement the following CPU scheduling algorithms
   a) Round Robin b) SJF c) FCFS d) Priority
4. Implement all file allocation strategies
   a) Sequential b) Indexed c) Linked
5. Implement Semaphores
6. Implement all File Organization Techniques
   a) Single level directory b) Two level c) Hierarchical d) DAG
7. Implement Bankers Algorithm for Dead Lock Avoidance  Dead Lock Detection
8. Implement  all page replacement algorithms
   a) FIFO b) LRU c) LFU
9. Implement Shared memory and IPC
10. Implement Paging Technique of memory management.
11. Implement Threading & Synchronization Applications

**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Design various Scheduling algorithms.

**CO2:** Apply the principles of concurrency.

**CO3:** Design deadlock, prevention and avoidance algorithms.

**CO4:** Compare and contrast various memory management schemes.

**CO5:** Design and Implement a prototype file systems.

**CO6:** Perform administrative tasks on Linux Servers.

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| U19CCLC301 | CAREER ENHANCEMENT PROGRAM – I | L | T | P | C |

**Course Objectives**
- To develop active listening skills in various contexts.
- To develop the student's ability to use English accurately, appropriately, and fluently in different social and professional situations.
- To enable students to gain a strong foundation by expanding their logical, numerical, and reasoning skills.
- To ensure students develop the ability to comprehend, work with, and apply general mathematical techniques and models to different situations.

**Course Outcomes**

At the end of the course, learners will be able to

C01: Listen and comprehend technical and non-technical spoken experts critically and functionally.

C02: Able to use English accurately, appropriately and fluently in different social and professional situations

C03: Able to gain a strong foundation by expanding their logical, numerical and reasoning skills.

C04: Ability to comprehend, work with, and apply general mathematical techniques and models to different situations.

**Course Articulation Matrix**

| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| 1 | | | | | | | | | | 3 | | 2 | | | 1 |
| 2 | | | | | | | 2 | | 2 | 3 | | 2 | | | 2 |
| 3 | 3 | 2 | | | | 2 | | | 1 | | | 2 | 2 | 3 | |
| 4 | 2 | 2 | | | | | | 2 | | | | 2 | | | 3 |

3 - High, 2 - Medium, 1 – Low

**UNIT I**                                                                                      6

Applied Language Skills:  Pronunciation  - Homophones/ Homonyms / Homographs - Listening to the Busin conversations and answering MCQs

Quants: Number Series - Sequence   -   Alphabet Series - Odd man out.

**UNIT II**                                                                                     6

Applied Language Skills: Telephone Etiquette - Understanding the tone - Listening to a Telephone conversation and filling out the forms

Quants: Seating Arrangements - Linear, Circular, Square, Rectangular   Arrangement

**UNIT III**                                                                                    6

Applied Language Skills: Idioms & Phrases - Phrasal Verbs - Listening to Self-introductions /conversations - Understanding the structure of the speech

Quants: Family Tree- Statement Problems on Blood Relations - Direction Problems – Left Right Movement – Clockwise – Anti-clockwise.

**UNIT IV**                                                                                     6

Applied Language Skills: Listening to describing the products - Interpretation of Charts- Usage of discourse markers

Quants: LOGICAL DEDUCTION - Introduction to Sets-Venn Diagrams – Logic-based questions using Venn diagram - Rules for solving syllogism questions-Statement and conclusion.

**UNIT V**                                                                                      6

Applied Language Skills: Strategies for presentation - Practice- Decision Making – Problem-Solving - Taking up a Listening Test

Quants: CLOCKS AND CALENDAR  - Minute Spaces - Hour Hand and Minute Hand - Odd Days - Leap Year – Ordinary Year  - Counting of Odd Days

**TOTAL: 30 HOURS**

**TEXTBOOKS**
1. Means,L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage learning,USA:

2007
2. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book). Cambridge University Press, New Delhi: 2005
3. Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand& Co Ltd., New Delhi.
4. Pearson Publication, "A Complete Manual for the CAT", 2018

**REFERENCES**
1. Carter, R., & McCarthy, M. (2006). Cambridge grammar of English: A comprehensive guide: spoken and written English grammar and usage. Cambridge University Press.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
3. Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014

**WEB RESOURCES**
1. https://learnenglish.britishcouncil.org/skills/listening
2. https://ieltspolska.pl/wp-content/uploads/2020/05/Listening-paper-assets.pdf
3. https://www.cambridgeenglish.org/learning-english/activities-for-learners/?skill=listening
4. https://testbook.com/aptitude-practice
5. https://www.indiabix.com/aptitude/questions-and-answers/

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| U19CCEX303 | ENGINEERING EXPLORATION III | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**COURSE OBJECTIVES**
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

**PRE-REQUISITES**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1  |     | 1   | 1   |     |     |     |     |     |     |      |      | 2    | 1    |      |      |
| CO2  | 3   | 3   | 3   | 2   |     |     |     |     |     |      |      |      | 3    | 3    |      |
| CO3  |     |     | 3   | 3   | 3   |     |     |     |     |      |      | 2    | 3    | 3    |      |
| CO4  |     |     |     |     |     | 3   | 3   | 3   |     |      |      |      |      | 3    | 3    |
| CO5  |     |     |     |     |     |     |     |     | 3   | 3    | 3    | 2    |      | 3    | 2    |
| CO6  |     |     |     |     |     |     |     |     | 3   | 3    | 3    | 2    |      | 2    | 2    |

**CONTENTS**

| S No | Topics | No of Hours |
|------|--------|-------------|
| 1 | Introduction to Engineering | 3 |
| 2 | Platform-based development | 12 |
| 3 | Mechanisms | 9 |
| 4 | Requirements | 3 |
| 5 | Design | |
| 6 | Ethics | 6 |
| 7 | Sustainability | |
| 8 | Project Management Principles | 3 |
| 9 | Guided Project | |
| 10 | Final Project | 9 |

**COURSE OUTCOMES**
- Understand the role of an engineer as a problem solver
- Apply multi-disciplinary principles and build systems using engineering design process
- Use appropriate tools for designing and development of solutions.
- Analyze engineering solutions from ethical and sustainability perspectives
- Use basics of engineering project management skills while doing projects
- Communicate, Collaborate and work as a team

**GUIDELINES**
- Practical based learning carrying credits.
- Multi-disciplinary/ Multi-focus group of 3-4 students.
- Groups can select to work on specific tasks, or projects related to real world problems.
- Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
- The students have to display their model at the end of semester.
- The progress of the course is evaluated based on class performance and final demonstration of prototype.

**Total:45 Hours**

U19MATH429          **PROBABILITY, STATISTICS AND QUEUEING THEORY**          L    T    P    C

**COURSE OBJECTIVES**

The course aims to provide the students

- Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems.
- The objective of the course is to expose students to understand the basics and importance of Random variables, Two dimensional discrete random variables, Testing of hypothesis, Design of experiments, and Queueing theory are being widely used in Information sciences.

**PREREQUISITES**

- Differentiation
- Integration

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 3 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO3 | 2 | 3 | 3 | | 2 | | | | | | | 2 | 2 | 3 | 2 |
| CO4 | 2 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |
| CO5 | 2 | 3 | 2 | | 2 | | | | | | | 2 | 2 | 2 | 2 |

**UNIT I          RANDOM VARIABLES                                         9+3**

Random variable – Discrete and continuous random variables – Moment generating functions – Properties (statement only) – Binomial, Poisson, Exponential and Normal distributions –Applications of Random variables in Information sciences.

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

Two dimensional discrete random variables – Joint distributions – Marginal and conditional distributions – Correlation and Linear regression – Properties (statement only) – Applications of Two – dimensional discrete random variables in Information sciences.

**UNIT III          TESTING OF HYPOTHESIS                                    9+3**

Sampling distributions – Type I and Type II errors – One sample and two sample tests for means and proportions of large samples (Ztest) – One sample and two sample tests for means of small samples (t test) – F test for two sample variances – Chisquare distribution tests for independence of attributes and goodness of fit – Applications of Testing of hypothesis in Information sciences.

**UNIT IV          DESIGN OF EXPERIMENTS                                    9+3**

Analysis of variance – Onaway classification – Completely Randomized Design (CRD) – Two-way classification – Randomized Block Design (RBD) – Latin square Design – Applications of design of experiments in Information sciences.

**UNIT V          QUEUEING THEORY                                         9+3**

Markov process (definition only) – Representation of Queueing models – (a / b / c: d / e) forms – (M/M/1 : ∞/FIFO) – (M/M/C : ∞/FIFO) – (M/M/1 : N/FIFO) – (M/M/C : N/FIFO) (problems only) – Applications of Queueing models in Information sciences.

**Total: 60  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Apply the techniques of discrete and continuous probability distributions in real life problems.

**CO2:** Apply the concepts of two dimensional discrete random variables such as mean, variance, covariance, correlation and regression in data analyzing.

**CO3:** Perform parameter testing techniques to single and multisample tests by means, proportions  and variances in order to decision making.

**CO4:** Understand the concepts of analysis of variance technique and the strategy to apply the same in engineering problems.

**CO5:** Understand the situation that generates queueing problems, various elements of queueing system and the  performance measures of different queueing models.

**TEXT BOOKS:**

**T1:** Johnson R.A, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, Delhi, 8th Edition 2015.

**T2:** Trivedi K. S, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", John Wiley and Sons, Second Edition, 2016.

**REFERENCE BOOKS:**

**R1:** Allen A.O, "Probability Statistics and Queuing Theory", Academic press, New Delhi, 2nd Edition 2014.

**R2:** Gupta S.C and Kapur J.N, "Fundamentals of Mathematical Statistics" , Sultan Chand, New Delhi, 11th Edition, 2019.

**R3:** Gross. D. and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student edition, 4th Edition, 2008.

**R4:** Robertazzi, "Computer Networks and Systems: Queueing Theory and performance evaluation", Springer, 3rd  Edition, 2006.

**R5:** Taha H. A, "Operations Research: An Introduction", 8th Edition, Prentice hall of India Ltd, New Delhi, 2008.

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**U19CHTH401**          **ENVIRONMENTAL SCIENCE AND ENGINEERING**          **L    T    P    C**

**COURSE OBJECTIVES**

The course aims to provide the students

- To create an exposure to the basic concepts of environment, ecosystem and biodiversity.
- To gain basic knowledge about various resources of environment.
- To gain knowledge on environmental pollution, threats and engineering problems for solving environmental issues.
- To acquire knowledge about social issues and green chemistry for sustainable development.
- To know about the human interactions with the environment.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | | | | | 2 | 2 | | | | | | | 2 | 1 |
| CO2 | 2 | | | | | 2 | 3 | | | | | | | 2 | 1 |
| CO3 | 2 | | | | | 2 | 3 | | | | | | | 2 | 1 |
| CO4 | 2 | | | | | 3 | 3 | | | | | | | 2 | 1 |
| CO5 | 2 | | | | | 3 | 3 | | | | | | | 1 | 1 |

**UNIT I                       ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY                       10**

Environment: Introduction  Scope and Importance of environmental science Need for public awareness; Ecosystem: Concept  Structure and function  Producers, Consumers and Decomposers  Energy flow in the ecosystem Ecological succession Food chains, Food webs and Ecological pyramids  Introduction, types, characteristic features, structure and function of the forest and marine ecosystem; Biodiversity: Definition – values of biodiversity  India as a mega diversity nation  Hot spots of biodiversity  Threats to biodiversity Endangered and endemic species of India  Conservation of biodiversity.

**UNIT II                       NATURAL RESOURCES                       10**

Natural resources: Introduction – types  Forest resources: deforestation  water resources: dams benefits and problems; Mineral resources: environmental effects of extracting and using mineral resources; Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer pesticide problems; Energy resources: renewable energy resources  Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification role of an individual in conservation of natural resources.

**UNIT III                       ENVIRONMENTAL POLLUTION                       9**

Definition, causes, effects, control measures and a relevant case study of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards – Municipal solid waste management and Sewage waste water treatment processes  role of an individual in prevention of pollution; Chemistry, effects, control measures and a relevant case study of: (a) Acid rain (b) Ozone layer depletion.

**UNIT IV                       SOCIAL ISSUES                       8**

Sustainable development  Urban problems related to energy  Water conservation: Rain water harvesting, Watershed management  Environmental ethics  Wasteland reclamation  EIA, Environment protection and conservation acts   Role of central and state pollution control boards; Introduction to Green chemistry: 12 principles.

**UNIT V            HUMAN INTERACTIONS AND ENVIRONMENT                            8**

Environment and human health – population growth – variation among nations, population explosion – human rights – value education – HIV/AIDS – Women and child welfare Family welfare programme – Role of information technology in environment and human health.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**   Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
**CO2:**   Take measures for the preservation of natural resources and need for sustainable lifestyle during development and improvement in standard of living.
**CO3:**   Use mass balance and risk based approaches to assess and manage pollution.
**CO4:**   Create awareness about social issues, environment & understand the needs of EIA.
**CO5:**   Understand the effect of human population & environment.

**TEXT BOOKS:**

**T1:**   Dr.A.Ravikrishnan, "Environmental science and Engineering", Sri Krishna HiTech Publication, Chennai,2018.

**T2:**   Benny Joseph, "Environmental Science and Engineering", Tata McGrawHill Education Pvt. Ltd., New Delhi, 2006.

**T3:**   Gilbert M. Masters, Introduction to "Environmental Engineering and Science", 2$^{nd}$Edition, Pearson Education, 2004.

**T4:**   C.Sawer, P.Mc. Carty, G. Parking, Chemistry for Environmental Engineering and science, Mc Graw Publishing company, 2003.

**REFERENCE BOOKS:**

**R1:**   A. Kaushik and C.P. Kaushik, "Environmental Science and Engineering", 3rd Edition, New Age International (P) Limited Publishers, 2009.

**R2:**   Dharmendra S. Sengar, "Environmental Law", Prentice Hall of India Pvt. Ltd., New Delhi, 2007.

**R3:**   R. Rajagopalan, "Environmental StudiesFrom Crisis to Cure", Oxford University Press, 2005.

**R4:**   G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt.  Ltd., Delhi, 2014.

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<table>
<tr><td rowspan="2"></td><td></td><td></td><td></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
</table>

|  |  | L | T | P | C |
|---|---|---|---|---|---|
| **U19CSTL408T** | **ADVANCED DATABASES** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To learn the  NoSQL and use of MongoDB in NoSQL along with configuring mongo server
- To learn to write Query for MongoDB
- To learn indexing and its usage
- To learn aggregation framework and MapReduce techniques in MongoDB
- To learn replica management on MongoDB, configure sharding on MongoDB

**PREREQUISITES**

- Database Management Systems

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 2 | 2 | 2 |  |  |  |  |  |  |  | 2 | 3 |  |
| CO2 | 1 | 3 | 1 | 2 | 1 |  |  |  |  |  |  |  | 3 | 2 |  |
| CO3 | 2 | 2 | 2 | 2 | 2 |  |  |  |  |  |  |  | 3 | 2 |  |
| CO4 | 2 | 2 | 2 | 2 | 2 |  |  |  |  |  |  |  | 2 | 3 | 1 |
| CO5 | 2 | 3 | 3 | 2 | 3 |  |  |  |  |  |  |  |  | 1 | 3 |
| CO6 | 2 | 1 | 3 | 2 | 3 |  |  |  |  |  |  |  |  | 3 |  |

| **UNIT I** | **INTRODUCTION, BASIC DATA TYPES, CREATING, UPDATING, AND DELETING DOCUMENTS** | **9** |
|---|---|---|

Introduction to NoSQL and MongoDB, Installation of MongoDB and GUI of MongoDB. Basic Data Types: Documents, Collections, Dynamic Schemas, Mongo Shell, Mongo Server and Client, Data Types, Embedded Documents, Creating Configuration file for Mongo. Creating, Updating, and Deleting Documents: Inserting and Saving Documents, Batch Insert, Insert Validation, Removing Documents, Updating Documents, Document Replacement, Using Modifiers, Upserts, Updating Multiple Documents, Returning Updated Documents.

| **UNIT II** | **QUERY** | **9** |
|---|---|---|

Introduction to find, Query Criteria, Query Conditionals, Conditional Semantics, Type Specific Queries, Regular Expressions, Querying Arrays, Querying on Embedded Documents, Cursors, Limits, Skips, Advanced Query Options, Getting Consistent Results Immortal Cursors.

| **UNIT III** | **INDEX, SPECIAL INDEX AND COLLECTION TYPES** | **9** |
|---|---|---|

Introduction to Indexing, Introduction to Compound Indexes, Using Compound Indexes, Indexing Objects and Arrays , Index Cardinality, Using explain() and hint(), The Query Optimizer, Index Administration, Changing Indexes, Capped Collections, Geospatial Indexing Storing Files with Grid FS , Getting Started with Grid FS: mongo files, Working with Grid FS from the MongoDB Drivers

**UNIT IV**        **AGGREGATION, REPLICATION**        **10**

The Aggregation Framework, Pipeline Operations, $match, $project, $group, $unwind, $sort, $limit, $skip, Using Pipelines, MongoDB and MapReduce, Aggregation Command. Introduction to Replication, Configuring a Replica Set, Networking, Elections, Member Configuration Options, Creating Election Arbiters, Priority, Heartbeats.

**UNIT V**        **SHARDING**        **8**

Introduction to Sharding, Config Servers, The mongos Processes, Adding a Shard from a Replica Set, Shard Keys,Hashed Shard Keys for GridFS , Shard Key.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**        Understand the NoSQL and use of MongoDB in NoSQL

**CO2:**        To add new document, modify and remove existing documents from collections

**CO3:**        Write  Query for MongoDB

**CO4:**        Apply indexing concepts

**CO5:**        Apply aggregation framework and MapReduce techniques in MongoDB.

**CO6**        Use replica management on MongoDB, configure sharding on MongoDB

**TEXT BOOKS:**

**T1:**    MongoDB: The Definitive Guide, 2nd Edition,by Kristina Chodorow,Released May 2013,O'Reilly Media, Inc.

**T2:**    MongoDB in Action by Kyle Banker

**REFERENCE BOOKS:**

**R1:**    MongoDb Applied Design Patterns 1st Edition, by Rick Copeland, O'Reilly Media, Inc

**R2:**    MongoDB: The Definitive Guide: Powerful and Scalable Data Storage 3rd Edition by Shannon Bradsh, Eoin Brazil, Kristina Chodorow

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|---|---|---|---|---|---|---|
| U19CSTL409T | INTERNET PROGRAMMING | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To make the students understand how server works and learn to use PHP as the scripting language
- To help the students understand the MySQL database management and integrate with the web application
- To inculcate the various design patterns available in designing the web application
- To make the students use Advanced Javascript and JQuery for clientside scripting
- To help the students to understand XML and Web Services, create and use them in web applications.

**PREREQUISITES :** NIL

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |

**UNIT I            SERVER SIDE DEVELOPMENT            9**

Apache web server  PHP Basics  Program control  Functions  Arrays  Super Globals  Reading and Writing files  Classes and Objects in PHP

**UNIT II            WORKING WITH DATABASES            9**

Databases and web development  Database API  Managing MySQL database with PHP  Error handling and validation  Managing state

**UNIT III            WEB APPLICATION DESIGN            9**

Real world web software design  Layering  Design patterns in the web context  Data and Domain patterns  Presentation patterns.

**UNIT IV            ADVANCED JAVASCRIPT AND JQUERY            9**

Pseudo classes  JQuery Foundations  Ajax  Asynchronous file transmission  Animation Backbone MVC Frameworks – Security

**UNIT V            XML AND WEB SERVICES            9**

XML Overview  XML Processing  JSON  Overview of Web Services  consuming web services in PHP  creating web services  Interacting asynchronously with web services.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Develop Web Applications using PHP

**CO2:** Connect MySQL Database with PHP Scripts and handle errors

**CO3:** Use the different design patterns in web application development

**CO4:** Use JQuery for client side scripting

**CO5:** Understand and Use XML and web Services

**TEXT BOOKS:**

**T1:** Randy Connolly, "Fundamentals of Web Development", Pearson Education, Inc, 2015.

**T2** Lynn Beighley, Michael Morrison, "Head First PHP & MySQL: A BrainFriendly Guide", O Reilly publications, 1st Edition

**REFERENCE BOOKS:**

**R1:** Jeffrey C. Jackson, "Web TechnologiesA Computer Science Perspective", Pearson Education, 2006.

**R2:** Kogent Learning Solutions Inc., " Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book", Dreamtech Press, 1 edition (2009)

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| | | | L | T | P | C |
|---|---|---|---|---|---|---|
| **U19CSTL410T** | **DESIGN AND ANALYSIS OF ALGORITHMS** | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand and apply the algorithm analysis techniques
- To understand the basic concepts of brute force and divide and conquer strategy
- To critically analyze the efficiency of alternate algorithmic solutions for the same problem
- To apply iteration improvement in feasible solution with an improved value of the objective function
- To understand different algorithm design techniques

**PREREQUISITES**

- Fundamentals of Programming and problem solving using C
- Advanced Data structure and Algorithms

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 3 | 1 | | | | | | | | | | 3 | | |
| CO2 | 2 | 3 | 1 | | | | | | | | | | 3 | | |
| CO3 | 2 | 3 | 1 | | | | | | | | | | 1 | | |
| CO4 | 2 | 3 | 1 | | | | | | | | | | 1 | | |
| CO5 | 2 | 2 | | | | | | | | | | | 1 | | |
| CO6 | 2 | 3 | 1 | | | | | | | | | | 3 | | |

**UNIT I          INTRODUCTION                                                                                      7**

Algorithm Space and Time Complexity Analysis Framework Fundamentals of Algorithmic Problem Solving – Important Problem Types – Asymptotic Notations – Mathematical analysis for Recursive and Non recursive algorithms.

**UNIT II          BRUTE FORCE AND DIVIDEANDCONQUER                                          10**

Brute Force: String Matching Closest Pair and Convex Hull Problems Exhaustive Search  Traveling Salesman Problem  Knapsack Problem  Assignment problem.               Divide and conquer methodology: Strassan's matrix multiplication - Master Theorem Binary search – Merge sort – Quick Sort –Heap Sort

**UNIT III          DYNAMIC PROGRAMMING                                                                9**

Dynamic Programming: Principle of optimality Floyd' algorithm Warshall's algorithm–Multistage Graph Optimal Binary Search Trees – Knapsack Problem.

**UNIT IV          ITERATIVE IMPROVEMENT AND GREEDY TECHNIQUE                        9**

Iterative improvement: The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs The Stable marriage Problem. Greedy Technique: Coin Change Problem-Prim's Algorithm Kruskal's Algorithm-Dijkstra's Algorithm-Huffman Trees.

**UNIT V**          **BACKTRACKING AND BRANCHANDBOUND**          **10**

Backtracking: n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem Branch and Bound: Assignment problem – Knapsack Problem – Travelling Salesman Problem-NP Complete and NP Hard Problems: Basic concepts-Non-Deterministic Algorithms-P, NP, NP – Complete and NP-Hard Classes.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**     Analyze the time and space complexity of algorithms.

**CO2:**     Design algorithms for various computing problems(brute force, divide and conquer)

**CO3:**     Analyze the different algorithm design techniques for a given problem.

**CO4:**     Understand the application of Iterative algorithm.

**CO5:**     Modify existing algorithms to improve efficiency.

**CO6:**     Adopt the recent algorithm design technique to solve the given problem.

**TEXT BOOKS:**

**T1:**     S.Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2015

**T2**     Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

**REFERENCE BOOKS:**

**R1:**     Rajesh K Shukla, "Analysis and Design of AlgorithmsA Beginner's Approach", Wiley publisher ,2015

**R2:**     Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.

**R3:**     Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

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**COURSE OBJECTIVES**

The course aims to provide the students

- To provide deeper understanding of the collections framework.
- To understand Regular Expressions and how to use it in java applications.
- To equip the students with the advanced feature of contemporary java that will enable them to handle complex programs relating to managing data.
- To provide the ability to design console based, GUI based and web based applications.
- To provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

**PREREQUISITES**

- NIL

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  | 3 |  |  | 3 |  |  |  |  |  |  |  | 2 | 3 |  |
| CO2 |  | 3 |  |  | 3 |  |  |  |  |  |  |  | 3 | 3 |  |
| CO3 |  | 3 | 3 |  |  |  |  |  |  |  | 2 |  | 3 | 3 | 2 |
| CO4 |  | 3 | 3 |  | 3 |  |  |  |  |  | 2 |  | 3 | 3 | 2 |
| CO5 |  |  | 3 |  | 3 |  |  |  |  |  |  |  | 3 | 3 | 2 |

**UNIT I**  **COLLECTIONS FRAMEWORK** **9**

Java Arrays – Collections Overview – Collections Framework – Collection Interface – Collections and Generic. List, Cursors, Iterators, Set  Basic Set and Extended Set. Comparable and Comparator  Sorting objects, Queue, Map, Concurrent Collections.

**UNIT II**  **REGULAR EXPRESSION AND JDBC** **8**

Java Regex API  Matcher class  Pattern class  Pattern Syntax Exception – POSIX Standards –JDBC  JDBC Drivers – JDBC Components – Driver Manager, Driver, Connection, Statement, Result Set, Handling  SQL Exception Prepared Statement – Callable Statement – Scrollable Result Set.

**UNIT III**  **SERVER SIDE PROGRAMMING** **8**

Introduction to Server side Programming – Servlets Architecture  – Request and Response, Reading Request parameters, Producing a HTML response, Redirecting the web server, Deployment Descriptors, Servlets Life Cycle, Relationship to a container, Servlet and JDBC

**UNIT IV**  **JSP** **12**

JSP  Basics – Architecture and Life Cycle – JSP Scripting Elements  JSP Implicit Objects and Directive Elements  Exception Handling in JSP  Creating Custom Tag in JSP – JSP Pagination – JSP Actions  Accessing Database. Interactive Web Applications – Cookies and Session Management – Managing Client State Sessions.

**UNIT V**            **ANNOTATIONS AND DESIGN PATTERNS**           **8**

Java Annotations – Design Patterns  Creational – Structural and Behavioural Design Patterns  Singleton – Factory Method Pattern  Adapter Pattern – Proxy  Iterator, MVC.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**        Use the type hierarchy in Collections Framework of Java and write code which uses iterators, Comparators.

**CO2:**        Use Regular Expression for Pattern Matching

**CO3:**        Build Java Console Based Projects with MySQL integration.

**CO4:**        Create a dynamic web application, using Servlets and JSP..

**CO5:**        Apply annotations and different design patterns in the application development

**TEXT BOOKS:**

**T1:**   Philip Wadler, Maurice Nafta lin, "Java Generics and Collections", O'Reilly Media, Inc. 2006

**T2**   Marty Hall and Larry Brown, "Core Servlets and JavaServer Pages", Second Edition.

**T3:**   Martin Kalin, "Java Web Services: Up and Running", 2nd Edition,  O'Reilly Media; 2 edition 2013

**T4:**   Stephen Stelting, Olav Maassen, "Applied java Patterns", the Sun Microsystems Press, 2002.

**REFERENCE BOOKS:**

**R1:**   Herbert Schildt, "Java The complete Reference", Ninth Edition, Mcgraw Hill, 2016

**R2:**   Bryan Basham, Kathy Sierra and Bert Bates, "Head First Servlets and JSP", 2nd Edition, O'Reilly, 2008.

**R3:**   Kathy Sierra, Bert Bates, "Head First Java", 2nd Edition.

**R4:**   Eric freeman & Elisabeth robson with kathy sierra and bert Bates, "Head First Design Patterns", O'Reilly, Second Release 2014

**R5:**   Alur Deepak, Malks Dan and Crupi John, Core J2EE Patterns: Best Practices and Design Strategies, Prentice Hall India (2001).

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|  | | | | | | | | | | | | | L | T | P | C |

<table>
<tr><td>U19CCLC402</td><td>CAREER ENHANCEMENT PROGRAM II</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td></td><td></td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
</table>

**COURSE OBJECTIVES**

The course aims to provide the students

- To Develop students ability to participate in conversation
- Develop an ability to use a number of key functional exponents with confidence and accuracy.
- To enable students to learn to interpret given information correctly, determine which mathematical model best describes the data, and apply the model correctly.
- To improve students' analytical and data interpretation skills.

**PREREQUISITES :**NIL

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 |  |  |  | 2 | 1 |  | 3 | 3 |  | 2 |  | 2 | 3 |
| CO2 | 3 | 3 |  |  |  | 2 | 1 |  | 3 | 2 |  | 2 |  | 2 | 3 |
| CO3 | 3 | 2 |  |  |  | 2 | 1 |  | 3 | 3 |  | 2 |  | 2 | 3 |
| CO4 | 3 | 2 |  |  |  | 3 | 1 |  | 3 | 3 |  | 2 |  | 3 | 3 |

**UNIT I** **6**

**Applied Language Skills :** Self Introduction  Attending Interviews  Greeting  Starting a conversation Social Conversation Skills

**Quants:**  ANALOGY PATTERN RECOGNITION  Relating two objects  Problems on Number Analogy  Pattern completion.

**UNIT II** **6**

**Applied Language Skills :** Asking and Giving Information  Apologising and Excusing  Giving Instructions Role plays

**Quants:** CODING AND DECODING PATTERN RECOGNITION  Coding and decoding by letter shifting Coding Letters of a Word Coding and decoding in fictitious language

**UNIT III** **SERVER SIDE PROGRAMMING** **6**

**Applied Language Skills :** Agreeing and disagreeing   Inviting, accepting and declining invitations Negotiating Skills  Persuasive Skills  Debate

**Quants:**  ANALYTICAL REASONING  Problems related to shapes  – To find the missing numbers  Shape Construction  Cubes & Dices.

**UNIT IV** **6**

**Applied Language Skills :** Expressing likes and dislikes  Complimenting  Mock Interviews  GD

**Quants:** Cognitive Problems & Puzzles  Find the next Image Mirror Image Water Image  Logical Puzzle

| UNIT V | ANNOTATIONS AND DESIGN PATTERNS | 6 |

**Applied Language Skills :**  Taking up certificate speaking test

**Quants:**  VEDIC MATHEMATICS AND SUDOKU   Addition Subtraction System of Multiplication Squaring numbers Cube roots – Square roots  Logic based Sudoku

**Total: 30 Hours**

## COURSE OUTCOMES

At the end of the course students should be able to

| | |
|---|---|
| **CO1:** | To Develop students ability to participate in conversation |
| **CO2:** | Develop an ability to use a number of key functional exponents with confidence and accuracy. |
| **CO3:** | To enable students to learn to interpret given information correctly, determine which mathematical model best describes the data, and apply the model correctly. |
| **CO4:** | To improve students' analytical and data interpretation skills. |

## TEXT BOOKS:

| | |
|---|---|
| **T1:** | Chris Anderson,  TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations The Newyork Times Paperback, 2018 |
| **T2** | by Kerry Patterson, Joseph Grenny,and Ron Mcmillan, Crucial Conversations Tools for Talking When Stakes Are High, McGraw Education, 2017 |
| **T3:** | Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand& Co Ltd., New Delhi. |
| **T4:** | Analytical Reasoning by M.K Pandey |

## REFERENCE BOOKS:

| | |
|---|---|
| **R1:** | Interact English Lab Manual for Undergraduate Students. Orient Black Swan: Hyderabad, 2016 |
| **R2:** | Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press: Oxford, 2014. |
| **R3:** | Arun Sharma "How to Prepare for Quantitative Aptitude for the CAT " , McGraw Hill Education; Eighth edition 2018 |
| **R4:** | Arun Sharma "How to Prepare for Logical Reasoning for the CAT " , McGraw Hill Education; Eighth edition  2018 |

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|---|---|---|---|---|
| U19CSTL408L     **ADVANCED DATABASES LABORATORY** | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To learn the  NoSQL and use of MongoDB in NoSQL along with configuring mongo server
- To learn to write  Query for MongoDB
- To learn  indexing and its usage
- To learn  aggregation framework and MapReduce techniques in MongoDB
- To learn replica management on MongoDB, configure sharding on MongoDB

CO1    Understand the NoSQL and use of MongoDB in NoSQL

CO2    To add new document, modify and remove existing documents from Collections

CO3    Write Query for MongoDB

CO4    Apply indexing concepts

CO5    Apply aggregation framework and MapReduce techniques in MongoDB

CO6    Use replica management on MongoDB, configure sharding on MongoDB

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 2 | 2 | 2 | | | | | | | | 2 | 3 | |
| CO2 | 1 | 3 | 1 | 2 | 1 | | | | | | | | 3 | 2 | |
| CO3 | 2 | 2 | 2 | 2 | 2 | | | | | | | | 3 | 2 | |
| CO4 | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | 3 | 1 |
| CO5 | 2 | 3 | 3 | 2 | 3 | | | | | | | | | 1 | 3 |
| CO6 | 2 | 1 | 3 | 2 | 3 | | | | | | | | | 3 | |

**LAB COMPONENTS**

1. Install MongoDB Community Edition on Windows
2. Implement aggregation and indexing with suitable examples using MongoDB.
3. Implementing Map reduces operation with suitable examples using MongoDB.
4. Design and Implement any 5 query using MongoDB.
5. Implement any one Concurrency Control Protocol using MongoDB and .net/Java.
6. Implement Replication and Sharding.
7. Design and Implement any Database Application using PHP/ python/Java and MongoDB as a back end.
8. Implement Database navigation operations (add, delete, edit etc.) usingODBC/JDBC.

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**Total: 30 Hours**

| U19CSTL409L | INTERNET PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To make the students understand how server works and learn to use PHP as the scripting language.
- To help the students understand the MySQL database management and integrate with the webapplication
- To inculcate the various design patterns available in designing the web application
- To make the students use Advanced Javascript and JQuery for client side scripting
- To help the students to understand XML and Web Services, create and use them in webapplications.

**COURSE OUTCOMES**

Co1:Develop Web Applications using PHP

CO2:Create and Connect MySQL Database with PHP Scripts and handle errors

CO3:Apply different design patterns in web application development

CO4:Apply the concepts of JQuery for client side scripting

CO5Understand and Use XML and web Services

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 3 | | | | 2 | | 1 | 2 | 3 | 2 | 3 |

**LAB COMPONENTS**

1. Apache and MySQL server installation and management
2. Development of PHP script to handle GET and POST requests
3. Development of web application to access database
4. State Management with Sessions and Cookies
5. Web development with AJAX
6. Asynchronous file transmission
7. Cross site scripting and SQL Injection
8. Creating and consuming web Services

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**Total: 30 Hours**

| U19CSTL410L | DESIGN AND ANALYSIS OF ALGORITHMS   LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims

- to provide the students learn the importance of designing an algorithm in an effective way by considering space andtime complexity
- To learn divide and conquer strategy based algorithms
- To learn greedy method based algorithms
- To learn the dynamic programming design techniques
- To develop Recursive backtracking algorithms

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 2 | 1 | 1 | | | | | | | 1 | 3 | 1 | |
| CO2 | 2 | 1 | 1 | 1 | 1 | | | | | | | 1 | 1 | 1 | |
| CO3 | 2 | 2 | 2 | 1 | 1 | | | | | | | 1 | 3 | 1 | |
| CO4 | 2 | 2 | 2 | 1 | 1 | | | | | | | 1 | 3 | 1 | |

**COURSE OUTCOMES**

Co1:Design algorithms using divide and conquer and greedy methods. . .
Co2:Analyze the performance of merge sort and quick sort algorithms using divide and conquer technique
C03:Design algorithms using dynamic programming and back tracking methods.
CO4:Design algorithms using BRANCH AND BOUND

**LAB COMPONENTS**

1.  Sort a given set of n integer elements using Quick Sort method and compute its  time complexity. Run the program for varied values of n> 5000 and record  the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and conquer method works along with its time complexity analysis: worst case, average case and best case.

2.  Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and  conquer method works along with its time complexity analysis: worst case, average  caseand best case.

3.  Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.

4.  From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.

5.  Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union Find algorithms in your program.

6.  Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.

7.  Write Java programs to Implement All Pairs Shortest Paths problem using Floyd's algorithm.

8.  Implement Travelling Sales Person problem using Dynamic Programming.

9.  Design and implement in Java to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S = {1, 2, 5, 6, 8}and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.

10. Design and implement in Java to find all Hamiltonian Cycles in a connected undirected GraphG of n vertices using backtracking principle

**Total: 30 Hours**

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| | 0 | 0 | 2 | 1 |

**U19ITTL405L**        **ADVANCED JAVA PROGRAMMING LABORATORY**

## COURSE OBJECTIVES

The course aims to provide the students

- To provide deeper understanding of the collections framework.
- To understand Regular Expressions and how to use it in java applications.
- To equip the students with the advanced feature of contemporary java that will enable them tohandle complex programs relating to managing data.
- To provide the ability to design console based, GUI based and web based applications.
- To provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

## COURSE OUTCOMES

CO1    Use the type hierarchy in Collections Framework of Java and write code which uses iterators, Comparators.

CO2    Use Regular Expression for Pattern Matching

CO3    Build Java Console Based Projects with MySQL integration.

CO4    Create a dynamic web application, using Servlets and JSP..

CO5    Apply annotations and different design patterns in the application development

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | 3 | | | 3 | | | | | | | | 2 | 3 | |
| CO2 | | 3 | | | 3 | | | | | | | | 3 | 3 | |
| CO3 | | 3 | 3 | | | | | | | | 2 | | 3 | 3 | 2 |
| CO4 | | 3 | 3 | | 3 | | | | | | 2 | | 3 | 3 | 2 |
| CO5 | | | 3 | | 3 | | | | | | | | 3 | 3 | 2 |

## LAB COMPONENTS

1. Write a Java program for implementing Regular Expressions
2. Write a Java program to display objects using Iterators, Enumerations, advanced For Loop.
3. Write a Java program using all classes of collections framework
4. Write a Java program to sort objects using Comparator and Comparable.
5. Create Web Application Using Servlets
6. Write a Java program to integrate login, signup and dashboard forms using servlets.
7. Write a Java program to connect Servlet and JSP with MySQL using JDBC API and perform CRUD Operation.
8. Demonstrate different design patterns.

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**Total: 30  Hours**

| U19CCEX404 | ENGINEERING EXPLORATION IV | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**COURSE OBJECTIVES**
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

**PRE-REQUISITES**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | 1 | 1 | | | | | | | | | 2 | 1 | | |
| CO2 | 3 | 3 | 3 | 2 | | | | | | | | | 3 | 3 | |
| CO3 | | | 3 | 3 | 3 | | | | | | | 2 | 3 | 3 | |
| CO4 | | | | | | 3 | 3 | 3 | | | | | | 3 | 3 |
| CO5 | | | | | | | | | 3 | 3 | 3 | 2 | | 3 | 2 |
| CO6 | | | | | | | | | 3 | 3 | 3 | 2 | | 2 | 2 |

**CONTENTS**

| S No | Topics | No of Hours |
|---|---|---|
| 1 | Introduction to Engineering | 3 |
| 2 | Platform-based development | 12 |
| 3 | Mechanisms | 9 |
| 4 | Requirements | 3 |
| 5 | Design | |
| 6 | Ethics | 6 |
| 7 | Sustainability | |
| 8 | Project Management Principles | 3 |
| 9 | Guided Project | |
| 10 | Final Project | 9 |

**COURSE OUTCOMES**
- Understand the role of an engineer as a problem solver
- Apply multi-disciplinary principles and build systems using engineering design process
- Use appropriate tools for designing and development of solutions.
- Analyze engineering solutions from ethical and sustainability perspectives
- Use basics of engineering project management skills while doing projects
- Communicate, Collaborate and work as a team

**GUIDELINES**
- Practical based learning carrying credits.
- Multi-disciplinary/ Multi-focus group of 3-4 students.
- Groups can select to work on specific tasks, or projects related to real world problems.
- Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
- The students have to display their model at the end of semester.
- The progress of the course is evaluated based on class performance and final demonstration of prototype.

**Total:45 Hours**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19CSTL511T** | **COMPILER DESIGN** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and runtime environment.
- To learn to implement frontend of the compiler.
- To learn to implement code generator.

**PREREQUISITES**

- Nil

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 1 | 1 | | | | | | | | 3 | 1 | 1 |
| CO2 | 3 | 3 | 1 | 3 | 2 | | | | | | | | | | 1 |
| CO3 | 3 | 3 | 1 | 3 | 2 | | | | | | | | 3 | 2 | 1 |
| CO4 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | | | | | | 3 | 2 | 1 |
| CO5 | 1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | | | 1 | 1 | | 3 |
| CO6 | 1 | | | | | | | | | | | 1 | 1 | | |

**UNIT I INTRODUCTION TO COMPILERS 9**

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

**UNIT II SYNTAX ANALYSIS 12**

Role of Parser – Grammars – Error Handling – Context free grammars – Writing a grammar – Top Down Parsing  General Strategies Recursive Descent Parser Predictive Parser LL (1) Parser Shift Reduce Parser LR Parse rLR (0) Item Construction of SLR Parsing Table  Introduction to LALR Parser  Error Handling and Recovery in Syntax Analyzer YACC.

**UNIT III INTERMEDIATE CODE GENERATION 8**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

**UNIT IV RUNTIME ENVIRONMENT AND CODE GENERATION 8**

Storage Organization, Stack Allocation Space, Access to Nonlocal Data on the Stack, Heap Management  Issues in Code Generation  Design of a simple Code Generator.

**UNIT V CODE OPTIMIZATION 8**

Principal Sources of Optimization – Peephole optimization  DAG Optimization of Basic Blocks  Global Data Flow Analysis  Efficient Data Flow Algorithm.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Understand the different phases of compiler and design a lexical analyzer for a sample language.

**CO2:** Apply different parsing algorithms to develop the parsers for a given grammar

**CO3:** Understand syntax directed translation

**CO4:** Understand runtime environment and a simple code generator.

**CO5:** Learn to implement code optimization techniques

**CO6:** Design and implement a scanner and a parser using LEX and YACC tools. Implement storage allocation strategies

**TEXT BOOKS:**

**T1:** Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education, 2009.

**REFERENCE BOOKS:**

**R1:** Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.

**R2:** Steven S. Muchnick, Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers Elsevier Science, India, Indian Reprint 2003.

**R3:** Keith D Cooper and Linda Torczon, Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004.

**R4:** V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010

**R5:** Allen I. Holub, Compiler Design in C‖, Prentice Hall Software Series, 1993.

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| | | L | T | P | C |
|---|---|---|---|---|---|
| U19CSTL512T | OBJECT ORIENTED ANALYSIS AND DESIGN | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the fundamentals of object modeling
- To design with the UML dynamic and implementation diagrams.
- To understand and differentiate Unified Process from other approaches.
- To improve the software design with design patterns.
- To test the software against its requirements specification

**PREREQUISITES**

- Object oriented programming

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | 1 | | | 3 | | | | | 2 | 2 | | | | 3 |
| CO2 | 3 | 2 | 2 | | 3 | | | | | 2 | 2 | | | | 3 |
| CO3 | | | 2 | 2 | 3 | | | | | 2 | 2 | | | | 3 |
| CO4 | | | 2 | 2 | 3 | | | | | 2 | 2 | | | | 3 |
| CO5 | | | 2 | 2 | 3 | | | | | 2 | 2 | | | | 3 |
| CO6 | | | 1 | 1 | | | | | | 1 | 1 | | | | 2 |

**UNIT I            OVERVIEW OF OBJECT ORIENTED SYSTEMS DEVELOPMENT            9**

Introduction to Object Oriented Systems  Object Basics  Object Oriented Systems Development Life Cycle, Rumbaugh Technique  Booch Methodology  Jacobson Methodology  The Unified Approach.

**UNIT II            OBJECT ORIENTED MODELING LANGUAGE            9**

UML Diagrams  Use Case Diagram  Class Diagram  Sequence Diagram – Collaboration Diagram  Activity Diagram  State Machine Diagram  Component Diagram  Deployment Diagram  Object Diagram  Package Diagram.

**UNIT III            OBJECT ORIENTED ANALYSIS            9**

UseCase Model  Object Analysis and Classification – Noun phrase approach  Use Case Driven approach  Object relationships, attributes and methods.

**UNIT IV            OBJECT ORIENTED DESIGN            9**

Designing classes  Designing Access Layer Classes  Designing Interface objects GRASP: Designing objects with responsibilities  GoF design patterns: factory method, Bridge, Adapter, Strategy, Observer – Mapping design to code.

**UNIT V            TESTING            9**

Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Express software design with UML diagrams.

**CO2:** Design software applications using OO concepts.

**CO3:** Identify various scenarios based on software requirements.

**CO4:** Transform UML based software design into pattern based design using design patterns.

**CO5:** Understand the various testing methodologies for OO software.

**CO6:** Compare and contrast various testing techniques.

**TEXT BOOKS:**

**T1:** Grady Booch, "Object Oriented Analysis and Design with Applications", Third Edition, Pearson Education, 2009.

**T2:** Craig Larman, "Applying UML and Patterns: An Introduction to ObjectOriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.

**REFERENCE BOOKS:**

**R1:** Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Second Edition, Pearson Education, 2017.

**R2:** Simon Bennet, Steve McRobb, Ray Farmer, "Object oriented Systems Analysis and Design using UML", Second Edition, Tata McGrawHill, 2008.

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| U19CSTL512T | DATA SCIENCE AND ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- Understand an in depth knowledge of building data models and frameworks and to evaluate model's quality.
- Demonstrate the basic concepts of data mining algorithm
- Infer knowledge about big data and its applications
- Understand the basics of digital data and its types
- Explain the various classification and clustering techniques

**PREREQUISITES**

- Database Management Systems

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | | | | | | | | | | | 2 | | |
| CO2 | 1 | 2 | 2 | 1 | 1 | | | | | | | 2 | 1 | 2 | 1 |
| CO3 | 1 | | 2 | 2 | 2 | | | | | | | | 1 | | |
| CO4 | 1 | 2 | 1 | 2 | 2 | | | | | | | 1 | 2 | | 1 |
| CO5 | 1 | 2 | 1 | | 3 | | | | | | | | | 2 | 2 |

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

Data science in a Nutshell . Properties of Data –Big Data  Data Objects and Attribute Types  Basic statistical Descriptions of Data  Data Visualization  Measuring Data Similarity and Dissimilarity  Data Mining and Functionalities – Data Preparation Algorithms  Data Visualization Tool Boxes for Data Scientists.

**UNIT II**      **CLUSTERING**      **10**

Basic Concepts of Cluster Analysis  Partitioning Methods  K Means – K Medoids  Hierarchical Methods  Agglomerative and Divisive Hierarchical Clustering BIRCH  Density Based Methods  Grid Based Methods .

**UNIT III**      **CLASSIFCATION**      **10**

Nearest Neighbors, Decision Trees, Naive Bayes, Logistic Regression, Generalized Linear Models, Perceptron. Multilayer Perceptron, Radial Basis Function, Support Vector Machines, Nonlinearity and Kernel Methods, Ensemble Learning: Boosting, Bagging, Random Forests.

**UNIT IV**      **DIMENSIONALITY REDUCTION**      **8**

Dimensionality Reduction: Principal Component Analysis, Linear Discriminant Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Canonical Correlation Analysis, I somap

**UNIT V**      **FRAMEWORKS AND VISUALIZATION**      **8**

Introduction, Types of data visualization, Analytics and Big Data  -Data Visualization with Tableau  Social Media Analytics and Text Mining.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Change any digital form of data to specific format for analytics.

**CO2:** Identify the relevant algorithms to perform analytics on real world data.

**CO3:** Formulate decisions based on the analyzed data.

**CO4:** Identify the relevant algorithms to perform analytics on real world data.

**CO5:** Outline the life cycle of data analytics using Tableu Tool.

**TEXT BOOKS:**

**T1:** Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Chris Ullman, Morgan Kaufmann Publishers, Third Edition, 2012

**T2:** Ethem Alpaydin, "Introduction to Machine Learning", (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014

**REFERENCE BOOKS:**

**R1:** Michael Minelli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today&#39;s Businesses", Wiley CIO Series, (2013)

**R2:** Laura Igual, Santi Seguí, "Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications", 1st ed. 2017 Edition, Springer

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| U19ITTL506T | COMPUTER NETWORKS | | L | T | P | C |
|---|---|---|---|---|---|---|
| | | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the concepts of data communications
- To be familiar with the Transmission media and Tools.
- To study the functions of OSI layers
- To learn about IEEE standards in computer networking
- To get familiarized with different protocols and network components

**PREREQUISITES**

- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | | | | | | | | | | 3 | 1 | |
| CO2 | 3 | 2 | 2 | | | | | | | | | | 3 | | 1 |
| CO3 | 3 | | 2 | 2 | | | | | | | 1 | 3 | 3 | 2 | |
| CO4 | 3 | 3 | | 1 | | | | | | | 1 | | | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | 2 | 3 | 1 |
| Co6 | 1 | 2 | 3 | 1 | | | | | | | | | | 2 | 2 |

**UNIT I          DATA COMMUNICATIONS                                                                9**

Data communication Components – Data representation and Data flow – Networks – Types of Connections – Topologies – Protocols and Standards – OSI model – Transmission Media – LAN –Wired LANs, Wireless LANs, Connecting LANs, Virtual LANs

**UNIT II          DATA LINK LAYER                                                                          9**

Error Detection and Error Correction – Introduction–Block coding–Hamming Distance – CRC–Flow Control and Error control – Stop and Wait – Go back – N ARQ – Selective Repeat ARQ – Sliding Window – Piggybacking – Random Access – CSMA/CD,CDMA/CA

**UNIT III          NETWORK LAYER                                                                          9**

Switching–Logical addressing – IPV4 – IPV6–Address mapping–ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

**UNIT IV          TRANSPORT LAYER                                                                      9**

Process to Process Delivery – User Datagram Protocol – Transmission Control Protocol – SCTP – Congestion Control with Examples.

**UNIT V          APPLICATION LAYER                                                                    9**

Domain Name Space – DDNS – TELNET – EMAIL – File transfer WWW – HTTP – SNMP – Cryptography – Basic concepts.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Analyse the basic layers and its functions in computer networks.

**CO2:** Evaluate the performance of a network.

**CO3:** Analyse of how data flows from one node to another.

**CO4:** Analyse and design routing algorithms.

**CO5:** Design protocols for various functions in the network.

**CO6:** Analyse the working of various application layer protocols.

**TEXT BOOKS:**

**T1:** Larry L.Peterson, Peter S. Davie, "Computer Networks", Elsevier, Fifth Edition, 2012.

**T2:** William Stallings, "Data and Computer Communication", Eighth Edition, Pearson Education, 2007.

**T3:** James F. Kurose, Keith W. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education, 2005.

**REFERENCE BOOKS:**

**R1:** Computer Networks – A System Approach, Larry L. Peterson & Bruce S. Davie, 2nd Edition

**R2:** B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH

**R3:** A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI

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| | | L | T | P | C |
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| **U19CSTL511L** | **COMPILER DESIGN LABORATORY** | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To learn the various parsing techniques.
- To understand intermediate code generation and runtime environment.
- To learn to implement frontend of the compiler.
- To learn to implement code generator.
- To implement the logic using LEX and YACC Tools

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

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

**LAB COMPONENTS**

1. Develop a lexical analyser to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.
2. Implement a Lexical Analyzer using Lex Tool
3. Implement an Arithmetic Calculator using LEX and YACC
4. Generate three address code for a simple program using LEX and YACC.
5. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
6. Implement backend of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.
7. Write a LEX Program and YACC program to count the number of words, vowels and consonants in a string
8. Write a LEX Program and YACC program to recognize and count the number of identifiers in a given input file.
9. Write a LEX Program and YACC program to recognize a string ending with 'aba'.
10. Write a LEX Program and YACC program to calculate average of given numbers
11. Write a LEX Program and YACC program to recognize a whether the given sentence is simple or compound.

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**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

CO1     Students will able to implement the techniques of Lexical Analysis and Syntax Analysis.
CO2     Students will able to apply the knowledge of Lex & Yacc tools to develop programs..
CO3     Students will be able to generate intermediate code
CO4     Students will be able to implement Optimization techniques and generate machine level code.

| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19CSTL512L** | **OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY** | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the fundamentals of object modelling
- To design with the UML dynamic and implementation diagrams.
- To understand and differentiate Unified Process from other approaches.
- To improve the software design with design patterns.
- To test the software against its requirements specification

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | 1 | 3 | | | | 2 | 1 | | 2 | 1 | | 3 |
| CO2 | | | | 1 | 3 | | | | 2 | 1 | | 2 | | 1 | 3 |
| CO3 | | | | 1 | 3 | | | | 2 | 1 | | 2 | 1 | | 3 |

**LAB COMPONENTS**

1. Online course registration
2. Student Information System
3. Fee management System
4. Exam registration system
5. Banking System
6. Library Management system
7. Student attendance management system
8. Blood donation management system
9. Student Result management system
10. Railway Management system

**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Analyze Software Requirements for the given Software Application.

**CO2:** Develop the UML Diagrams to view Software System in Static and Dynamic Aspects.

**CO3:** Creating Class and Object diagram for a given project using the UML notation

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| U19CSTL513L | DATA SCIENCE AND ANALYTICS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the statistical concepts and inferences to analyse different types of data, and characterize it to make more intelligent predictions
- To understand various data Pre processing in Data Analytics
- Apply theoretical foundations of decision trees and naïve bayes classifier to make decision modelling process more intelligent.
- To familiarize data analysis using python programming
- Apply the different visualization techniques in data analysis
- To familiarize the concepts behind the association rule mining and clustering techniques

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | | | | | | | | | | | 2 | | |
| CO2 | 1 | 2 | 2 | 1 | 1 | | | | | | | 2 | 1 | 2 | 1 |
| CO3 | 1 | | 2 | 2 | 2 | | | | | | | | 1 | | |
| CO4 | 1 | 2 | 1 | 2 | 2 | | | | | | | 1 | 2 | | 1 |
| CO5 | 1 | 2 | 1 | | 3 | | | | | | | | | 2 | 2 |

**LAB COMPONENTS**

1. Preprocess the dataset to remove missing values, outliers and to transform and discretize the dataset.
2. Implement the classification techniques: Decision Tree and Naïve Bayes algorithms and compare its performance.
3. Implement K-Means and K-Medoids clustering algorithms
4. Implement Apriori algorithm to derive association rules.
5. Classify the input dataset using Support Vector Machine (SVM)
6. Demonstrate clustering approach using Kohonen's selforganizing map
7. Implement Principal Component Analysis (PCA) technique to reduce the dimensionality of the dataset

**Total: 30 Hours**

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**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Apply statistical concepts and inferences to analyse different types of data, and characterize it to make more intelligent predictions.

**CO2:** Apply various data Pre processing in Data Analytics.

**CO3:** Apply theoretical foundations of decision trees and naïve bayes classifier to make decision modelling process more intelligent.

**CO4:** Design the solution for real world problem using association rule mining and clustering techniques.

**CO5:** Apply the different visualization techniques in data analysis.

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| | | | L | T | P | C |
|---|---|---|---|---|---|---|
| U19CSTL506L | **COMPUTER NETWORS LABORATORY** | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

- The course aims to provide the students
- To understand the concepts of data communications
- To be familiar with the Transmission media and Tools.
- To study the functions of OSI layers
- To learn about IEEE standards in computer networking
- To get familiarized with different protocols and network components

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | | | | | | | | | | | | | | |
| CO2 | 2 | 2 | | | 2 | | | | | | | | | | |
| CO3 | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | 2 | |
| CO4 | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | 2 | |
| CO5 | 2 | 2 | 2 | 2 | 2 | | | | | | | | | | |
| Co6 | 2 | 2 | 2 | 2 | 2 | | | | | | | | | | |

**LAB COMPONENTS**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like: a) Echo client and echo server b) Chat c) File Transfer.
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of error correction code (like CRC)

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**Total: 30 Hours**

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Explain OSI Reference Model and in particular have a good knowledge of Layers 13

CO2: Working knowledge of datagram and internet socket programming

CO3: Design and test simple programs to implement networking concepts using Java.

CO4: Design simple data transmission using networking concepts and implement.

CO5: Compare and analyze different existing protocols.

Co6 Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies

| | | | L | T | P | C |
|---|---|---|---|---|---|---|
| **U19CSLC501** | | **WEB DEVELOPMENT LABORATORY** | 0 | 0 | 4 | 2 |

COURSE OBJECTIVES

The course aims to provide the students

To be familiar with Web page design using HTML and Cascading Style Sheets.

To be exposed to creation of user interfaces using Java Script.

To learn to create user defined servers using HTTP and Express.

To learn to apply possible routing methods in NodeJS.

To be exposed to creating applications with Database technologies with Web applications

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | | 3 | | | 3 | 3 | 3 | | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | | 3 | | | 3 | 3 | 3 | | 3 | 3 | | 3 |
| CO3 | 3 | 3 | 3 | | 3 | | | 3 | 3 | 3 | | 3 | 3 | | 3 |
| CO4 | 3 | 3 | 3 | | 3 | | | 3 | 3 | 3 | | 3 | 3 | | 3 |
| CO5 | 3 | 3 | 3 | | 3 | | | 3 | 3 | 3 | | 3 | 3 | 2 | 3 |

**LAB COMPONENTS**

1. Demonstrate static web page using simple HTML and CSS.
2. Design a sample static page using HTML and CSS with set of constraints.
3. Apply Client side Java Script validation for signup page.
4. Create Node server using HTTP and Express.
5. Create a web application with possible Routing methods and view engines for rendering dynamic contents.
6. Develop a web application with CRUD operation using MySql module in node.
7. Develop a web application with MongoDB using Mongoose in node.

**Total: 45 Hours**

COURSE OUTCOMES

At the end of the course students should be able to

**CO1:** Create a Web page design using HTML and Cascading Style Sheets.

**CO2:** Create a user interfaces with Java Script validation.

**CO3:** Develop user defined servers using HTTP and Express.

**CO4:** Apply possible routing methods in NodeJS.

**CO5:** Create applications with Modern Database technologies with Web applications.

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| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19CCLC503** | **CAREER ENHANCEMENT PROGRAM III** | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To develop making inferences and predictions based on comprehension of a text
- To distinguish main idea(s) from supporting detail
- To enhance the problem solving skills, to improve the basic mathematical skills
- To help the students who are preparing for any type of competitive examinations.
- To draw conclusions and/or make decisions based on analysis and critique of quantitative information using proportional reasoning.

**PREREQUISITES**

- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | | | | 2 | 1 | | 3 | 3 | | 2 | | 2 | 3 |
| CO2 | 3 | 3 | | | | 2 | 1 | | 3 | 2 | | 2 | | 2 | 3 |
| CO3 | 3 | 2 | | | | 2 | 1 | | 3 | 3 | | 2 | | 2 | 3 |
| CO4 | 3 | 2 | | | | 3 | 1 | | 3 | 3 | | 2 | | 3 | 3 |
| CO5 | 3 | 2 | | | | 2 | 1 | | 3 | 3 | | 2 | | 2 | 3 |

**UNIT I** 6

**Applied Language Skills:** Reading for main ideas  Making Inferences Identifying the theme  Writing different types of paragraphs – Parajumbles

**Quants:** NUMBER SYSTEM – LCM &; HCF – SIMPLIFICATION – SURDS &  INDICES –  CYCLICITY QUATIONS Classification on Numbers Power cycles and remainders  Concept of highest common factor  concept of least common multiple  Divisibility Rule  Number of zeros in an expression  Problems on Surds and Indices Concept of Unit digit  Simultaneous equations Quadratic equations – In equation.

**UNIT II** 6

**Applied Language Skills :** Email etiquette  Email writing  Dangling modifiers  Writing different types of essays

**Quants:** FUNDAMENTALS OF ALGEBRA  AVERAGES  Variables  Algebraic expressions  Substitution &amp; evaluating expressions  Writing algebraic expressions  PERCENTAGES – concept of percentage values through additions  fraction to percentage conversion table.

**UNIT III** 6

**Applied Language Skills :** Resume and cover letter writing  Visumes  Practice Preparation of Resumes for placements

**Quants:** RATIOS AND PROPORTION comparison of ratios  proportions  relation among the quantities more than two – variation.  PARTNERSHIP  MIXTURES AND ALLEGATIONS  PROBLEM ON AGES  Definition Allegation rule  mean value (cost price) of the mixture  Problems on ages and Problems related to ratios

6

**UNIT IV**

**Applied Language Skills :** Technical Reports  Structure of the report  Critical Reasoning Employee motivation, Satisfaction and commitment  Work Ethics

**Quants:** Problem on Ages  Profit & Loss  Discount  Simple Interest & Compound Interest  Data Interpretation.
**UNIT V**                                                                                                                    **6**

**Applied Language Skills :** Organisational Communication  Leadership skills Stress management  Self Appraisal  Taking up Reading test

**Quants**: Time, Speed & Distance  Problems on Trains  Boats & Streams  Data Sufficiency.

**Total: 30 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**     Able to infer and predict content based on comprehension of a text.

**CO2:**     Understand and distinguish main idea(s) from supporting detail.

**CO3:**     Able to make decisions based on analysis and critique of quantitative information using proportional reasoning.

**CO4:**     Ability to enhance the problem solving skills.

**CO5:**     Ability to enhance the employability skills.

**TEXT BOOKS:**

**T1:**     Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

**T2:**     The Slight Edge, Jeff Olsen, Momentum Media, 2013

**T3:**     Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand & Co Ltd., New Delhi

**T4:**     Arihant Publications," Quantitative Aptitude Quantum CAT ", Sarvesh Kumar Verma

**REFERENCE BOOKS:**

**R1:**     Interact English Lab Manual for Undergraduate Students. Orient Black Swan: Hyderabad, 2016

**R2:**     Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford  University Press: Oxford, 2014.

**R3:**     Pearson Publication, "A Complete Manual for the CAT", 2018

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| U19CCEX505 | ENGINEERING EXPLORATION V | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**COURSE OBJECTIVES**
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

**PRE-REQUISITES**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | 1 | 1 | | | | | | | | | 2 | 1 | | |
| CO2 | 3 | 3 | 3 | 2 | | | | | | | | | 3 | 3 | |
| CO3 | | | 3 | 3 | 3 | | | | | | | 2 | 3 | 3 | |
| CO4 | | | | | 3 | 3 | 3 | | | | | | | 3 | 3 |
| CO5 | | | | | | | | | 3 | 3 | 3 | 2 | | 3 | 2 |
| CO6 | | | | | | | | | 3 | 3 | 3 | 2 | | 2 | 2 |

**CONTENTS**

| S No | Topics | No of Hours |
|---|---|---|
| 1 | Introduction to Engineering | 3 |
| 2 | Platform-based development | 12 |
| 3 | Mechanisms | 9 |
| 4 | Requirements | 3 |
| 5 | Design | |
| 6 | Ethics | 6 |
| 7 | Sustainability | |
| 8 | Project Management Principles | |
| 9 | Guided Project | 3 |
| 10 | Final Project | 9 |

**COURSE OUTCOMES**
- Understand the role of an engineer as a problem solver
- Apply multi-disciplinary principles and build systems using engineering design process
- Use appropriate tools for designing and development of solutions.
- Analyze engineering solutions from ethical and sustainability perspectives
- Use basics of engineering project management skills while doing projects
- Communicate, Collaborate and work as a team

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**GUIDELINES**
- Practical based learning carrying credits.
- Multi-disciplinary/ Multi-focus group of 3-4 students.
- Groups can select to work on specific tasks, or projects related to real world problems.
- Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
- The students have to display their model at the end of semester.
- The progress of the course is evaluated based on class performance and final demonstration of prototype.

**Total:45 Hours**

| | | | L | T | P | C |
|---|---|---|---|---|---|---|

**U19CSTL614T**         **SOFTWARE ENGINEERING**        L T P C   3 0 0 3

**COURSE OBJECTIVES**

The course aims to provide the students

- Understand the software life cycle models
- Understand the importance of the requirement analysis in software development process.
- Learn the concept of modeling
- Learn the importance of testing
- Design and develop correct and robust software products

**PREREQUISITES : Nil**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 1 | | | | | | | | | 2 | | | | 3 |
| CO2 | 1 | 1 | 3 | | | | | | | 1 | 2 | | | | 3 |
| CO3 | 1 | 2 | | | | | | | | 1 | 2 | | | | 3 |
| CO4 | 1 | | 3 | 2 | | | 1 | | | 1 | | | | | 3 |
| CO5 | 1 | | | 2 | | | | | | | | | | | 3 |

**UNIT I**         **OVERVIEW OF SOFTWARE ENGINEERING**         **9**

Nature of Software, Software Engineering, Software process, project, product, Process Models, Classical Perspective models Waterfall model Incremental models Evolutionary models Specialized models Unified Process Models

**UNIT II**         **REQUIREMENTS**         **9**

Requirements Engineering process Requirement Elicitation Developing Use Cases Building the analysis model – Negotiation Validation Building the Analysis Model. Requirement Analysis – Approaches Data modelling concepts OO Analysis Scenario Based modelling Flow Oriented modelling Class based modelling Behavioral Modelling

**UNIT III**         **DESIGN – MODELING WITH UML**         **9**

Modeling Concepts and Diagrams Use Case Diagrams Class Diagrams Interaction Diagrams State chart Diagrams – Activity Diagrams Package Diagrams Component Diagrams – Deployment Diagrams Diagram Organization Diagram Extensions. Design Process Design concepts: Abstraction, Architecture, patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object Oriented Design Concepts, Design Classes Design Model: Data, Architectural, Interface, Component, Deployment Level Design Elements.

**UNIT IV**     **IMPLEMENTATION AND TESTING**     **9**

Structured coding Techniques Coding Styles Standards and Guidelines Documentation Guidelines Modern Programming Language Features: Type checking User defined data types-Data Abstraction-Exception Handling Concurrency Mechanism.

Testing Strategies: Strategic Approach to Software Testing, Testing Fundamentals  Blackbox and Whitebox Testing  Test Plan, Test Design, Test Execution, Reviews, Inspection Auditing  Product Metrics. Case Study: SWEBOK.

**UNIT V**     **MAINTENANCE AND QUALITY ASSURANCE**     **9**

MAINTENANCE: Software Maintenance-Software Supportability Reengineering Business Process Reengineering Software Reengineering Reverse Engineering Restructuring Forward Engineering Economics of Reengineering.

QUALITY ASSURANCE: Product Process Metrics, Quality Standards Models ISO, TQM, Six Sigma

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**     Develop the software projects using Software life cycle models.

**CO2:**     Identify the requirements for the software projects.

**CO3:**     Design the prototype of the software projects.

**CO4:**     Test the software products that are implemented using the software development process from requirement analysis to verification and validation.

**CO5:**     Apply benchmarking standards in process and in product.

**TEXT BOOKS:**

**T1:**     Pressman R S, Bruce R.Maxim, "Software engineering  A Practitioner's Approach", Eighth Edition, Tata McGrawHill, 2014.

**REFERENCE BOOKS:**

**R1:**     Sommerville I, "Software Engineering", Sixth Edition, Addison Wesley, 2003.

**R2:**     Fairley R, "Software Engineering Concepts", Seventh Edition, Tata McGrawHill, 1999.

**R3:**     G J Myers, Corey S, Tom B and Todd M T, "The Art of Software Testing", Third Edition, Wiley, 2011.

**R4:**     Pankaj J, "An Integrated Approach to Software Engineering", Third Edition, Narosa Publishing House, 2005.

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| | | L | T | P | C |
|---|---|---|---|---|---|
| U19CSTL615T | MOBILE COMPUTING | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the basic concepts of mobile computing.
- To be familiar with the network layer protocols and AdHoc networks.
- To Design Android application user interfaces with various layouts and UI Components.
- To Develop Android applications with data management and services.
- To Develop Android applications with content providers and location services.

**PREREQUISITES**

   NIL

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO2 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO3 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO4 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO5 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO6 | 3 | 2 | 2 | | | | | | | | | | | | |

**UNIT I             INTRODUCTION                                                          10**

Introduction to Mobile Computing – Applications of Mobile Computing Generations of Mobile Communication Technologies Multiplexing – Spread spectrum MAC Protocols – SDMA TDMA FDMA CDMA

**UNIT II           MOBILE TELECOMMUNICATION SYSTEM                                 10**

Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS UMTS – Architecture – Handover – Security.

**UNIT III          MOBILE ADHOC NETWORKS                                             9**

AdHoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks ( VANET) – MANET Vs VANET – Security.

**UNIT IV          ANDROID OS                                                           8**

Introduction – Architecture – Android Service – Android Service API – Layouts– Adapters– Android Started Service – Android Bound Service – Android Service Life Cycle – Android Service Example

**UNIT V           CONTENT PROVIDERS AND GPS                                         8**

Content Provider Fundamental – Builtin Content Providers – Android Notification – Location based Services – GPS network connectivity services Internal Storage – External Storage – SQLite – SQLite API

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Students will be able to Explain the basics of mobile telecommunication systems

**CO2:** Students will be able to Design android applications with basic to advanced user interface components and layouts.

**CO3:** Students will be able to Develop android applications for basic data management.

**CO4:** Develop android applications for location based applications.

**CO5:** Develop the backend for android applications in the cloud.

**CO6** Develop a mobile application using android

**TEXT BOOKS:**

**T1:** Jochen Schiller, —Mobile Communications‖, PHI, Second Edition, 2003

**T2:** Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi – 2012

**T3:** Dawn Griffiths; David Griffiths, "Head First Android Development", 2nd Edition, O'Reilly Publications, 2015.

**REFERENCE BOOKS:**

**R1:** Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005..

**R2:** Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile Computing‖, Springer, 2003.

**R3:** William.C.Y.Lee,—Mobile Cellular Telecommunications Analog and Digital Systems, Second Edition,Tata McGraw Hill Edition ,2006.

**R4:** Pradeep Kothari, "Android Application Development (With Kitkat Support), Black Book", First edition, Dream tech Press, 2014

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| | L | T | P | C |
|---|---|---|---|---|
**U19ITTL608T**           **CLOUD COMPUTING**       L T P C   3 0 0 3

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in the cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 1 | 2 | | 3 | | | | | 3 | 2 | | 3 | 3 | |
| CO2 | 3 | 2 | 3 | | | | | | | 2 | 1 | | 3 | 2 | |
| CO3 | 3 | 3 | | 3 | | | | | | | 1 | 1 | 3 | | 2 |
| CO4 | 3 | 3 | | | | | | | | | | 1 | 3 | | |
| CO5 | 3 | 2 | 3 | | 2 | | | 2 | 1 | 3 | 1 | | 3 | 3 | 2 |

**UNIT I**          **INTRODUCTION**                         **8**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On demand Provisioning.

**UNIT II**          **CLOUD ENABLING TECHNOLOGIES**              **10**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization –

Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.

**UNIT III**         **CLOUD ARCHITECTURE, SERVICES AND STORAGE**           **9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds  IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage as a Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**UNIT IV**         **RESOURCE MANAGEMENT AND SECURITY IN CLOUD**        **9**

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software as a Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

Virtual Box  Google App Engine – Programming Environment for Google App Engine –– OpenStack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**       Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

**CO2:**       Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

**CO3:**       Explain the core issues of cloud computing such as resource management and security.

**CO4:**       Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

**CO5:**       Create and work on recent applications in cloud computing.

**TEXT BOOKS:**

**T1:**   Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

**T2:**   Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.

**REFERENCE BOOKS:**

**R1:**   Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, ―Mastering Cloud Computing, Tata McGraw Hill, 2013

**R2:**   Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing  A Practical Approach, Tata McGraw Hill, 2009.

**R3:**   George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

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| | | L | T | P | C |
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| **U19CSTL614L** | **SOFTWARE ENGINEERING LABORATORY** | 0 | 0 | 2 | 1 |

## COURSE OBJECTIVES

The course aims to provide the students
- Understand the software life cycle models
- Understandtheimportanceoftherequirementanalysisinsoftwaredevelopmentprocess.
- Learn the concept of modeling
- Learn the importance of testing
- Design and develop correct and robust software products.

## COURSE OUTCOMES

CO1    Understand the software life cycle models

CO2    Understand the importance of the requirement analysis in software development process

CO3    Learn the concept of modeling

CO4    Learn the importance of testing

CO5    Design and develop correct and robust software products.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | | | | | | | | | 2 | | 1 | 1 | 3 |
| CO2 | 2 | 2 | 3 | | | | | | | 2 | 2 | | | | 3 |
| CO3 | 2 | 3 | | | | | | | | 3 | 2 | | | | 3 |
| CO4 | 1 | | 3 | 2 | | | 2 | | | 2 | | | | | 3 |
| CO5 | 2 | | 1 | 2 | | | | | | | | | | | 3 |

## LAB COMPONENTS

1. Case Study on Waterfall model Vs Agile Methodology.

2. Exploration of Agile tools

3. Creation of User Story for Concern Project

4. Sprint Planning-Sprint 1,Sprint 2

5. Scrum Meeting

6. Bug fixing and Backlog Refinement.

7. Demo Call

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**Total: 30 Hours**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19CSTL615L** | **MOBILE APPLICATION DEVELOPMENT LABORATORY** | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

The course aims to provide the students
- T o understand the basic concepts of mobile computing.
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To Design Android application user interfaces with various layouts and UI Components.
- To Develop Android applications with data management and services.
- ToDevelopAndroidapplicationswithcontentprovidersandlocationservices.

**COURSE OUTCOMES**

CO1    Explain the components and structure of mobile application development frameworks for Android based mobiles.

CO2    Explain how to work with various mobile application development frameworks.

CO3    Illustrate the basic and important design components and issues of development of mobile applications

CO4    Apply the location identifier using GPS in an application.

CO5    Create new applications to handheld devices.

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

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

**LAB COMPONENTS**

1. GUI components, Font and Colors, Layout Managers and event listeners.

2. Calculator application.

3. Develop a Login and Registration application that connects with are mote database.

4. Develop a student information management application.

5. GPS location information.

6. Local data base applications using SQLite.

7. Develop a Mobile application for simple needs(MiniProject).

**Total: 45 Hours**

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**U19ITTL608L**  **CLOUD COMPUTING LABORATORY**

## COURSE OBJECTIVES

The course aims to provide the students
- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in the cloud.
- To appreciate the emergence o f cloud as the next generation computing paradigm.

## COURSE OUTCOMES

CO1    Configure various virtualization tools such as Virtual Box, VMware  workstation

CO2    Design and deploy a web application in a PaaS environment link layer

CO3    Learn how to simulate a cloud environment to implement new schedulers

CO4    Analyse, design and develop adaptable and reusable solutions

CO5    Demonstrate generic cloud environment that can be used as a private cloud

CO6    Express the Engineering activities with effective presentation and report.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 1 | | | 3 | | | | | | | | 2 | 2 | |
| CO2 | 3 | 1 | 2 | | 3 | | | | | | | | 2 | 2 | |
| CO3 | 3 | 1 | 2 | | 3 | | | | | | | | 2 | 2 | |
| CO4 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 2 | 3 | |
| CO5 | 3 | 2 | 2 | 3 | 3 | | | | | | | | 2 | 3 | |

## LAB COMPONENTS

1. Study of Cloud Computing & Architecture
2. Installation and Configuration of virtualization using Virtual Box.
3. Installation of C compiler in the virtual machine created using virtual box and execute Simple Programs.
4. Study and Implementation of Infrastructure as a Service
5. Study and Implementation of Cloud Security Management.
6. Study and Implementation User Management in Cloud.
7. Install Google App Engine. Create *hello world* app and other simple web applications using python/java.
8. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
9. Case study on Amazon EC2/Microsoft Azure/Google Cloud Platform

**Total: 30 Hours**

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**Course Objectives**

To enable learners of Engineering and Technology develop their basic communication skills in English.

To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.

To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.

To inculcate the habit of reading and writing leading to effective and efficient communication.

**Course Outcomes**

At the end of the course, learners will be able to

CO1 identify technically and economically feasible problems of social relevance

CO2 plan and build the project team with assigned responsibilities

CO3 identify and survey the relevant literature for getting exposed to related solutions

CO4 analyse, design and develop adaptable and reusable solutions of minimal complexity by using modern tools

CO5 implement and test solutions to trace against the user requirements

CO6 deploy and support the solutions for better manageability and provide scope of improvability

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 1 | | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |

The students are assigned project work related to product / process development, solution to the technical problems in industry and current research at national and international level. The student is required to submit a report at the end of semester based on the findings. The evaluation is made as per the Regulations of University.

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| U19CCLC604 | CAREER ENHANCEMENT PROGRAMME IV | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to all Programmes) | 1 | 1 | 0 | 1 |

**COURSE OBJECTIVES**

● To develop strategies to improve students' writing skills.
● To learn different types of documents used for business writing.
● To understand the relevance & need of quantitative methods for making business decisions.
● To demonstrate a sound knowledge of the fundamentals of statistics and statistical techniques.
● To apply quantitative methods to solve a variety of decision-making problems.

**PRE-REQUISITES: Nil**

**UNIT I** 4

**Applied Language Skills:** Active Vocabulary - Writing Personal experiences - Process Description
**Quants:** Time & Work - Pipes & Cisterns - using fractions, percentages & negative work.

**UNIT II** 4

**Applied Language Skills:** Writing notices, business letters, and reports (Minutes & Projects).
**Quants:** Permutation & Combination - Probability - arrangements - selections - chances.

**UNIT III** 4

**Applied Language Skills:** Feasibility Report, Progressive Report - Evaluation report.
**Quants:** Geometry - Mensuration Concepts - Area & Volume - 2D & 3D.

**UNIT IV** 4

**Applied Language Skills:** Book review- Article writing - Writing emails - Letter to the editor.
**Quants:** Trigonometry - Basic concepts - Heights & Distance and its applications.

**UNIT V** 4

**Applied Language Skills:** Taking up certificate tests in reading.
**Quants:** Sequence & Series - Progressions - AP, GP & HP - Data Interpretations - Data Sufficiency.

**Total: 20 Hours**

**COURSE OUTCOMES**

At the end of the course, students should be able to

**CO1 :** Able to participate in formal/informal conversations

**CO2 :** Speak in different contexts confidently and accurately

**CO3 :** Ability to understand the relevance & need of quantitative methods for making business decisions

**CO4 :** Able to solve real-time problems statistically.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
| CO1 | | 3 | 3 | | | | 2 | 1 | | 3 | 3 | | 2 | | 2 |
| CO2 | | 3 | 3 | | | | 2 | 1 | | 3 | 2 | | 2 | | 2 |
| CO3 | | 3 | 2 | | | | 2 | 1 | | 3 | 3 | | 2 | | 2 |
| CO4 | | 3 | 2 | | | | 3 | 1 | | 3 | 3 | | 2 | | 3 |

**TEXTBOOKS**

1. Chris Anderson,  TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations The Newyork Times Paperback, 2018

2. by Kerry Patterson, Joseph Grenny,and Ron Mcmillan, Crucial Conversations Tools for Talking When Stakes Are High, McGraw Education, 2017

3 Quantitative Aptitude for Competitive Examinations - R S Aggarwal

4 A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal

**REFERENCE BOOKS**

1. Interact English Lab Manual for Undergraduate Students. Orient Black Swan: Hyderabad, 2016.

2. Raman, Meenakshi, and Sangeetha Sharma. Professional Communication. Oxford University Press: Oxford, 2014.

3. Arun Sharma "How to Prepare for Quantitative Aptitude for the CAT ", McGraw Hill Education; Eighth edition 2018.

4. Pearson Publication, "A Complete Manual for the CAT", 2018.

**WEB RESOURCES**

1. https://www.ted.com/talks

2. https://www.toastmasters.org/

3 https://testbook.com/aptitude-practice/

4 http://www.allindiaexams.in/online-test/online-aptitude-test/all

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|  |  |  | L | T | P | C |
|---|---|---|---|---|---|---|
| U19CSTL716T | **CRYPTOGRAPHY AND NETWORK SECURITY** | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- Understand Cryptography Theories, Algorithms and Systems.
- Understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

**PREREQUISITES :**Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 |  |  |  |  |  |  |  |  |  | 3 | 2 |  |
| CO2 | 2 | 1 | 1 |  |  |  |  |  |  |  |  |  | 3 | 3 |  |
| CO3 | 3 | 2 | 2 | 1 |  |  |  |  |  |  |  |  | 2 | 2 |  |
| CO4 | 3 | 2 | 2 | 1 |  |  |  |  |  |  |  |  | 2 | 1 |  |
| CO5 | 3 | 2 | 2 | 1 |  |  |  |  |  |  |  |  | 2 | 1 |  |
| CO6 | 2 | 1 | 1 |  |  |  |  |  |  |  |  |  | 1 | 1 |  |

**UNIT I          INTRODUCTION                                                                                    9**

Need for security at multiple levels  Security Goals – Network security model – OSI Security Architecture Security attacks, services and mechanisms – Classical encryption techniques: substitution techniques, transposition techniques, steganography Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis

**UNIT II          SYMMETRIC KEY CRYPTOGRAPHY                                                   9**

 Mathematics Of Symmetric Key Cryptography: Algebraic structures – Modular arithmetic-Euclid"s algorithm Congruence and matrices – Groups, Rings, Fields Finite fields SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – rC4 Key distribution.

**UNIT III          PUBLIC KEY CRYPTOGRAPHY                                                          9**

Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing Factorization – Eulers totient function, Fermats and Eulers Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT IV          MESSAGE AUTHENTICATION AND INTEGRITY                                 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS Entity Authentication: Biometrics, Passwords, Challenge Response protocols Authentication applications – Kerberos, X.509

**UNIT V**        **SECURITY PRACTICE AND SYSTEM SECURITY**        **9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**
        Describe the fundamentals of networks security, security architecture, threats and vulnerabilities

**CO2:**        Discuss the mathematical support for both symmetric and asymmetric key cryptography

**CO3:**        Make use of symmetric key cryptographic algorithms to perform cryptographic operations

**CO4:**        Solve cryptographic operations using public key cryptographic algorithms

**CO5:**        Apply the various Authentication schemes to simulate different applications.

**Co6:**
        Explain various Security practices and System security standards

**TEXT BOOKS:**

**T1:**        William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006

**REFERENCE BOOKS:**

**R1:**        C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd.

**R2:**        BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

**R3:**        Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0130460192

**R4:**        Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.

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| | | | L | T | P | C |
|---|---|---|---|---|---|---|
| U19METH707 | PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

> To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

**PREREQUISITES :** NIL

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | 2 | 2 | | 2 | 2 | 3 | 2 | | | 3 |
| CO2 | 2 | 2 | | | | 2 | 2 | | 3 | 3 | 3 | 2 | | | 3 |
| CO3 | | | | | | 2 | 2 | | 3 | 3 | 3 | 2 | | | 3 |
| CO4 | | | | | | 3 | 3 | 3 | 3 | 3 | 2 | 2 | | | 3 |
| CO5 | | | | | | 2 | 2 | 2 | 2 | 3 | 2 | 2 | | | 3 |

**UNIT I          MANAGEMENT  CONCEPTS          9**

Management – Definition – Importance – Functions – Skills required for managers - Roles and functions of managers – Science and Art of Management –Management and Administration-Evolution of Classical, Behavioural and Contemporary management thoughts

**UNIT II          PLANNING and ORGANISATION          9**

Nature & Purpose – Steps involved in Planning – Forms of Planning – Types of plans – Plans at Individual, Department and Organization level - Managing by Objectives. Forecasting – Purpose – Steps and techniques. Decision-making – Steps in decision making-Nature and Purpose of Organizing - Types of Business Organization - Formal and informal organization – Organization Chart – Structure and Process – Strategies of Departmentation– Line and Staff authority –Benefits and Limitations. Centralization Vs De-Centralization and Delegation of Authority. Staffing – Manpower Planning –Recruitment – Selection – Placement – Induction.

**UNIT III          DIRECTING AND CONTROLLING          9**

Nature & Purpose – Manager Vs. Leader - Motivation - Theories and Techniques of Motivation. Leadership – Styles and theories of Leadership. Communication – Process – Types – Barriers – Improving effectiveness in Communication. Controlling – Nature – Significance – Tools and Techniques- Corporate Governance Social responsibilities – Ethics in business – Recent issues. American approach to Management, Japanese approach to Management, Chinese approach to Management and Indian approach to Management

**UNIT IV          HUMAN VALUES AND ENGINEERING ETHICS          8**

Definition, Moral issues, Human values -Types of inquiry- Morality and issues of morality- Kohlberg and Gilligan's theories-consensus and controversy- Professional and professionalism-moral reasoning and ethical theories- virtues, professional responsibility, integrity, self-respect, duty ethics, ethical rights, self-interest, moral obligations-Engineering as social experimentation- codes of ethics

**UNIT V          RIGHTS, RESPONSIBILITY OF ENGINEERS AND GLOBAL ISSUES          8**

Safety and risk – assessment of safety and risk-Collegiality and loyalty – respect for authority – collective

bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination - Multinational Corporations – Environmental ethics – computer ethics – weapons development- –Engineers as trend setters for global values.

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

| CO1 | (Understand)  Explain the  management  concepts, evolution of management and contemporary management thoughts and issues |
|------|---|
| CO2 | (Analyze) Analyze steps in planning, decision making and structure of    organization |
| CO3 | (Apply) Apply motivational theories and leadership qualities |
| CO4 | (Apply) Apply human values in engineering ethics |
| CO5 | (Understand) Explain safety, Rights and responsibilities of employee        and employer |

**TEXT BOOKS:**

**T1:** Tripathy PC And Reddy PN, "Principles of Management", Tata McGraw-Hill, 9th Edition, 2018.

**T2:** Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2018.

REFERENCE BOOKS:

**R1:** Dinkar Pagare, "Principles of Management", Sultan Chand & Sons, 2017.

**R2:** Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 9th Edition, Pearson Education, 2017.

**R3:** Harold Koontz & Heinz Weihrich, "Essentials of Management – An International perspective", 10th edition. Tata McGraw-Hill, 2019.

**R4:** Mike Martin and Roland Schinzinger, "Ethics in Engineering". (2015) McGraw-Hill, New York

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**U19CSTL716L**          **SECURITY LABORATORY**

## COURSE OBJECTIVES

The course aims to provide the students
- To learn different cipher techniques
- To implement the algorithms DES, RSA,MD5,SHA-1
- To use network security tools and vulnerability assessment tools

## COURSE OUTCOMES

CO1    Describe the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2    Discuss the mathematical support for both symmetric and asymmetric key cryptography

CO3    Make use of symmetric key cryptographic algorithms to perform cryptographic operations

CO4    Solve cryptographic operations using public key cryptographic algorithms

CO5    Apply the various Authentication schemes to simulate different applications.

CO6    Explain various Security practices and System security standards

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | | | | | | 3 | 2 | |
| CO2 | 2 | 1 | 1 | | | | | | | | | | 3 | 3 | |
| CO3 | 3 | 2 | 2 | 1 | | | | | | | | | 2 | 2 | |
| CO4 | 3 | 2 | 2 | 1 | | | | | | | | | 2 | 1 | |
| CO5 | 3 | 2 | 2 | 1 | | | | | | | | | 2 | 1 | |
| CO6 | 2 | 1 | 1 | | | | | | | | | | 1 | 1 | |

## LAB COMPONENTS

1.  Perform encryption ,decryption using the following substitution techniques
    (i)Ceaser cipher,(ii) play fair cipher iii) Hill Cipheriv) Vigenere cipher
2.  Perform encryption and decryption using following transposition techniques
    i)Rail fence ii)row& Column Transformation
3.  Apply DES algorithm for practical applications.
4.  Apply AES algorithm for practical applications.
5.  Implement RSA Algorithm using HTML and JavaScript
6.  Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7.  Calculate the message digest of a text using theSHA-1 algorithm.
8.  Implement the SIGNATURE SCHEME- Digital Signature Standard.
9.  Demonstrate intrusion detection system (ids)using any tool eg.Snortorany others/w.
10. Automated Attack and Penetration Tools   Exploring N-Stalker, a Vulnerability Assessment Tool
11. Defeating Malware
    i)Building Trojans ii) Root kit Hunter

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**Total: 30 Hours**

| U19CSPR702 | PROJECT PHASE I | L T P C |
|---|---|---|
| | | 0 0 4 2 |

**Course Objectives**

To enable learners of Engineering and Technology develop their basic communication skills in English.

To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.

To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.

To inculcate the habit of reading and writing leading to effective and efficient communication.

**Course Outcomes**

At the end of the course, learners will be able to

CO1 identify technically and economically feasible problems of social relevance

CO2 plan and build the project team with assigned responsibilities

CO3 identify and survey the relevant literature for getting exposed to related solutions

CO4 analyse, design and develop adaptable and reusable solutions of minimal complexity by using modern tools

CO5 implement and test solutions to trace against the user requirements

CO6 deploy and support the solutions for better manageability and provide scope of improvability

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 1 | | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |

The students are assigned project work related to product / process development, solution to the technical problems in industry and current research at national and international level. The student is required to submit a report at the end of semester based on the findings. The evaluation is made as per the Regulations of University.

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| U19CSPR803 | PROJECT PHASE II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 12 | 6 |

**Course Objectives**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**Course Outcomes**

At the end of the course, learners will be able to

CO1 identify technically and economically feasible problems of social relevance

CO2 plan and build the project team with assigned responsibilities

CO3 identify and survey the relevant literature for getting exposed to related solutions

CO4 analyse, design and develop adaptable and reusable solutions of minimal complexity by using modern tools

CO5 implement and test solutions to trace against the user requirements

CO6 deploy and support the solutions for better manageability and provide scope of improvability

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 1 | | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |

The students are assigned project work related to product / process development, solution to the technical problems in industry and current research at national and international level. The student is required to submit a report at the end of semester based on the findings. The evaluation is made as per the Regulations of University.

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# PROFESSIONAL ELECTIVES

| U19CSPE001 | MACHINE LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

* To understand the basics of Python Programming
* To understand the machine learning Packages
* To learn the introduction to machine Learning
* To learn Fundamentals of Statistics and Probability, Preprocessing the data
* To Concepts of Regression and Classification and its Applications

**PREREQUISITES**

Linear algebra, Probability and statistics

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | | | | | | | | | | | | 2 | | |
| CO2 | 1 | 1 | 2 | 1 | 2 | 1 | | | | | | 1 | 1 | 2 | 1 |
| CO3 | 1 | 1 | 2 | 1 | 2 | 1 | | | | | | 1 | 1 | 2 | 1 |
| CO4 | 1 | 2 | | | | 1 | | | | | | | | | 1 |
| CO5 | 1 | | 1 | 1 | 2 | | | | | | | 1 | | 2 | |

**UNIT I**          INTRODUCTION  TO  PYTHON  PROGRAMMING          9


**Introduction to Python**  Introduction to Python Language – Basic structure of a Python Program keywords, Variables, Identifiers ,commenting Style in Python(singleline, multiline, and documentation),Multiline Statements Reading input from console Operators.
**Control Structures**  Decision making statement, iterative Statements, Loop Control statements Pass, Continue, Break, range(),Nested Looping Statements
**String**  Mutable Vs Immutable types, String Operations Indexing Slicing Striding, String Built-in functions. **Tuple**  Tuple operations and functions.
**List**  list operations, list slicing, Built-in list functions, List Comprehension **Set**  Set Operations Built in functions
**Dictionary**  key value pair, dictionary operations – functions.


**UNIT II**          PYTHON PACKAGES FOR MACHINE LEARNING          9

**NumPy** Basics of NumPy array, Broadcasting an array, Matrix indexing, Selection techniques, Saving and loading arrays. **Pandas** Series, Indexing elements of a series, Dictionaries, Data frame, Different ways of indexing in a data frame, Conditional indexing in a data frame, Drop, fill, replace, Group by, merging similar to SQL logic, Filtering, sorting and indexing, Loops and functions, Saving and loading a csv, excel file.
**Matplotlib, Seaborn** Need for Visualization, Fundamentals for Matplotlib, Types of Plot Dist plot, count plot, Boxplot, Bar chart, Pair plot, Reg plot, Joint plot, Point plot, Factor plot, Strip plot, Swarm plot, Violoin, Heat MapCase Study Using all Packages


**UNIT III**          INTRODUCTION  TO MACHINE LEARNING          9

**Introduction** Need for Machine Learning, ML is the future & Applications - Machine Learning works-Difference between ML Vs AI Vs Deep Learning, Machine Learning Categories Supervised Learning, Unsupervised Learning, Reinforcement Learning. Machine Learning Life Cycle, Setting Up the Environment.

**Descriptive Statistics and Probability** Basics of Probability, Bayes Theorem, Overall Statistical Measures Central Tendency (mean, mode, median), Correlation between variables and Analysis, Modality, Skewness & Kurtosis, Central Limit Theorem Central limit theorem(Experimentation).

| UNIT IV | DATA PREPROCESSING AND VISUALIZATION | 9 |
|---------|--------------------------------------|---|

**Inferential Statistics** Hypothesis Type I and Type II errors, Hypothesis Testing and steps. Types of Hypothesis tests One tailed vs Two tailed-Case Study in Hypothesis. **ANOVA** Single sample test, ztest , ttest, Test for variance, Anova and Chi Square, Case Study.

**Preprocessing-**Dealing with Missing Data, Handling Categorical Data, Normalizing Data, Handling Outliers, Feature Scaling Standardization, Normalization, Feature Selection and its uses Exploratory Data Analysis (EDA), Univariate Analysis, Multivariate Analysis. Case Study

| UNIT V | REGRESSION AND CLASSICATION | 9 |
|--------|----------------------------|---|

**Regression-**Concepts of Regression Linear Regression, Multiple Regression Assumptions of Regressions Features' Exploration Overfitting and Underfitting Regression Metrics of Evaluation. Types of Regression, Applications Of Regression Case Studies.

**Classification-** Classification Concepts, Performing Exploratory Data Analysis, Classification Logistic Regression, Evaluating a Classification Model Performance, ROC Curve, Fitting Line, Stochastic Gradient Descent, Multiclass Logistic Regression, Applications – Case Studies. Bagging Boosting.

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Understood the machine learning Types and Statistics and Probability.

**CO2:** Applied the machine learning Algorithms.

**CO3:** Mine the behaviour of the users in the social network

**CO4:** Implemented the Classification concepts and its Applications in Python.

**CO5:** Understood the Unsupervised Learning and Types.

**TEXT BOOKS:**

**T1:** Danish Haroon –"Python Machine Learning Case Studies",Apress Publications,2017,First Edition.

**T2:** Manohar Swamynathan – "Mastering Machine Learning with Python in Six Steps : A Practical Implementation Guide to Predictive Data Analytics Using Python", Apress Publications,2017, First Edition.

**T3:** Joel Grus "Data Science from Scratch", Published by O'Reilly Media, April 2015: First Edition.

**T4:** Thomas Mailund .R "Beginning Data Science in R", Apress Publications,2017, First Edition.

**T5:** Jaynal Abedin "Data Manipulation in R, Packt Publishing",2014, First Edition.

**REFERENCE BOOKS:**

**R1:** Sabastine Raschka"Python Machine Learning, Packt Publishing",2014, First Edition

**R2:** Samir Madhavan"Mastering Python for Data Science",Packt Publishing,2015, First Edition.

**R3:** Gavin Hackeling"Mastering Machine Learning with Scikit Learn",
Packt Publishing,2014, First Edition.

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**U19CSPE002**                    **ADVANCED MACHINE LEARNING**         | **L** | **T** | **P** | **C** |
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**OBJECTIVES:**
- To understand the K Means Clustering
- To understand the Advanced Classification Algorithms.
- To learn the Time Series Algorithm and its Applications.
- To learn the Basics of Natural Language Processing.
- To understand the Fundamentals of Deep Learning.

**PREREQUISITES**

Fundamentals of Machine learning

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | | | | | | | | | | 3 | 1 | |
| CO2 | 3 | 2 | 2 | | | | | | | | | | 3 | | 1 |
| CO3 | 3 | | 2 | 2 | | | | | | | 1 | 3 | 3 | 2 | |
| CO4 | 3 | 3 | | 1 | | | | | | | 1 | | | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | 2 | 3 | 1 |

**UNIT I                    CLUSTERING                                                        9**

Features' Exploration – Supervised Vs. Unsupervised Learning – Clustering Data Transformation for Modeling Metrics of Evaluating Clustering Models Clustering Models k-Means Clustering, Applying k Means Clustering for Optimal Number of Clusters, Applications of Clustering, Case Studies.

**UNIT II                    ADVANCED CLUSTERING ALGORITHMS                              9**

Features' Exploration – Supervised Vs. Unsupervised Learning – Clustering Data Transformation for Modeling Metrics of Evaluating Clustering Models Clustering Models Hierarchical Clustering, Applications of Clustering, Case Studies **.**

**UNIT III                    ADVANCED CLASSIFICATION AND ALGORITHMS                      9**

Features' Exploration   Performing Data Wrangling   Performing Exploratory Data Analysis – Classification – KNN,SVM, Naïve Bayes-Bayesian Classifier Decision Tree Classification  Random Forest Classification  Model Evaluation Techniques  Applications of Classification  Case Study.

**Time Series Forecasting-**Introduction, ML Methods and Models   Evaluating the Stationary Nature of a Time Series Object   Tests to Determine If a Time Series Has Autocorrelation   Modeling a Time Series  Auto Regressive Integrated Moving Averages – Scaling Back the Forecast – Applications of Time Series Analysis  Case Studies.

**UNIT IV                    TEXT   PROCESSING                                              9**

Classical Approaches to NLP-Morphological and Lexical   Analysis, Syntactic Analysis, Semantic Analysis, Discourse Integration, Pragmatic Analysis.
 **Text Mining And Recommended Systems** Data Assemble (Text), **Data Preprocessing** Convert to Lower Case and Tokenize, Removing Noise, Part of Speech (PoS) Tagging, Stemming, Lemmatization, Bag of Words (BoW), Term Frequency Inverse Document Frequency (TFIDF), Data Exploration, Model Building with regression, Clustering and Classification. Case Study Sentiment Analysis of Movie Reviews

**UNIT V**        **BASICS OF NEURAL NETWORK   AND DEEP LEARNING**        **9**

Relation between ML, NLP and Deep Learning, Basics of Neural Network-The Brain and the Neuron, Artificial Neural Network-Multilayer Perceptron (Feed forward Neural Network), Classification of Neural Networks-Multilayer network using back propagation network Going Forwards – Going Backwards, Back Propagation Error .**Deep Learning** –Introduction, Process, Types, Feed forward neural networks.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**        Implement the  Hierarchical Clustering in Python

**CO2:**        Applied   the Advanced Classification Algorithms in Python.

**CO3:**        Implemented   the Time Series Algorithm and its Applications.

**CO4:**        Understood the Basics of Natural Language Processing.

**CO5:**        Applied   the Fundamentals of Deep Learning.

**TEXT BOOKS:**

**T1:**    Danish Haroon –"Python Machine Learning Case Studies", A press Publications,2017,First Edition

**T2:**    Manohar Swamynathan – "Mastering Machine Learning with Python in Six Steps : A Practical Implementation Guide to Predictive Data Analytics Using Python", Apress Publications,2017, First Edition.

**T3:**    Steven Bird,Ewan Klein,Edward Loper "Natural Language Processing with Python", Published by O'Reilly Media,First Edition,2009.

**REFERENCE BOOKS:**

**R1:**    Nitin Indurkhya And Fred J.Damerau "Handbook of Natural Language Processing", Chapman & Hall/CRC Publications ,2010, First Edition.

**R2:**    Sabastine Raschka "Python Machine Learning", Packt Publishing,2014, First Edition

**R3:**    Samir Madhavan "Mastering Python for Data Science", Packt Publishing,2014, First Edition.

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**BIG DATA ANALYTICS**

| | L | T | P | C |
|---|---|---|---|---|
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**COURSE OBJECTIVES**

The course aims to provide the students

- Be exposed to big data
- To understand the big data frameworks
- Learn the classification and clustering
- To understand the big data issues

**PREREQUISITES :Nil**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | | | | | | | | | | | | |
| CO2 | 3 | | | | | | | | | | | | | | |
| CO3 | 3 | | | | | | | | | | | | | | |
| CO4 | 3 | 2 | 3 | | | | | | | | | | | 2 | |
| CO5 | 3 | 3 | 3 | 2 | | | | | | | | | | 2 | |

**UNIT I**      **INTRODUCTION TO BIG DATA**      **9**

Introduction to Big Data Platform – Challenges of conventional systems  Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting  Modern data analytic tools, Statistical concepts: Sampling distributions, resampling, statistical inference, prediction error.

**UNIT II**      **HADOOP FRAMEWORK**      **9**

Distributed File Systems  Large Scale File System Organization – HDFS concepts  MapReduce Execution, Algorithms using MapReduce, Matrix Vector Multiplication – Hadoop YARN.

**UNIT III**      **CLUSTER ANALYSIS**      **9**

Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data.

**UNIT IV**      **CLASSIFICATION TECHNIQUES**      **9**

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

**UNIT V**      **BIG DATA ISSUES**      **9**

Privacy, Visualization Visual data analysis techniques, interaction techniques; Systems and applications:, Compliance and Security, Structured vs Unstructured Data

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**      Understand how to leverage the insights from big data analytics

**CO2:**      Analyze data by utilizing various statistical and data mining approaches

**CO3:**      Analyze data by utilizing clustering algorithms.

**CO4:**      Analyze data by utilizing classification algorithms

**CO5:**      Understand and analyse the big data issues.

**TEXT BOOKS:**

**T1:** Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.

**T2:** Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

**REFERENCE BOOKS:**

**R1:** EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.

**R2:** Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

**R3:** Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.

**R4:** Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

**R5:** Jimmy Lin and Chris Dyer, "Data Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1177, Morgan Claypool publishers, 2010.

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| | | L | T | P | C |
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| **U19ITPE009** | **ADVANCED BIG DATA AND ITS ECO SYSTEMS** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- Apply Stream data model.
- To explore tools and practices for working with big data
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics
- To understand the competitive advantages of big data analytics with case studies.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | | | | | | | | | | | | |
| CO2 | 3 | | | | | | | | | | | | | | |
| CO3 | 3 | | | | | | | | | | | | | | |
| CO4 | 3 | 2 | 3 | | | | | | | | | | | 2 | |
| CO5 | 3 | 3 | 3 | 2 | | | | | | | | | | 2 | |

**UNIT I          ASSOCIATION AND RECOMMENDATION SYSTEM                                    9**

Advanced Analytical Theory and Methods: 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 Approaches.

**UNIT II          STREAM MEMORY                                                            9**

Introduction to Streams Concepts – Stream Data Model and Architecture  Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications

**UNIT III          BIG DATA FRAMEWORKS                                                      9**

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration.

**UNIT IV          PIG AND HIVE                                                             9**

Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries.

**UNIT V          CASE STUDIES                                                             9**

Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

**Total: Periods**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**          Work with big data tools and its analysis techniques

**CO2:**          Analyze data by utilizing clustering and classification algorithms

**CO3:**          Learn and apply different mining algorithms and recommendation systems for large volumes of data

**CO4:**          Perform analytics on data streams

**CO5:**          Learn NoSQL databases and management.

**TEXT BOOKS:**

**T1:** Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012

**T2:** David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.

**REFERENCE BOOKS:**

**R1:** Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.

**R2:** David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.

**R3:** Michael Berthold, David J. Hand, —Intelligent Data Analysis‖, Springer, Second Edition, 2007.

**R4:** Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

**R5:** P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison Wesley Professional, 2012.

**R6:** Richard Cotton, "Learning R – A Step by step Function Guide to Data Analysis, , O'Reilly Media, 2013.

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**U19CSPE003**

### DATA VISUALIZATION TECHNIQUES

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**AIM:**

The main aim of the course is to make the students to get more knowledge about the visualization of data for the purpose of Prediction.

**COURSE OBJECTIVES**

- The course aims to provide the students
- To extend student's knowledge in the area of Data Science with emphasis on Predictions.
- To make the predictions using the associated statistical methods and software tools.

**PREREQUISITES**

- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 2 |   | 2 |   |   |   |   |   |   | 2 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 2 |   | 2 |   |   |   |   |   |   | 2 | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 |   | 2 |   |   |   |   |   |   | 2 | 2 | 2 | 2 |
| CO4 | 3 | 2 | 2 |   | 2 |   |   |   |   |   |   | 2 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 2 |   | 2 |   |   |   |   |   |   | 2 | 2 | 2 | 2 |

**UNIT I          INTRODUCTION TO VISUALIZATION          9**

Value of Visualization – What is Visualization and Why do it: External representation – Interactivity – Difficulty in Validation. Data Abstraction: Dataset types – Attribute types – Semantics. Task Abstraction – Analyze, Produce, Search, Query.

**UNIT II          VALIDATION AND ARRANGEMENT OF DATA          9**

Four levels of validation – Validation approaches – Validation examples. Marks and Channels. Rules of thumb – Arrange tables: Categorical regions – Spatial axis orientation – Spatial layout density. Arrange spatial data: Geometry – Scalar fields – Vector fields – Tensor fields. Arrange networks and trees: Connections, Matrix views – Containment.

**UNIT III          VISUALIZING DATA PROGRAMMATICALLY          9**

Map color: Color theory, Color maps and other channels. Manipulate view: Change view over time – Select elements – Changing viewpoint – Reducing attributes.

**UNIT IV          VIEWS AND FILTERS          9**

Facet into multiple views: Juxtapose and Coordinate views – Partition into views – Static and Dynamic layers – Reduce items and attributes: Filter – Aggregate. Focus and context: Elide – Superimpose Distort – Case studies.

**UNIT V          INFORMATION DASHBOARD DESIGN          9**

Introduction, Dashboard design issues and assessment of needs, Considerations for designing dashboard visual perception, Achieving eloquence, Advantages of Graphics _Library of Graphs, Designing Bullet Graphs, Designing Sparklines, Dashboard Display Media, Critical Design Practices, Putting it all together  Unveiling the dashboard.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Classify precise and accurate mathematical definitions of objects in graph theory.

**CO2:** illustrate fundamentals of circuits, cut sets, network flows & graph

**CO3:** Discuss about chromatic characteristics and directed graph.

**CO4:** Outline Permutations and Combinations with generating function.

**CO5:** Make use of theoretical knowledge and independent mathematical thinking in graph theory questions' investigation.

**TEXT BOOKS:**

**T1:** Tamara Munzner, Visualization Analysis and Design, A K Peters Visualization Series, CRC Press, 2014.

**T2:** Scott Murray, Interactive Data Visualization for the Web, O'Reilly, 2013.

**REFERENCE BOOKS:**

**R1:** Alberto Cairo, The Functional Art: An Introduction to Information Graphics and Visualization, New Riders, 2012

**R2:** Nathan Yau, Visualize This: The Flowing Data Guide to Design, Visualization and Statistics, John Wiley & Sons, 2011.

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**U19CSPE004**                    **SOFTWARE TESTING**               **L   T   P   C**

                                                                        **3   0   0   3**

**AIM:**

The main aim of the course is to Gives an understanding of the basics of Software Quality, Functional testing, Control Flow based testing, Data Flow based testing Mutation testing, Software Reliability, and formal verification of programs.

**COURSE OBJECTIVES**

The course aims to provide the students

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
- To expose the advanced software testing topics, such as object oriented software testing methods, and component based software testing issues, challenges, and solutions.
- To gain software testing experience by applying software testing knowledge and methods to practice oriented software testing projects.

**PREREQUISITES**

- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
|      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1  | 3   |     |     |     |     |     |     |     |     |      |      |      |      |      | 3    |
| CO2  | 3   | 2   |     |     |     |     |     |     |     |      |      |      |      |      | 3    |
| CO3  | 3   | 2   | 2   | 2   |     |     |     |     |     |      |      |      | 2    | 3    | 3    |
| CO4  | 3   | 2   | 2   | 2   |     |     |     |     |     |      |      |      | 2    | 3    | 3    |
| CO5  | 3   | 2   | 2   | 2   |     |     |     |     |     |      |      |      | 2    | 3    | 3    |
| Co6  | 3   | 2   |     |     |     |     |     |     |     |      |      |      | 2    | 3    | 3    |

**UNIT I**            **INTRODUCTION**                                       **9**

Introduction: Software Testing, Importance of testing, Roles and Responsibilities, Testing Principles, Attributes of Good Test, VModel, Test Case Generation , SDLC Vs STLC, Software Testing Life Cyclein detail. Types of Testing: Testing Strategies: Unit Testing, Integration Testing, System Testing, Smoke, Regression Testing, Acceptance Testing. Clean Room Software Engineering. Functional/Non Functional Testing. Testing Tools, Categorization of testing methods: Manual Testing, Automation Testing and Automated Testing Vs. Manual Testing.

**UNIT II**            **NON FUNCTIONAL TESTING**                          **9**

Performance Test, Memory Test , Scalability Test, Compatibility Test, Security Test, Cookies Test, Session Test, Recovery Test, Installation Test, Adhoc Test, Risk Based Test, Compliance Test. McCall's Quality Factors, FURPS.

**UNIT III**            **SOFTWARE TESTING METHODOLOGIES**                  **9**

Validation & Verification, White/Glass Box Testing, Black Box Testing, Grey Box Testing, Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Boundary Value Analysis, Equivalence Class Partition, State Based Testing, Cause Effective Graph, Decision Table, Use Case Testing, Exploratory testing and Testing Metrics, Testing GUI

**UNIT IV**         **TESTING LIFE CYCLE AND TEST CASES DESIGN**         **9**

Requirements Analysis/Design, Traceability Matrix, Test Planning, Objective, Scope of Testing, Schedule, Approach, Roles & Responsibilities, Assumptions, Risks & Mitigations, Entry & Exit Criteria, Test Automation, Deliverables. Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Environment setup, understand the SRS, Hardware and software requirements, Test Data.

**UNIT V**         **TEST EXECUTION AND TEST METRICS**         **9**

Execute test cases, Error/Defect Detecting and Reporting, DRE(Defect Removal Efficiency), Object ,Types of Bugs , Art of Debugging,. Debugging Approaches, Reporting the Bugs, Severity and priority, Test Closure, Criteria for test closure, Test summary report. Quality Assurance, What is Quality Control, Differences of QA , QC & Testing.

                                                     **Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

co1     Explain the fundamentals of software testing.

CO2     Illustrate the limitation of testing process.

CO3     Analyze the design of test cases for different testing techniques.

CO4     Create test strategies and plans, deign test case, prioritize and execute them.

CO5     Apply various testing activities in effective manner.

CO6     Illustrate the significance of software testing in web and object oriented techniques.

**TEXT BOOKS:**

**T1:**     Roger S.Pressman, Software engineering A practitioner's Approach, Mc Graw Hill International Editions

**T2:**     Ian Sommerville, Software engineering, Pearson education Asia

**T3:**     Software Testing Techniques, 2nd edition, Boris Beizer, 1990

**T4:**     Software Testing: Principles and Practices by Srinivasan Desikan

**REFERENCE BOOKS:**

**R1:**     Software Testing and Quality Assurance: Theory and Practice by Kshirasagar Naik and Priyadarshi Tripathy

**R2:**     Software Quality Approaches: Testing, Verification, and Validation: Software Best Practice by Michael Haug and Eric W Olsen

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**SOFTWARE TEST AUTOMATION**

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|---|---|---|---|
| 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To Learn basic principles of Software testing.
- To Learn about the test data and test plan.
- To Understand the importance of automation testing and tools available.
- To understand the fundamentals of Selenium for automation.
- To understand basic concepts of TestNG and to Implement automated testing.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | | | | | | | | | | | 2 | | |
| CO2 | 1 | 2 | 2 | 1 | 1 | | | | | | | 2 | 1 | 2 | 1 |
| CO3 | 1 | | 2 | 2 | 2 | | | | | | | | 1 | | |
| CO4 | 1 | 2 | 1 | 2 | 2 | | | | | | | 1 | 2 | | 1 |
| CO5 | 1 | 2 | 1 | | 3 | | | | | | | | | 2 | 2 |

**UNIT I**               **SOFTWARE TESTING INTRODUCTION**         **9**

Introduction: SDLC, Software Testing, Manual Testing, Automation Testing, Purpose of Test automation. Role of tester, Types of Testing, Use cases for testers, Test Basis, Test Bed.

**UNIT II**               **TEST CASES**         **9**

Test case, Test case parameters, Test case Design Techniques, Test suite, Test completion criterion and report, Test data management, Test Driven Development, Test Execution, Test plan.

**UNIT III**               **AUTOMATION TESTING AND TOOLS**         **9**

Automation Testing – Need, Test cases to automation, Automated testing process, Test tool selection, Framework for automation, Automation tool best practices, Benefits of automation testing, Types of automated testing, Ways to choose automation tool, Types of Automation testing tools.

**UNIT IV**               **AUTOMATION USING SELENIUM**         **9**

Selenium fundamentals, Components of Selenium Test environment – Selenium IDE, Java for selenium, Selenium WebDriver, Selenium Automation framework.

**UNIT V**               **TESTNG AND CASE STUDY**         **9**

TestNG Environment, writing tests, Basic Annotations, Execution Procedure, Test results, Checking reports generated by TestNG. Advantages of TestNG over JUnit. Case study: Implementation of automated testing for any web application using Selenium and TestNG.

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**     Achieve Knowledge of testing and automation.

**CO2:**     Understands the basic concepts of test data and test plan.

**CO3:**     Achieve Knowledge of automation testing and tools for automation.

**CO4:**     Understands the concepts of Selenium for automation

**CO5:**     Understands the concepts of TestNG and automated testing for web application.

**TEXT BOOKS:**

**T1:** Daniel J. Mosley, Bruce A. Posey, —Just Enough Software Test Automation, Prentice Hall PTR,2002.

**T2:** Unmesh  Gundecha, Satya Avasarala, —Selenium WebDriver 3 Practical Guide, Second Edition, Packt Publishing, 2018.

**T3:** Robert C. Martin, The Clean Coder, Pearson Education, 2011

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**U19ITPE015**　　　　　**SOFTWARE PROJECT MANAGEMENT**　　　　| **L** | **T** | **P** | **C** |
| 3 | 0 | 0 | 3 |

**AIM:**

　　The main aim of the course is to make the students to acquire knowledge on software project management, managerial skills for software project development and understand software economics.

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization's strategic goals.

**PREREQUISITES**

- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | 2 |  | 2 | 2 |  | 2 |  |  |  | 3 |  | 2 |
| CO2 | 3 |  |  |  |  | 2 |  |  | 2 |  |  |  | 3 |  | 2 |
| CO3 | 3 | 3 | 3 |  |  |  |  |  |  |  |  |  | 3 |  | 2 |
| CO4 | 3 | 3 | 3 | 2 |  | 2 |  |  |  |  |  |  | 3 | 3 |  |
| CO5 | 3 | 3 | 3 |  |  | 2 |  |  |  |  |  |  | 3 |  | 2 |
| CO6 |  |  |  |  |  | 2 |  | 2 |  |  |  |  |  |  | 2 |

**UNIT I**　　　　　**PROJECT EVALUATION AND PROJECT PLANNING**　　　　　**9**

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II**　　　　　**PROJECT LIFE CYCLE AND EFFORT ESTIMATION**　　　　　**9**

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

**UNIT III**　　　　　**ACTIVITY PLANNING AND RISK MANAGEMENT**　　　　　**9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**UNIT IV**          **PROJECT MANAGEMENT AND CONTROL**          **9**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**UNIT V**          **STAFFING IN SOFTWARE PROJECTS**          **9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual
teams – Communications genres – Communication plans – Leadership.

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**    Gains knowledge of software economics, phases in the life cycle of software development.

**CO2:**    Describes the purpose and importance of project management and analyze the artifacts and metrics from the perspective of planning, tracking and completion of the project.

**CO3:**    Analyzes the major and minor milestones in technical perspective

**CO4:**    Gains knowledge of Project organization, process instrumentation and differentiate Organization structures and Project Structures

**CO5:**    Implements a Project to manage project schedule, expenses and resources with the application of suitable project management tools

**CO6**    Designs and develops a software product using conventional and modern principles of software project management

**TEXT BOOKS:**

**T1:**    Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

**REFERENCE BOOKS:**

**R1:**    Robert K. Wysocki, "Effective Software Project Management", Wiley Publication, 2011.

**R2:**    Walker Royce, "Software Project Management", Addison Wesley, 1998.

**R3:**    Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), Fourteenth Reprint 2013.

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| U19ITPE003 | AGILE TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To Knowledge the methodology and issues in Agile.
- To understand the fundamental principles and practices associated with various agile development methods
- To analyze how agile methods scale to large and distributed projects, including the role of systems engineering
- To develop a project using DevOps

**PREREQUISITES**

- Knowledge on software Engineering

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | | | 1 | 1 | 1 | 1 | | | | | 2 | 1 | |
| CO2 | 2 | 2 | | 2 | | | 1 | | | | | | 2 | 2 | |
| CO3 | 2 | 2 | | 1 | | 1 | | 1 | | | | | 2 | 2 | |
| CO4 | 1 | 3 | 2 | 1 | | 1 | 1 | | | | | | 1 | 1 | |
| CO5 | | | 3 | 2 | 1 | | 1 | 1 | | | | | | | |

**UNIT I          INTRODUCTION TO AGILE          9**

Introduction to Agile Software Process Model  Agile Methodology & Principles – Types – Benefits  Life Cycle, Agile Project Management – Design and Construction  Agile Testing Agile Tools.

**UNIT II          AGILE REQUIREMENTS          9**

Trees : Basics: equivalent characterizations of trees, forests, Spanning trees and 2switches , Distance and Meeting the requirements challenge iteratively Requirements for Agile approach – Gathering & analysis – Behavior Driven Development (BDD) and Acceptance Test Driven Development (ATDD) Designing storyboards and scrums in Agile approach.

**UNIT III          SCRUM          9**

Scrum Foundations  Scrum Roles  Scrum Master  Product Owner – Team  Scrum Meetings  Scrum Artifacts Product Backlog Sprint Backlog  Burndown Charts  Scaling Scrum –Manager in Scrum and Product Backlog.

**UNIT IV          AGILE METHODOLOGIES          9**

Pair Programming – Refactoring – Dynamic Systems Development (DSD) – Feature Driven Development (FDD) – Test Driven Development (TDD), Agile Unified Process – Agile Failure Models  Various reasons for  agile failures

**UNIT V          DEV OPS INTRODUCTION          9**

Introduction to dev ops Continuous Integration Continuous deployment Dev ops tool sets Maven Jenkins

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Explain the agile methodologies

**CO2:** Analyze various agile development process

**CO3:** Work on Scrum Framework and its application

**CO4:** Design a agile model

**CO5:** Deploy/built application in Dev Ops

**TEXT BOOKS:**

**T1:** K.S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process ,Addison Wesley, 2012.

**T2:** DevOps: A Software Architect's Perspective by Len Bass, Ingo Weber, Liming Zhu

**REFERENCE BOOKS:**

**R1:** R. Diestel: Graph Theory, Springer( low price edition) 2000

**R2:** S.W. Ambler, M. Lines, Disciplined Agile Delivery: A Practitioner's Guide to Agile Software Delivery in the Enterprise, IBM Press, 2012.

**R3:** Kevin C. Desouza, Agile information systems: conceptualization, construction, and management, Butter worth Heinemann, 2007

**R4:** K. Beck, C. Andres, Extreme Programming Explained: Embrace Change, 2nd Edition, Addison Wesley, 2004.

**R5:** Practical DevOps by Joakim Verona

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**COURSE OBJECTIVES**

The course aims to provide the students

- Basic understanding of what is meant by Internet of Things, components of IoT, generic architecture of any IoT application, different technologies used in building IoT, end-to-end information flow in IoT
- Learning programming in different micro controllers, interacting with IoT cloud platforms, developing simple mobile apps to monitor and control IoT application

**PREREQUISITES : Nil**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 1 | | | | | | | | | 1 | | 2 | 3 |
| CO2 | 3 | 1 | 3 | | | | | | | | | 1 | 1 | 1 | 3 |
| CO3 | 3 | 3 | | | | | | | | | | 1 | | 2 | 3 |
| CO4 | 3 | 3 | 3 | | | | | | | | | 1 | 3 | 2 | 3 |
| CO5 | 3 | 1 | 3 | | | | | | | | | 1 | | 2 | 3 |
| CO6 | 1 | 2 | | 1 | | | | | | | | 1 | 2 | 2 | 1 |

**UNIT I**             **FUNDAMENTALS OF IOT**                                          **9**

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks

**UNIT II**             IoT ARCHITECTURE                                                    **9**

M2Mhigh-levelETSIarchitecture-IETF architecture for IoT-OGC architecture-IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

**UNIT III**             IoT PROTOCOLS                                                       **9**

ProtocolStandardizationforIoT–Efforts–M2MandWSNProtocols–SCADAandRFIDProtocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol – Modbus– Zigbee Architecture– Network layer – 6LowPAN-CoAP – Security

**UNIT IV**             DESIGN AND DEVELOPMENT-BUILDINGWITH RASPBERRY PI             **9**

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks, Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi, Data Handling and Analytics

**UNIT V**             CASE STUDIES/INDUSTRIAL APPLICATIONS                           **9**

Cisco IoT system–IBM Watson IoT platform–Manufacturing–Converged Plant wide Ethernet Model(CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**Total: 45  Hours**

**Project1**
**Smart Home:**

Using Node MCU, Switching ON / OFF Lights based on light intensity Switching ON / OFF Fan based on Temperature Switching ON Fire alarm, based on smoke detection

**Project 2**
 **Weather  Station**

Using Rasp berry Pi,
ReadTemperature,Humidity,Lightintensity,AirQualityintoRaspberryPiSendthisdatatothingspeak.com
Develop a mobile app to see the weather data using APIs of thing speak.com

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**    Learning theory behind different aspects of Internet of Things

**CO2:**    Perform hands-on practice to work with microcontrollers

**CO3:**    Knowledge on reading sensor data, control actuators performance

**CO4:**    Learn to build IoT applications from scratch

**CO5:**
          Implement  the IoT concepts for real-time application

**CO6:**     Enhance the implementation in product based development

**TEXT BOOKS:**

**T1:**     CunoP fister, Getting Started with the Internet of Things: Connecting Sensors and
          Microcontrollers to theCloud,2011


**T2:**     RajKamal,Internet of Things,McGraw Hill Pvt Ltd,2017

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| U19CSPE006 | SOCIAL NETWORK ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**AIM:**

The main aim of the course is to make the students to get more knowledge about the analysing the web social networks and visualization of the human behaviour and making predictions on the same.

**COURSE OBJECTIVES:**

The course aims to provide the students
- To comprehend the concept of semantic web and its associated applications.
- To acquire knowledge representation using ontology
- To understand human behaviour in social web  and allied communities
- To Study visualization of social networks

**PREREQUISITES**
- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | 1 | | | | | | | | | | 1 | |
| CO2 | 3 | | | | | | | | | | | | | 2 | |
| CO3 | 3 | 2 | 2 | 1 | 3 | | | | | | | | | 1 | |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | | | | | | | 1 | 2 | |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | | | | | | | 2 | 2 | |

**UNIT I            INTRODUCTION                                        9**

Introduction to Semantic Web  Limitations of current Web  Development of Semantic Web  Emergence of the Social Web  Social Network analysis: Development of Social Network Analysis  Key concepts and measures in network analysis  Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities  Web based networks  Applications of Social Network Analysis.

**UNIT II            MODELING AND VISUALIZATION                                9**

Visualizing Online Social Networks  A Taxonomy of Visualizations  Graph Representation  Centrality Clustering Node Edge Diagrams  Visualizing Social Networks with Matrix Based Representations Node Link Diagrams Hybrid Representations   Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce  Ontology and their role in the Semantic Web: Ontology based knowledge Representation  Ontology languages for the Semantic Web: Resource Description Framework Web Ontology Language

**UNIT III            MINING COMMUNITIES AND EXTRACTION IN SOCIAL NETWORKS            9**

Extracting evolution of  Web Community from a Series of Web Archive  Detecting communities in social networks  Definition of community  Evaluating communities  Methods for community detection and  mining Applications of community mining algorithms  Tools for detecting communities social network infrastructures and communities  Decentralized online social networks  Metarelational characterization of dynamic social network communities.

**UNIT IV**            **PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES**            **9**

Understanding and predicting human behaviour for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures

**UNIT V**            **APPLICATIONS**            **9**

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**     Work on the internals components of the social network

**CO2:**     Model and visualize the social network

**CO3:**     Mine the behaviour of the users in the social network

**CO4:**     Predict human behaviour in social web and related communities

**CO5:**     Visualize social networks in real time applications

**TEXT BOOKS:**

**T1:**     Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, ―Computational Social Network Analysis: Trends, Tools and Research Advance, Springer, 2012

**T2:**     Borko Furht, ―Handbook of Social Network Technologies and Applications Springer, 1 st edition, 2011

**T3:**     Peter Mika, "Social Networks and the Semantic Web", , First Edition, Springer 2007.

**REFERENCE BOOKS:**

**R1:**     Charu C. Aggarwal, ―Social Network Data Analytic, Springer; 2014

**R2:**     Giles, Mark Smith, John Yen, ―Advances in Social Network Mining and Analysis‖, Springer, 2010.

**R3:**     Guandong Xu , Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications Springer, 1st edition, 2012

**R4:**     Max Chevalier, Christine Julien and Chantal Soulé Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.

**R5:**     John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

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**U19ITPE013**                          **ARTIFICIAL INTELLIGENCE**                    **L   T   P   C**

                                                                                       3   0   0   3

**AIM:**

The main aim of the course is to impart concepts of Artificial Intelligence and Expert System

**COURSE OBJECTIVES**

The course aims to provide the students

- To study the concepts of Artificial Intelligence
- Methods of solving problems using Artificial Intelligence
- Learn to represent knowledge in solving AI problems
- Analyze the different ways of designing software agents and its application.

**PREREQUISITES**

- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 3 | 2 | | | | | | | | | | 3 | 2 | 2 |
| CO2 | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | 3 |
| CO3 | 2 | 2 | 3 | | | | | | | | | | 3 | 3 | 3 |
| CO4 | 2 | 3 | 3 | | | | | | | | | | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | | | | | | | | | | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | | | | | | | | | | 3 | 3 | 3 |

**UNIT I            INTRODUCTION TO ARTIFICIAL INTELLIGENCE                               9**

Overview of Artificial intelligence, Definition, Future of Artificial Intelligence , Behavioral 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.

**UNIT III           AI AND GAME                                                         9**

Game Playing , Optimal Decisions in Games , Alpha , Beta Pruning , Stochastic Games, Rule, based systems, Decision tree learning, Reinforcement learning.


**UNIT IV            KNOWLEDGE REPRESENTATION                                            9**

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 V             SOFTWARE AGENTS AND APPLICATIONS                                    9**

Architecture for Intelligent Agents , Agent communication , Negotiation and Bargaining ,
Argumentation among Agents , Trust and Reputation in Multiagent systems, AI applications , Language Models , Information Retrieval, Information Extraction , Natural Language Processing , Machine Translation , Speech Recognition , Robot , Hardware , Perception , Planning, Moving

                                                                              **Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Understand the basics of Artificial Intelligence

**CO2:** Summarize the appropriate search algorithms for any AI problem

**CO3:** Represent a problem using behavioral logics

**CO4:** Apply AI problem solving techniques, information representation, and cognitive methods in AI based systems.

**CO5:** Develop simple intelligent / expert system that uses Artificial Intelligence.

**CO6:** Design software agents to solve a problem.

**TEXT BOOKS:**

**T1:** S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2016.

**T2:** I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison Wesley Educational Publishers Inc., 2011.

**REFERENCE BOOKS:**

**R1:** M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2015

**R2:** Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009

**R3:** William F. Clocksin and, Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2012 Reprint

**R4:** Ian Millington, John Funge, "Artificial intelligence for Games", Second edition, Morgan Kaufmann Publishers, CRC Press, 2012.

**R5:** Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2016.

**R6:** David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

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**U19CSPE007**                    **SOFTWARE DEFINED NETWORKS**                    **L    T    P    C**

                                                                                   3    0    0    3

**Course Objectives**
● To learn the fundamentals of software defined networks.
● To understand the separation of the data plane and the control plane.
● To study about the SDN Programming.
● To study about the various applications of SDN

**PREREQUISITES**
● Computer Networks

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | 1 | | | | | | | | | 2 | 1 | 2 |
| CO2 | 3 | | | | | | | | | | | | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 2 | 1 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | | | | | | | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | | | | | | | 3 | 2 | 2 |

**UNIT I                    INTRODUCTION                                            9**

SDN Origins and Evolution – Introduction – Why SDN?  Centralized and Distributed Control and Data Planes The Genesis of SDN

**UNIT II                    SDN ABSTRACTIONS                                       9**

How SDN Works  The OpenFlow Protocol  SDN Controllers: Introduction – General Concepts  VMware  Nicira VMware/Nicira  OpenFlow Related  Mininet  NOX/POX

**UNIT III                    DATA CENTERS                                         9**

Definition of Datacenters Uses Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

**UNIT IV                    SDN PROGRAMMING                                       9**

Programming SDNs : Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs  Network Functions Virtualization (NFV) and Software Defined Networks : Concepts, Implementation and Applications.

**UNIT V                    SDN CONTROLLERS                                       9**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

                                                                   **Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**     Differentiate between traditional networks and software defined networks.
**CO2:**     Understand advanced and emerging networking technologies
**CO3:**     Learn how to use SDN controllers to perform complex networking tasks
**CO4:**     Demonstrate the skills to do advanced networking research and programming
**CO5:**     Apply the knowledge on SDN and security measures to solve real world problem

**TEXT BOOKS:**

**T1:**  Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.

**T2:**  Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O Reilly Media, 2013.

**REFERENCE BOOKS:**

**R1:**  Siamak Azodolmolky, Software Defined Networking with Open Flow, Packet Publishing, 2013

**R2:**  Vivek Tiwari, SDN and Open Flow for Beginners, Amazon Digital Services, Inc., 2013

**R3:**  Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

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**U19CSPE008**  **INFORMATION RETRIEVAL TECHNIQUES**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

**PREREQUISITES**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | | | | | | 2 | 2 | |
| CO2 | 3 | 2 | 2 | | | | | | | | | | 2 | 2 | |
| CO3 | 3 | 2 | 2 | 1 | | | | | | | | | 2 | 2 | |
| CO4 | 3 | 2 | 2 | 1 | | | | | | | | | 2 | 2 | |
| CO5 | 2 | 1 | 1 | 1 | | | | | | | | | 2 | 1 | |
| CO6 | 2 | 1 | 1 | | | | | | | | | | 2 | 2 | |

**UNIT I**  **INTRODUCTION**  **9**

Information Retrieval – Early Developments – The IR Problem – The User_s Task – Information versus Data Retrieval  The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes  The Web – The ePublishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT II**  **MODELING AND RETRIEVAL EVALUATION**  **9**

Basic IR Models  Boolean Model  TFIDF (Term Frequency/Inverse Document Frequency) Weighting  Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

**UNIT III**  **TEXT CLASSIFICATION AND CLUSTERING**  **9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – kNN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multidimensional Indexing

**UNIT IV**  **WEB RETRIEVAL AND WEB CRAWLING**  **9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations  Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT V**  **RECOMMENDER SYSTEM**  **9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**      Interpret open-source search engine framework and explore its capabilities

**CO2:**      Apply appropriate method of classification or clustering

**CO3:**      Design and implement innovative features in a search engine

**CO4:**      Design and implement a recommender system

**CO5:**      Demonstrate an open-source search engine framework and explore its capabilities

**CO6:**      Demonstrate the entire process flow of a search engine

**TEXT BOOKS:**

**T1:**     Ricardo BaezaYates, Berthier RibeiroNeto, "Modern information retrieval: The concepts and technology behind search(ACM press books)",second edition 2011.

**T2:**     Christopher D.Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to information

**REFERENCE BOOKS:**

**R1:**     Ricci, F, Rokach, L. Shapira, B.Kantor, "Recommender Systems Handbook", First Edition, 2011.

**R2:**     Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2010.

**R3:**     C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.

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| U19ITPE012 | MERN STACK – WEB APPLICATION DEVELOPMENT | L | T | P | C |
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**COURSE OBJECTIVES**
- Understand the concept of Authentication
- Learn to design a web application with Server side validation
- Learn to create web page using Angular JS
- Understand the basics of React
- Learn to develop a web application using MERN

**PREREQUISITES**

Full Stack Development

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | | | | | | | | | | 3 | 1 | |
| CO2 | 3 | 2 | 2 | | | | | | | | | | 3 | | |
| CO3 | 2 | | 2 | 2 | | | | | | | 1 | 3 | 3 | 2 | |
| CO4 | 2 | 3 | | 1 | | | | | | | 1 | | | 2 | 2 |
| CO5 | 2 | 3 | 3 | 3 | | | | | | | 2 | 3 | 2 | 3 | 1 |

**UNIT I          AUTHENTICATION                                    9**

Session and Cookies Authentication – Passport.js – Installation and Configuration Serializing and Deserializing User Instances Passport Strategies – Logout Functionality – Protecting rules – JWT

**UNIT II          VALIDATION AND API                              9**

Validation – Server side Validation  Client vs Server side – Error Handling – API – Introduction – Integration of Weather API – Email Authorization –Transporter Object  Token Verification – REST API – Working of REST API Postman

**UNIT III          ANGULAR JS                                    9**

**AngularJS** Introduction to AngularJS  Expressions  Modules  Data Binding  Scope  Directives & Events Controllers  Filters  Services  HTTP  Tables  Select  Fetching Data from MySQL  Validation  AngularJS API Animations  AngularJS i18n and i10n

**UNIT IV          REACT                                          9**

React  React Accessibility – React Code Splitting  Context – Error Boundaries – Forwarding Refs – Fragments – Higher Order Components – Integrating with Other Libraries – JSX in depth – Optimizing Performance – Portals – React without ES6 – React without JSX – Reconciliation – Refs and DOM – Render Props – Static Type Checking – Strict Mode – Type checking – Uncontrolled Components – Web Components

**UNIT V          REDUX                                          9**

Redux – Introduction – Core Concepts –Dataflow –Store –Actions –Pure Functions – Reducers – Redux Middleware –Dev Tools – testing – Integrating React

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Build an application with Authentication using Passport.js

**CO2:** Differentiate between Clientside and Serverside Validation

**CO3:** Design a web page using Angular JS

**CO4:** Develop a web application with React components.

**CO5:** Understand the core concepts of Redux

**TEXT BOOKS:**

**T1:** Amos Q Haviv, "MEAN Web Development", Second Edition, Packt Publishing 2016

**T2:** Colin J Ihrig & Adam Bretz, "Full Stack Javascript Development with MEAN", Sitepoint Pty. Ltd. 2014.

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| U19CSPE009 | FULL STACK WEB DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**
- Understand the fundamentals of Web.
- Learn to build web page with NodeJS and Express JS.
- Learn to integrate a Relational Database with a Web Application.
- Learn to develop web pages using Bootstrap.
- Learn to design a web application with NoSQL Database.

**PREREQUISITES**
- Knowledge in HTML, CSS & JavaScript

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | | | | | 3 | 3 | 3 | | 3 | 3 | 2 | 3 |
| CO2 | 3 | 3 | 3 | | 3 | | | 3 | 3 | 3 | | 3 | 3 | | 3 |
| CO3 | 3 | 3 | 3 | | | | | 3 | 3 | 3 | | 3 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | | | | | 3 | 3 | 3 | | 3 | 3 | | 3 |
| CO5 | 3 | 3 | 3 | | 3 | | | 3 | 3 | 3 | | 3 | 3 | 2 | 3 |

**UNIT I**             **INTRODUCTION**             **9**

The Internet Basic Internet Protocols  Web Fundamentals  Web Clients  Web Servers. Overview of Full stack – MVC Architecture – Frontend and Backend technologies  Middleware – Handling request and response MEAN – MERN – Django

**UNIT II**             **DESIGNING A STATIC WEB PAGE**             **9**

HTML – Structure of HTML - HTML tags  CSS – Styling – JavaScript Introduction  Overview of NPM **Node.js** – Introduction  Modules  HTTP Module –Installation and configuration – File structure **Express.js** Request  Response  Get  Post – Routing

**UNIT III**             **RELATIONAL DATABASE**             **9**

DOM Manipulation  DOM Events  Call back function – Promises  Database Integration using MySQL  Working with Database Schemas  Implementing MVC in Express  Retrieve the data from Database  Template Engines  HTML Injection  EJS – Handle bars

**UNIT IV**             **BOOTSTRAP**             **9**

**Bootstrap**  Introduction to Bootstrap Boot strap Basics  Grid system  Basic Components  Page Header  Button Groups – Dropdown Nav & Navbars **Responsive Web Design** Viewport  Grid View  Media Queries – Validation  Understanding Client side validation – JavaScript in Validation

**UNIT V**             **NOSQL DATABASE**             **9**

NoSQL – Serialization  Modelling NoSQL data  Document Databases (MongoDB) – **MongoDB-** MongoDB Environment  Database  Collection  Read Operations  Write Operations –Working with NoSQL and MongoDB  Working with Mongoose – Creating a Cluster in MongoDB Atlas Defining a Schema (Model in Node JS) – MongoDB Integration with NodeJS

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Differentiate between Frontend and Backend Technologies.

**CO2:** Build a web page using NodeJS and Express JS

**CO3:** Work on JavaScript Events, Database schemas and Integrate a Relational Database with the web application

**CO4:** Develop a responsive web page using Bootstrap

**CO5:** Connect the web application with NoSQL Database

**REFERENCE BOOKS:**

**R1:** John Duckett, "HTML and CSS design and build websites", John Wiley &amp; Sons, Inc.

**R2:** Shay Howe, "Learn to Code HTML & CSS Develop & Style Websites", New Riders, Pearson Education, 2014.

**R3:** Brad Dayley ,Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", Second Edition, Pearson, 2017

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**U19ITPE004**  **C# AND .NET PROGRAMMING**

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Course Objectives
- Learn the technologies of the .NET framework
- Know the object oriented aspects of C#
- Be aware of application development in .NET
- Learn web based applications on .NET(ASP.NET)
- Learn to develop applications that connect with database.

**PREREQUISITES**
- Object Oriented Programming

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | | 3 | | 3 | 1 | 1 | | | | | | | | |
| CO2 | 1 | | 3 | | | | 1 | | | | | | 2 | | |
| CO3 | | | 3 | | 2 | | | | | | | | 2 | | |
| CO4 | 2 | | 2 | | 2 | | | | | | | | | 2 | |
| CO5 | | | 3 | | | | 1 | | | | | | | | |

**UNIT I**  **INTRODUCTION**  **9**

Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing

**UNIT II**  **OBJECT ORIENTED ASPECTS OF C#**  **9**

Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading

**UNIT III**  **APPLICATION DEVELOPMENT ON .NET**  **9**

Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless), validating controls, windows application configuration.

**UNIT IV**  **WEB BASED APPLICATION DEVELOPMENT ON .NET**  **9**

Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions.

**UNIT V**  **DATABASE AND EXCEPTION HANDLING**  **9**

Accessing data with ADO.NET, Data Set, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, returning exceptions from SQL Server.

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

| | |
|---|---|
| **CO1:** | Understand .NET Framework, its runtime environment and application development IDE of Visual Studio. |
| **CO2:** | Understand the concept of object oriented for making programs. |
| **CO3:** | Implement C# language constructs in the form of standalone console and window form applications. |
| **CO4:** | Understand database concepts in ADO.NET and apply the knowledge to implement distributed data driven applications. |
| **CO5:** | Design, document, debug ASP.NET web forms with server and validation controls and implement ASP.NET web services. |

**TEXT BOOKS:**

**T1:** Andrew Troelsen and Philip Japikse, "Pro C# 7: With .NET and .NET Core", 8th Edition, 2017

**T2:** Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012.Packt Publishing, 2017.

**T3:** Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012

**REFERENCE BOOKS:**

**R1:** Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.

**R2:** Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.

**R3:** Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O"Reilly, 2010

**R4:** Balagurusamy E, "Programming in C# ", Tata McGraw Hill, 2010

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**U19ITPE010**                      **AUGMENTED REALITY**            | L | T | P | C |

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|---|---|---|---|
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**Course Objectives**
- Understand VR and AR and their applications
- Learn the different components involved in AR application.
- Understand the concept of Visual Coherence
- Learn to use the Unity and Vuforia.
- Learn to develop AR Application

**PREREQUISITES: Nil**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | | | | | | | | | | | | 2 | | |
| CO2 | 1 | 1 | 2 | 1 | 2 | 1 | | | | | | 1 | 1 | 2 | 1 |
| CO3 | 1 | 1 | 2 | 1 | 2 | 1 | | | | | | 1 | 1 | 2 | 1 |
| CO4 | 1 | 2 | | | 1 | | | | | | | | | | 1 |
| CO5 | 1 | | 1 | 1 | 2 | | | | | | | 1 | | 2 | |

**UNIT I                    BASIC CONCEPTS OF AUGMENTED REALITY                                11**

Computer Generated World, Understanding Virtual Space, The Mechanics of Sight, Component Technologies of Head – Mounted Displays, Augmenting Displays, Fully Immersive Displays, The Mechanics of Hearing, Audio Displays, The Mechanics of Feeling, Sensors for Tracking Positions, Orientation and Motion, Devices to enable Navigation and Interaction, How AR works?, Types of AR targets, Technical issues in relation to augmented reality, Applications of augmented reality.

**UNIT II                 DISPLAYS AND TRACKING                                10**
Displays, Tracking, Calibration, Registration, Coordinate System, Characteristics, Stationary Tracking System, Mobile Sensors, Optical Tracking, Sensor Fusion

**UNIT III                VISUAL COHERENCE                                13**
CR Rendering, AR Rendering, Depth Cues, Occulution, Phantom Rendering, Edge Occulution Pipeline, Probabilistic Occlusion Handling, Depth Image Phantom Rendering, Illumination Reconstruction, Shadows, AR Shadow Volumes, Differential Rendering, Diminished Reality

**UNIT IV                UNITY, VUFORIA                                12**

Setting Up Your System, Installing Unity, Introduction to Unity,  Using Cameras in AR,  Getting and using Vuforia, Installing Vuforia, Setting up your Project for Vuforia, Project Architecture, Setting up Image Target, Importing and activating the Target Database in Unity, Adding Image Targets to your Scene, Displaying 3D models on top of tracked images. Building and Running Application, Best practices for mixed reality AR/VR experiences

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**    Differentiate VR and AR and Explain the different types of AR targets

**CO2:**    Differentiate the different displays and understand the physics behind the tracking mechanism

**CO3:**    Understand and use the rendering mechanism in the AR applications

**CO4:**    Install and develop AR applications using Unity and Vuforia

**CO5:**    Use the best practices for Mixed reality experiences

**TEXT BOOKS:**

**T1:**    Dieter Schmalstieg, Tobias Hollerer , "Augmented Reality: Principles and Practice (Usability)" , Addison Wesley Professional, 2016

**T2:**    Jonathan Linowes, Krystian Babilinski, "Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia", Packt Publishing, 2017.

**REFERENCE BOOKS:**

**R1:**    Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications and Human Factors for AR and VR"

**R2:**    Jesse Glover, "Unity 2018 Augmented Reality Projects: Build four immersive and fun AR applications using ARKit, ARCore, and Vuforia", Packt Publishing, 2018

**WEB RESOURCES:**

W1:    https://unity3d.com/learn/tutorials/s/scripting

W2:    https://docs.unity3d.com

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**U19CSPE011**                    **GAME PROGRAMMING**                    | L | T | P | C |
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**Aim:**
    The main aim of the course is to make the students to apply the knowledge on design and development of gaming.

**COURSE OBJECTIVES:**
    The course aims to provide the students
- To understand the game design and development, which includes the processes, mechanics, and issues in game design, game engine development, modeling, techniques, handling situations, and logic.
- To create interactive games based on the problem.

**PREREQUISITES**
- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 1 | | | | | | | | | 2 | 1 | |
| CO2 | 3 | | | | | | | | | | | | 3 | 2 | |
| CO3 | 3 | 2 | 2 | 1 | 3 | | | | | | | | 2 | 1 | 1 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | | | | | | | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | | | | | | | 3 | 2 | |

**UNIT I**                    **3D GRAPHICS FOR GAME PROGRAMMING**                    **9**

3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics based Simulation, Scene Graphs.

**UNIT II**                    **GAME DESIGN PRINCIPLES**                    **9**

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding

**UNIT III**                    **GAMING ENGINE DESIGN**                    **9**

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics.

**UNIT IV**                    **GAMING PLATFORMS AND FRAMEWORKS**                    **9**
Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines  Adventure Game Studio, DXStudio, Unity

**UNIT V**                    **GAME DEVELOPMENT**                    **9**
Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

                                                                          **Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**    Understand the basic concepts of a 3D graphics used for game programming.

**CO2:**    Interpret the principles of Game designing..

**CO3:**    Analyse the different concepts in Game Engine design.

**CO4:**    Apply the different platforms for designing the game

**CO5:**    Create an interactive games using Open software tools.

**TEXT BOOKS:**

**T1:**    David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real Time Computer Graphics" Morgan Kaufmann, 2 Edition, 2006.

**T2:**    JungHyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 1st edition, 2011

**T3:**    Mike McShaffrfy, "Game Coding Complete", Third Edition, Charles River Media, 2009.

**T4:**    Jonathan S. Harbour, "Beginning Game Programming", Course Technology PTR, 3 edition, 2009

**REFERENCE BOOKS:**

**R1:**    Jason Gregory, "Game Engine Architecture", A K Peters, 2009

**R2:**    Jeannie Novak, "Game Development Essentials", 3rd Edition, Delmar Cengage Learning, 2011

**R3:**    Andy Harris, "Beginning Flash Game Programming For Dummies", For Dummies;Updated edition, 2005.

**R4:**    John Hattan, "Beginning Game Programming: A GameDev.net Collection", Course Technology PTR, 1 edition, 2009

**R5:**    Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", Third Edition, Course Technology PTR, 3rd edition, 2011.

**R6:**    Dino Dini, "Essential 3D Game Programming", Morgan Kaufmann, 1st edition 2012

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**COURSE OBJECTIVES**

The course aims to provide the students

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

**PREREQUISITES**

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

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

**UNIT I          INTRODUCTION TO BLOCKCHAIN                    9**

Introduction to Blockchain –Centralized vs. Decentralized Systems, The Byzantine Generals Problem Satoshi Nakamoto's Blockchain Breakthrough Types of Blockchain Blockchain Implementations  Blockchain Collaborative Implementations Blockchain in practical use today  Financial Services Use Cases  Smart Contracts on the Blockchain

**UNIT II          BITCOIN                              9**

Bitcoin Working Procedure Transactions, Blocks, Mining, and the Blockchain  Bitcoin Transactions Constructing a Transaction-Bitcoin Mining-Mining Transactions in Blocks Spending the Transaction Bitcoin Core: The Reference Implementation-Compiling Bitcoin Core from the Source Code Creating, Signing, and Submitting Transactions Based on Unspent Outputs..

**UNIT III          ETHEREUM                            9**

Ethereum Accounts  Ethereum Work  Decentralized Applications  Decentralized Autonomous Organizations Ethereum Blockchain Development  Best Practices – Smart Contract Design – Lifecycle – Migration Interaction with Users and Enterprise Applications – Debugging  Validation

**UNIT IV          HYPERLEDGER                          9**

Open computing  Hyperledger frameworks, tools, and building blocks  Hyperledger Fabric component design – Sample transaction  Understanding governance  Business Scenario  Trading and letter of credit Business scenario and use case  Setting up the development environment  Network components configuration files  Launching trade network..

**UNIT V          BLOCKCHAIN APPLICATIONS                    9**

Case studies in Financial Sector, Energy sector, Identity management, Supply chains, Pharma sector, Trade & Logistics, Media, and Government sector.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** (Understand) Understand the fundamentals of Blockchain

**CO2:** (Apply) Perform simple operations using Bitcoins.

**CO3:** (Apply) Perform simple operations on Ethereum

**CO4:** ((Apply) Practice basic operations in permissioned hyper ledgers and blockchain networks

**CO5:** ((Understand) Understand the latest advances and its applications in Block Chain Technology

**TEXT BOOKS:**

**T1:** Joseph J. Bambara, Paul R. Allen "Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions" McGrawHill Education: 1 edition, 2018.

**T2:** Andreas M. Antonopoulos" Mastering Bitcoin: Unlocking Digital Cryptocurrencies " O'Reilly Media: 2nd edition (March 2018).

**REFERENCE BOOKS:**

**R1:** Arshdeep Bahga and Vijay Madisetti, "Blockchain Applications: A Hands On Approach", 2017.

**R2:** S. Shukla, M. Dhawan, S. Sharma and S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019.

**R3:** Roger Wattenhofer, "The Science of the Blockchain" Create Space Independent Publishing Platform,2016

**R4:** Alex Leverington, "Ethereum Programming" Packt Publishing Limited, 2017

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| U19ITPE014 | DIGITAL IMAGE PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Aim:**

The main aim of the course is to give the students a general understanding of the fundamentals of digital image processing.

**COURSE OBJECTIVES:**

The course aims to provide the students
- To understand the image fundamentals necessary for Digital Image Processing.
- To apply the concept of image enhancement, degradation function, restoration and the image segmentation techniques.
- To Impart the knowledge on image compression and recognition methods

**PREREQUISITES**
- Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | | | 1 | 1 | 1 | 1 | | | | | | | |
| CO2 | 2 | 2 | | 2 | | | 1 | | | | | | | 2 | |
| CO3 | 2 | 2 | | 1 | | 1 | | 1 | | | | | | | |
| CO4 | 1 | 3 | 2 | 1 | | 1 | 1 | | | | | | | 2 | |
| CO5 | | | 3 | 2 | 1 | | 1 | 1 | | | | | | | |

**UNIT I**  **IMAGE PROCESSING FUNDAMENTALS**  **9**

Introduction to image processing – imaging modalities – image file formats Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels– Color image fundamentals

**UNIT II**  **IMAGE ENHANCEMENT**  **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters – Selective Filtering

**UNIT III**  **IMAGE RESTORATION AND WAVELETS**  **9**

Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Wavelets – Sub band coding – Multi resolution expansions

**UNIT IV**  **IMAGE SEGMENTATION**  **9**

Edge detection – Thresholding – Region based segmentation–Region growing – Region splitting and merging – Morphological processing erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**UNIT V**  **IMAGE COMPRESSION AND RECOGNITION**  **9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Texture – Patterns and Pattern classes – Recognition based on matching

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Review the fundamental concepts of a digital image processing system

**CO2:** Apply the techniques used for image enhancement in both spatial and frequency domain using various transforms.

**CO3:** Evaluate the techniques for image restoration and Wavelets

**CO4:** Evaluate various techniques for image segmentation.

**CO5:** Interpret image compression standards and the image representation techniques.

**TEXT BOOKS:**

**T1:** Rafael C Gonzalez, Richard E Woods, "Digital Image Processing" 2nd Edition, Pearson Education 2003

**T2:** Jain A.K., "Fundamentals of Digital Image Processing", Pearson education

**REFERENCE BOOKS:**

**R1:** D, E. Dudgeon and RM. Mersereau, —" Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.

**R2:** William K. Pratt, —" Digital Image Processing", John Wiley, New York, 2002

**R3:** Milan Sonka et al. —" Image Processing, Analysis and Machine Vision", Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

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| U19ITPE005 | COMPUTER GRAPHICS AND MULTIMEDIA | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- To become familiar with various software programs used in the creation and implementation of multi-media
- To appreciate the importance of technical ability and creativity within design practice.
- T gain knowledge about graphics hardware devices and software used.
- To understand the two-dimensional graphics and their transformations.
- To understand the three-dimensional graphics and their transformations.
- To appreciate illumination and color models
- To become familiar with understand clipping techniques
- To become familiar with Blender Graphics

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | | | | | | | | | 3 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 2 | | | | | | | | | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 2 | | | | | | | | | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 2 | | | | | | | | | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 2 | | | | | | | | | 3 | 3 | 3 |
| CO6 | 3 | 2 | 3 | 2 | | | | | | | | | 3 | 3 | 3 |

**UNIT I        ILLUMINATION AND COLOR MODELS                                                    9**

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

**UNIT II        TWO-DIMENSIONAL GRAPHICS                                                    9**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two-dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**UNIT III        THREE-DIMENSIONAL GRAPHICS                                                    9**

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping;

Visible surface detection methods.

**UNIT IV**   **MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING**   **9**

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

**UNIT V**   **HYPERMEDIA**   **9**

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems. CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures.

**Total:45 Hours**

### COURSEOUTCOMES

Upon successful l  completion of this course, the student will be able to:

**CO.1:** Design two-dimensional graphics and two dimensional transformations.

**CO.2:** Design three-dimensional graph and  three dimensional transformations.

**CO.3:** Apply Illumination and color models.

**CO.4:** Apply clipping techniques to graphics.

**CO.5:** Understood Different types of Multimedia File Format

**CO6** Design Basic 3d Scenes using Blender

### TEXTBOOKS:

**T1:** Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, New Delhi, 2007 [UNIT I – III]

**T2:** Andleigh, P. K and KiranThakrar, ―Multimedia Systems and Design‖, PHI, 2003. [UNIT IV, V]

**T3:** WenjunZeng, Heather Yu, and Ching-Yung Lin,"multimedia security technologies for digital rights management," Academic Press, ISBN:9780123694768

### REFERENCEBOOKS:

**R1:** Judith Jeffcoate, ―Multimedia in practice: Technology and Applications, PHI, 1998.

**R2:** Foley, Vandam, Feiner and Hughes, ―Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003

**R3:** Jeffrey McConnell, ―Computer Graphics: Theory into Practice‖, Jones and Bartlett Publishers,2006

**R4:** Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990

**R5:** Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, ―Fundamentals of Computer Graphics‖, CRC Press, 2001

**R6:** William M. Newman and Robert F.Sproull, ―Principles of Interactive Computer Graphics McGraw Hill 1978. https://www.blender.org/support/tutorials/

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| **U19CSPE013** | **GRAPH THEORY AND APPLICATIONS** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

The course aims to provide the students

- To understand and apply the core theorems and algorithms, generating examples as needed, and asking the next natural question.
- To work on clearly expressing mathematical arguments, in discussions and in their writing.
- To learn the major viewpoints and goals of graph Theory: classification, externality, optimization and sharpness, algorithms, and duality.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO2 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO3 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO4 | 2 | 1 | 1 | | | | | | | | | | | | |
| CO5 | 3 | 2 | 2 | 1 | | | | | | | | | | | |

**UNIT I          FUNDAMENTAL CONCEPTS OF GRAPHS                                                    9**

Basic definitions of graphs and multi graphs; adjacency matrices, isomorphism, girth, decompositions, independent sets and cliques, graph complements, vertex coloring, chromatic number, important graph like cubes and the Petersen graph. Paths, cycles, and trails; Eulerian circuits. Vertex degrees and counting; large bipartite subgraphs, the handshake lemma, Havel Hakimi Theorem. Directed graphs: weak connectivity, connectivity, strong components

**UNIT II          TREEES MATCHING AND COVERING                                                    9**

Trees : Basics: equivalent characterizations of trees, forests, Spanning trees and 2switches , Distance and center and Optimization: Kruskal's Theorem and Dijkstra's Theorem. Matching and covering : Bipartite matching, vertex cover, edge cover, independent

**UNIT III          CONNECTIVITY AND NETWORK FLOW                                                    9**

Connectivity:  Vertex cuts, separating sets, bonds; vertex and edge connectivity, block cut point tree and Menger's Theorem: undirected vertex and edge versions. Network flow:  Ford Fulkerson Labeling algorithm, flow integrality, Maxflow/Mincut Theorem and proof of Menger's Theorem.

**UNIT IV          MATRIX REPRESENTATION AND COLORING                                                    9**

Matrix Representation   Adjacency matrix Incidence matrix Circuit matrix  Cutset matrix  Path Matrix Properties  Related Theorems  Correlations. Graph Coloring  Chromatic Polynomial  Chromatic Partitioning Matching  Covering  Related Theorems.

**UNIT V          COLORING AND PLANARITY                                                    9**

Coloring :  Chromatic number: lower bounds from clique number and maximum independent set, upper bounds from greedy coloring ( WelshPowell), SzekeresWilf, and Brooks' Theorem. Also kcritical graphs, Cartesian product of graphs, and interval graphs. kChromatic graphs: Mycielski's construction, Turán's Theorem. Edge coloring, line graphs, Vizing's Theorem. Planarity  Embeddings, dual graphs and Euler's formula.  Kuratowski's Theorem  and Coloring; including the 5color theorem

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Explain fundamentals of graph theory

**CO2:** Interpret the basic concepts of graphs, and different types of graphs

**CO3:** Elucidate proof techniques related to various concepts in graphs

**CO4:** Relate the properties and theorems to prove theorems.

**CO5:** Apply suitable graph model and algorithm for solving applications.

**TEXT BOOKS:**

**T1:** West, Introduction to Graph Theory, 2nd ed., Prentice (UNIT IV)

**T2:** J.A.Bondy and U.S.R.Murty: Graph Theory, Springer, 2008.

**REFERENCE BOOKS:**

**R1:** R.Diestel: Graph Theory,Springer( low price edition) 2000

**R2:** J.A.Bondy and U.S.R.Murty: Graph Theory and Applications ( Freely downloadable from Bondy's website; Google Bondy)

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| | CYBER FORENSICS | L | T | P | C |
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**Aim:**

The main aim of the course is to make the students to get more knowledge about the cybercrime and cyber forensics.

**COURSE OBJECTIVES:**

The course aims to provide the students
- To learn computer forensics
- To become familiar with forensics tool
- To learn to analyze and validate forensics data

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | | | | | | | | | | | 2 | 2 | |
| CO2 | 3 | 3 | 3 | 3 | | 2 | | | | | | | 2 | 2 | |
| CO3 | 3 | 3 | 3 | 3 | | 2 | | | | | | | 2 | 2 | |
| CO4 | 3 | 3 | | | | 2 | | | | | | | 2 | 2 | 1 |
| CO5 | 3 | 3 | 3 | 3 | | 2 | | | | | | | 2 | 2 | 1 |

**UNIT I        INTRODUCTION TO COMPUTER FORENSICS                9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition

**UNIT II        EVIDENCE COLLECTION AND FORENSICS TOOLS                9**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

**UNIT III        ANALYSIS  AND VALIDATION                9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

**UNIT IV        ETHICAL HACKING                9**

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing

**UNIT V        ETHICAL  HACKING IN WEB                9**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**Total:45 HOURS**

**COURSE OUTCOMES**

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

**CO.1:** Understand the basics of computer forensics

**CO.2:** : Apply a number of different computer forensic tools to a given scenario

**CO.3:** Analyze and validate forensics data

**CO.4:** Identify the vulnerabilities in a given network infrastructure

**CO.5:** Implement real-world hacking techniques to test system security

**TEXTBOOKS:**

**T1:** C Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations‖, Cengage Learning, India Edition, 2016..

**T2:** CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.

**REFERENCEBOOKS:**

**R1:** John R.Vacca, —Computer Forensics, Cengage Learning, 2005

**R2:** MarjieT.Britz, —Computer Forensics and Cyber Crime: An Introduction‖, 3rd Edition, Prentice Hall, 2013.

**R3:** AnkitFadia — Ethical Hacking‖ Second Edition, Macmillan India Ltd, 2006

**R4:** Kenneth C.Brancik —Insider Computer Fraud  Auerbach Publications Taylor & Francis Group– 2008.

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| | | | | | | | | | L | T | P | C |
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| **U19CSPE014** | | | **AD HOC AND WIRELESS SENSOR NETWORKS** | | | | | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

**The student should be made to:**

- Learn Ad hoc network and Sensor Network fundamentals
- Understand the different routing protocols
- Have an indepth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks
- Have an exposure to mote programming platforms and tools

**PREREQUISITES :Nil**

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

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

**UNIT I          AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS          9**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols  Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

**UNIT II          SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES          9**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single Node Architecture  Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture  Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

**UNIT III          WSN NETWORKING CONCEPTS AND PROTOCOLS          9**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts  SMAC, The Mediation Device Protocol, Contention based protocols  PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

**UNIT IV          SENSOR NETWORK SECURITY          9**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

**UNIT V          SENSOR NETWORK PLATFORMS AND TOOLS          9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node level software platforms – Tiny OS, nesC, CONTIKIOS, Node level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Know the basics of Ad hoc networks and Wireless Sensor Networks

**CO2:** Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement

**CO3:** Apply the knowledge to identify appropriate physical and MAC layer protocols

**CO4:** Understand the transport layer and security issues possible in Ad hoc and sensor networks.

**CO5:** Be familiar with the OS used in Wireless Sensor Networks and build basic modules

**TEXT BOOKS:**

**T1:** C. Siva Ram Murthy and B. S. Manoj, —Ad Hoc Wireless Networks Architectures and Protocols, Prentice Hall, PTR, 2004. (UNIT I)

**T2:** Holger Karl , Andreas willig, —Protocol and Architecture for Wireless Sensor Networks, John wiley publication, Jan 2006.(UNIT IIV)

**REFERENCE BOOKS:**

**R1:** Feng Zhao, Leonidas Guibas, —Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.

**R2:** Charles E. Perkins, —Ad Hoc Networking, Addison Wesley, 2000.

**R3:** I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci,—Wireless sensor networks: a survey‖, computer networks, Elsevier, 2002, 394 422.

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# OPEN ELECTIVES

**U19AEOE001**         **AGRICULTURAL WASTE MANAGEMENT**

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| | 3 | 0 | 0 | 3 |

### COURSE OBJECTIVES

To impart knowledge to students on various methods of agricultural waste management for ecofriendly energy and manure production.

### PREREQUISITES

Nil

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO2 | 3 | 2 | 2 | | | | | | | | | | | 3 | 3 |
| CO3 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO4 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO5 | 2 | 1 | 1 | | | | | | | | | | | 3 | 3 |
| CO6 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |

**UNITI**      **INTRODUCTION**      **9**

Availability of different types of agriculture wastes its overall characteristics – classification of agro wastes based on their characteristics its recycling and utilization potential current constraints in collection and handling of agricultural wastes – its environmental impact.

**UNITII**      **COMPOSTING**      **9**

Definition Solid waste suitable for composting – Methods of composting vermicomposting Mineralization process in composting Biochemistry of composting – Factors involved – Infrastructure required – maturity parameters – value addition – application methods

**UNITIII**      **BIOMASS BRIQUETTING**      **9**

Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant appliances for biomass briquettes.

**UNITIV**      **BIOCHAR PRODUCTION**      **9**

Definition characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration.

**UNITV**      **BIOGAS AND BIO ETHANOL PRODUCTION**      **9**

Screening of suitable lingo cellulosic substrate for biogas production determination of bioenergy potential of agro waste by estimating total solids volatile solids Calorific value per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio digestion – types of digesters – factors affecting nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes Processing of Biomass to Ethanol –pretreatment fermentation distillation.

**Total:45 Hours**

## Course Outcomes

| | |
|---|---|
| **CO1** | Build various eco-friendly methods for agricultural waste management |
| **CO2** | To develop the process of composting of different types of solid wastes |
| **CO3** | To understand the techniques of briquetting from agro-residues |
| **CO4** | To understand the role of biochar in soil nutrition and carbon sequestration |
| **CO5** | Nutritive value and energy production potential of agro wastes |
| **CO6** | To develop and understand the techniques for processing of ethanol and biogas production |

**TEXTBOOKS:**

**T1:** Raymond C Loehr, "Agricultural Waste Management problems, processes and approaches". First edition, Academic press, 1974.

**T2:** Diaz,l.F.,M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1380.

**REFERENCEBOOKS:**

**R1:** Uta Krogmann, Ina Körne and Luis F. Diaz.2010. Solid waste technology and management (Vol 1 and2). Blackwel Pub Ltd., Wiley Online library.

**R2:** Yong Sik Ok, Sophie M. Uchimiya, Scott X. Chang, Nanthi Bolan.," Biocharproduction characterization and applications". 2015. CRC press

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| | | L | T | P | C |
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| **U19AEOE002** | **FARM MANAGEMENT** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

●      To impart the fundamental knowledge and basic concepts of Economics and Farm Management
· To understand the types of resources and Investment analysis in agriculture sector
· To understand the Farm financial analysis, Investment and Budgeting for farms.
· To expose the students to different extension methods for communication to take the work from lab to field
· To plan the financial aspects, economics related to farm management in a cost effective manner.

**PREREQUISITES: NIL**

| Course Articulation Matrix : 3- High, 2- Medium, 3- Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | – | – | – | – | – | – | – | – | – | – | – | – | – | |
| **CO2** | 3 | – | – | – | – | – | – | – | – | – | – | – | – | – | |
| **CO3** | 3 | 2 | 2 | 2 | – | – | – | – | – | – | – | – | – | - | - |
| **CO4** | 3 | 2 | 2 | 2 | – | – | – | – | – | – | – | – | – | – | |
| **CO5** | 3 | 3 | 2 | 2 | – | – | – | – | – | – | – | – | – | 1 | 1 |
| **CO6** | 2 | 3 | 2 | 1 | | | | | | | | | | 1 | 1 |

**UNIT I      FARM MANAGEMENT & PLANNING      10**

Farm Management – definition – scope- Classification of farms – Basic concepts in farm management - Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts– Farm appraisal techniques – Valuation - Farm management- need and analysis –Elements of farm planning– Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit - examples of farm planning and budgeting

**UNIT II      LAWS OF ECONOMICS      8**

Agricultural Economics – definition and scope – Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns - Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies - Cost concepts – types - Opportunity cost – comparison of costs – Factor relationship – concepts.

**UNIT III      COST CURVES      10**

Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs-Product-product relationship – Production possibility curve, isorevenue line and optimum combination of outputs – Cost curves –Optimum input and output levels – Factor &relationship – Least cost combination of inputs – Estimation of cost of cultivation and cost of production of crops - annual and perennial crops

**UNIT IV      MANAGEMENT OF RESOURCESAND FINANCIAL ANALYSIS      9**

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques- Farm financial analysis – Balance sheet – Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles - Preparation of interview schedule and farm visit for data collection.

Communication – models – elements and their characteristics – types and barriers - Programme planning – monitoring and evaluation - Extension teaching methods - Audio-Visual aids – classification – purpose, planning and selection – individual, group and mass contact methods –Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone – Diffusion - Adoption –Capacity building of extension personnel and farmers –types of training, training to farmers, farm women and rural youth, FTC & KVK.

**Total: 45 Hours**

## COURSE OUTCOMES

At the end of the course students should be able to

| | |
|---|---|
| **CO1** | Gain knowledge in various farm management and farm layout aspects |
| **CO2** | familiarize with the various laws of economics and product relationship aspects |
| **CO3** | gain knowledge on cost curvesand its applications |
| **CO4** | Understand about the various concepts of management of resources |
| **CO5** | Gain knowledge on farm management and financial analysis |
| **CO6** | Familiarize with budgeting and cost estimation for farm layout |

## TEXT BOOKS:

| | |
|---|---|
| **T1:** | Johl, S.S., and Kapur, T.R.,Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007 |
| **T2:** | Subba Reddy, S., Raghu Ram, P., NeelakantaSastry T.V and Bhavani . Devi, I., "Agricultural Economics"Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006. |

## REFERENCE BOOKS:

| | |
|---|---|
| **R1:** | Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002. |
| **R2:** | Subba Reddy, S., and Raghu Ram, P. „ "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002. |

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| | | L | T | P | C |
|---|---|---|---|---|---|
| U19AEOE003 | INTRODUCTION TO BIOENERGY | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES**

To impart the fundamental knowledge on the importance of Bio resources, Bio energy and reactors.

• Alcohol and ethanol production and

• Energy and Environment

**PREREQUISITES**

Nil

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 2 | 2 | | | | | | 2 | 2 | 3 |
| CO2 | 3 | 2 | | | | 2 | 2 | | | | | | 3 | 3 | 3 |
| CO3 | 3 | 2 | | | | 2 | 2 | | | | | | 2 | 2 | 3 |
| CO4 | 3 | 2 | | | | 2 | 2 | | | | | | 2 | 2 | 3 |
| CO5 | 3 | 2 | | | | 2 | 2 | | | | | | 3 | 3 | 3 |
| CO6 | 3 | 2 | | | | 2 | 2 | | | | | | 2 | 2 | 3 |

**UNIT I    BIO RESOURCE  AN INTRODUCTION`**                                                    **9**

Bio resource – origin – biomass types and characteristics biomass conversion technology Biodegradation steps in biogas production parameters affecting gas production Types of biogas plants Construction details operation and maintenance.

**UNIT II    BIO ENERGY**                                                                           **9**

Slurry handling enrichment and utilization – Biogas appliances Biochemical characteristics of bio resources Bioenergetics –Bio catalysis –Kinetics of product formation

**UNIT III    BIO REACTORS AND FERMENTORS**                                                      **9**

Bio reactors/ fermentors – Batch type – continuous stirred tank reactors Biological waste water treatment Activated sludge process Down stream processing Recovery and purification of products

**UNIT IV    ALCOHOL PRODUCTION**                                                                 **9**

Alcohol ethanol production  Acid hydrolysis  enzyme hydrolysis Methanol synthesis – Antibiotics enzymes principles of thermochemical conversion – combustion  pyrolysis Gasification – types of gasifiers.

**UNIT V    ENERGY AND ENVIRONMENT**                                                             **9**

Principles of operation chemical reaction cleaning and cooling  Utilization Improved wood burning stove Energy plantations Biomass briquetting  co generation Impact on Environment – – Bioenergy policy.

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**Understanding the importance of bio resources .

**CO2:**Ability to classify the bio energy and characteristics of bio energy.

**CO3:**Knowledge in bio reactors and fermentors.

**CO4:**Ability to gain knowledge in Alcohol production process

**CO5:**Understanding the importance of Energy and Environment

**CO6:**Knowledge in capturing and applying bioenergy on replacement of fossil fuels.

**TEXTBOOKS:**

**T1:**      Rai G.D,Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.

**T2:**      Bouley James .E & David Follis  Biochemical Engineering Fundamentals Mc GrawHill publishing company, Tokyo.1986 71

**REFERENCEBOOKS:**

**R1:**      Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986

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**U19AEOE004**                    **ROBOTICS IN AGRICULTURE**

| | | | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|---|
| | | | 3 | 0 | 0 | 3 |

### COURSE OBJECTIVES

To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.

**PRE REQUISITES:** Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | | | | | | | | | | | | |
| CO2 | 3 | | | | | | | | | | | | | | |
| CO3 | 3 | 2 | 2 | 2 | | | | | | | | | | | |
| CO4 | 3 | 2 | 2 | 2 | | | | | | | | | | | |
| CO5 | 3 | 3 | 2 | 2 | | | | | | | | | | 1 | 1 |
| CO6 | 2 | 3 | 2 | 1 | | | | | | | | | | 1 | 1 |

**UNITI      INTRODUCTION & CONCEPTS                                          9**

Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels. Definition & Characteristics of IoT Physical Design of IoT Things in IoT IoT Protocols Logical Design of IoT IoT Functional Blocks IoT Communication Models IoT Communication APIs IoT Enabling Technologies M2M towards IoT -IoT Interfacing Esp8266

**UNITII      ENVIRONMENTAL IMPACTS                                          9**

Irrigation development and watersheds – mechanized agriculture and soil cover impacts – Erosion and problems of deposition in irrigation systems – Agricultural drainage and downstream impacts Agriculture versus urban impacts.

**UNITIII                                                              9**
**            CLIMATE CHANGE**

Global warming and changing environment – Ecosystem changes – Changing blue green grey water cycles – Water scarcity and water shortages – Desertification.

**UNITIV      WEATHER PREDICTION                                          9**

 Weather and climate  Seasonal forecasting – Understanding the world climate system – Global climate models – Importance of climate variability – Importance of agricultural meteorology for crop production

**UNITV      EMERGING ISSUES                                            9**

Global environmental governance – alternate culture systems – Mega farms and vertical farms Virtual water trade and its impacts on local environment – Agricultural environment policies and its impacts – Sustainable agriculture..

**Total:45 Hours**

**COURSE OUTCOMES**

**CO1**  Understand basic concept of robotic systems and their dynamics.

**CO2**  Analyze system stability and types of stability

**CO3**  Know about joint space and task space control schemes

**CO4**  Understand the concept of nonlinear control and observer schemes

**CO5**  Gain knowledge on farm management and financial analysis

**CO6**  Familiarize with budgeting and cost estimation for farm layout

**TEXTBOOKS:**

**T1:**  M.Lakshmi Narasaiah, Environment and Agriculture, Discovery Pub. House, 2006.

**T2:**  Arvind Kumar, Environment and Agriculture, ABH Publications, New Delhi, 2005

**REFERENCEBOOKS:**

**R1:**  C. Byerly, Environment and Agriculture, United States. Dept. of Agriculture. Economic Research Service, 2006.

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**U19BTOE001**  **BASICS OF BIOINFORMATICS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

To enable the students

- To improve the programming skills of the student
- To let the students know the recent evolution in biological science

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  | 1 |  |  |  | 2 |  |  |  |  |  |  |  |  |  |
| CO2 |  |  | 3 |  | 2 | 3 |  |  |  |  |  |  |  |  | 1 |
| CO3 |  |  | 2 |  | 3 | 3 |  |  |  |  |  |  |  |  | 1 |
| CO4 |  | 3 | 2 |  |  | 2 |  |  |  |  |  |  |  | 1 | 1 |
| CO5 |  |  | 2 |  | 2 | 3 |  |  |  |  |  |  |  | 2 |  |
| CO6 | 1 |  |  |  | 1 |  |  |  |  |  |  |  |  | 2 |  |

**UNIT I**  **DATABASES**  9

Introduction to Bioinformatics-Biological information resources-Genome sequence acquisition and analysis-Retrieval of biological data-Data acquisition, databases, structure and annotation-Data mining and data characteristics.

**UNIT II**  **SEQUENCE ALIGNMENT AND DATABASE SEARCHES**  9

Database searches and Sequence Alignment-Pair wise and multiple sequence alignment Methods of local and global alignment Dynamic programming, Scoring matrix, PAM, searching sequence databases by sequence similarity BLAST and FASTA.

**UNIT III**  **PHYLOGENY ANALYSIS**  9

Phylogenetics, Molecular Phylogeny and evolutionary analysis-ClustalW, MSA, Dendrogram-Maximum likelihood, Maximum Parsimony, convergent and parallel evolution, Bootstrapping, Jackknifing-Phylograms.

**UNIT IV**  **STRUCTURAL BIOINFORMATICS**  9

Structural bioinformatics, analysis for protein structure, Predicting protein structure and function from Sequence Homology modeling Microarray Data analysis proteomic data analysis Visualization of molecular structures.

**UNIT V**  **APPLICATIONS OF BIOINFORMATICS**  9

Scope of bioinformatics-Bioinformatics in the Pharmaceutical Industry Structure Based Rational Drug Design and discovery-Cheminformatics in Biology.

**Total: 45 Hours**

**COURSE OUTCOMES**

After successful completion of this course, the students should be able to r3e2w

**CO 1**    Use bioinformatics tools with programming skills.

**CO 2.**    Apply computational based solutions for biological perspective

**CO 3.**    Alignment of nucleotide and protein sequences

**CO 4.**    Predict gene and protein structure.

**CO 5.**    Construct, interpret and assess the different molecular phylogenetic tree prediction and gene prediction algorithms

**CO6.**    understand the Application of Bioinformatics

**TEXT BOOKS:**

**T1:**    Attwood, T. and P.S. David. 2006. Introduction to Bioinformatics. Pearson Education Ltd., New Yor

**T2:**    axevanis, A.D., and Ouellette, B.F.F. (eds) 2006. Bioinformatics A Practical Guide to Analysis of Ger and Proteins. 3rd Edition, John Wiley and Sons, New York.

**REFERENCEBOOKS:**

**R1:**    Attwood T.K. and Higgs, P.G. 2005. Bioinformatics and molecular evolution. Blackwell Publishers, London.

**R2:**    Lesk, A.M. 2002. Introduction to Bioinformatics. Oxford University Press

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**U19BTOE002**　　　**INTRODUCTION TO BIOENERGY AND BIOFUELS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

To enable the students

- This course will be focused on achievement, acquisition of knowledge and enhancement of comprehension of information regarding bioenergy and biofuel technologies and their sustainable applications..

**Course Outcomes**

At the end of the course, learners will be able to

CO1. Understand in depth of the bioenergy and biofuels.
CO2. Distinguish various forms of bioenergy and biofuels production
CO3. Analyse concepts related to and advantages of bioenergy.
CO4. Develop novel products from biofuels.
CO5. Understand the environmental sustainability.
CO6. Understand the yield and efficiency of Biofuels

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 3 | 3 |  |  |  |  |  |  |  |  |  | 2 |  | 2 |
| CO2 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 |  | 1 | 3 |  |  |  |  | 2 | 3 |
| CO4 | 3 | 1 | 1 |  |  | 1 |  | 1 |  |  |  |  |  | 1 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 2 |  |  | 1 |  |  |  |  |  | 1 | 3 |
| CO6 | 3 | 3 | 2 | 1 | 2 |  |  | 1 |  |  |  |  |  | 1 | 3 |

**UNITI**　　**BASIC CONCEPTS OF BIOFUELS**　　　　　　　　　　　　　　　　　　**9**

Biopower, Bioheat, Biofuels, advanced liquid fuels, drop-in fuels, biobased products

**UNITII**　　　　**FEEDSTOCKS**　　　　　　　　　　　　　　　　　　　　　　　**9**

Harvested Feedstocks: First generation biofuels, Second generation biofuels, third generation biofuels. Residue Feedstocks: Agricultural wastes, forestry wastes, farm waste, organic components of residential, commercial, institutional and industrial waste..

**UNITIII**　　**CONSERVATION TECHNOLOGIES**　　　　　　　　　　　　　　　**9**

Biorefinery concept – biorefineries and end products, Biochemical conversion – hydrolysis, enzyme and acid hydrolysis, fermentation, anaerobic digestion and transesterification, Thermochemical conversion – Combustion, Gasification, Pyrolysis, other thermochemical conversion technologies. Scaling up of emerging technologies.

**UNITIV**　　**BIOMETHANE AND BIOHYDROGEN**　　　　　　　　　　　　　　**9**

Biomethanol – Principles, materials and feedstocks, Process technologies and techniques, Advantages and limitations – Biological hydrogen production methods, Fermentative hydrogen production, Hydrogen economy – Advantages and limitations..

Environmental Sustainability, bioenergy sustainability, emissions of biomass to power generation applications, emissions from biofuels. ILUC issues, Carbon footprint, Advanced low carbon fuels

**Total:45 Hours**

**TEXT BOOKS:**
- **T1:** Bio renewable Resources – Engineering new products. Robert C Brown. Blackwell Publishing Professional, 2003.
- **T2:** Biomass for Renewable Energy, Fuels and Chemicals. Donald Klass. Academic press. 1998

**REFERENCEBOOKS:**
- **R1:** Introduction to Bioenergy.Vaughn C. Nelson and Kenneth L. Starcher.

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**U19BTOE003**        **ANALYTICAL METHODS AND INSTRUMENTATION**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To inculcate the entrepreneurship spark among the student community by converting their research ideas into commercial products
- To develop the entrepreneurial skill in the field of biotechnology
- To study the Business strategy and Technology Transfer

**Course Outcomes**

At the end of the course, learners will be able to

CO1. Learn the different bio potential and its propagation.

CO2. get Familiarize the different electrode placement for various physiological recording

CO3. design bio amplifier for various physiological recording

CO4. understand various technique non electrical physiological measurements

CO5. Understand the different biochemical measurements

CO6. Characterize and analyze various macromolecules

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | | 2 | | | | | | | | | | 2 | 3 |
| CO2 | 3 | 1 | 2 | 1 | | 1 | | | | | | | 1 | 2 | 3 |
| CO3 | 3 | 2 | 3 | | | | | | | | | | 1 | 1 | 3 |
| CO4 | 2 | 2 | 3 | | | | | | | | | | | 2 | 2 |
| CO5 | 2 | 2 | 3 | | | 3 | | | | | | | | | 2 |
| CO6 | 2 | 2 | | | | | | | | | | | | | 2 |

**UNITI**       **SPRECTOMETRY**                                           **9**

Properties of electromagnetic radiation wave properties – components of optical instruments Sources of radiation – wavelength selectors – sample containers – radiation transducers Signal process and read outs – signal to noise ratio – sources of noise – Enhancement of signal to noise – types of optical instruments – Applications.

**UNITII**       **MOLECULAR SPECTROSCOPY**                                  **9**

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beers law – Instrumentation – Applications Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications Theory of Raman spectroscopy – Instrumentation – applications.

**UNITIII**       **NMR AND MASS SPECTROMETRY**                             **9**

Theory of NMR — chemical shift NMR spectrometers – applications of 1H and 13C NMR Molecular mass spectra – ion sources. Mass spectrometer. Applications of molecular mass Electron paramagnetic resonance g values – instrumentation.

**UNITIV          SEPARATION METHODS**

           **9**

General description of chromatography – Band broadening and optimization of column performance Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography size exclusion chromatography Affinity chromatography principles of GC and applications – HPLC Capillary electrophoresis – Applications.

**UNITV          ELECTRO ANALYSIS AND SURFAVE MICROSCOPY**

           **9**

Electrochemical cells Electrode potential cell potentials – potentiometry reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry Cyclic and pulse voltametry Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

           **Total: 45 Hours**

**TEXT BOOKS:**

   **T1:**     Skoog, D.A. F. James Holler, and Stanky, R.Crouch Instrumental Methods of Analysis.Cengage Learning , 2007

   **T2:**     Willard, Hobart, etal., Instrumental Methods of Analysis. VIIth Edition, CBS, 1986

**REFERENCEBOOKS:**

   **R1:**    Haven, Mary C., etal., Laboratory Instrumentation .IVth Edition, John Wiley, 1995.

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**U19BTOE004**          **INDUSTRIAL WASTE MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To develop the knowledge on nano materials synthesis characterization
- To gain knowledge in involvement of macromolecules in nano biotechnology
- To study the application in drug delivery and cancer treatment.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 3 | 3 | | | | | | | | | | 2 | | |
| CO2 | 3 | 2 | | | | | | | | | | | | | |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | | 1 | 3 | | | | | 2 | |
| CO4 | 3 | 1 | 1 | | | 1 | | 1 | | | | | | 1 | |
| CO5 | 3 | 3 | 2 | 1 | 2 | | | 1 | | | | | | 1 | |
| CO6 | 3 | 3 | 2 | 1 | 2 | | | 1 | | | | | | 1 | |

**UNIT I          INTRODUCTION  TO WASTE MANAGEMENT          9**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health  Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

**UNIT II          CLEANER PRODUCTION          9**

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and by product recovery – Applications.

**UNIT III          POLLUTION FROM MAJOR INDUSTRIES          9**

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

**UNIT IV          REACTORS USED IN WASTE WATER TREATMENT          9**

Theory: Modeling of Ideal Attached Growth Reactors, Biofilm Modeling Aerobic Growth of Biomass in Packed Towers, Aerobic Growth of Heterotrophs in Rotating Disc Reactors, Fluidized Bed Biological Reactors,

**UNIT V          CASE STUDIES          9**

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries Textiles Pulp and Paper Metal finishing – Sugar and Distilleries.

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course student should be able to

**CO 1**     This course will make the students to design biological treatment units

**CO 2.**     To undertake projects on biological wastewater treatment

**CO 3.**     To design the treatment plants with fundamental understanding

**CO 4.**     Be familiar with sampling of wastes.

**CO 5.**     The students will undertake projects related to waste management.

**CO6:**     Understand various case studies related to waste management

**TEXT BOOKS:**

**T1:**     Bhatia, Handbook of Industrial Pollution and Control, Volume I and II, CBS Publishers, New Delhi, 2003

**T2:**     1.Mahajan, S.P.Pollution Control in Process Industries, Tata McGraw Hill Publishing Co., New Delhi, 1991.

**REFERENCEBOOKS:**

**R1:**     Nelson Leonard Nemerow, "Industrial waste treatment – contemporary practice and vision for the future", Elsevier, Singapore, 2007

**U19BMOE001**　　　　**BIO HEALTHCARE AND TELEMEDICINE**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objective**

The student should be made:

- To enable the students to acquire knowledge about the principles and application of telemedicine in biomedical industry

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 3 | 1 | | | | | | | | | 2 | 2 | |
| CO2 | 2 | 2 | 3 | 1 | | | | | | | | | 2 | 2 | |
| CO3 | 2 | 2 | 3 | 1 | | | | | | | | | 2 | 2 | |
| CO4 | 2 | 2 | 3 | 1 | | | | | | | | | 2 | 2 | |
| CO5 | 3 | 2 | 3 | 1 | | | | | | | | | 3 | 2 | |
| CO6 | 2 | 2 | 3 | 1 | | | | | | | | | 2 | 2 | |

**UNIT I　　BACKGROUND OF TELEMEDICINE**　　　　　　　　　　　　　　　　　　　**9**

Introduction ,definitions of telemedicine, telehealth and telecare, Origins and development of telemedicine: from beginning to modern times, modern telemedicine and telecare Drivers of telemedicine and telecare: technology drivers, non technological drivers, the funding dilemma Telemedicine in developed and underdeveloped countries ,benefits and limitations of telemedicine Types of information and transmission in telemedicine: audio, video, still images, text and data, Fax

**UNIT II　　COMMUNICATION AND NETWORK SYSTEMSIN TELEMEDICINE**　　　　　　**9**

Types of communication and network: public switched telephone network, plain old telephone service, integrated services digital network, internet, asynchronous transfer mode Wireless communications basics and its types Wireless sensor standards and homecare concerns, medical sensors for mobile communication devices Development of disposable adhesive wearable human monitoring system Implantable systems: implantable system architecture Signal Processing in implantable neural recording microsystems, electronic health signal processing

**UNIT III　　TECHNOLOGIES FOR SAFEGUARDING MEDICAL DATA AND PRIVACY**　　　　**9**

Data Exchanges: Network configuration, circuit and packet switching, H.320 series Data security and standards: Encryption, cryptography, mechanisms of encryption, phases of encryption Cryptography, safeguarding patient medical history Anonymous data collection and processing, biometric security
and identification

**UNIT IV　　TELEHEALTH AND MOBILE HEALTH**　　　　　　　　　　　　　　　　　**9**

Medical robotics: surgical robots, rehabilitation robots Modern devices for telesurgery: Main component and functionalities of a robotics telesurgery System, design guidelines and methodology Microsurgery Systems: Robot assisted microsurgery system, miniaturization, microsurgical tools, visualization methods and systems Image guided microsurgery: Image guidance component and workflow, image guidance by surgical domain

Telecardiology: Tools and devices Teleradiology and Tele audiology Telepathology system development and implementation Acute care telemedicine and monitoring for elderly care Virtual doctor systems for medical practices, wireless electrical impedance tomography Synthetic biometrics in biomedical systems, bio kinematics for mobility

**Total:45 Hours**

### COURSE OUTCOMES

At the end of the course students should be able to

**CO1:** Explain the development and transmission techniques used in telemedicine

**CO2:** Describe the types of communication and network systems

**CO3:** Explain the technologies used in data exchange and privacy of telemedicine

**CO4:** Illustrate the current system of telehealth and mobile health

**CO5:** Describe the currents and futures perspective of telemedicine

**CO6:** Acquire knowledge about the principles and application of telemedicine

### TEXTBOOKS:

**T1** Bernard Fong, A.C.M. Fong, C.K. Li, ‒Telemedicine Technologies: Information Technologies in Medicine and Telehealth‖, Wiley, 1$^{st}$ edition,2010.

**T2** HalitEren,JohnG.Webster,—TheEMedicine,EHealth,MHealth,Telemedicine,and Telehealth Handbook‖, CRC Press,1$^{st}$ edition, 2015.

T3   OlgaFerrerRoca,M.SosaLudicissa,—Handbook of Tele medicine ,IOS press,1$^{st}$edition,2002.

### REFERENCEBOOKS:

**R1** GeorgiGraschew,StefanRakowsky,—TelemedicineTechniquesandApplications,In ech, 1$^{st}$edition,2011

**R2** A.C.Norris,—EssentialsofTelemedicineandTelecare,JohnWiley&Sons,1$^{st}$edition**,**2002.

**R3** RichardW.Carlson,‒Telemedicine in the ICU, An Issue of Critical Care Clinics,(The Clinics: Internal Medicine), Elsevier, 1$^{st}$ edition,2015.

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**Course Objective**

The student should be made:

- Understand the design of embedded system for various medical devices.

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 2 | 2 |  |  |  |  | 2 | 2 | 3 | 3 |  |
| CO2 | 2 | 2 | 2 | 2 | 2 | 2 |  |  |  |  | 2 | 2 | 3 | 3 |  |
| CO3 | 3 | 3 | 2 | 3 | 2 | 1 |  |  |  |  | 2 | 2 | 2 | 2 |  |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 |  |  |  |  | 2 | 2 | 2 | 2 |  |
| CO5 | 2 | 2 | 2 | 3 | 2 | 1 |  |  |  |  | 2 | 2 | 2 | 2 |  |
| CO6: | 2 | 2 | 2 | 2 | 2 | 1 |  |  |  |  | 2 | 2 | 2 | 2 |  |

**UNIT I      EMBEDDED DESIGN WITH MICROCONTROLLERS      9**

Product specification – hardware / software partitioning Detailed hardware and software design – integration, product testing Microprocessor Vsmicro controller Performance tools, bench marking processors RTOS micro controller issues in selection of processors.

**UNIT II      PARTITIONING DECISION      9**

Hardware / software duality Hardware software portioning, coding for hardware/software development, ASIC revolution Managing the risk, co verification, execution environment Memory organization of controller, memory enhancement Firmware, speed and code density, system startup.

**UNIT III      FUNCTIONALITIES FOR SYSTEM DESIGN      9**

Timers, watch dog timers RAM, flash memory, basic toolset, integration of hardware & firmware Application programming, IDE, target configuration Host based debugging analyser Remote debugging, ROM emulators, logic

**UNIT IV      DESIGN OF PATIENT MONITORING DEVICES**

     **9**

Design consideration of patient monitoring systems Basic block diagram of pulse oximeter, design requirement of device Circuit implementation of interfacing of oximeter sensors with microcontroller Software coding and implementation.

**UNIT V      DESIGNING OF PACEMAKER      9**

System description of pacemaker Design requirement and basic block diagram of pacemaker Interfacing of pacemaker elements with processors Software coding of pacemaker and implementation.

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Attain knowledge on the basic concepts and the building blocks for embedded system

**CO2:** Understand the hardware and software partitioning in embedded systems

**CO3:** Gain knowledge about timers and memory organization of embedded systems

**CO4:** Design a pulse oximeter using embedded tool

**CO5:** Design a pacemaker using embedded tool

**CO6:** Understand the design of embedded system for various medical devices

**TEXTBOOKS:**

**T1** James K. Peckol, —Embedded system Design‖, John Wiley & Sons, 1ˢᵗ edition, 2010

**REFERENCEBOOKS:**

**R1** Geo EliciaWhite,—MakingEmbeddedSystems‖,O'ReillySeries,SPD,1ˢᵗedition,2011.
Georgi Graschew StefanRakowsky,—Telemedicine Technique sand Applications, In Tech, 1ˢᵗedition,2011

**R2** G. Baura, "A Biosystems Approach to Industrial Patient Monitoring and Diagnostic Devices, Morgan&Claypool, IEEE,2008.

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**U19BMOE003**　　　　　　　　　　**HOSPITAL MANAGEMENT SYSTEM**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objective**

The student should be made:

- To understand the fundamentals of hospital administration and management.
- To know the market related research process
- To explore various information management systems and relative supportive services.
- To learn the quality and safety aspects in hospital.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 3 | 3 | | 1 | 2 | | | | 1 | | 2 | 2 | |
| CO2 | 2 | 3 | 3 | 3 | | 1 | 3 | | | | 1 | | 3 | 2 | |
| CO3 | 2 | 3 | 3 | 3 | | 1 | 3 | | | | 1 | | 3 | 3 | |
| CO4 | 3 | 2 | 3 | 3 | | 1 | 2 | | | | 1 | | 2 | 3 | |
| CO5 | 2 | 2 | 3 | 3 | | 1 | 2 | | | | 1 | | 2 | 2 | |
| CO6 | 2 | 2 | 3 | 3 | | 1 | 2 | | | | 1 | | 2 | 2 | |

**UNIT I　　　　　OVERVIEW OF HOSPITAL ADMINISTRATION　　　　　　　　　9**

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning Equipment Planning – Functional Planning  Current Issues in Hospital Management – Telemedicine Bio Medical Waste Management.

**UNIT II　　　　　HUMAN RESOURCE MANAGEMENT IN HOSPITAL　　　　　　　9**

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

**UNIT III　　　　　MARKETING RESEARCH PROCESS　　　　　　　　　　9**

Marketing information systems  assessing information needs, developing & disseminating information
Market Research process  Other market research considerations – Consumer Markets & Consumer Buyer Behaviour  Model of consumer behaviour  The buyer decision process  Model of business buyer behavior – Major types of buying situations  WTO and its implications.

**UNIT IV　　　　　HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES　　　9**

Management Decisions and Related Information Requirement  Clinical Information Systems  Administrative Information Systems  Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services  Laundry Services.

**UNIT V　　　　　QUALITY AND SAFETY ASPECTS IN HOSPITAL　　　　　　　9**

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Explain the principles of Hospital administration.
**CO2:** Identify the importance of Human resource management.
**CO3:** List various marketing research techniques.
**CO4:** Identify Information management systems and its uses.

**CO5:** Understand safety procedures followed in hospitals
**CO6:** Analyze the quality and safety aspects in hospital

**TEXTBOOKS:**

**T1** R.C.Goyal,―HospitalAdministrationandHumanResourceManagement‖,PHI–Fourth Edition, 2006.

**T2** G.D.Kunders, ―Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

**REFERENCE BOOKS:**

**R1** Cesar A.Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New York,1977.

**R2** Norman Metzger, ―Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA,1990

**R3** Peter Berman ―Health Sector Reform in Developing Countries‖ Harvard University Press, 1995.

**R4** WilliamA. Reinke ―Health Planning For Effective Management Oxford University Press.1988

**R5** Blane, David, Brunner, ―Health and SOCIAL Organization: Towards a Health Policy for the 21st Century‖, Eric Calrendon Press2002.

**R6** Arnold D. Kalcizony& Stephen M. Shorte, ―Health Care Management, 6thEdition

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**U19BMOE004**　　　　　　　　　**BIOMEDICAL INSTRUMENTATION**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objective**

The student should be made:
- To impart knowledge of the principle of operation and design of sensory equipment's.
- To render a broad and modern account of neurological, muscular, cardiological and respiratory instruments.
- To introduce idea about instrumentation in patient care and diagnosis.

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 2 | 2 | 2 | 2 | 2 |   |   |   |   | 2 | 2 | 3 | 3 |   |
| CO2 | 2 | 2 | 2 | 2 | 2 | 2 |   |   |   |   | 2 | 2 | 3 | 3 |   |
| CO3 | 3 | 3 | 2 | 3 | 2 | 1 |   |   |   |   | 2 | 2 | 2 | 2 |   |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 |   |   |   |   | 2 | 2 | 2 | 2 |   |
| CO5 | 2 | 2 | 2 | 3 | 2 | 1 |   |   |   |   | 2 | 2 | 2 | 2 |   |
| CO6 | 2 | 2 | 2 | 2 | 2 | 1 |   |   |   |   | 2 | 2 | 2 | 2 |   |

**UNIT I　　RECORDING OF BIOSIGNALS**　　　　　　　　　　　　　　　　　　　9

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, Lead configuration, 12 lead ECG machine circuit, common mode and interference reduction circuits, Vector cardiograph EEG – 1020 electrode system. EMG– Recording, Electro encephalogram, Magneto encephalogram, EOG & ERG: origin, measurement of EOG, electroretinogram

**UNIT II　　SENSORY INSTRUMENTATION**　　　　　　　　　　　　　　　　　　9

Psycho physiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses  Audiometer Pure tone, Hearing and speech aids: conductive and nervous, hearing aids Types, constructional and functional characteristics. Cochlear implants Need, constructional details, speech trainer.

**UNIT III　　CARDIAC EQUIPMENTS**　　　　　　　　　　　　　　　　　　　9

Normal and abnormal ECG waveform, diagnosis interpretation, cardiac pace maker external pacemaker, implantable pacemaker, different types of pacemakers, fibrillation, defibrillator, AC defibrillator, DC defibrillator, electrodes, synchronised and un synchronised types. EEG diagnostic interpretation, recording and analysis of EMG waveforms.

**UNIT IV　RESPIRATORY MEASUREMENT SYSTEM**　　　　　　　　　　　　　　　9

Instrumentation for measuring the mechanics of breathing – Spirometer Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer – Airway resistance measurement,  Whole body Plethysmograph, Intra Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators – Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

**UNIT V　ADVANCED DEVICES**　　　　　　　　　　　　　　　　　　　　9

Cardiac pacemakers and modern stimulators, Hemodyalysis ventilators, incubators, drug delivery devices, surgical instruments, Therapeutic application of laser, Neonatal Monitoring.

**Total:45 Hours**

**COURSE OUTCOMES**

**At the end of the course students should be able to**

**CO1:** Demonstrate the principle of operation and design of sensory equipments

**CO2:** Determine the basic parameters of the equipment used in patient diagnosis

**CO3:** Analyze the broad and modern account of neurological equipments.

**CO4:** Illustrate the principle and working of muscular and respiratory instruments

**CO5 :** Render a broad and modern account of neurological, muscular, craniological and respiratory instruments..

**CO6** Gain idea about instrumentation in patient care and diagnosis.

**TEXTBOOKS:**

**T1** Siamak Najarian, Javad Dargahi, Ali Abouei Mehrizi, —Artificial Tactile Sensing in Biomedical Engineering ,McGraw Hill publication,2009

**T2** Martin Grunwald, —Human Haptic Perception, Birkhaeuser Verlag AG, Boston Basel Berlin publication,2008

**REFERENCE BOOKS:**

**R1** Abdul motaleb El Saddik, Mauricio Orozco, Mohamad Eid, Jongeun Cha,—Haptics Technologies: Bringing touch to multimedia‖, Springer,2011

**R2** MyerKutz.,—Biomedical Engineering and Design Handbook .Vol2,McGrawHill

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| U19CEOE001 | GREEN BUILDINGS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course aims to provide the students,

- About the importance and necessity of green buildings.
- Asses the the boiling based in LEED Rating systems.

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

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

**UNIT I          INTRODUCTION                                                                    9**

Green Building  Need for Green Building  Benefits of Green Buildings  Green Building Materials and Equipment in India  Key Requisites for Constructing a Green Building  Important Sustainable featuresfor Green Building.

**UNIT II          GREEN BUILDING CONCEPTS AND PRACTISES                              9**

Indian Green Building Council  Green Building Moment in India  Benefits Experienced in Green Buildings  Launch of Green Building Rating Systems  Residential Sector  Market Transformation. Green Building Opportunities And Benefits: Opportunities of Green Building  Green Building Features,Material and Resources  Water Efficiency  Optimum Energy Efficiency  Typical Energy Saving Approach in Buildings  LEED India Rating System and Energy Efficiency.

**UNIT III          GREEN BUILDING DESIGN                                                      9**

Introduction  Reduction in Energy Demand  Onsite Sources and Sinks  Maximise System Efficiency  Steps to Reduce Energy Demand and Use Onsite Sources and Sinks  Use of Renewable EnergySources. Ecofriendly captive power generation for factory  Building requirement.

**UNIT IV          UTILITY OF SOLAR ENERGY IN BUILDINGS                                  9**

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings  Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

**UNIT V          GREEN COMPOSITES FOR BUILDINGS                                        9**

Concepts of Green Composites  Water Utilization in Buildings  Low Energy Approaches to Water Management, Management of Solid Wastes, Management of Sullage Water and Sewage, Urban Environment and Green Buildings, Green Cover and Built Environment.

**Total:45 Hours**

**COURSE OUTCOMES:**

At the end of the course, students should be able to

**CO1:** Know about the importance and necessity of green buildings.

**CO2:** Asses a building on the norms available in green buildings.

**CO3:** Suggest materials and technologies to improve energy efficiency of building.

**Textbooks**

**T1.** K.S.Jagadish,B.U.VenkataramareddyandK.S.Nanjundarao."Alternative Building Materials and Technologies".New Age International,2007.

**T2.** Low Energy Cooling for Sustainable Buildings. John Wileyand SonsLtd,2009.

**T3.** SustainableBuildingDesignManual.Vol1and2, Teri,New Delhi,2004.

**Reference Books**

**R1.** OsmanAttmann,"GreenArchitectureAdvancedTechnologiesandMaterials".McGrawHill,2010.

**R2.** JerryYudelson,"GreenbuildingThroughIntegratedDesign".McGrawHill,2009.

**R3.** Fundamentals of Integrated Design for Sustainable Building By MarianKeeler, BillBurke.

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| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19CEOE002** | **DISASTER PREPARDNESS AND MANAGEMENT** | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course aims to provide the students,

- To Understand the basic concepts of disaster management.
- To acquire knowledge on types and categories of disasters.
- To understand the impacts and challenges posed by disasters.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | 1 | 1 | 2 | 3 | | | | | | 1 | | 1 |
| CO2 | 1 | 1 | | 1 | 1 | | 3 | | | | | | 1 | | |
| CO3 | 1 | | 1 | | | 2 | 2 | | | | | | 2 | 1 | |
| CO4 | 1 | | 1 | | | 2 | 2 | | | | | | 2 | 1 | |
| CO5 | | | | 1 | | | 2 | 3 | 2 | 1 | | | | | |

**UNIT I          INTRODUCTION TO DISASTER          9**

Concepts and definitions  disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation. Global trends in disasters  urban disasters, pandemics, complex emergencies, Climate change. Disaster's classification  natural disasters  manmade disasters – hazard and vulnerability profile of India  mountain and coastal areas, ecological fragility. Dos and Don'ts

during various types of Disasters.

**UNIT II          DISASTER IMPACTS          9**

Disaster impacts (environmental, physical, social, ecological, economic, political, etc.)  health, psycho, social issues  demographic aspects (gender, age, special needs)  hazard locations  global and nationaldisaster trends  climate change and urban disasters.

**UNIT III          DISASTER RISK REDUCTION          9**

Disaster management cycle – its phases : prevention, mitigation, preparedness, relief and recovery; structural and nonstructural measures  risk analysis  vulnerability and capacity assessment  early warning systems  Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications)  Roles and responsibilities of government – community  local institutions  NGOs and other stakeholders  Policies and legislation for disaster risk reduction  DRR programmes in India and the activities of National Disaster Management Authority

**UNIT IV         DISASTER RISK MANAGEMENT IN INDIA                          9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy  Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V         DISASTERS, ENVIRONMENT AND DEVELOPMENT                     9**

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development methods.

**Total: 45 Hours**

**Course Outcomes:**

At the end of the course, students should be able to,

**CO1:**  Develop the application of Disaster Concepts to Management

**CO2:**  Analyse relationship between Development and Disasters.

**CO3:**  Ability to Understand categories of Disaster

**CO4:**  Draw the hazard and vulnerability profile of India, Scenarios in the Indian context

**CO5:**  Realise the responsibilities of Individual and Society in Management

**Textbooks:**
**T1.** Singhal J.P. "Disaster Management", Laxmi Publications, 2010.
**T2.**Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat  Publication.
**T3.** Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

**Reference Books:**

**R1.** Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005. **R2.**Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California,  EMSA no.214, June 2003.

**R3.** Government of India, National Disaster Management Policy,2009.

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| U19CEOE003 | REMOTE SENSING AND GIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course aims to provide the students,

- Understanding about the basic concepts of remote sensing and analyse satellite imagery and extract the required units.
- Usage of thematic maps for various application.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | | | | 1 | | | | | | | | 2 | | 2 |
| CO2 | 2 | 1 | | | 3 | | | | | | | | 2 | | 2 |
| CO3 | 3 | | | 1 | 2 | | | | | | | | 2 | | 3 |
| CO4 | 2 | | 1 | 1 | 2 | | | | | | | | 2 | | 2 |
| CO5 | 2 | 1 | 2 | 1 | | | | | | | | | 2 | | 2 |

**UNIT I    REMOTE SENSING                                                                     9**

Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages&Limitations,RemoteSensingprocess.ElectromagneticSpectrum,Energyinteractionswith atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False colour composite, elements of visual interpretation techniques.

**UNIT II       REMOTE SENSING PLATFORMS AND SENSORS                                   9**

Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms – IRS, sensors, sensor resolutions, Basics of digital image processing  introduction to digital data, systematic errors and nonsystematic errors, Image enhancements, image filtering.

**UNIT III       GEOGRAPHIC INFORMATION SYSTEM                                            9**

Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data Attribute Data Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

**UNIT IV       DATA MODELS                                                                     9**

Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data conversion.

**UNIT V      INTEGRATED APPLICATIONS OF REMOTE SENSING AND GIS                    9**

Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services and Its Applications.

**Total: 45 Hours**

**Course Outcomes:**

At the end of the course, students should be able to,

**CO1:**   Understand the principles of aerial and satellite remote sensing, Able to comprehend the energy interactions with earth surface features.

**CO2:**   Understand the basic concepts of remote sensing and know about different types of satellite and sensors.

**CO3:**   Illustrate spatial and nonspatial data features in GIS and understand the map projections and coordinates systems

**CO4:**   Collect data and delineate various elements from the satellite imagery using their spectral signature.

**CO5:**   Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.

**Textbooks:**

**T1.**   Anji Reddy M., "Remote sensing and Geographical information system", B.S. Publications 2008.

**T2.**   Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13: 9788173716287, University Press 2008.

**T3.**   Basudeb Bhatta, "Remote sensing and GIS", Oxford University Press 2011

**Reference Books:**

**R1.**   Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006

**R2.**   PeterA.Burrough, Rachael  A.McDonnell,and Christopher D.Lloyd,"Principals of Geophysical Information system", Oxford Publications 2004.

**R3.**   S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005.

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| U19CEOE004 | AIR POLLUTION AND CONTROL ENGINEEIRNG | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Course Objectives:**

This course aims to provide the students,

- Knowledge on the principle and design of control of Indoor/ particulate / gaseous air pollutant and its emerging trends.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | | | 1 | | | | | | | | 2 | | 2 |
| CO2 | 2 | 3 | 2 | 1 | | 2 | 2 | | | | | | 2 | 1 | 2 |
| CO3 | 3 | 2 | 3 | 1 | | 1 | 1 | | | | | | | 1 | 3 |
| CO4 | 2 | | | | 1 | | 1 | | | | | | | 1 | 2 |
| CO5 | 1 | | | | | 2 | 2 | | | | | | | 1 | 1 |

**UNIT I        INTRODUCTION                                    9**

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility Ambient Air Quality and Emission standards

**UNIT II        METEROLOGY                                    9**

Effects of meteorology on Air Pollution  Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns  Atmospheric Diffusion Theories – Dispersion models, Plume rise

**UNIT III        CONTROL OF PARTICULATE CONTAMINANTS                9**

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle  Gravity Separators,         Centrifugal     separators Fabric    filters,    Particulate    Scrubbers, Electrostatic Precipitators.

**UNIT IV        CONTROL OF GASEOUS CONTAMINANTS                9**

Factors affecting Selection of Control Equipment – Working principle  absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

**UNIT V        INDOOR AIR QAULITY MANAGEMENT                9**

Sources, types and control of indoor air pollutants, sick building syndrome and building related illness Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

**Total: 45 Hours**

**Course Outcomes:**

At the end of the course, students should be able to,

**CO1:** Understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management.

**CO2:** Ability to identify, formulate and solve air and noise pollution problems.

**CO3:** Ability to design stacks and particulate air pollution control devices to meet applicable standards.

**CO4:** Ability to select control equipment's.

**CO5:** Ability to ensure quality, control and preventive measures.

**Textbooks:**

**T1.** Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science media LLC,2004.

**T2.** Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017.

**T3.** Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

**Reference Books:**

**R1.** David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.

**R2.** Arthur C. Stern, "Air Pollution (Vol. I – Vol. VIII)", Academic Press, 2006.

**R3.** Wayne T. Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.

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**COURSE OBJECTIVES**

To understand the phases in a software project

- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing and maintenance measures•

**PREREQUISITES: NIL**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO2 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO3 | 3 | 2 | 2 | | | | | | | | | | | 2 | 2 |
| CO4 | 3 | 2 | 2 | | | | | | | | | | | 2 | 2 |
| CO5 | 3 | 2 | 2 | | | | | | | | | | | 2 | 2 |
| CO6 | 3 | 2 | 2 | | | | | | | | | | | 2 | 2 |

**UNIT I**          **SOFTWARE PROCESS AND AGILE DEVELOPMENT**      9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility Agile process Extreme programming XP Process.

**UNIT II**          **REQUIREMENTS ANALYSIS AND SPECIFICATION**      9

Software Requirements: Functional and Non Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management    Classical analysis: Structured system Analysis, Petri Nets Data Dictionary.

**UNIT III**          **SOFTWARE DESIGN**      **9**

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

**UNIT IV**          **TESTING AND MAINTENANCE**      9

Software testing fundamentals Internal and external views of Testing white box testing   basis path testing control structure testing black box testing Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices Refactoring Maintenance and Reengineering BPR model Reengineering process model Reverse and Forward Engineering..

**UNIT V**          **PROJECT MANAGEMENT**      **9**

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

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1**     Identify the key activities in managing a software project.

**CO2**     Compare different process models.

**CO3**     Concepts of requirements engineering and Analysis Modeling

**CO4**     Apply systematic procedure for software design and deployment

**CO5**     Compare and contrast the various testing and maintenance

**CO6**     Manage project schedule, estimate project cost and effort required

**TEXT BOOKS:**

**T1:**     Roger S. Pressman, "Software Engineering – A Practitioner"s Approach", Seventh Edition, Mc GrawHill International Edition, 2010..

**T2:**     Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

**REFERENCE BOOKS:**

**R1:**     Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009

**R2:**     Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

**R3:**     Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.

**R4:**     Stephen R.Schach, "Software Engineering", Tata McGrawHill Publishing Company Limited,2007.

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| U19CSOE002 | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**
- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- 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

**PREREQUISITES: NIL**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO2 | 3 | 2 | 2 | | | | | | | | | | | 3 | 3 |
| CO3 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO4 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |
| CO5 | 2 | 1 | 1 | | | | | | | | | | | 3 | 3 |
| CO6 | 2 | 1 | 1 | | | | | | | | | | | 2 | 2 |

| **UNIT I** | **RELATIONAL DATABASES** | 9 |
|---|---|---|

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

| **UNIT II** | **DATABASE DESIGN** | 9 |
|---|---|---|

Entity Relationship model – ER Diagrams – Enhanced ER Model – ER to Relational Mapping – Functional Dependencies – Non loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multivalued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

| **UNIT III** | **TRANSACTIONS** | **9** |
|---|---|---|

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

| **UNIT IV** | **TESTING AND MAINTENANCE** | 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 – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL  XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1**     Discuss the fundamental concepts of relational database and SQL

**CO2**     Use ER model for Relational model mapping to perform database design effectively

**CO3**     Summarize the properties of transactions and concurrency control mechanisms

**CO4**     Outline the various storage and optimization techniques

**CO5**     Compare and contrast various indexing strategies in different database systems

**CO6**     Explain the different advanced databases

**TEXT BOOKS:**

**T1:**     Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.

**T2:**     Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011.

**REFERENCE BOOKS:**

**R1:**     C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

**R2:**     Raghu Ramakrishnan, —Database Management Systems‖, Fourth Edition, McGrawHill College Publications, 2015.

**R3:**     G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.

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| U19CSOE003 | DATA STRUCTURES AND ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES**

- Understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

**PREREQUISITES: NIL**

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | | | | |
| CO2 | 3 | | | | | | | | | | | | | | |
| CO3 | 3 | 2 | 2 | 2 | | | | | | | | | | | |
| CO4 | 3 | 2 | 2 | 2 | | | | | | | | | | | |
| CO5 | 3 | 3 | 2 | 2 | | | | | | | | | | 1 | 1 |
| CO6 | 2 | 3 | 2 | 1 | | | | | | | | | | 1 | 1 |

**UNITI          ALGORITHM ANALYSIS, LIST ADT**                                       11

Algorithms: Notation  analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array based implementation – linked list implementation – singly linked lists applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

**UNITII          STACKS AND QUEUES**                                                 9

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

**UNITIII          SEARCHING AND SORTING ALGORITHMS**                                 8

Divide and conquer methodology  Searching: Linear Search  Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort. Analysis of searching and sorting techniques. Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.C.

**UNITIV          TREES**                                                              9

Tree ADT – tree traversals  Binary Tree ADT – expression trees – binary search tree ADT – applications of trees. Heap – applications of heap. Implementation of Binary search tree and its operations, tree traversal methods, finding height of the tree using C. Implementation of heap and heap sorting using arrays in C.

**UNIT V      GRAPHS                                                                  8**

Definition – Representation of Graph – Breadth first traversal   Depth first traversal – Dynamic programming Technique – Warshall's and Floyd's algorithm – Greedy method   Dijkstra's algorithm – applications of graphs. Implementation of graph, graph traversal methods, finding shortest path using Dijkstra's algorithm in C

**Total:45 Hours**

### COURSE OUTCOMES

At the end of the course students should be able to

CO1    Define data structures like array, stack, queues and linked list.

CO2    Explain insertion, deletion and traversing operations on data structures.

CO3    Identify the asymptotic notations to find the complexity of an algorithm.

CO4    Compare various searching and sorting techniques.

CO5    Choose appropriate data structure while designing the algorithms.

CO6    Design advance data structures using non linear data structures.

**TEXTBOOKS:**

**T1:**      Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997..

**T2:**      Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988.

**REFERENCE BOOKS:**

**R1:**      Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983

**R2:**      S.Sridhar, "Design and Analysis of Algorithms", First Edition, Oxford University Press. 2014

**R3:**      Byron Gottfried, Jitender Chhabra, "Programming with C" (Schaum's Outlines Series), Mcgraw Hill Higher Ed., 3RD Edition, 2010

**R4:**      YashvantKanetkar, "Data Structures Through C", BPB publications, 2ND edition, 2003

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**U19EEOE001**                **RENEWABLE ENERGY RESOURCES**

**COURSE OBJECTIVES**
1. To get exposure on renewable energy source.
2. To know about the solar radiation and its environmental impact to power.
3. To learn about the wind energy and its economic aspects.
4. To know about geothermal energy with other energy sources.

To get exposure on distributed generation in storage systems

**PREREQUISITES**
- Fundamentals of electrical engineering
- Basic concepts of Differentiation
- Basic concepts of  Integration
- Fundamentals of Battery concepts

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
|      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1  | 3   |     | 2   | 2   |     | 1   | 3   |     |     |      | 2    |      | 3    | 3    | 2    |
| CO2  | 3   |     | 2   | 2   |     | 1   | 3   |     |     |      | 2    |      | 2    | 2    | 2    |
| CO3  | 3   |     | 2   | 2   |     | 1   | 3   |     |     |      | 2    |      | 2    | 3    | 3    |
| CO4  | 3   |     | 2   | 2   |     | 1   | 3   |     |     |      | 2    |      | 1    | 2    | 2    |
| CO5  | 3   |     | 2   | 2   |     | 1   | 3   |     |     |      | 2    |      | 2    | 2    | 2    |
| CO6  | 3   |     | 2   | 2   |     | 1   | 3   |     |     |      | 2    |      | 3    | 2    | 2    |

**UNIT I        INTRODUCTION**                                                                                    **9**

Energy scenario: National and International – Energy resources and their availability – Conventional    power generation plant (Thermal power plant)  Environmental aspects of fossil fuels – Necessity for renewable energy sources – Types of renewable energy source and its limitation.

**UNIT II        SOLAR PHOTOVOLTAIC SYSTEM**                                                                       **9**

Introduction – Solar radiation and measurements – Basic principle of SPV conversion – Solar energy collectors – Solar energy storage: Solar pond – Types of solar PV cells – PV cell connections – Characteristics of PV module and its parameters  Application of solar energy: Solar pumping and solar cooking.

**UNIT III            WIND ENERGY SYSTEM**                                                                          **9**

Introduction – Wind energy conversion – Power produced from wind  Relationship between wind speed and power – Components of wind power plant (WPP) – Types of WPP – Selection of site for WPP – Advantages and challenges of WPP.

**UNIT IV        ENERGY FROM OTHER SOURCES**                                                                      **9**

Geothermal energy (GTE): operation of GTE power plants  Types– Advantage of GTE Tidal energy: Operation of tidal power plant – Ocean Thermal Energy Conversion system: Open and closed cycles  Fuel cell: Construction and working principle Advantage and applications of Fuel cell.

**UNIT V       DISTRIBUTED GENERATION                                                                 9**

Concept of DG – Benefits of DG – Types of DG resources – Security issues in integrating DG with power grid Energy storage elements: Batteries, supercapacitors, flywheels  Captive power plants

**Total: 45 Hours**

**COURSE OUTCOMES**

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

**CO1:** Acquire knowledge on power demand scenario of world and the importance of renewable energy sources in meeting the power demand

**CO2:** Understand the working principle of solar photovoltaic system and its applications

**CO3:** Outline the various components and performance of wind energy conversion system

**CO4:** Explain the operation of geothermal and tidal power plants, fuel cell and ocean thermal energy conversion scheme.

**CO5:** Understand the necessity of distributed generation and energy storage elements.

**CO6:** Understand about the power generation through renewable energy sources

**TEXTBOOKS:**

**T1:** Rai, G.D., "Non Conventional Energy Sources", Khanna Publishers, Sixth Edition 2017

**T2:** Khan, B.H, Non Conventional Energy Resources", Mc. Graw Hill Education Ltd, third reprint 2017.

**REFERENCEBOOKS:**

**R1:** Rao S. Paruklekar,B.B, "Energy Technology –Non Conventional, Renewable and Conventional", KhannaPublishers,1994

**R2:** John Twidell and Tony Weir, "Renewable Energy Resources", Taylor and Francis Publications, Third edition, 2015.

**R3:** Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC..

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**U19EEOE002**          **INTRODUCTION TO CONTROL SYSTEMS**          L T P C
                                                                    3 0 0 3

### COURSEOBJECTIVES

1. To understand the concepts of control systems open loop and closed loop control systems.
2. To understand the (mathematical modelling) Transfer function from mechanical, electrical, block diagram and signal flow graph.
3. To learn the concepts of steady state and transient responses from first and second order systems at different inputs and also steady state errors.
4. To learn the stability concepts are Root locus, Bode plot and Polar plot
5. To learn the concept of state space analysis applying on multi input/output state of the system to find the stability.

### PREREQUISITES

- Basic concepts of circuit analysis
- Fundamentals of electrical engineering
- Basic concepts of Differentiation
- Basic concepts of Integration

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | 2 | 2 | | 1 | 3 | | | | 2 | | 3 | 3 | 2 |
| CO2 | 3 | | 2 | 2 | | 1 | 3 | | | | 2 | | 2 | 2 | 2 |
| CO3 | 3 | | 2 | 2 | | 1 | 3 | | | | 2 | | 2 | 3 | 3 |
| CO4 | 3 | | 2 | 2 | | 1 | 3 | | | | 2 | | 1 | 2 | 2 |
| CO5 | 3 | | 2 | 2 | | 1 | 3 | | | | 2 | | 2 | 2 | 2 |
| CO6 | 3 | | 2 | 2 | | 1 | 3 | | | | 2 | | 3 | 2 | 2 |

**UNITI          INTRODUCTION          9**

Concepts of control systems open loop and closed loop control systems and their differences different examples of control systems classification of control systems, feedback characteristics, effects of feedback. Mathematical models differential equations, impulse response and transfer functions.

**UNITII          TRANSFER FUNCTION REPRESENTATION          9**

Block diagram representation of systems considering electrical systems as examples block diagram algebra representation by signal flow graph reduction using mason's gain formula.

**UNITIII          TIME RESPONSE ANALYSIS          9**

Standard test signals time response of first order systems characteristic equation of feedback control systems, transient response of second order systems time domain specifications steady state response steady state errors and error constants effects of proportional derivative, proportional integral systems, PID controllers.

**UNITIV          STABILITY AND FREQUENCY RESPONSE ANALYSIS          9**

The concept of stability routh's stability criterion The root locus concept –construction of root loci effects of adding poles and zeros to G(S) H(S) on the root loci  Frequency domain specifications  bode diagrams determination of frequency domain specifications and transfer function from the bode diagram phase margin and gain margin stability analysis from bode plots. Polar plots.

Concepts of state, state variables and state model, derivation of state models from block diagrams, diagonalization solving the time invariant state equation state transition matrix and it's properties concepts of controllability and observability.

**Total: 45 Hours**

### COURSE OUTCOMES

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

**CO1:** Acquire knowledge on power demand scenario of world and the importance of renewable energy sources in meeting the power demand

**CO2:** Understand the working principle of solar photovoltaic system and its applications

**CO3:** Outline the various components and performance of wind energy conversion system

**CO4:** Explain the operation of geothermal and tidal power plants, fuel cell and ocean thermal energy conversion scheme.

**CO5:** Understand the necessity of distributed generation and energy storage elements.

**CO6:** Understand about the power generation through renewable energy sources

### TEXTBOOKS:

**T1:** C. Kuo, Automatic Control Systems, 8th edition, John Wiley and sons, India, 2003

**T2:** J. Nagrath, M. Gopal, Control Systems Engineering, 2nd edition, New Age International (P) Limited, New Delhi.

### REFERENCEBOOKS:

**R1:** Katsuhiko Ogata, Modern Control Engineering, 3rd edition, Prentice Hall of India Pvt. Ltd., India, 1998

**R2:** Norman S. Nice, Control Systems Engineering, 6th edition, John Wiley, India, 2015

**R3:** N. K. Sinha(1998), Control Systems, 3rd edition, New Age International (P) Limited Publishers, India.

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| | | L | T | P | C |
|---|---|---|---|---|---|
| U19EEOE003 | SENSORS AND TRANSDUCERS | 3 | 0 | 0 | 3 |

**Course Objectives:**

**COURSE OBJECTIVES**

- To understand the concepts of measurement technology
- To learn the various sensors used to measure various physical parameters
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | - | 3 | - | 3 | 2 | - | - | 2 | - | 2 | - | 2 | 2 | 2 |
| CO2 | 2 | - | 3 | - | 3 | 2 | - | - | 2 | - | 2 | - | 3 | 2 | 2 |
| CO3 | 2 | - | 3 | - | 3 | 2 | - | - | 2 | - | 2 | - | 2 | 3 | 3 |
| CO4 | 2 | - | 3 | - | 3 | 2 | - | - | 2 | - | 2 | - | 3 | 2 | 2 |
| CO5 | 2 | - | 3 | - | 3 | 2 | - | - | 2 | - | 2 | - | 2 | 2 | 2 |
| CO6 | 2 | - | 3 | - | 3 | 2 | - | - | 2 | - | 2 | - | 3 | 2 | 1 |

**UNIT I          INTRODUCTION                                                                                              9**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

**UNIT II              MOTION, PROXIMITY AND RANGING SENSORS                                          9**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

**UNIT III              FORCE, MAGNETIC AND HEADING SENSORS                                                9**

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

**UNIT IV              OPTICAL, PRESSURE AND TEMPERATURE SENSORS                                   9**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors  Smart Sensors  Film sensor, MEMS & Nano Sensors, LASER sensors.

**UNIT V              SIGNAL CONDITIONING AND DAQ SYSTEMS                                               9**

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging  applications  Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

**Total: 45 Hours**

**Course Outcomes:**

At the end of the course, students should be able to,

**CO1:** Expertise in various calibration techniques and signal types for sensors.

**CO2:** Understand about the various sensors

**CO3:** Apply the various sensors in the Automotive and Mechatronics applications

**CO4:** Study the basic principles of various smart sensors.

**CO5:** Implement the DAQ systems with different sensors for real time applications

**CO6:** Understand about different sensors with applications

**Textbooks:**

**T1.** Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGrawHill, 2009.

**T2.** Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

**Reference Books:**

**R1.** Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2010.

**R2.** John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999

**R3.** Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press,2015.

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**U19EEOE004**                                    **ENERGY TECHNOLOGY**                    | L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**
- Students will gain knowledge about different energy scenario
- To understand about the conventional energy sources.
- To understand about the nonconventional energy sources.
- To understand about the biomass energy sources.
- To learn the concept of energy conservation

**PREREQUISITES**
- Fundamentals of electrical engineering
- Basic concepts of Differentiation and Integration

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 3 | - | 3 | - | 2 | - | 2 | - | 2 | - | 2 | 2 | 2 |
| CO2 | 2 | 1 | 3 | - | 3 | - | 2 | - | 2 | - | 2 | - | 2 | 2 | 2 |
| CO3 | 2 | 1 | 3 | - | 3 | - | 2 | - | 2 | - | 2 | - | 2 | 3 | 3 |
| CO4 | 2 | 1 | 3 | - | 3 | - | 2 | - | 2 | - | 2 | - | 3 | 2 | 3 |
| CO5 | 2 | 1 | 3 | - | 3 | - | 2 | - | 2 | - | 2 | - | 2 | 3 | 2 |
| CO6 | 2 | 1 | 3 | - | 3 | - | 2 | - | 2 | - | 2 | - | 3 | 2 | 1 |

**UNIT I**          **ENERGY**                                                                                 **9**

Introduction to energy – Global energy scene – Indian energy scene  Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives.

**UNIT II**          **CONVENTIONAL ENERGY**                                                      **9**

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants

**UNIT III**          **NONCONVENTIONAL ENERGY**                                                **9**

Solar energy, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, energy plantations. Wind energy, types of windmills, types of wind rotors, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

**UNIT IV**          **BIOMASS ENERGY**                                                              **9**

Biomass origin  Resources – Biomass estimation. Thermo chemical conversion – Biological conversion,– Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.

**UNIT V**          **ENERGY CONSERVATION**                                                     **9**

Energy conservation  Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management.

**Total: 45  Hours**

**COURSE OUTCOMES**

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

**CO1:** Understand energy scenario in India

**CO2:** Understand conventional Energy sources,

**CO3:** Understand Non- conventional Energy sources,

**CO4:** Understand biomass sources and develop design parameters for equipment to be used in Chemical process industries

**CO5:** Understand energy conservation in process industries

**CO6:** Understand about different energy technology

**TEXT BOOKS:**

**T1:** Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.

**T2:** Rai, G.D., Nonconventional Energy Sources, Khanna Publishers, New Delhi, 1984.

**T3:** Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

**REFERENCE BOOKS:**

**R1:** Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York.

**R2:** Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008

**R3:** El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.

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| | | | L | T | P | C |
|---|---|---|---|---|---|---|
| **U19ECOE001** | **SOFT COMPUTING** | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES**
- **T**o learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

**PREREQUISITES**
- Basic concepts of communication theory
- Basics of Computer Networks
- Basics of Biological systems
- Linear Algebra

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO6 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |

**UNIT I    INTRODUCTION TO SOFT COMPUTING                                    9**

Introduction Artificial Intelligence -Artificial Neural Networks Fuzzy Systems Genetic Algorithm and Evolutionary Programming Swarm Intelligent Systems Classification of ANNs-McCulloch and Pitts Neuron Model Learning Rules: Hebbian and Delta Perceptron Network Adaline Network Adaline Network.

**UNIT II    ARTIFICIAL NEURAL NETWORKS                                        9**

Back propagation Neural Networks  Kohonen Neural Network Learning Vector Quantization Hamming Neural Network  Hopfield Neural Network Bidirectional Associative Memory Adaptive Resonance Theory Neural Networks Support Vector Machines  Spike Neuron Models.

**UNIT III    FUZZY SYSTEMS                                                          9**

– Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets  Classical Relations and Fuzzy Relations Membership Functions Defuzzification  Fuzzy Arithmetic and Fuzzy Measures  Fuzzy Rule Base and Approximate Reasoning Introduction to Fuzzy Decision Making.

**UNIT  IV    GENETIC ALGORITHMS                                                 9**

Basic Concepts Working Principles Encoding Fitness Function  Reproduction  Inheritance Operators  Cross Over Inversion and Deletion Mutation Operator  Bitwise Operators Convergence of Genetic Algorithm.

**UNIT V         HYBRID SYSTEMS**                                                                9

Hybrid Systems Neural Networks, Fuzzy Logic and Genetic GA Based Weight Determination  LRType Fuzzy Numbers  Fuzzy Neuron  Fuzzy BP Architecture  Learning in Fuzzy BP Inference by Fuzzy BP  Fuzzy ArtMap: A Brief Introduction  Soft Computing Tools  GA in Fuzzy Logic Controller Design  Fuzzy Logic Controller

                                                                                              **Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:**    Apply suitable neural computing techniques for various applications.

**CO2:**    Explain various ANN models

**CO3:**    Apply fuzzy concepts for various applications

**CO4:**    Apply genetic algorithms to solve problems

**CO5:**    Integrate various soft computing techniques for complex problems.

**CO6:**    Apply neural techniques for various applications

**TEXT BOOKS:**

**T1:**    N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.

**T2:**    S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.

**T3:**    S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

**REFERENCE  BOOKS:**

**R1:**    JyhShing Roger Jang, ChuenTsai Sun, EijiMizutani, —NeuroFuzzy and Soft Computing, Prentice Hall of India, 2002.

**R2:**    Kwang H.Lee, —First course on Fuzzy Theory and Application, Springer, 2005.

**R3:**    George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic Theory and Applications, Prentice Hall, 1996.

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| | | L | T | P | C |
|---|---|---|---|---|---|
| **U19ECOE003** | **CONSUMER ELECTRONICS** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- .Understand troubleshooting in loudspeakers and Microphones
- Gain knowledge on television signals and components
- Gain knowledge on various types of audio recording and playback techniques
- Understand communication systems
- Understand principle of working of home appliances

**PREREQUISITES**

- Basic Electronics
- Electronic devices

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |

**UNIT I          LOUDSPEAKERS AND MICROPHONES                                                                9**

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones

**UNIT II          TELEVISION STANDARDS AND SYSTEMS                                                      9**

Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes  Colour TV systems – NTSC, PAL,SECAM  Components of a Remote Control.

**UNIT III          OPTICAL RECORDING AND REPRODUCTION                                                9**

Audio Disc – Processing of the Audio signal – read out from the Disc –Reconstruction of the audio signal – Video Disc – Video disc formats recording systems – Playback Systems.

**UNIT IV          TELECOMMUNICATION SYSTEMS                                                                9**

Telephone services  telephone networks – switching system principles –PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modem

**UNIT V          HOME APPLIANCES                                                                                        9**

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Troubleshoot different types of microphones and speakers

**CO2:** Maintain audio systems

**CO3:** Analyse composite video signal used in TV transmission

**CO4:** Troubleshoot TV Receivers

**CO5:** Maintain various home appliances

**TEXT BOOKS:**

**T1:** S.P.Bali, "Consumer Electronics", Pearson Education, 2005.

**T2:** Gupta. R.G, " Audio Video Systems principles maintenance and trouble shooting, Mc graw Hill, New Delhi, India, 2010

**REFERENCE BOOKS:**

**R1:** Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006

**R2:** Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015

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**ADVANCED WIRELESS COMMUNICATION**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

### COURSE OBJECTIVES

- To expose the students to the importance of improving capacity of wireless channel using MIMO
- To enable understanding of channel impairment mitigation using space time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MUMIMO System and MIMOOFDM systems

### PREREQUISITES

- Basic concepts of communication theory
- Basics of Computer Networks
- Limits and Continuity
- Basic concepts of Differentiation
- Basic concepts of Integration

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO6 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |

### UNITI          CAPACITY OF WIRELESS CHANNELS                                                9

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to theTX – capacity of deterministic channels, Random channels and frequency selective channels..

### UNITII          RADIO WAVE PROPAGATION                                                        9

Radio wave propagation – Macroscopic fading free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods

### UNITIII
#### SPACE TIME BLOCK CODES                                                                           9

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation – decoding of STBC.

### UNITIV          SPACE TIME TRELLIS CODES                                                       9

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC..

## UNIT V        LAYERED SPACE TIME CODES                                    9

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF Vblast Rx MMSE Vblast Rx, Iterative Rx  capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

**Total:45 Hours**

### COURSE OUTCOMES

**At the end of the course students should be able to**

**CO1:** Comprehend and appreciate the significance and role of this course in the present contemporary world

**CO2:** Apply the knowledge about the importance of MIMO in today's communication

**CO3:** Appreciate the various methods for improving the data rate of wireless systems

**CO4:** Explain the working of layered space time transmitter and receiver

**CO5:** Describe various radio propagation techniques

**CO6:** Explain various MIMO systems

### TEXT BOOKS:

**T1:** Mohinder Jankiraman, Spacetime codes and MIMO systems, Artech House, Boston, London . www.artech house.com, ISBN 15805386572004

**T2:** Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.

**T3:** S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

### REFERENCEBOOKS:

**R1:** David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.

**R2:** Sergio Verdu — Multi User Detection Cambridge University Press, 1998

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| U19ECOE006 | MEDICAL ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques

**PREREQUISITES:** Basic Electronics, Electronic devices

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |
| CO6 | 3 | 2 | 2 | 2 | | | | | | | 2 | 1 | 3 | 3 | 1 |

**UNITI          ELECTROPHYSIOLOGY AND BIOPOTENTIAL RECORDING                          9**

Sources of bio medical signals, Biopotentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

**UNITII          NON ELECTRICAL PARAMETER MEASUREMENTS                          9**

Blood flow mete-rTypes, Cardiac output measurements-Types, respiratory measurement, blood pressure measurement, temperature and pulse measurement, Blood Cell Counters

**UNITIII          THERAPEUTIC EQUIPMENTS                          9**

Cardiac pacemakers  types, Cardiac defibrillators-types, Dialyzers, Heart Lung Machines –Oxygenations, Diathermies Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy

**UNITIV          MEDICAL IMAGING                          9**

X-Ray machine, computer axial tomography CT scans, Positron Emission Tomography PET Scans. MRI and NMR Ultrasonic Imaging systems, Medical Thermograph

**UNITV          RECENT TRENDS IN MEDICAL INSTRUMENTATION AND APPLICATION IN MEDICINE          9**

Bio medical telemetry remote patient monitoring systems, Telemedicine, Radio pill, Application of cryogenics in medicine, Application of LASERS in medicines. Diagnosis of Cancers and tumors using image processing, diagnosis of dental plague using image processing, diagnosis of various eye problems using image processing

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

| | |
|---|---|
| **CO1:** | Know the human body electro- physiological parameters and recording of bio-potentials |
| **CO2:** | Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc. |
| **CO3:** | Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators |
| **CO4:** | Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods |
| **CO5:** | Know about recent trends in medical instrumentation |
| **CO6:** | Implement application of Instruments |

**TEXT BOOKS:**

| | |
|---|---|
| **T1:** | Leslie Cromwell, Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi,  2007. (UNIT I – V) |
| **T2:** | Khandpur, R.S., -Handbook of Biomedical Instrumentation‖, TATA Mc Graw Hill, New Delhi, 2003.(UNIT I – V) |

**REFERENCE BOOKS:**

| | |
|---|---|
| **R1:** | Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006 |
| **R2:** | Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015 |

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| U19FTOE001 | FOOD SCIENCE AND NUTRITION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

ain the basic concepts of food and nutrition. Define the overall classification, function, and source of carbohydrates, lipids and proteins. Discuss the overall aspects of vitamins. Outline the role of health and nutritional importance of micro and macro minerals. Summarize the recent trends in nutrition

**PREREQUISITES**

- Basic idea on biomolecules
- Knowledge of essential nutrition requirement
- Health benefits and function of nutrition
- Diet based nutrition
- Effect of storage and processing on nutrition

**UNIT I    HUMAN NUTRITION                                          9**

Historical perspective of nutrient requirements – Assessment of nutritional status – recommended dietary allowances of macronutrients for all age groups – Assessment of protein quality – Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

**UNIT II        BIOMOLECULES                                        9**

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Refined & Hydrogenated fats process. Proteins – Definitions, Classification, Function, Amino Acids, Sources of Proteins.

**UNIT III        VITAMINS                                            9**

Physiological role, bio-availability, requirements, sources and deficiency of Fat Soluble Vitamins: Vitamin A, Vitamin D, E & K. Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.

**UNIT IV        MINERALS                                            9**

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.

**UNIT V        RECENT TRENDS IN DIETETICS                            9**

Principles of dietary management in gout, rheumatism, AIDS/HIV – Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

                                                                    Total: 45 Hours

**COURSE OUTCOMES**

At the end of the course students should be able to

| CO1: | scuss the basics in the area of nutritional assessment in health and disease and to categorize the recommended dietary allowances for different age groups |
|---|---|
| CO2: | press the classifications, functions and sources of carbohydrates, lipids and proteins |
| CO3: | t the various attributes of fat- and water-soluble vitamins |
| CO4: | Report the role, bioavailability, sources and deficiency diseases of macro and micro minerals |
| CO5: | Recognize the diets and concepts of foods suggested for nutritional, chronic and acute disorders |
| CO6: | Classify and to analyse the different techniques of qualitative and quantitative analysis |

**Course Articulation Matrix**

| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | 1 | |
| 2 | 3 | 2 | | 3 | | | | | | | | | | 1 | |
| 3 | 1 | 3 | | | 3 | | | 2 | | | | | | | 1 |
| 4 | 1 | | | | 3 | | | 2 | | | | | | | 1 |
| 5 | | | | | | | | | | | | | | | |
| 6 | 1 | 1 | | 2 | | | | | | | | | | | |

3 – High, 2 – Medium, 1 – Low

TEXT BOOKS:

T1: Gordon M. Wardlaw. Perspectives in Nutrition. WCB McGraw-Hill Publishers, Boston, 9th Edition. 2013.

T2: Shubhangini A. Joshi. Nutrition and Dietetics. Tata Mc Grow- Hill publishing Company Ltd, New Delhi. 4th Edition. 2016.

T3: Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017.

REFERENCE BOOKS:

R1: Ronald Ross Watson. Functional foods and Nutraceuticals in Cancer Prevention. Ed. Wiley – Blackwell. 2003.

R2: Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018.

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| U19FTOE002 | FOOD PRESERVATION TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Course Objectives**

To introduce the students to the area of Food Processing and preservation.

To have an effective understanding of food processing and technology subjects.

To enable students to appreciate the importance of food processing with respect to the large-scale production.

To import knowledge on processing of food waste

**Course Outcomes**

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

C01: Describe the fundamentals of food processing and preservation

C02: Familiar with the functional properties of Carbohydrates, fats, lipids, proteins in food

C03: Knowledge about the importance of food additives and their function and will develop strategies that will promote food safety and prevent food borne illness

C04: Analyze the uses of enzymes, modified proteins and develop novel products, explain, analyze and evaluate scenarios related to various unit operations in food processing and preservation

C05: Identify spoilage and deterioration mechanism in food and methods to control deterioration and spoilage

C06: Demonstrate packing methods, materials and factors affecting food packing

**Course Articulation Matrix**

| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | 3 | | | | | | | | | | | | 3 |
| 2 | 3 | | | | | | | | | | | | | | 3 |
| 3 | 2 | | 3 | | | | | | | | | | 3 | | 2 |
| 4 | 3 | 3 | 2 | | | | | | | | 3 | | | 2 | |
| 5 | | 3 | 2 | | | | | | | | 3 | | | 2 | |
| 6 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | | | | | | | | |

3 - High, 2 - Medium, 1 – Low

**UNIT I          PROCESSING OF FOOD AND ITS IMPORTANCE                    9**

Source of food - significance for processing and preservation of foods – Different food groups-, food pyramids, classification and functions, cooking of foods – methods and cooking media, advantages of processing of foods, changes of nutritional components in cooking, effects of processing of foods on anti-nutritional components.

**UNIT II          FOOD COMPONENTS                    9**

Classification, Structure, nutritive value, processing outlines of major Cereals and millets-Pulses-fruits and vegetables, fats, oilseeds and nuts. Major and minor nutrients, sugar and related products, spices and aromatics, beverages and appetizers, organic foods

**UNIT III          PROCESSING OF ANIMAL FOODS                    9**

Meat, Poultry and Fish-Structure, composition, nutritive value and processing outline. Processing of milk and milk products, egg processing and storage, need and nutritional benefits of animal products, value added products

**UNIT IV          INTRODUCTION TO FOOD PROCESSING AND PRESERVATION                    9**

Food spoilage, fermentation, methods of preservation - High temperature and Low temperature Preservation, traditional methods of food processing and preservation, radiation processing, microwave, non-thermal techniques. Role of enzymes and additives in food preservation

**UNIT V          FOOD PACKAGING AND QUALITY**                                                              9

Food packaging – importance, types and functions, packaging materials – synthetic and natural, Impact of packaging materials on food quality, shelf-life of foods, bottling and canning, nutritional labelling, labelling of vegan and animal based products

**TOTAL: 45 Hours**

TEXT BOOKS
1. Karnal, Marcus and D.B. Lund "Physical Principles of Food Preservation". Rutledge, 2003.
2. Sivasankar, B. "Food Processing & Preservation", Prentice Hall of India, 2002.

**REFERENCES**
1. Khetarpaul, Neelam, "Food Processing and Preservation", Daya Publications, 2005

WEBSITES:
1. https://www.heartfoundation.org.nz/educators/edu-resources/food-tech
2. https://www.stemcrew.org/guides/subjects/food-technology-teaching-resources/

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| | L | T | P | C |
|---|---|---|---|---|
| **U19FTOE003**        **BEVERAGE TECHNOLOGY** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

Impart knowledge on processing and ingredients applied for beverage preparation according to the standard categorization of beverages. Based on the ingredients incorporated and type of processing method applied will give a classification of beverages. Sanitization schemes and quality control measures according to standards and regulations.

**PREREQUISITES**

- Basic classification of beverages in the market
- Storage and preparation of beverages
- Purpose of preparing beverages
- Market and trends in beverages sector

**UNIT I        INGREDIENTS IN BEVERAGES                                         9**

Beverage definition ingredients water, quality evaluation and raw and processed water, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nano emulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

**UNIT II        CARBONATED BEVERAGES                                         9**

Procedures ingredients preparation of Syrup making, carbonation of soft drinks. Carbonation equipments and machineries containers and closures. low-calorie and dry beverages; isotonic and sports drinks; Fruit based carbonated beverages, carbonated water

**UNIT III        NONCARBONATED BEVERAGES                                         9**

Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy based beverages, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages. bottled. Water; mineral water, natural spring water, flavored water.

**UNIT IV        ALCOHOLIC BEVERAGES                                         9**

Alcoholic beverages types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipment's used for brewing and distillation, wine and related beverages, distilled spirits

**UNIT V        SANITATION AND QUALITY CONTROL                                         9**

Quality control, Filling inspection and quality controls sanitation and hygiene in beverage industry Quality of water used in beverages threshold limits of ingredients. FSSAI, EFSA and FDA regulations

**Total: 45  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

CO1:Capable of formulating beverages using various ingredients.
CO2:Demonstrate various unit operations involved in the food beverage manufacturing
CO3:Understand the various production techniques in beverages
CO4:Evaluate the quality parameters of all beverages
CO5:Familiarize with food laws and regulations of beverages

**Course Articulation Matrix**

| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| 1 | 3 | 2 | | | | | | | | | | | | | |
| 2 | 1 | 3 | | | | | | | | | | | | 1 | |
| 3 | 1 | | | 3 | | | | | | | | | | 1 | |
| 4 | | | | | 3 | | | 2 | | | | | | | 1 |
| 5 | | | | | 3 | | | 2 | | | | | | | 1 |
| 6 | 1 | 1 | | 2 | | | | | | | | | | | |

3 High, 2 Medium, 1 – Low

**TEXT BOOKS**:

T1:  L.Jagan Mohan Rao and K.Ramalakshmi (2011)"Recent trend in Soft beverages", Woodhead Publishing India Pvt Ltd.

T2:  Boulton, Christopher, and David Quain (2008) Brewing yeast and fermentation. John Wiley & Sons.

**REFERENCE BOOKS**:

R1:  Hui, Yiu H., et al., eds. (2004) Handbook of food and beverage fermentation technology. Vol. 134. CRC Press.

R2:  Mitchell, Alan J. (199) "Formulation and Production Carbonated Soft Drinks". Springer Science & Business Media.

R3:  Woodroof, Jasper Guy, and G. Frank Phillips. (1981) Beverages: carbonated and noncarbonated. AVI Pub. Co

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| | L | T | P | C |
|---|---|---|---|---|
**U19FTOE004**         **PRINCIPLES OF FOOD MATERIALS**        **L** **T** **P** **C** / **3** **0** **0** **3**

**COURSE OBJECTIVES**

- Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oil seeds.
- Summarize the production and processing methods of fruits and vegetables and to discuss the chemical composition, processing, production, spoilage and quality of milk and milk product.
- Outline the overall processes involved in the production of meat, poultry and fish products Review the production and processing methods of plantation and spice products

**PREREQUISITES**

- Need an idea of nature of food materials to be handled
- Prior storage conditions before processing the materials
- Basic handling techniques of materials
- Preparation of materials prior to processing

**UNITI      CEREAL, PULSES AND OIL SEEDS TECHNOLOGY             9**

Rice milling, Pulse milling, Wheat milling - Oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies -Pasta products -Tortilla - Method of manufacture.

**UNITII      FRUITS AND VEGETABLE PROCESSING                9**

Production of Fruits and vegetables in India, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing.

**UNITIII      DAIRY PROCESSING                     9**

Basic dairy terminology, composition, General tests at reception, Dairy Processing - Method of manufacture of Standardized, toned and double toned milk, milk powder - Equipment - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products – Ice cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk.

**UNITIV      MEAT, POULTRY AND FISH PROCESSING             9**

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Fish and other Marine Products Processing.

**UNITV      PLANTATION PRODUCT TECHNOLOGY               9**

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course student should be able to

CO1:     Discuss the various processing technologies involved in cereal, pulses and oilseed technology

CO2:     Demonstrate the major operations applied in fruits and vegetable processing

CO3:     Illustrate the techniques involved in the processing of dairy products

CO4:     List the overall processing of meat, poultry and fish processing

CO5:     Outline the processing of spices and plantation products

CO6:     Analyse the manufacturing methods involved in various byproducts of food materials

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | | | | | | | | | | | | | |
| CO2 | 1 | 3 | | 3 | | | | | | | | | | | |
| CO3 | 1 | | | | | | | | | | | | | 1 | |
| CO4 | | | | | | 3 | | | 2 | | | | | 1 | |
| CO5 | | | | | | 3 | | | 2 | | | | | | 1 |
| CO6 | 1 | 1 | | 2 | | | | | | | | | | | 1 |

TEXT BOOKS:

T1: Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010.

T2: Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003.

REFERENCEBOOKS:

R1: Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23rd impression. 2016.

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| U19ITOE001 | UX/UI DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**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..

**PREREQUISITES: NIL**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 3 | | 2 | | | | 3 | | 2 | 2 | 3 | 3 | 2 |
| CO2 | 3 | 2 | 3 | | 2 | | | | 3 | | 2 | 2 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 3 | | 2 | | | | 3 | | 2 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | | 2 | | | | 3 | | 2 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | | 2 | | | | 3 | | 2 | 2 | 3 | 3 | 2 |
| CO6 | 3 | 2 | 3 | | 2 | | | | 3 | | 2 | 2 | 3 | 3 | 2 |

**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
126

**UNIT III         FOUNDATIONS OF UX DESIGN**                                   **9**

⎯   Introduction to User Experience  Why You Should Care about 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**

Sketching Principles  Sketching Red Routes  Responsive Design – Wireframing  Creating Wire flows  Building a Prototype  Building High Fidelity Mockups  Designing Efficiently with Tools  Interaction Patterns  Conducting Usability Tests  Other Evaluative User Research Methods  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  Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Understand the principles of UI and UX design, including usercentered design, information architecture, visual hierarchy, and usability testing.

**CO2:** Build UI for user Applications

**CO3:** Evaluate UX design of any product or application

**CO4:** Demonstrate UX Skills in product development

**CO5:** Implement Sketching principles

**CO6:** Create Wireframe and Prototype

**TEXT BOOKS:**

**T1:** Weathers David. (2021). "UX/UI Design 2021 For Beginners: A Simple Approach to UX/UI Design for Intuitive Designers" (ISBN13 : 9798719605470)

**T2:** Branson Steven (June 2020) "UX / UI Design: Introduction Guide To Intuitive Design And User Friendly Experience" (ISBN13 : 9798653877315)

**T3:** Anderson Gail. (2016). "The Typography Idea Book: Inspiration from 50 Masters" (ISBN10 : 1780678495, ISBN13 : 9781780678498)

**T4:** SladeBrooking Catharine (2016). "Creating a Brand Identity: A Guide for Designers: (Graphic Design Books, Logo Design, Marketing". (ISBN10 : 1780675623, ISBN13 : 9781780675626)

**REFERENCE BOOKS:**

**R1:** A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing, USA, 2012

**R2:** The Elements of User Experience: UserCentered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011.

**R3:** The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007.

**R4:** The UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha S. Pyla, Elsevier, 2012

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**U19ITOE002**                                **MULTIMEDIA SYSTEMS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- Students will be able to understand the relevance and underlining infrastructure of multimedia system.
- The purpose of the course for the students is to apply contemporary theories of multimedia learning to the development of multimedia products.
- Analyze instructional and informational media (audio/ visual materials, web based materials, games and simulations etc) applied with multimedia techniques.
- Acquire knowledge about multimedia software tools.

To understand the multimedia systems components, evolving technologies and fundamental elements of any multimedia system.

**PREREQUISITES: NIL**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 3 | | 3 | 2 | 2 | | | 3 | 2 | | 2 | | 3 |
| CO2 | 3 | 2 | 3 | | 3 | 2 | 2 | | | 3 | 2 | | 2 | | 3 |
| CO3 | 3 | 2 | 3 | | 3 | 2 | 2 | | | 3 | 2 | | 2 | | 3 |
| CO4 | 3 | 2 | 3 | | 3 | 2 | 2 | | | 3 | 2 | | 2 | | 3 |
| CO5 | 3 | 2 | 3 | | 3 | 2 | 2 | | | 3 | 2 | | 2 | | 3 |
| CO6 | 3 | 2 | 3 | | 3 | 2 | 2 | | | 3 | 2 | | 2 | | 3 |

**UNIT I**         **INTRODUCTION, MEDIA AND DATA STREAMS, AUDIO TECHNOLOGY**       8

Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases. Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces &Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete& Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams. Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.

**UNIT II**         **GRAPHICS AND IMAGES, VIDEO TECHNOLOGY, COMPUTERBASED ANIMATION**       8

Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options. Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modelling Language.

**UNIT III**       **DATA COMPRESSION**        **9**

Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT based Mode, Expanded Lossy DCT based Mode, Lossless Mode, Hierarchical Mode. H.261 (Px64) andH.263: Image Preparation, Coding Algorithms, Data Stream, H.263+ and H.263L; MPEG: Video Encoding, Audio Coding, Data Stream, MPEG2, MPEG4, MPEG7; Fractal Compression.

**9**

**UNIT IV**       **OPTICAL STORAGE MEDIA & CONTENT ANALYSIS**

History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CDROM Extended Architecture; Further CDROMBased Developments; Compact Disc Recordable; Compact Disc MagnetoOptical; Compact Disc Read/Write; Digital Versatile Disc.
Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

**UNIT V**       **DATA AND FILE FORMAT STANDARDS &MULTIMEDIA APPLICATION DESIGN**     **11**

RichText Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1:** Acquire knowledge about the fundamentals of handling multimedia data, compression / decompression and various media file formats.

**CO2:** Understand the underlying principles of processing various multimedia data.

**CO3:** Understand the working principles of various multimedia inputoutput devices.

**CO4:** Gain knowledge about various multimedia related standards.

**CO5:** Understand the technologies of multimedia used in Internet and its applications.

**CO6:** Understand the design and development process of multimedia projects.

**TEXT BOOKS:**

**T1:** Tim Morris, "Multimedia Systems Delivering, Generating and Interacting with Multimedia", 2012, Springer London.

**REFERENCE BOOKS:**

**R1:** ZeNian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia (2nd ed.)", 2014, Springer International Publishing.

**R2:** Tay Vaughan, "Multimedia making it work", 2014, McGrawHill Education; 9 edition

**R3:** An Introduction to Digital Multimedia 2nd Edition, 2013, Jones & Bartlett Learning; 2 edition, ISBN 144968839X9781449688394.

**R4:** Vic Costello, "Multimedia Foundations: Core Concepts for Digital Design, 2nd Edition", 2017, T&F/FOCAL PRESS.

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| U19ITOE003 | FOUNDATIONS OF INFORMATION TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- Understand the basic concepts and terminology of information technology
- Identify the components of a computer system and their functions
- Describe different types of software and their applications
- Explain the principles of computer networking and internet technologies
- Understand the basics of database design and management
- Use IT effectively in personal and professional settings

**PREREQUISITES: Nil**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | 3 | | | 2 | | 2 | | 3 | 2 | 3 | 3 | | 3 |
| CO2 | 3 | | 3 | | | 2 | | 2 | | 3 | 2 | 3 | 3 | | 3 |
| CO3 | 3 | | 3 | | | 2 | | 2 | | 3 | 2 | 3 | 3 | | 3 |
| CO4 | 3 | | 3 | | | 2 | | 2 | | 3 | 2 | 3 | 3 | | 3 |
| CO5 | 3 | | 3 | | | 2 | | 2 | | 3 | 2 | 3 | 3 | | 3 |
| CO6 | 3 | | 3 | | | 2 | | 2 | | 3 | 2 | 3 | 3 | | 3 |

**UNIT I          BASICS OF INFORMATION TECHNOLOGY                                         9**

Internet: World Wide Web, Web servers, Web Clients, Web sites, Web Pages, Web Browsers, Blogs, News groups, HTML, Web address, Email address, URL, HTTP, FTP, downloading and uploading files from remote site; Services available on Internet: Information Retrieval, Locating sites using search engines and finding people on the net; Web Services: Chat, email, Video Conferencing, eLearning, eBanking, eShopping, eReservation, eGovernance, eGroups, Social Networking

**UNIT II          INFORMATION PROCESSING TOOLS                                         9**

Office Tools: Database Management Tool: Basic Concepts and need for a database, Creating a database. Datatypes Text, Number, Date, Time, Setting the Primary Key, Entering data into a database, Inserting and deleting Fields, Inserting and deleting Records, Field Size, Default Value, Creating Query using Design view.

**UNIT III          HYPER TEXT MARKUP LANGUAGE                                         9**

Introduction to Web Page Designing using HTML, Creating and saving an HTML document, accessing a web page using a web browser (Google Chrome, Internet Explorer, Mozilla Firefox, Opera, Apple Safari, Net scape Navigator); Elements in HTML.

**UNIT  IV          XML                                                                                                 9**

Introduction to XML, Difference between XML and HTML with respect to the following: Data separation, data sharing, document structure, tags, nesting of elements, attributes, values. XML Elements  Defining own tags in XML, root elements, child elements and their attributes; Comments in XML, White space and new line in XML, well formed XML documents, validating XML documents, XML Parser, Viewing XML documents in a web browser.

**UNIT V          Societal Impacts of IT                                                        9**

Information Security: Virus, Worms, Trojans and AntiVirus Software, Spyware, Malware, Spams, Data Backup and recovery tools and methods, Online Backups, Hacker and Cracker with regard to Computer Data and Applications, Social Networking Information security provisions in ecommerce, Benefits of ICT in Education, Healthcare, Governance, Virtual, School, emergence of Knowledge economy, Impact of ICT on Society: Knowledge based society, Infomania, Digital Unity and Digital Divide

**Total:45 Hours**

**COURSE OUTCOMES**

**At the end of the course students should be able to**

**CO1:**  Understand fundamental concepts, principles, and applications of information technology

**CO2:**   Understand the different types of software and their applications

**CO3:**   Understand the basics of database design and management.

**CO4:**  Understand the role of information systems in organizations and their applications

**CO5:**  Understand the principles of computer networking and internet technologies

**Co6 :**  Apply IT effectively in personal and professional settings.

**TEXT BOOKS:**

**T1:**       Introduction to Information Technology" by Turban, Rainer, and Potter (Wiley, 2015)

**T2:**       Discovering Computers" by Vermaat, Sebok, and Freund (Cengage Learning, 2019)

**REFERENCEBOOKS:**

**R1:**       Computer Science Illuminated" by Nell Dale and John Lewis (Jones & Bartlett Learning, 2018)

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| U19ITOE004 | WEB DESIGN AND MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**
- To Learn the basic concepts in HTML, CSS, Javascript
- To Understand the responsive design and development
- To Understand the responsive design and development
- To Design a Website with HTML, JS, CSS / CMS  Word press

**PREREQUISITES: Nil**

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | | 3 | | 3 | 3 | 2 | | 3 | | 3 | 3 | 3 | | 3 |
| CO2 | 3 | | 3 | | 3 | 3 | 2 | | 3 | | 3 | 3 | 3 | | 3 |
| CO3 | 3 | | 3 | | 3 | 3 | 2 | | 3 | | 3 | 3 | 3 | | 3 |
| CO4 | 3 | | 3 | | 3 | 3 | 2 | | 3 | | 3 | 3 | 3 | | 3 |
| CO5 | 3 | | 3 | | 3 | 3 | 2 | | 3 | | 3 | 3 | 3 | | 3 |
| CO6 | 3 | | 3 | | 3 | 3 | 2 | | 3 | | 3 | 3 | 3 | | 3 |

**UNIT I        WEB DESIGN  HTML MARKUP FOR STRUCTURE                              9**
Working of Web  HTML Markup for Structure  Creating simple page  Marking up text  Adding Links  Adding Images  Table Markup  Forms  HTML5

**UNIT II        CSS AND JAVASCRIPT                                                  9**
CSS  Formatting text  Colours and Background  Padding, Borders and Margins  Floating and positioning  Page Layout with CSS  Transition, Transforms and Animation  Javascript  Using Java Script

**UNIT III        RESPONSIVE WEB DESIGN                                             9**

Sass for Responsive Web Design  Marking Content with HTML5  MobileFirst or Desktop First  CSS Grids, CSS Frameworks, UI Kits, and Flexbox for RWD  Designing small UIs by Large Finger  Images and Videos in Responsive Web Design  Meaningful Typography for Responsive Web Design

**UNIT IV        WEB PROJECT MANAGEMENT                                            9**
Definite and Indefinite integrals – Substitution rule – Integration by parts – Double integrals – Double Project Life Cycle  Project Definition  Discovery and Requirements  Project Schedule and Budgeting  Running the project  Technical Documentation   Development , Communication, Documentation  QA and testing  Deployment  Support and operations

 **UNIT V        PROJECT CASE STUDY                                                 9**
Using HTML, CSS, JS or using Opensource CMS like WordPress, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project  Host and manage the project live in any public hosting

**Total:45 Hours**

**COURSE OUTCOMES**

**At the end of the course students should be able to**

**CO1:** Understand the principles of web design, including layout, color theory, typography, and user experience design.

**CO2:** Design Website using HTML CSS and JS

**CO3:** Design Responsive Sites

**Co4:** Manage, Maintain and Support Web Apps

**CO5:** Gain practical experience working on real-world web design projects, and learn how to collaborate with clients, stakeholders, and team members.

**CO6:** Develop an understanding of web analytics and digital marketing, and learn how to use data to improve website performance and user engagement

**TEXT BOOKS:**

**T1:** Jennifer Niederst Robbins, "Learning Web Design", O'REILLY 4th Edition

**T2:** Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015

**T3:** . Justin Emond, Chris Steins, "Pro Web Project Management", Apress,2011

**REFERENCEBOOKS:**

**R1:** Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, edition 2014

**R2:** Jon Duckett, Jack Moore, "JavaScript & JQuery: Interactive FrontEnd Web Development", John Wiley and Sons, edition 2014

**R3:** Uttam K. Roy "Web Technologies" Oxford University Press, 13th impression, 2017

**R4:** Wordpress  http://www.wpbeginner.com/category/wptutorials/

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| U19MEOE001 | ENGINEERING DRAWING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**
- To have the knowledge of interpretation of dimensions of different quadrant projections.
- To understand the basic principles of engineering drawing.
- To have the knowledge of generating the pictorial views

**PREREQUISITES**

Nil

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

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

**THEORY COMPONENT  CONTENTS**

**UNIT I                INTRODUCTION TO ENGINEERING DRAWING                                 12**

.       Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction **CURVES USED IN ENGINEERING PRACTICE AND THEIR CONSTRUCTIONS**: Conic Sections ,Special Curves Cycloids, Epicycloids, and Hypocycloids.

**UNIT II                ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY                12**

Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes.

**UNIT III                PROJECTIONS OF PLANES AND SOLIDS                                        12**

Projections of regular planes, inclined to both planes. Projections of regular solids inclined to both planes.

**UNIT IV                DEVELOPMENT OF SURFACES                                                12**

Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

**UNIT V        ISOMETRIC PROJECTIONS                                                        12**

Principles of Isometric Projections Isometric Scale Isometric Views Conventions Plane Figures, Simple and Compound Solids. **TRANSFORMATION OF PROJECTIONS**: Conversion of isometric Views to Orthographic Views. Conversion of orthographic views to isometric projections vice versa

**Total:  60 Hours**

**COURSE OUTCOMES** :

On completion of this course students will be able to

**CO1 :**     Prepare and understand drawings.

**CO2 :**     Identify various D curves used in Engineering Drawing and their applications.

**CO3 :**     Use the principles of orthographic projections.

**CO4 :**     By studying about projections of solids students will be able to visualize three dimensional objects and that will enable them to design new products.

**CO5 :**     Design and fabricate surfaces of different shapes.

**TEXT BOOKS**

   T1.     Basant Agarwal, "Engineering Drawing", TMH.

   T2.     Jolhe, Dhananjay,         "Engineering Drawing: With an Introduction to CAD", Tata Mc Graw Hill, India. 2006.

**REFERENCE BOOKS**

   R 1.     N. D. Bhat, "Engineering Drawing" Charotar Publications, New Delhi., 2006.

   R2.     Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. International Publishers, 2007

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| | | | L | T | P | C |
|---|---|---|---|---|---|---|
| **U19MEOE002** | **MODERN MANUFACTURING TECHNIQUES** | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**
• To understand the various advancements in casting processes
• To learn about the different types of welding techniques.
• To understand the principles and process of forming.
• To understand the significance of different advancements such as CAE in manufacturing.
• To learn about the mechanics of high speed machining.

**PREREQUISITES**
1.   Fundamentals of manufacturing processes.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | | 2 | | 2 | | 2 | | 2 | | | 2 | | |
| CO2 | | | | 1 | | | | | | | | | 1 | | |
| CO3 | | 1 | | 2 | | | | | | | | | 2 | | |
| CO4 | 1 | 1 | | 1 | | 1 | | | | 1 | | | 1 | | |
| CO5 | 2 | | | 1 | | 1 | | 2 | | | | | 1 | | |

**THEORY COMPONENT  CONTENTS**

**UNIT I**             **ADVANCED CASTING PROCESSESES**                                                9

Expendable Mold  shell mould casting, Vacuum Mould casing, investment casting, plaster mold and ceramic mold casting, Permanent Mold casting processes  squeeze casting and semisolid metal casting, centrifugal casting, uses of Rapid Prototyping to produce pattern, process selection  dimensional tolerances for various casting processes and metals.

**UNIT II**           **ADVANCED WELDING PROCESSES**                                                 9
Electron beam welding, laser beam welding, Solid-state welding  diffusion welding, friction welding, ultrasonic welding, physics of welding, design considerations in welding, NDT methods for testing.

**UNIT III**                                                                                          9
             **ADVANCED FORMING PROCESSES**

Material behavior in metal forming, temperature in metal forming, strain rate sensitivity, friction and lubrication in metal forming, bulk deformation processes, sheet metalworking, HERF, hydro forming, explosive forming, magnetic forming process

**UNIT IV**                                                                                           9
             **APPLICATION OF CAE IN MANUFACTURING**

Need for CAE in manufacturing, simulation of molten metal flow using CAE Techniques, solidification process in casting, inspections of casting. Thermal analysis of Heat Affected Zone (HAZ), analysis of forging process using CAE, CL data generation for machining process.

**UNIT V**                                                                                            9
             **HIGHSPEED MACHINING**

High-speed machining centers, high speed spindles, spindle sped, feed rate, cutting velocity, surface finish, selection of process parameters, ultrahigh speed machining centers, hard machining.

                                                                                    **Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course students should have the

**CO1 :** Use appropriate casting technique to develop a given component

**CO2 :** Make the right choice of welding technique as per the required application

**CO3 :** Understand about the different significant factors in forming

**CO4 :** Formulate real time problems with the help of computer simulation tools

**CO5 :** Implementing the probable capabilities of artificial intelligence to develop end user products such as robots.

**TEXT BOOKS**

T1. Mikell P Grover "Principles of Modern Manufacturing (SI Version)" John Wiley & Sons, 2014.

T2. Paul DeGarmo E, Black J T and Ronald A Kohjer, "Materials and Processes in Manufacturing, John Wiley India, 2011.

**REFERENCE BOOKS**

R 1. Philip F Ostwald and Jairo Munoz, "Manufacturing Processes and Systems" John Wiley India, New Delhi, 2013.

R2. Kaushish J P, "Manufacturing Processes", Prentice Hall India, 2013.

R3. Sanjay K Mazumdar, "Composite Manufacturing: Materials, Product and Process Engineering", CRC Press, 2010.

**AUTOMOBILE TECHNOLOGY**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**
- To gain knowledge on the automobile architecture and understand its performance.
- To learn about the significant parameters that determine the engine performance.
- To learn about the different types of transmission systems used in automobiles
- To understand the different components and mechanism of a suspension system
- To learn about the mechanism involved in operation of steering

**PREREQUISITES**
Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 1 | | 3 | | | | 3 | | | | | 3 | 2 | 1 |
| CO2 | 2 | 1 | | | | | | 2 | | | | | 3 | 2 | 2 |
| CO3 | 3 | 2 | | 1 | | | | 1 | | | | | 3 | 2 | 3 |
| CO4 | 1 | 3 | | 3 | | | | 2 | | | | | 2 | 2 | 1 |
| CO5 | 3 | 2 | | | | | | | | | | | 3 | 2 | 3 |

**THEORY COMPONENT  CONTENTS**

**UNIT    I        AUTOMOBILE ARCHITECTURE AND PERFORMANCE                                9**

Automotive components, subsystems and their positions Chassis, frame and body, front, rear and four wheel drives, Operation and performance, Traction force and traction resistance, Power required for automobile Rolling, air and gradient resistance.

**UNIT    II       ENGINE ARCHITECTURE AND PERFORMANCE                                    9**

Types of engine, multi valve engine, inline engine, vee engine, Petrol engine direct, single point and multipoint injection, diesel engine common rail diesel injection, supercharging and turbo charging, alternate fuels ethanol and ethanol blend, compressed natural gas, fuel cells, hybrid vehicles, Engine Control Unit.

**UNIT    III      TRANSMISSION SYSTEMS                                                   9**

Clutch : Types coil spring and diaphragm type clutch, single and multi plate clutch, centrifugal clutch, Gear box : Types constant mesh, sliding mesh and synchromesh gear box, layout of gear box, gear selector and shifting mechanism, overdrive, automatic transmission, Propeller shaft, universal joint, slip joint, differential and real axle arrangement, hydraulic coupling

**UNIT    IV       SUSPENSION SYSTEM                                                      9**

Types front and rear suspension, conventional and independent type suspension, leaf springs, coil springs, dampers, torsion bars, stabilizer bars, arms, air suspension systems.

**UNIT    V        STEERING SYSTEM                                                        9**

Types of steering systems, Ackermann principle, Davis steering gear, steering gear boxes, steering linkages, power steering, wheel geometry caster, camber toe in, toe out etc., wheel Alignment and balancing.

**Total: 45 Hours**

## COURSE OUTCOMES

At the end of the course students should have the ability to

**CO1 :**    Apply the concepts of automobile architecture in an automobile assembly.

**CO2 :**    Device the right choice of process parameters to fine tune the performance.

**CO3 :**    Choose the right choice of transmission system as per the requirements

**CO4 :**    Make the right choice of suspension system for the given application

**CO5 :**    Visualize and understand the working mechanism of steering.

## TEXT BOOKS

T1.    Gupta .R.B, "Automobile Engineering ", SatyaPrakashan, 2009.

T2.    Kirpal Singh, "Automobile Engineering VolI & II", Standard publishers, New Delhi, 2011.

## REFERENCE BOOKS

R 1.    Julian Happian Smith, "An Introduction to Modern Vehicle Design", ButterworthHeinemann, New Delhi, 2002

R2.    Crouse W H, "Automotive Transmissions and Power trains", McGraw Hill Book Co., New Delhi, 1976.

R3    Heinz Heisler, "Vehicle and Engine Technology", SAE International and Elsevier, 1999.

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**U19MEOE004**                        **CAD/CAM**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

**PREREQUISITES**
Engineering Drawing

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | | 3 | | | | | | | | | 3 | 2 | 3 |
| CO2 | 3 | 2 | | 3 | | | | 2 | | | | | 3 | 2 | 3 |
| CO3 | 3 | 3 | | 3 | | | | | | | | | 3 | 2 | 3 |
| CO4 | 3 | 2 | | 3 | | | | 2 | | | | | 2 | 2 | 3 |
| CO5 | 3 | 2 | | 3 | | | | | | | | | 3 | 2 | 3 |

**UNIT   I      INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS                    9**

.       Output primitives (points, lines, curves etc.,), 2D & 3D transformation (Translation, scaling, rotation) windowing  view ports  clipping transformation.

**UNIT II              CURVES AND SURFACES MODELING                    9**
Introduction to curves  Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline Bezier curve and BSpline curve – curve manipulations. Introduction to surfaces  Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermitebicubic surface Bezier surface and BSpline surface surface manipulations.

**UNIT III              NURBS AND SOLID MODELING                    9**
NURBS Basics curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operations  primitive instancing  sweep representations  boundary representations – constructive solid Geometry  comparison of representations  user interface for solid modelling.

**UNIT IV              VISUAL REALISM                    9**
Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.

**UNIT V              ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE                    9**
Assembly modeling  interferences of positions and orientation  tolerances analysis – mass property calculations  mechanism simulation. Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc– Communication standards.

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course students should be able to

**CO1 :**    Understand the fundamentals of computer graphics.

**CO2 :**    Apply different techniques for geometric modelling.

**CO3 :**    Apply different algorithm to create prismatic and lofted parts.

**CO4 :**    Discuss tolerance analysis and mass property calculations.

**CO5 :**    Explain data exchange standards and communication standards.

**TEXT BOOKS**

   T1.    David F. Rogers, James Alan Adams, "Mathematical elements for computer graphics", second edition, Tata McGrawHill edition.

   T2.    Ibrahim Zeid,    "Mastering CAD/CAM", McGraw Hill, International Edition, 2007.

**REFERENCE BOOKS**

   R 1.    Donald Hearn and M. Pauline Baker, "Computer Graphics" Prentice Hall, Inc., 1992.

   R2.    William M Neumann and Robert F.Sproul, "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.

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**COURSE OBJECTIVES**

- To prepare learners to face the challenges of regular/online competitive exams I  the English language globally.

- To enable students to prepare for competitive exams of various kinds especially meant for testing ability in the English language.
- To introduce students to the common question types asked in competitive examinations concerning English grammar, vocabulary, comprehension, and other significant topics.
- To help the students to overcome the fear of English as a compulsory subject in various competitive exams.
- To encourage students to appear and prepare for the competitive exams.

**PREREQUISITES:** Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | | 2 | 2 | 2 | 3 | | 2 | | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 2 | | | 2 |
| CO3 | | | | | | 2 | | 2 | 3 | 3 | | 2 | | | 2 |
| CO4 | | | | | | | 3 | 2 | 1 | 3 | | 3 | | | 3 |
| CO5 | | | | | | 3 | 3 | 3 | 3 | 3 | | 3 | | | 3 |

**UNIT I** 9

Types of Sentences  Sentence correction Sentence sequence –Word Reordering  Data Interpretation: Tree Diagram, Flow Chart, Table, Line Graph – Discourse Markers – Identifying the exams interested to appear for Online Course: Udemy, Edx, Future Learn

**UNIT II** 9

Reading Comprehension: Focus on different levels of Comprehension Literal, Inferential, Analytical, and Critical reasoning – Identifying keywords and signal words, decoding the building blocks of a passage, understanding the jargon and double distractors – Error Spotting Rules – Identification Common Errors

**UNIT III** 9

Listening Comprehension: Micro skills and Macro skills of Listening – Idioms and Phrases Homonyms and Homophones – Collocations Synonyms and Antonyms: Banking, Indian Constitution, Education, Corporate, and Higher Education  Para jumbles

**UNIT IV** 9

Speaking: Presentation and Public: Record of videos – Verbal Ability; Sentence Completion, and  Verbal analogies –Confirmation of registering for competitive exams.

**UNIT V** 9

Speech Project – Time Management – Stress Management –Standard Assessment: 5 Mock Tests

**Total: 45 Hours**

## COURSE OUTCOMES

At the end of the course, students should be able to

| CO1 | Confidently use the English language at an advanced level sharing their points of view with effective conclusions. |
| CO2 | Construct correct sentences with the advanced vocabulary of the fields like Banking, Indian polity, Education, Corporate, etc. |
| CO3 | Read accurately using contextual, analytical thinking and logical thinking skills |
| CO4 | Aware of the opportunities available in the government and private sectors |
| CO5 | Demonstrate excellent Time Management skills with regard to various competitive exam patterns |

## TEXT BOOKS

| T1 | Richards, C. Jack. Interchange Students Book3 New Delhi: CUP, 2015. |
| T2 | Means,L. Thomas and Elaine Langlois. English and Communication For Colleges. Cengage Learning, USA: 2007. |
| T3 | The Official Guide to the GRE General Test, Third Edition (TEST PREP)by Educational Testing Service | 16 February 2017 |
| T4 | The Yearly Current Affairs 2022 for Competitive Exams (Upsc, State Psc, Ssc, Bank Po/ Clerk, Bba, MBA, Rrb, Nda, Cds, Capf, Crpf), Disha Publication, Genre: General, ISBN: 9789355640888 |

## REFERENCE BOOKS

| R1 | Brians, Paul. (2013). Common errors in English usage: Third edition. Wilsonville: Franklin, Beedle & Associates Inc |
| R2 | Harrison, Louis. (2009). Achieve IELTS grammar and vocabulary: English for international education. London: Cengage Learning EMEA. |
| R3 | Khashoggi, K.,&Astuni.A. (2014)SA Treading comprehension workbook :Advanced practice series. New York:Ilex Publications. |
| R4 | Prasad, Hari Mohan.(2013). Objective English for competitive exams. New Delhi: Tata McGraw-Hill Education India. |
| R5 | Seely, John. (2013). Oxford guide to effective writing and speaking: How to communicate clearly. Oxford: Oxford University Press. |

## WEB RESOURCES

| W1 | https://www.edubull.com/exams/competitiveexams |
| W2 | https://sscstudy.com/ |
| W3 | https://examsdaily.in/importantstudymaterialspdf |
| W4 | http://www.recruitmenttopper.com/studymaterialforallcompetitiveexams/ |

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**ENGLISH FOR EMPLOYABILITY SKILLS**

| L | T | P | C |
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**COURSE OBJECTIVES**

- To hone the employability related communication skills of the students on the foundations built during Executive

- To assist students in becoming well-versed, responsible, creative communicators.

- To develop students' knowledge of communication skills in the structure, elucidation, and delivery of messages in diverse cultural and global communities; and

- To promote theoretical understanding and professional/personal practice of effective and ethical human communication between and within a broad range of contexts and communities.

- To write responses appropriately, organize ideas, and use vocabulary accurately

**PREREQUISITES:** Nil

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | | 2 | 2 | 2 | 3 | | 2 | | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 2 | | | 2 |
| CO3 | | | | | | 2 | | 2 | 3 | 3 | | 2 | | | 2 |
| CO4 | | | | | | | 3 | 2 | 1 | 3 | | 3 | | | 3 |
| CO5 | | | | | | 3 | 3 | 3 | 3 | 3 | | 3 | | | 3 |

**UNIT I** 9

SWOT Analysis – Perception Management – Positive Attitude – Empathy – Altruism – Self Management Etiquette: Social, Dinner, Corporate, Telephone and Netiquette – Interview Skills

**UNIT II** 9

Reading Comprehension: Technical passages –Kinds of sentences –Sentence correction – Error spotting – Idioms – Vocabulary: Jargon and Distractors – Punctuation errors – Online Course: Udemy, Edx, Future Learn

**UNIT III** 9

Letter writing: Formal Letters – Letters accepting Offers  Chart description – process description – Essays –– Internship Reports

**UNIT IV** 9

Self Introduction  Talking about friends and Family –Resume Preparation: Single Page and Detailed– Persuasion Skills – Emotional Intelligence – Teamwork  Establishing Credibility: Understanding the Workplace – Body Language

**UNIT V** 9

Industry Psychology: Characteristics of the workplace: Physical working conditions: Noise, Illumination, Colour, Music, Miscellaneous Factors; Work Schedules: Working Hours, Permanent Part-time Employment, Flexible Work Schedules; Psychological and Social Issues  Stress management – Time management

**Total: 45 Hours**

**COURSE OUTCOMES**

At the end of the course, students should be able to

| | |
|---|---|
| **CO1** | Be prepared for the personal interview through mock interviews while being aware of the various kinds of interviews. |
| **CO2** | Introspect & develop a planned approach towards his career & life in general. |
| **CO3** | Have clarity on his career exploration process and match his skills and interests with a chosen career path. |
| **CO4** | Explain the use of a functional and chronological resume. |
| **CO5** | Develop thinking ability and polish his expression in group discussions. |

**TEXT BOOKS**

| | |
|---|---|
| **T1** | Richards, C. Jack. Interchange Students Book3 New Delhi: CUP, 2015. |
| **T2** | Skills for Employability, Dr. M. Sen Gupta, ISBN: 9788193381915, 2020, First Edition |
| **T3** | Soft Skills & Employability Skills, SABINA PILLAI, AGNA FERNANDEZ, Cambridge, ISBN: 9781316981320, 1316981320, 2017 |

**REFERENCE BOOKS**

| | |
|---|---|
| **R1** | Bridging the Soft Skills Gap: How to Teach the Missing Basics to Todays Young, ASIN : 8126563435, ISBN10 : 9788126563432, ISBN13 : 9788126563432, Pan Macmillan India; 2016 |
| **R2** | Soft Skills Training: A workbook to develop skills for employment, Amazon Digital Services; Large edition, 2012, ISBN10: 1468096494, ISBN13 : 9781468096491 |
| **R3** | https://www.sircicai.org/images/cabf/Soft%20Skills%20&%20Personality%20Development.pdf |
| **R4** | http://worldwideuniversity.org/library/bookboon/softskills.pdf |
| R5 | https://www.futurelearn.com/subjects/businessandmanagementcourses/softskills |

**WEB RESOURCES**

| | |
|---|---|
| **W1** | https://bharatskills.gov.in/pdf/E_Books/EmployabilitySkillsSWB2W.pdf |
| **W2** | https://link.springer.com/book/10.1007/9783319751665 |
| **W3** | https://cbseacademic.nic.in/web_material/Curriculum21/publication/secondary/Employability_Skills10.pdf |
| **W4** | https://www.oreilly.com/library/view/softskillsfor/9781119875536/ |

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| | L | T | P | C |
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| **U19PHOE001**      **NANOTECHNOLOGY AND ENGINEERING APPLICATIONS** | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To introduce the concept of nanotechnology and understand the importance of nanotechnology
- To give deep insight into fabrication and characterization techniques for nanostructures
- To provide an overview of the wide applications of nanotechnology in various technological fields.

**PREREQUISITES:** As a prerequisite for this course Nanotechnology and Engineering Applications, knowledge in Engineering Physics and Applied Physics is essentially required.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | |
| CO2 | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | |
| CO3 | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | |
| CO4 | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | |
| CO5 | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | |
| CO6 | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | | 3 | 3 | |

**THEORY COMPONENT CONTENTS**

**UNIT I      INTRODUCTION AND SYNTHESIS OF NANOMATERIALS      9**

Introduction to nanotechnology –definition, invention, building blocks of nanotechnology, chemical bonds  Van der Waals Interactions, DipoleDipole interactions, Microstructure and Defects in Nanocrystalline Materials – dislocations, twins, stacking points and voids; grain boundaries, triple junctions and disclinations.
Synthesis of nanomaterials**:** Bottom – Up Approaches: physical vapour deposition (PVD), chemical vapour deposition (CVD), spray pyrolysis. Top Down Approaches: Mechanical alloying, high pressure torsion (HPT)

**UNIT II      TYPES OF NANOMATERIALS      9**

Carbon Nanotubes (CNT): Introduction, classification of CNT'S, synthesis and physical properties of CNT (Electrical, Transport, Mechanical), applications.
Fullerenes: Introduction, synthesis and purification, physical properties, applications.  Semiconductor Quantum dots: Introduction, synthesis of Quantum dots, physical and chemical properties, applications.
Nanocomposites: Introduction, synthesis and processing of Inorganic nanotubes and polymeric nanocomposites, applications.
Nanowires: Introduction, physical properties of nanowires – ( structural, Optical, Chemical),  Applications.

**UNIT III      PROPERTIES OF NANOMATERIALS      9**

Mechanical Properties:   Introduction, Grain Size Effect, Creep, Hardness, Fracture Strength, Strengthening and Toughening Mechanisms, Crack Healing (Annealing Treatment). [From Advanced nanomaterials  byHofman, Powder Technology Laboratory, IMX, EPFL, Version 1 Sept 2009].
Electrical and Optical properties: Electrical conduction and tunnelling conduction in nanoparticles, electronic conduction with nanoparticles (AC Conductivity & DC Conductivity).
Optical properties: Transmission, Absorption, Reflection in nanoparticles, optical constants (Absorption coefficient, extinction coefficient and Refractive index).

**UNIT IV            CHARACTERIZATION TOOLS                                        9**

XRD (XRay diffraction), SAXS (Small Angle Xray Emission Spectroscopy), SEM (Scanning Electron Microscopy), TEM (Transmission Electron Microscopy), STM (Scanning Tunnelling Microscopy), AFM (Atomic Force Microscopy).

**UNIT V            APPLICATIONS OF NANOTECHNOLOGY                                 9**

Electrical and electronic applications: MEMS (Micro Electro Mechanical Systems), NEMS (Nano Electro Mechanical Systems), Nano sensors, nanolithography.
Nanotechnology for Renewable Energy: Hydrogen energy, fuel cell technology, wind and solar energy.
Nanotechnology for information technology and Data Storage applications.

**Total:45 Hours**

**COURSE OUTCOME**

At the end of the course, students should be able to

| | | |
|---|---|---|
| **CO1** | Understand the basic concepts of nanotechnology | |
| **CO2** | Gain basic knowledge on various synthesis and techniques involved in preparation of nanomaterials | |
| **CO3** | Understand the general types and different classes of Nanomaterials | |
| **CO4** | Apply the knowledge on different properties of Nanomaterials and selection of material for the specific purpose of application. | |
| **CO5** | Understand and apply the knowledge of different characterization tools and characterization of Nanomaterials | |
| **CO6** | Apply the basic knowledge about the wide applications of nanotechnology in various technological fields. | |

**TEXT BOOKS**

| | |
|---|---|
| **T1** | Köhler, Michael, and Wolfgang Fritzsche. Nanotechnology An Introduction to Nanostructuring Techniques 2nd ed. Wiley. |
| **T2** | T. Pradeep, Nano: The Essentials – Understanding Nano Science and Nano Technology, McGrawHill |
| **T3** | A. K. Bandyopadhyay, Nano Materials, New Age International Publishers. |
| **T4** | M. H. Fulekar, Nanotechnology Importance and applications. I.K. International publishing house pvt. ltd |

**REFERENCE BOOKS**

| | |
|---|---|
| **R1** | B.S. Murty, P. Shankar, Baldev Raj, James Murday, Textbook of Nanoscience and Nanotechnology, Springer Berlin Heidelberg |
| **R2** | B. Bhushan, Springer Handbook of Nano Technology |

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**U19PHOE002**        **THIN FILM TECHNOLOGY AND APPLICATIONS**

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**COURSE OBJECTIVES**

- To learn the fundamental atomistic mechanisms and thin film deposition techniques.
- To acquire knowledge on thin film devices.
- To provide an overview of the wide applications of thin film technology in various technological fields.

**PREREQUISITES:** As a prerequisite for this course Nanotechnology and Engineering Applications, knowledge in Engineering Physics and Applied Physics is essentially required.

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | | | | | | | | | | | | | |
| CO2 | 3 | 3 | | | | | | | | | | | | | |
| CO3 | 3 | 3 | | | | | | | | | | | | | |
| CO4 | 3 | 3 | | | | | | | | | | | | | |
| CO5 | 3 | 3 | | | | | | | | | | | | | |
| CO6 | 3 | 3 | | | | | | | | | | | | | |

**THEORY COMPONENT CONTENTS**

**UNIT I          THIN FILM GROWTH                                                9**

Classification of films – formation of films – Condensation and nucleation, growth and coalescence of islands – nucleation theories: capillarity and atomistic models, sticking coefficient, adhesion, substrate effect, film thickness effect

**UNIT II          DEPOSITION TECHNIQUES                                       9**

Thin film deposition techniques – simple thermal evaporation – Chemical vapour deposition technique – advantages and disadvantages of Chemical vapour deposition, Physics vapour deposition, electron beam evaporation – RF sputtering, flash evaporation, laser ablation – Spin coating – molecular beam epitaxy – film thickness measurement – ellipsometry, quartz crystal oscillator techniques, structure, and microstructure of thin films.

**UNIT III          THIN FILM MATERIAL CHARACTERIZATION TECHNIQUES          9**

Characterization techniques: XRD (XRay diffraction), working principle of SEM (Scanning Electron Microscopy), working principle of TEM (Transmission Electron Microscopy), STM (Scanning Tunnelling Microscopy), AFM (Atomic Force Microscopy), Filed ion microscope.

**UNIT IV          PROPERTIES OF THIN FILMS                                    9**

Electrical conduction in continuous and discontinuous metallic thin films, transport and optical properties of metallic, semiconducting and dielectric films.

**UNIT V          THIN FILM DEVICES AND APPLICATIONS                          9**

Anti – reflection Coatings, fabrication of thin film resistor, capacitor, diode, gas sensors and temperature sensors. Thin film solar cells, Quantum well and Quantum dot solar cells. Application of thin films, in different areas such as electronics, medical defence, sports, and automobile.

**Total:45 Hours**

**COURSE OUTCOMES**

At the end of the course, students should be able to

| | | |
|---|---|---|
| **CO1** | Understand the basic concepts of thin film technology. | |
| **CO2** | Understand the classification of thin films. | |
| **CO3** | Understand the various thin film deposition techniques. | |
| **CO4** | Understand and apply the knowledge of different characterization tools and characterization of thin films. | |
| **CO5** | Describe the properties of thin films. | |
| **CO6** | Apply the basic knowledge about the wide applications of thin film technology in various technological fields. | |

**TEXT BOOKS**

| | |
|---|---|
| **T1** | Kasturi Chopra, Thin film device applications, McGraw Hill, Newyork, 2012 |
| **T2** | A. Goswami, Thin film fundamentals, New age international, 2006 |

**REFERENCE BOOKS**

| | |
|---|---|
| **R1** | Manuel P. Soriaga, John Stickney, Lawrence A. Bottomley, Thin Films: Preparation, Characterization, Applications, Springer US |
| **R2** | Krishna Seshan, Handbook of Thin film Deposition Processes and Techniques, Elseiver. |

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**ENVIRONMENTAL SCIENCES**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the inter relationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To  study the integrated themes and biodiversity ,natural resources, pollution control and waste management

| Course Articulation Matrix : 3 High, 2 Medium, 3 Low | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | | | | | | 3 | 3 | | | | | | | | 1 |
| CO2 | | | | | | 3 | 3 | | | | | | | | 1 |
| CO3 | | | | | | 3 | 3 | | | | | | | | 1 |
| CO4 | | | | | | 3 | 3 | | | | | | | | 1 |
| CO5 | | | | | | 3 | 3 | | | | | | | | 1 |
| CO6 | | | | | | 3 | 3 | | | | | | | | 1 |

**UNIT I          ENVIRONMENT, ECOSYSTEMS ANDBIODIVERSITY                    9**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds ,streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values– Biodiversity at global, national and local levels–India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts –endangered and endemic species of India–conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc

**UNIT II          ENVIRONMENTAL POLLUTION**

**9**

Definition-causes, effects and control measures of:(a)Air pollution(b)Water pollution(c)Soil pollution(d)Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control  measures of municipal solid wastes–role of an individual in prevention of pollution –pollution case studies–disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural /Industrial /Agricultural

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**UNIT III**          **NATURAL RESOURCES**          **9**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies–Food resources :World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies–Energy resources: Growing energy needs, renewable and non renewable energy sources ,use of alternate energy sources. case studies–Land resources: Land as a  rsource, land degradation, man induced landslides, soil erosion and desertification–role of an individual in conservation of natural resources–Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill /mountain

**UNIT IV**          **SOCIAL ISSUES AND THE ENVIRONMENT**

         **9**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management– resettlement and rehabilitation of people ;its problems and concerns, case studies–role of non-governmental organization-eenvironmental ethics :Issues and possible solutions–climate change ,global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation –consumer is and waste products–environment production act–Air(Prevention and Control of Pollution)act–Water(Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation-central and state pollution control boards-Public awareness.

**UNIT V**          **HUMAN POPULATION AND THE ENVIRONMENT**

         **9**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

         **Total:45 Hours**

**COURSE OUTCOMES**

Upon successful l completion of this course, the student will be able to:

**CO.1:**    Awareness on environmental factors.

**CO.2:**    Finds  scientific, technological, economic and political solutions to environmental problems

**CO.3:**    Knowledge on interrelationship between living organism and environment

**CO.4:**    Assess impact on the human world envision the surrounding environment, its functions and its value.

**CO.5:**    Knowledge on the dynamic processes and understand the features of the earth's interior and surface.

**CO6:**    Understands the integrated themes and biodiversity, natural resources, pollution control and waste management.

**TEXTBOOKS:**

**T1:**    BennyJoseph,'EnvironmentalScienceandEngineering',TataMcGraw-Hill,NewDelhi,2006

**T2:**    GilbertM.Masters,'IntroductiontoEnvironmentalEngineeringandScience',2ndedition,Pearson Education,2004.

**REFERENCEBOOKS:**

**R1:**    Dharmendra S .Sengar,'Environmental  law',Prentice hall ofIndiaPvtLtd,NewDelhi,2007.

**R2:**    Erach Bharucha,"Text book of Environmental Studies", Universities Press(I)Pvt,Ltd,Hydrabad,2015

**R3:**    G.TylerMillerandScottE.Spoolman,"EnvironmentalScience",CengageLearningIndiaPvt,Ltd,Delhi,2014.

**R4:**    Rajagopalan.R,'EnvironmentalStudies-FromCrisistoCure',OxfordUniversityPress,2005.

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**COURSEOBJECTIVES**

• To give an idea about IPR, registration and its enforcement..

**PREREQUISITES:** Fundamentals of Innovative Product Development

Course Articulation Matrix : 3 High, 2 Medium, 3 Low

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | 3 | 2 | - | 2 | - | - | 2 | - | - | 2 | 2 | 2 | 2 |
| CO2 | 1 | - | 3 | 2 | - | 2 | - | - | 2 | - | - | 2 | 2 | 2 | 2 |
| CO3 | 1 | - | 3 | 2 | - | 2 | - | - | 2 | - | - | 2 | 2 | 3 | 3 |
| CO4 | 1 | - | 3 | 2 | - | 2 | - | - | 2 | - | - | 2 | 1 | 2 | 2 |
| CO5 | 1 | - | 3 | 2 | - | 2 | - | - | 2 | - | - | 2 | 2 | 2 | 1 |
| CO6: | 1 | - | 3 | 2 | - | 2 | - | - | 2 | - | - | 2 | 3 | 2 | 1 |

**UNIT I        INTRODUCTION                                                                          9**

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT II        REGISTRATION OF IPRs                                                             9**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

**UNIT III        AGREEMENTS AND LEGISLATIONS                                           9**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV        DIGITAL PRODUCTS AND LAW                                               9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V        ENFORCEMENT OF IPRs                                                          9**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**Total:45 Hours**

**COURSE OUTCOMES**

Upon successful l completion of this course, the student will be able to:

**CO.1:** Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**CO.2:** Ability to learn the registration of IPRs

**CO.3:** Ability to learn the agreements and legislations process

**CO.4:** Ability to understand the digital products and law

**CO.5:** Ability to learn the enforcement of IPRs.

**CO6:** Ability to patent filing and publishing

**TEXTBOOKS:**

**T1:** V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

**T2:** S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

**REFERENCEBOOKS:**

**R1:** Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

**R2:** Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

**R3:** Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013

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