# K. S. Rangasamy College of Technology

### (Autonomous)



# Curriculum & Syllabus
# of
# B.Tech. Artificial Intelligence and Data Science
### (For the batch admitted in 2021 - 2025)

# R2018

**Accredited by NAAC with A++ Grade,
Approved by AICTE, Affiliated to Anna University, Chennai.**

**KSR Kalvi Nagar, Tiruchengode – 637 215.
Namakkal District, Tamil Nadu, India.**

# ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**VISION**

To achieve excellence in educational programming, industry collaboration, research, and innovation in the field of Data Science and Artificial Intelligence.

**MISSION**

- To empower the cognitive skills of the students by enhancing knowledge in the Artificial Intelligence domain
- To facilitate Data Science Technology and Professionalism through value-added courses and collaborative learning

## 1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

**PEO1:** **Core Competence:** Graduates will demonstrate their technical skills and competency in various applications through the use of Artificial Intelligence and Data Science

**PEO2:** **Successful Career:** Graduates will establish their knowledge by adopting Artificial Intelligence and Data Science technologies to solve the real-world problems

**PEO3:** **Ethics and life-long learning:** Graduates will engage in lifelong learning to excel in their profession with social awareness and responsibility

## 2. PROGRAMME OUTCOMES (POs)

**Engineering Graduates will be able to:**

**PO1:** **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2:** **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3:** **Design /development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4:** **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5:** **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

**PO6:** **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7:** **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

**PO9:** **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10:** **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11:** **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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**PO12:** **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## 3. PROGRAMME SPECIFIC OUTCOMES (PSOs):

**Engineering Graduates will be able to:**

**PSO1:** **Develop IT infrastructure:** Ability to design, implement and apply computational skills related to Artificial Intelligence and Data Science
**PSO2:** **Design / Develop software products:** Ability to apply tools and techniques to provide successful solutions in the multidisciplinary field
**PSO3:** **Innovative Career:** Ability to critique the role of information and analytics for an innovative career, research activities, and consultancy

## 4. PEO/PO Mapping

| Programme Educational Objectives | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| PEO 1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 |
| PEO 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 |
| PEO 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |

**Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution**

### MAPPING – UG –ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

| YEAR | SEMESTER | COURSE NAME | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year I | I | Business Communication and Value Science I | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 3 |
| | | Calculus and Differential Equations | 3 | 3 | 2.8 | 2.4 | 2.4 | | | | | | | 2 |
| | | Optoelectronics and New Materials | 3 | 2.8 | 2.4 | 2.4 | 2.2 | 2.2 | 2 | 1 | 1 | 1.2 | 1.2 | 1.3 |
| | | Programming for Problem Solving | 1 | 3 | | 2.4 | 2.8 | | | 2 | | | | 1.8 |
| | | Introduction to Modern AI | 3 | 3 | 3 | 2 | 2 | | | | | | | |
| | | Essence of Indian Traditional Knowledge | | | | | | 2.6 | 2 | | | | | 2.2 |
| | | Applied Physics Laboratory | 3 | 2.6 | 2.4 | 2.2 | 2 | 2.4 | 1.6 | 1.4 | 1 | 1.2 | 1.6 | 1.6 |
| | | Programming for Problem Solving Laboratory | 1 | 3 | | 2.4 | 2.8 | | | 2 | | | | 1.8 |
| | II | Business Communication and Value Science II | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 3 |
| | | Mathematical Foundations of Data Science | 3 | 3 | 3 | 3 | 2 | 2 | | | | 2 | 2 | 2 |
| | | Computer Architecture | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 |
| | | Python Programming | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 |
| | | Introduction to Database System | 2 | 1.4 | | 2 | 3 | | | | | | 2 | 3 |
| | | Ethics for Engineers | | | | | | 3 | 2 | 3 | 3 | | 1 | 1 |
| | | Python Programming Laboratory | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 |
| | | Database Systems Laboratory | 2 | 3 | 2.33 | 1.6 | 3 | | | | | | | |
| Year II | III | Randomized Algorithms and Probabilistic Analysis | 3 | 3 | 3 | 2.8 | 22 | | | | | | 2 | 2 |
| | | Data Structures | 1 | 3 | 3 | 3 | 2.3 | | 2 | | | 2 | | 2 |
| | | Software Engineering | 2.5 | 2.7 | 2.75 | 3 | 3 | | | | 3 | 3 | 2.6 | |
| | | Advanced Database Technologies | 2 | 2 | 2.6 | 2.6 | 3 | | | | 2 | 2 | 2.6 | |
| | | Java Programming | 3 | 3 | 3 | 2 | 1 | | | 1 | | | | 1 |
| | | Environmental Science | 2.6 | 2.4 | 2.6 | 2.6 | 2.5 | 2.8 | 3 | 3 | 2.8 | 2.8 | 2.5 | 2 |
| | | Data Structures Laboratory | 1 | 3 | 3 | 3 | 3 | | 3 | | | 3 | | 3 |
| | | Java Programming Laboratory | 3 | 3 | 3 | 2 | 2 | | | 1 | 2 | | | 1 |
| | | Career Competency Development I | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 3 |
| | IV | Statistical Methods for Data Science | 3 | 3 | 3 | 3 | 2 | | | | | | 2 | 2 |
| | | Design and Analysis of Algorithms | 3 | 3 | 3 | 2.4 | 3 | | | | | | | |
| | | Data Communication and Networks | 3 | 2.6 | 2.6 | 2 | 2 | | | | 2 | | | |
| | | Operating Systems | 3 | 2.6 | 2 | 2 | 2 | | | | | | | |
| | | Data Warehousing and Data Mining | 2 | 2.8 | 2.6 | 2.6 | 3 | | | | 2 | 2 | 2 | 2 |
| | | Open Elective – I | | | | | | | | | | | | |
| | | Start-ups and Entrepreneurship | 2.8 | 2.6 | 3 | 2.4 | 2.2 | 2.5 | 1.6 | 1.7 | 1.3 | 2 | 2.2 | 2.4 |

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| Year | Sem | Course | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | National Cadet Corps(Air Wing) | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | National Cadet Corps(Army Wing) | | | | | | 1 | | 3 | | | | |
| | | Networking Laboratory | 3 | 3 | 3 | 3 | 3 | | | | 2 | | | |
| | | Data Mining Laboratory | 2 | 2 | 2.6 | 2.6 | 3 | | | | 2 | 2 | 2 | 2 |
| Year III | V | Career Competency Development II | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 |
| | | Artificial Intelligence for Industry 4.0 | 3 | 3 | 2.4 | 2.2 | 3 | | | | | 2 | 2.6 | 2.6 |
| | | Distributed Computing | 2 | 3 | 2.8 | 2.6 | 3 | | | | | 2 | | 2 |
| | | Compiler Design | 2.8 | 2.4 | 2.6 | 2.8 | 2.4 | | | | | | | |
| | | Machine Learning | 2 | 3 | 3 | 3 | 3 | | | | 2 | 2 | 2 | 2 |
| | | Elective – I | | | | | | | | | | | | |
| | | Open Elective – II | | | | | | | | | | | | |
| | | Compiler Design Laboratory | 3 | 2.6 | 3 | 3 | 3 | | | | 3 | | | |
| | | Machine Learning Laboratory | 2 | 3 | 3 | 3 | 3 | | | | 2 | 2 | 2 | 2 |
| | | Career Competency Development III | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 |
| | VI | Data Analytics and Modeling Techniques | 3 | 2.2 | 2.4 | 2.5 | 2.7 | | 3 | 2 | | 2 | 3 | 2.7 |
| | | Big Data Framework | 3 | 3 | 2 | 2.4 | 2.7 | | 3 | | | 2 | 3 | 2.7 |
| | | Web Technology | 3 | 2.5 | 2 | 2.5 | 2.7 | | 3 | | | 2 | 2.7 | |
| | | Data Science | 3 | 2.5 | 2 | 2.5 | 2.7 | | 3 | | | 2 | 3 | 2.7 |
| | | Elective – II | | | | | | | | | | | | |
| | | Elective – III | | | | | | | | | | | | |
| | | Open Elective – III | | | | | | | | | | | | |
| | | Data Science Laboratory | 3 | 2.5 | 3 | 2.5 | 2.8 | 2.6 | 3 | | 2.4 | 2.2 | 2.2 | 2.8 |
| | | Big Data Framework Laboratory | 3 | 2.2 | 2 | 2.5 | 2.7 | | 3 | | | 2 | 3 | 2.7 |
| | | Career Competency Development IV | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 |
| Year IV | VII | Data Visualization Techniques | 2.8 | 2.2 | 2.6 | 2.2 | 2.2 | 2 | 2.4 | 2 | 2.6 | 2.4 | 1.8 | 2.2 |
| | | Cloud Computing | 2.6 | 2.3 | 3 | 2 | 2.6 | 2 | 2 | 2 | | | | |
| | | Business Analytics | 2.4 | 2.6 | 2.6 | 2 | 2.2 | 1.4 | 1.8 | 1.8 | 1.8 | 2 | 1.6 | 1.5 |
| | | Deep Learning | 2 | 1.6 | 2 | 1.6 | 1.8 | 1.4 | 1.4 | 2 | 1.6 | 1.8 | 1.4 | 1.6 |
| | | Research Skill Development - I | 3 | 3 | 2 | 2.2 | 2 | 2 | 1.5 | 2 | 1.75 | 3 | 2.25 | 1.5 |
| | | Data Visualization Laboratory | 2 | 2.8 | 2.8 | 2.2 | 3 | | | | | 2 | 2.2 | 2.5 |
| | | Deep Learning Laboratory | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.2 | 1.6 | 2 | 2.2 |
| | | Project Work - Phase I | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | Career Competency Development V | 3 | 2.3 | 2 | 2.3 | 2.5 | 1.5 | 1 | 2 | 3 | 2.6 | 2.7 | 3 |
| | VIII | Research Skill Development – II | 3 | 3 | 2.8 | 2.67 | 2.67 | 2 | 1.75 | 2.33 | 1.75 | 2 | 2 | 1.4 |
| | | Project Work – Phase II | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## SEMESTER I

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 BC 001 | Business Communication and Value Science I | HS | 2 | 2 | 0 | 0 | 2 |
| 2. | 50 MA 001 | Calculus and Differential Equations | BS | 4 | 3 | 1 | 0 | 4 |
| 3. | 50 PH 011 | Optoelectronics and New Materials | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 CS 001 | Programming for Problem Solving | ES | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD101 | Introduction to Modern AI | PC | 4 | 3 | 1 | 0 | 4 |
| 6. | 50 MY 006 | Essence of Indian Traditional Knowledge | MC | 2 | 2 | 0 | 0 | 0 |
| | | **PRACTICALS** | | | | | | |
| 7. | 50 PH 0P2 | Applied Physics Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| 8. | 50 CS 0P1 | Programming for Problem Solving Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| | | **Total** | | 26 | 16 | 02 | 08 | 20 |

## SEMESTER II

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 BC002 | Business Communication and Value Science II | HS | 2 | 2 | 0 | 0 | 2 |
| 2. | 51MA 020 | Mathematical Foundations of Data Science | BS | 4 | 3 | 1 | 0 | 4 |
| 3. | 50 AD 201 | Computer Architecture | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD 202 | Python Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD 203 | Introduction to Database System | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 MY 004 | Universal Human Values | MC | 3 | 2 | 1 | 0 | 3* |
| **PRACTICALS** | | | | | | | | |
| 7. | 50 AD 2P1 | Python Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | 50 AD 2P2 | Database Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |

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| | | Total | | | 26 | 16 | 02 | 08 | 19 |
|---|---|---|---|---|---|---|---|---|---|

**\*UHV Additional credit is offered.**

## SEMESTER III

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 51 MA 024 | Randomized Algorithms and Probabilistic Analysis | BS | 4 | 3 | 1 | 0 | 4 |
| 2. | 50 CS 002 | Data Structures | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD 301 | Software Engineering | PC | 5 | 3 | 0 | 2 | 4 |
| 4. | 50 AD 302 | Advanced Database Technologies | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD 303 | Java Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 MY 002 | Environmental Science | MC | 2 | 2 | 0 | 0 | 0 |
| | | **PRACTICALS** | | | | | | |
| 7. | 50 CS 0P2 | Data Structures Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | 50 AD 3P1 | Java Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | 50 TP 0P1 | Career Competency Development I | EEC | 2 | 0 | 0 | 2 | 0 |
| | | **Total** | | 30 | 17 | 1 | 12 | 21 |

## SEMESTER IV

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 51 MA 025 | Statistical Methods for Data Science | BS | 4 | 3 | 1 | 0 | 4 |
| 2. | 51 IT 001 | Design and Analysis of Algorithms | PC | 4 | 2 | 0 | 2 | 3 |
| 3. | 50 AD 401 | Data Communication and Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD 402 | Operating Systems | PC | 4 | 3 | 1 | 0 | 4 |
| 5. | 50 AD 403 | Data Warehousing and Data Mining | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 AD L** | Open Elective – I | OE | 3 | 3 | 0 | 0 | 3 |
| 7. | 50 MY 014 | Start-ups and Entrepreneurship | MC | 2 | 2 | 0 | 0 | 0 |
| | | **PRACTICALS** | | | | | | |
| 8. | 50 AD 4P1 | Networking Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | 50 AD 4P2 | Data Mining Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 10. | 50 TP 0P2 | Career Competency Development II | EEC | 2 | 0 | 0 | 2 | 0 |
| | | **Total** | | 33 | 19 | 2 | 12 | 24 |

**\* NCC is optional, Additional credit is offered**

## SEMESTER V

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 AD 501 | Artificial Intelligence for Industry 4.0 | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD 502 | Distributed Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD 503 | Compiler Design | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD 504 | Machine Learning | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E** | Elective – I | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 AD L** | Open Elective – II | OE | 3 | 3 | 0 | 0 | 3 |
| | | **PRACTICALS** | | | | | | |

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| S.No. | | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 7. | | 50 AD 5P1 | Compiler Design Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | | 50 AD 5P2 | Machine Learning Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | | 50 TP 0P3 | Career Competency Development III | EEC | 2 | 0 | 0 | 2 | 0 |
| **Total** | | | | | **28** | **18** | **0** | **10** | **22** |

## SEMESTER VI

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 50 AD 601 | Data Analytics and Modeling Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD 602 | Big Data Framework | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD 603 | Web Technology | PC | 5 | 1 | 0 | 4 | 3 |
| 4. | 50 AD 604 | Data Science | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E** | Elective – II | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 AD E** | Elective – III | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | 50 AD L** | Open Elective – III | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 8. | 50 AD 6P1 | Data Science Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | 50 AD 6P2 | Big Data Framework Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 10. | 50 TP 0P4 | Career Competency Development IV | EEC | 2 | 0 | 0 | 2 | 0 |
| **Total** | | | | **33** | **19** | **0** | **14** | **25** |

## SEMESTER VII

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 50 AD 701 | Data Visualization Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD 702 | Cloud Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD 703 | Business Analytics | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD 704 | Deep Learning | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E** | Elective – IV | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 AD L** | Open Elective – IV | OE | 3 | 3 | 0 | 0 | 3 |
| 7. | 50 AC 001 | Research Skill Development –I | AC | 1 | 1 | 0 | 0 | 0 |
| 8. | 50 GE 00* | National Cadet Corps(Air/Army Wing)* | GE | 4 | 2 | 0 | 2 | 3* |
| **PRACTICALS** | | | | | | | | |
| 9. | 50 AD 7P1 | Data Visualization Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 10. | 50 AD 7P2 | Deep Learning Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 11. | 50 AD 7P3 | Project Work – Phase I | PC | 4 | 0 | 0 | 4 | 2 |
| 12. | 50 TP 0P5 | Career Competency Development V | EEC | 2 | 0 | 0 | 2 | 0 |
| 13. | 50 TP 0P6 | Internship | EEC | - | - | - | - | 1/2/3* |
| **Total** | | | | **33** | **21** | **0** | **16** | **24** |

**\* NCC is optional, Additional credit is offered**

## SEMESTER VIII

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |

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| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 AD E** | Elective – V | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AC 002 | Research Skill Development –II | AC | 1 | 1 | 0 | 0 | 0 |
| **PRACTICALS** | | | | | | | | |
| 3. | 50 AD 8P1 | Project Work – Phase II | PC | 16 | 0 | 0 | 16 | 8 |
| 4. | 50 TP 0P6 | Internship | EEC | - | - | - | - | 1/2/3* |
| **Total** | | | | **20** | **4** | **0** | **16** | **11** |

**\*Internship Additional credit is offered**

### TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 166

**Note**: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PE-Professional Core Courses, PE-Professional Elective Courses, GE-General Elective Courses, OE-Open Elective Courses, EEC-Employability Enhancement Courses, AC-Audit Courses& MC- Mandatory Courses

### HONORS DEGREE IN DATA SCIENCE
### CURRICULUM & SYLLABI

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 AD H01 | Data and Information Security | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD H02 | Data Storage and Management in cloud | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD H03 | Web Mining | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD H04 | Text and Speech Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD H05 | Image and Video Analytics | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 AD H06 | Health Care Analytics | PE | 3 | 3 | 0 | 0 | 3 |
| **Total** | | | | **18** | **18** | **0** | **0** | **18** |

### HUMANITIES AND SOCIAL SCIENCE (HS)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 BC 001 | Business Communication and Value Science  I | HS | 2 | 2 | 0 | 0 | 2 |
| 2. | 50 BC 002 | Business Communication and Value Science  II | HS | 2 | 2 | 0 | 0 | 2 |

### BASIC SCIENCE (BS)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 MA 01 | Calculus and Differential Equations | BS | 4 | 3 | 1 | 0 | 4 |
| 2. | 50 PH 011 | Optoelectronics and New Materials | BS | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PH P2 | Applied Physics Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| 4. | 51 MA 020 | Mathematical Foundations of Data Science | BS | 4 | 3 | 1 | 0 | 4 |
| 5. | 51 MA 024 | Randomized Algorithms and Probabilistic Analysis | BS | 4 | 3 | 1 | 0 | 4 |
| 6. | 51 MA 025 | Statistical Methods for Data Science | BS | 4 | 3 | 1 | 0 | 4 |

### ENGINEERING SCIENCE (ES)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 CS 001 | Programming for Problem Solving | ES | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 CS 0P1 | Programming for Problem Solving Laboratory | ES | 4 | 0 | 0 | 4 | 2 |

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## PROFESSIONAL CORE (PC)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 AD 101 | Introduction to Modern AI | PC | 4 | 3 | 1 | 0 | 4 |
| 2. | 50 AD 201 | Computer Architecture | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD 202 | Python Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD 203 | Introduction to Database System | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD 2P1 | Python Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 6. | 50 AD 2P2 | Database Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 7. | 50 CS 002 | Data Structures | PC | 3 | 3 | 0 | 0 | 3 |
| 8. | 50 AD 301 | Software Engineering | PC | 5 | 3 | 0 | 2 | 4 |
| 9. | 50 AD 302 | Advanced Database Technologies | PC | 3 | 3 | 0 | 0 | 3 |
| 10. | 50 AD 303 | Java Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 11. | 50 CS 0P2 | Data Structures Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 12. | 50 AD 3P1 | Java Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 13. | 50 AD 401 | Data Communication and Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 14. | 50 AD 402 | Operating Systems | PC | 4 | 3 | 1 | 0 | 4 |
| 15. | 51 IT 001 | Design and Analysis of Algorithms | PC | 4 | 2 | 0 | 2 | 3 |
| 16. | 50 AD 404 | Data Warehousing and Data Mining | PC | 3 | 3 | 0 | 0 | 3 |
| 17. | 50 AD 4P1 | Networking Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 18. | 50 AD 4P2 | Data Mining Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 19. | 50 AD 501 | Artificial Intelligence for Industry 4.0 | PC | 3 | 3 | 0 | 0 | 3 |
| 20. | 50 AD 502 | Distributed Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 21. | 50 AD 503 | Compiler Design | PC | 3 | 3 | 0 | 0 | 3 |
| 22. | 50 AD 504 | Machine Learning | PC | 3 | 3 | 0 | 0 | 3 |
| 23. | 50 AD 5P1 | Compiler Design Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 24. | 50 AD 5P2 | Machine Learning Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 25. | 50 AD 601 | Data Analytics and Modeling Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 26. | 50 AD 602 | Big Data Framework | PC | 3 | 3 | 0 | 0 | 3 |
| 27. | 50 AD 603 | Web Technology | PC | 5 | 1 | 0 | 4 | 3 |
| 28. | 50 AD 604 | Data Science | PC | 3 | 3 | 0 | 0 | 3 |
| 29. | 50 AD 6P1 | Data Science Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 30. | 50 AD 6P2 | Big Data Framework Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 31. | 50 AD 701 | Data Visualization Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 32. | 50 AD 702 | Cloud Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 33. | 50 AD 703 | Business Analytics | PC | 3 | 3 | 0 | 0 | 3 |
| 34. | 50 AD 704 | Deep Learning | PC | 3 | 3 | 0 | 0 | 3 |
| 35. | 50 AD 7P1 | Data Visualization Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 36. | 50 AD 7P2 | Deep Learning Laboratory | PC | 4 | 0 | 0 | 4 | 2 |

## PROFESSIONAL ELECTIVES (PE)

### SEMESTER V, ELECTIVE I

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 AD E11 | Software Quality Assurance and Testing | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD E12 | Object Oriented Analysis and Design | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD E13 | C# and .NET | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD E14 | User Interface Design | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E15 | Intelligent Database Systems | PE | 3 | 3 | 0 | 0 | 3 |

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## SEMESTER VI, ELECTIVE II

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 AD E21 | Information Retrieval and Web Search | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD E22 | Social Networking and Mining | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD E23 | Business Intelligence | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD E24 | Natural Language Processing | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E25 | Database and Web Application Security | PE | 3 | 3 | 0 | 0 | 3 |

## SEMESTER VI, ELECTIVEIII

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 AD E31 | Pattern Recognition | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD E32 | Predictive Modeling and Data Analytics | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD E33 | Reinforcement Learning | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD E34 | Web Intelligence | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E35 | Mining Massive Datasets | PE | 3 | 3 | 0 | 0 | 3 |

## SEMESTER VII, ELECTIVE IV

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 AD E41 | Data Analytics for Industry 4.0 | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD E42 | Design of Artificial Intelligence Products | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD E43 | Blockchain System through Predictive Analytics | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD E44 | Kernel Methods for Machine Learning | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E45 | Game theory for Decision Analysis | PE | 3 | 3 | 0 | 0 | 3 |

## SEMESTER VIII, ELECTIVE V

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| | | **THEORY** | | | | | | |
| 1. | 50 AD E51 | Block chain Technology | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD E52 | Geographical Information Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD E53 | Data Centric Computing | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD E54 | Ethics for Data | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD E55 | Social Media Analytics | PE | 3 | 3 | 0 | 0 | 3 |

## GENERAL ELECTIVE (GE)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1. | 50 GE 001 | National Cadet Corps(Air Wing) | GE | 4 | 2 | 0 | 2 | 3 |
| 2. | 50 GE 002 | National Cadet Corps(Army Wing) | GE | 4 | 2 | 0 | 2 | 3 |

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## SEMESTER VII & SEMESTER VIII, AUDIT COURSES (AC)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1. | 50 AC 001 | Research Skill Development –I | AC | 1 | 1 | 0 | 0 | 0 |
| 2. | 50 AC 002 | Research Skill Development –II | AC | 1 | 1 | 0 | 0 | 0 |

## MANDATORY COURSES (MC)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1. | 50 MY 002 | Environmental Science | MC | 2 | 2 | 0 | 0 | 0 |
| 2. | 50 MY 004 | Universal Human Values | MC | 3 | 2 | 1 | 0 | 3 |
| 3. | 50 MY 006 | Essence of Indian Traditional Knowledge | MC | 2 | 2 | 0 | 0 | 0 |
| 4. | 50 MY 014 | Start-ups and Entrepreneurship | MC | 2 | 2 | 0 | 0 | 0 |

## OPEN ELECTIVES (OE)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| | | THEORY | | | | | | |
| 1. | 50 AD L01 | Data Analytics | OE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 AD L02 | Machine Learning using R | OE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 AD L03 | Python for Data Science | OE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AD L04 | Introduction to Deep Learning | OE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 AD L05 | Robotic Process Automation | OE | 5 | 1 | 0 | 4 | 3 |
| 6. | 50 AD L06 | Visualization Techniques | OE | 5 | 1 | 0 | 4 | 3 |

## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|-------|-------------|--------------|----------|-----------------|---|---|---|---|
| 1. | 50TP 0P1 | Career Competency Development I | EEC | 2 | 0 | 0 | 2 | 0 |
| 2. | 50TP 0P2 | Career Competency Development II | EEC | 2 | 0 | 0 | 2 | 0 |
| 3. | 50TP 0P3 | Career Competency Development III | EEC | 2 | 0 | 0 | 2 | 0 |
| 4. | 50TP 0P4 | Career Competency Development IV | EEC | 2 | 0 | 0 | 2 | 0 |
| 5. | 50TP 0P5 | Career Competency Development V | EEC | 2 | 0 | 0 | 2 | 0 |
| 6. | 50 AD 7P3 | Project Work - Phase I | EEC | 4 | 0 | 0 | 4 | 2 |
| 7. | 50 AD 8P1 | Project Work - Phase II | EEC | 16 | 0 | 0 | 16 | 8 |

## SUMMARY

| S.No. | Category | I | II | III | IV | V | VI | VII | VIII | Total Credits | Percentage % |
|-------|----------|---|----|-----|----|---|----|----|------|---------------|--------------|
| 1. | HS | 2 | 2 | - | - | - | - | - | - | 04 | 02.40 |
| 2. | BS | 9 | 4 | 4 | 4 | - | - | - | - | 21 | 12.6 |
| 3. | ES | 5 | - | - | - | - | - | - | - | 05 | 03.01 |
| 4. | PC | 4 | 13 | 16 | 18 | 16 | 16 | 16 | - | 99 | 59.63 |
| 5. | PE | - | - | - | - | 3 | 6 | 3 | 3 | 15 | 09.04 |
| 6. | OE | - | - | - | 3 | 3 | 3 | 3 | - | 12 | 07.22 |
| 7. | EEC | - | - | - | - | - | - | 2 | 8 | 10 | 06.02 |
| 8. | MC | MC I | MC II | MC III | MC IV | - | - | - | - | - | - |
| 9. | AC | - | - | - | - | - | - | AC I | AC II | - | - |
| Total | | 20 | 19 | 20 | 25 | 22 | 25 | 24 | 11 | 166 | 100 |

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| K. S. Rangasamy College of Technology – Autonomous   R2018 ||||||||
|---|---|---|---|---|---|---|---|---|
| 50 BC 001 -  Business Communication and Value Science I ||||||||
| Common to CB, AD ||||||||
| Semester | Hours / Week ||| Total hrs | Credit | Maximum Marks |||
| | L | T | P | | C | CA | ES | Total |
| I | 2 | 0 | 0 | 30 | 2 | 40 | 60 | 100 |

| Objective(s) | ● To embellish students' overall communication and interpersonal skills by engaging them in group activities and helping them to emerge as thorough professionals.<br>● To focus on the development of basic English language skills with appropriate usage of vocabulary both in general and technical specific terms pertaining to their domain.<br>● To sensitize the learners with the importance of communication and listening skill by overcoming the barriers for effectiveness.<br>● To equip the students with the ability of setting personal and career goals so as to self-appraise them on value and belief systems for better understanding cultural sensitivities at the work place<br>● To reinforce team dynamics in order to maximize personal effectiveness for the healthier understanding of both personal and corporate values. |
|---|---|
| Course Outcomes | **At the end of the course, the students will be able to:**<br>CO1: Formulate meaningful sentences by using suitable tenses, voices and academic lexical words with phonological proficiency<br>CO2: Compose different types of letters of correspondence and reports in the academic and professional contexts.<br>CO3: Interpret and examine the importance of communication skills in general and listening skills in particular<br>CO4: Restate self-awareness by values and beliefs for better goal setting and understand the cultural sensitivities that is prevalent at the workplace<br>CO5: Examine the team effectives and group dynamics in making better decisions by the effective managerial exposition of human values |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Essential Grammar - I**

Tenses: Basic forms and use -  Sentence formation (general & Technical) -  Common errors -  Parts of speech through context -  Direct and reported speech structures and voices - Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West -  Academic word list (AWL) technical specific terms related to the field of technology -  Phrases -  Idioms -  significant abbreviations formal business vocabulary - Phonetic: Pronunciation -  Reduction of MTI in spoken English - Question formation with emphasis on common errors made during conversation. [9]

**Written Communication – I**

Letter Writing - Formal and Informal letter writing -  Application letters -  Report writing: Academic and Business report -  Job application letter [3]

**Communication Skills**

Importance of effective communication - Types of communication - Verbal and Non-verbal - Barriers to communication - Effective communication - Listening Skills: Law of nature- Importance of listening skills - Difference between listening and hearing - Types of listening. [2]

**Self – Awareness**

Self-Assessment -  Self-Appraisal -  SWOT - Self-esteem -  Self- awareness -  Perceptions and attitudes - Positive attitude -  Values and belief systems -  Personal goal setting -  Career planning -  Personal success factors - Handling failures -  Depression and habit -  Relating SWOT analysis & goal setting and prioritization - Socio-cultural and cross-cultural sensitivities at the workplace: What is Inclusion? - Women's contributions in Industry - Work issues faced by women - what is sexual harassment? -  What is appropriate behavior for everyone at work? [9]

**Interpersonal Skills**

 Team work - Team effectiveness -  Group discussion -  Decision making - Team communication team: Conflict Resolution -  Team goal setting -  Team motivation - Understanding team development -  Team problem solving - Building the team dynamics – Multi-cultural team activity - Time Management: The Time management matrix - [7]

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Application of Pareto Principle (80/20 Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters -  How to plan? -  How to handle interruptions? -  to maximize your personal effectiveness -  How to say no to time wasters - Values of a good manager: Understanding corporate values and behavior: Personal / Human Values - Pride and grace in Nationalist.

| | Total Hours | 30 |
|---|---|---|

**Text book(s):**

| 1. | Dr. Saroj Hiremath, "Business Communication", NiraliPrakashan, Mumbai, 2017. |
|---|---|
| 2. | Raymond Murphy, "Essential English Grammar",2nd Edition, Cambridge University Press, 2015. |

**Reference(s):**

| 1. | Alan McCarthy and Felicity O'Dell, "English Vocabulary in Use", Preliminary and Advanced, 4th Edition, Cambridge University Press, 2017. |
|---|---|
| 2. | Charles Marsh, David W. Guth, Bonnie Poovey Short, "Strategic Writing Multimedia Writing for Public Relations, Advertising, and More", 4th Edition, 2017. |
| 3. | Christopher Booker, "The Seven Basic Plot", Bloomsbury, New Delhi, 2004. |
| 4. | Norman Lewis, "Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book", Penguin Random House India, 2020. |

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

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|---|---|---|---|---|---|---|---|---|---|
| 50 MA 001 - Calculus and Differential Equations | | | | | | | | | |
| Common to all Branches | | | | | | | | | |
| Semester | Hours / week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| I | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 | |

| Objective(s) | ● To familiarize the students with the basic concepts in Cayley - Hamilton theorem and Orthogonal transformation.<br>● To get exposed to the fundamentals in circle of curvature, evolute and envelope of the curves.<br>● To acquire skills to understand the concepts involved in Jacobians and maxima and minima.<br>● To solve various linear differential equations and simultaneous differential equations.<br>● To learn various techniques and methods in solving definite and indefinite integrals. |
|---|---|
| Course Outcomes | At the end of the course, the students will be able to<br>CO1: Apply Cayley - Hamilton theorem and to reduce quadratic form into canonical form<br>CO2: Compute the equation of the circle of curvature, evolute and envelope of the curves.<br>CO3: Analyze Jacobian methods and constrained maxima and minima functions.<br>CO4: Apply various methods in differential equations to solve linear and simultaneous differential equations.<br>CO5: Evaluate definite and indefinite integrals using different techniques. |

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Matrices**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem (without proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation - Nature of quadratic form

[9]

**Differential Calculus**

Curvature – radius of curvature (Cartesian and polar co-ordinates) – Centre of curvature – Circle of curvature – Involute and evolute – envelope.

[9]

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**Functions of Several Variables**

Partial differentiation – Homogeneous functions and Euler's theorem – Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's Method of Undetermined Multipliers. [9]

**Differential Equations**

Linear differential equations of second and higher order with constant co-efficient - R.H.S is $e^{\alpha x}$, $sin\alpha x$, $cos\alpha x$, $x^n n > 0$ , $e^{\alpha x}sin\beta x$ , $e^{\alpha x}cos\beta x$, $e^{\alpha x}x^n$, $x^n sin\alpha x$ and $x^n cos\alpha x$ –  Differential equations with variable co-efficients: Cauchy's and Legendre's form of linear equation– Method  of variation of parameters – Simultaneous first-order linear equations with constant co-efficient. [9]

**Integral Calculus**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals. [9]

| | |
|---|---|
| Total Hours: 45+15(Tutorial) | 60 |

| | Text book(s): |
|---|---|
| 1. | Grewal B.S, "Higher Engineering Mathematics", 43rd  Edition, Khanna Publishers, Delhi, 2014. Web site: https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html. |
| 2. | T. Veerarajan., "Engineering Mathematics", for Semesters I & II , Tata McGraw Hill Publishing Co., New Delhi,2010. |

| | Reference(s): |
|---|---|
| 1. | Kreyszig Erwin, "Advanced Engineering Mathematics", 10thEdition, John Wiley and Sons (Asia)Limited, New Delhi, 2016. |
| 2. | Dr. P.N. Agrawal and Dr.D.N. Pandey," Integral Equations,calculus of variations and its applications", NPTEL online video courses. |
| 3. | Dr.S. K.Gupta and  Dr. Sanjeev Kumar, "Matrix Analysis with Applications" and   Prof Somnath Roy "Matrix Solvers" , NPTEL online video courses. |
| 4. | Dr. P.Kandasamy , Dr.K.Thilagavathy and  Dr. K.Gunavathy , "Engineering Mathematics-II",        S.Chand& Company Ltd, New Delhi. |

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

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|---|
| **50 PH 011 - Optoelectronics and New Materials** |
| **AD** |

| Semester | Hours/week | | | | Credit | Maximum marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | Total hrs | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| Objectives | <ul><li>To instill knowledge on physics of semiconductors, determination of charge carriers and device Applications</li><li>To enable the students to correlate the theoretical principles with application-oriented studies in opto electronic materials.</li><li>To explain the principles of laser, types of laser and demonstrate the applications of laser</li><li>To state the principle of optical fiber and to understand the design and applications of optical fibers.</li><li>To introduce advanced materials and nano technology for engineering applications</li></ul> |
| Course Outcomes | At the end of the course, students will be able to<br>CO1: Analyze the basic ideas of semiconductors and apply the concept in devices<br>CO2: Apply the principles of optoelectronic devices for various engineering applications<br>CO3: Recognize the basic ideas about classification of laser and various applications of laser.<br>CO4: Assess the propagation of light in fiber optic cables, communication link and applications<br>CO5: Relate the properties of new engineering materials and nanomaterials for potential |

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| | | applications. |
|---|---|---|

Note: Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus.

**Semiconductor Physics**

Introduction-Elemental and compound semiconductors-Intrinsic and extrinsic semiconductors-Properties-carrier concentration in intrinsic and extrinsic semiconductors (qualitative)-p-n junction diode: characteristics, p-n junction transistors: characteristics (CB and CE)-Bipolar characteristics (Biased and unbiased)-FET: characteristics and applications.  [10]

**Optoelectronic Materials and Devices**

Photoconductive materials – Light Dependent Resistor – Working of LDR – Applications of LDR, Photovoltaic materials – Solar cell – Construction and working of a solar cell – Applications of solar cells, Liquid crystals – Liquid crystal Display (LCD) – Construction and advantages of LCD, Electro optic materials – Optoelectric effect-Electro-Optic Modulation.  [9]

**Laser Technology**

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion-different types of lasers: gas lasers ($CO_2$), solid-state lasers (Nd: YAG), dye lasers, Semiconductor laser (Homojunction and Hetero junction)-Properties of laser beams-applications of lasers in science and engineering.  [8]

**Fiber Optics and Sensors**

Principles – cone of acceptance, numerical aperture (derivation)- Modes of propagation –Fabrication of optical fibre: Crucible-crucible technique - Classification: based on materials, modes and refractive index profile– Splicing : types of splicing- Losses in optical fiber – Detectors – Fiber optical communication links (Block diagram) – Advantage of fiber optical cable over copper cables-  Fiber optic sensors: liquid level sensors, Temperature and Displacement sensors.  [9]

**New Materials**

Engineering Materials: Metallic glasses – preparation, properties and applications, Shape memory alloys (SMA) : characteristics, properties of NiTi alloy applications – advantages and disadvantages of SMA
Nano Materials: Nanomaterials: Properties- Top-down process: Ball Milling method – Bottom-up process: Vapour Phase Deposition method- Carbon Nano Tube (CNT): Properties, preparation by electric arc method - Applications.  [9]

| | Total Hours | 45 |
|---|---|---|

Text Book(s):

| 1. | V.Rajendran, "Engineering Physics", Tata McGraw Hill, New Delhi, 2017. |
|---|---|
| 2. | Arumugam M, "Engineering Physics-II", 6th  Anuradha Publications, Kumbakonam, 2010. |

Reference (s) :

| 1. | Malvino,"Electronic Principle", Tata McGraw Hill, New Delhi, , 8th Edition, 2016. |
|---|---|
| 2. | P.K.Palanisamy, "Physics of Materials", Scitech Publications, Chennai, 2012. |
| 3. | B. K. Pandey and S. Chaturvedi, "Engineering Physics", Cengage Learning India Pvt Ltd., New Delhi, 1st Edition,2017. |
| 4. | Halliday and Resnick, "Fundamentals of Physics", John Wiley and Sons, Inc, 11th Edition,2018. |

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

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|---|---|---|---|---|---|---|---|---|
| **50 CS 001 – Programming for Problem Solving** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

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| | | |
|---|---|---|
| **Objective(s)** | ● To learn the evolution of computers and examines the most fundamental element of the C language<br>● To examine the execution of branching, looping statements, arrays and strings.<br>● To understand the concept of functions, pointers and the techniques of putting them to use<br>● To apply the knowledge of structures and unions to solve basic problems in C language<br>● To enhance the knowledge in file handling functions for storage and retrieval of data | |
| **Course Outcomes** | **At the end of the course, the student will be able to:**<br>CO1: Infer the evolution, generation, representation of problem and recognize the concepts of data types and expressions<br>CO2: Annotate the concept of console Input and output features and examine the execution of branching, looping statements, arrays and strings<br>CO3: Recognize the concepts of functions, recursion, storage class specifies and pointers with its features<br>CO4: Comprehend basic concepts of structures ,unions ,user defined data types and preprocessor<br>CO5: Interpret the file concepts using proper standard library functions | |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction to Computer and Programming**<br>Introduction to Computers - Evolution of computers - Generations of computers and Programming Languages– Introduction to components of a computer system -Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart–Pseudocode with examples. From algorithms to programs–variables (with data types)– Type Qualifiers - Constants – Operators –expressions and precedence. | [9] |
| **I/O ,Branching ,Loops and Arrays**<br>Console I/O– Unformatted and Formatted Console I/O – Conditional Branching and Loops -Writing and evaluation of conditionals and consequent branching -Iteration and loops - Arrays (1-D, 2-D), Character arrays and Strings | [9] |
| **Functions and Pointers**<br>Functions: Scope of a Function – Library Functions and User defined functions - Function Prototypes – Function Categorization - Function Arguments - Arguments to main function - The return Statement - Recursion - Passing Arrays to Functions– Storage class Specifiers, Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions - Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers– Dynamic memory allocation | [9] |
| **Structures, Unions, Enumerations, Typedef and Preprocessors**<br>Structures - Arrays of Structures- Arrays and Structures within Structures - Passing Structures to Functions - Structure Pointers - Unions – BitFields - Enumerations - typedef – The preprocessor and comments. | [9] |
| **File**<br>File: Streams –Reading and Writing Characters - Reading and Writing Strings -,File System functions - Random Access Files | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Herbert Schildt, "The Complete Reference C", 4th Edition, Tata McGraw Hill Edition, 2010. |
| 2. | Byron Gottfried, "Programming with C", Third Edition, McGraw Hill Education, 2014. |

| **Reference(s):** | |
|---|---|
| 1. | E.Balagurusamy, "Programming in ANSI C", 7th Edition, Tata McGraw Hill Edition, New Delhi, 2016. |
| 2. | Brian W. Kernighan and Dennis M. Ritchie, "C Programming Language", Prentice-Hall. |
| 3. | Reema Thareja, "Computer Fundamentals and Programming in C", 2nd Edition, Oxford Higher Education, 2016. |
| 4. | K N King, "C Programming: A Modern Approach", 2nd Edition, W.W.Norton, New York, 2008. |

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

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO4** | 1 | 3 | | 3 | 3 | | | 2 | | | | 2 | 3 | 3 | |
| **CO5** | 1 | 3 | | 2 | 3 | | | 2 | | | | 2 | 3 | 2 | |

| Module | Suggested Activities | Suggested Evaluation Methods |
|---|---|---|
| 1 | Knowing the history of computers | Group Discussion on Introduction to Computers and its generation |
| | Developing Pseudocodes and flowcharts for real life activities | |
| | Developing algorithms for basic mathematical expressions using arithmetic operations. | Assignments on pseudocodes and flowcharts |
| 2 | Simple programs using I/O statements, arithmetic operations | Tutorial for the above activities |
| | Implementation of simple programs using Branching ,Loops and Arrays | |
| | Performing String operations | Group discussion on  role of Branching, loop and Arrays in Programming Language |
| 3 | Develop simple applications like Calculator, Various Conversion Process using functions | Tutorial for the above activities |
| | Develop a  simple program by applying pointer concepts | Group discussion on   Function and Pointers |
| 4 | Develop simple programs using Structures, Unions, Enumerations, Typedef and Preprocessors | Tutorial for the above activities |
| 5 | Develop simple applications to apply files operations | Tutorial for the above activities |
| | | Group discussion on   Files Concepts |

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|---|---|---|---|---|---|---|---|---|
| **50 AD 101 - Introduction to Modern AI** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |
| **Objective(s)** | ● To use appropriate search algorithms for any AI problem<br>● To know about the various applications of AI.<br>● To design software agents to solve a problem.<br>● To gain knowledge on different types of learning<br>● To learn represent knowledge in solving AI problems | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Recognize the various characteristics of intelligent agents.<br>CO2: Analyze the different search strategies in AI.<br>CO3: Design software agents to solve a problem and represent a problem using first order and predicate logic.<br>CO4: Classify the different ways of planning and acting in the real world<br>CO5: Infer about the various learning of AI. | | | | | | | |
| Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated. | | | | | | | | |

**Introduction to AI and Intelligent Systems**

Introduction to AI - The Foundations of AI - The History of AI – The State of the art – Agents and Environments – Good Behavior: The Concept of Rationality – The Nature of Environments – The Structure of agents, Case study: Google Duplex     [9]

**Solving Problems by Searching**     [9]

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Problem-Solving Agents – Example Problems: Toy problems – Searching for solution – Uninformed searchstrategies-    Informed search and Exploration: Heuristic Functions – Constraint Satisfaction Problems: Backtrackingsearch, Case Study: Scheduling

| Knowledge and reasoning | [9] |
|---|---|

Logical Agents: Knowledge based agents – The Wumpus World – Logic –Propositional Logic – First order Logic: Syntax and Semantics of First-order Logic – Knowledge Representation: Ontological Engineering - Categories and Objects - Actions, Situations and Events

| Planning and Acting | [9] |
|---|---|

The Planning Problem – Planning with State-Space Search – Partial- Order Planning – Planning and acting in the real world: Time, Schedules and Resources – Hierarchical Task Network Planning – Conditional Planning – Continuous Planning – MultiAgent Planning

| Uncertain knowledge and reasoning | [9] |
|---|---|

Uncertainty: Acting under uncertainty – Basic Probability Notation – The Axioms of Probability – Making Simple decisions: Utility Functions – Decision Networks – Learning: Forms of Learning - Reinforcement Learning – Passive and Active Learning

| | Total Hours: 45+15(Tutorial) | 60 |
|---|---|---|

**Text book(s):**

| 1. | Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4 th Edition, Prentice Hall, 2020. |
|---|---|
| 2. | I. Bratko, "Prolog: Programming for Artificial Intelligence", 4th edition, Addison-Wesley Educational Publishers Inc., 2011. |

**Reference(s):**

| 1. | Gerhard Weiss, —Multi Agent Systemsll, Second Edition, MIT Press, 2013. |
|---|---|
| 2. | M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; 1st Edition, 2008. |
| 3. | William F. Clocksin and ChristopherS. Mellish, "Programming in Prolog: Using theISO Standard", 5th Edition, Springer, 2003. |
| 4. | K.R.Chowdhary, "Fundamentals of Artificial Intelligence",Springer,2020. |

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

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|---|---|---|---|---|---|---|---|---|
| 50 MY 006 – Essence of Indian Traditional Knowledge | | | | | | | | |
| Common to all Branches | | | | | | | | |
| **Semester** | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 2 | 0 | 0 | 30 | 0 | 100 | - | 100 |
| **Objective(s)** | ● To imparting basic principles of thought process, reasoning and inferencing. <br> ● To gain knowledge on sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. <br> ● To inculcate holistic life style of yogic science and wisdom capsulesin <br> ● To know sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. <br> ● To gain the knowledge on Indian artistic and its tradition | | | | | | | |
| **Course Outcomes** | **At the end of the course, the student will be able to** <br> CO1: Know many festivals have religious origins and entwine cultural and religious significance in traditional activities <br> CO2: Know harvest festivals, celebrate seasonal change <br> CO3: Ability to do case studies on philosophical tradition <br> CO4: Perform Indian artistic works | | | | | | | |

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|  | CO5: Ability to conduct exhibition and advertisement about artistic |
|---|---|
|  |  |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| Basic structure of Indian Knowledge System | [6] |
| Modern Science and Indian Knowledge System | [6] |
| Yoga and Holistic Healthcare | [6] |
| Case studies, Philosophical Tradition | [6] |
| Indian Linguistic Tradition (Phonology, morphology, syntax and semantics), Indian Artistic Tradition | [6] |
| **Total Hours** | **30** |

**Text book(s):**

| 1. | V.Sivaramakrishnan(Ed.),"Cultural Heritage of India Course material", Bharatiya Vidya Bhavan, Mumbai, 5thEdition,2014. |
|---|---|
| 2. | G N Jha (Eng. Trans.), Ed. RN Jha, "Yoga-darshanamwithVyasaBhashya", dyanidhiPrakashan, Delhi, 2016. |

**Reference(s):**

| 1. | RN Jha, "Science of Consciousness Psychotherapy and Yoga Practices", VidyanidhiPrakashan, Delhi, 2016 |
|---|---|
| 2. | Sengupta, Nirmal, "Traditional Knowledge in Modern India Preservation, Promotion, Ethical Access and Benefit Sharing Mechanisms", Springer, 2014. |
| 3. | Kapil Kapoor, Textbook of "Knowledge Traditions and Practices of India", Ancient Scientific Publishing, 2015 |
| 4. | Kapoor Kapil, "Indian Knowledge Systems: Vol. 2",  Ancient Scientific Publishing, 2017 |

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

| **K.S.Rangasamy College of Technology – Autonomous R2018** |
|---|
| **50 PH 0P2  -  Applied Physics Laboratory** |
| **Common to  EC, EE, EI, CS, IT,AD** |

| Semester | Hours/week | | | Total hrs | Credit | Maximum marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | TOTAL | |
| I | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 | |

| **Objective(s)** | ● To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory. <br> ● To demonstrate an ability to make physical measurements and understand the limitsof precision in measurements <br> ● To introduce different experiments to test basic understanding of physics concepts applied in optics and electronics. <br> ● To enable the students to correlate the theoretical principles with application oriented studies. <br> ● To analyze the behavior and characteristics of various materials for its optimum utilization |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will able to** <br> CO1:  Analyze the wavelength of laser and the particle size by diffraction phenomenon. (1) <br> CO2:  Apply the knowledge of interference to produce Newton rings and airwedge.(2-3) <br> CO3:  Extend the knowledge of diffraction property of light through grating and fiber optic cable (4,6) <br> CO4:  Infer the concept of refractive index and dispersion of light by aprism(5) |

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| | CO5: | Interpret the knowledge of semiconductor band gap, Hall coefficient, photovoltaic effect, Zener diode characteristics for its potential applications(7-10) |
|---|---|---|

**LIST OF EXPERIMENTS**

1. Determination of wavelength of laser and particle size – diffraction.

2. Determination of radius of a plano convex lens – Newton's ring.

3. Determination of thickness of a thin wire – Air wedge method.

4. Determination of wavelength of mercury spectral lines – spectrometer grating.

5. Determination of dispersive power of a prism.

6. Determination of numerical aperture (NA) & acceptance angle of an optical fiber

7. Determination of band gap of a semiconductor PN junction diode.

8. V-I characteristics of solar cell.

9. Characteristics of Zener diode.

10. Determination of Hall coefficient of a given semiconductor and its charge carrier density.

**Lab Manual:**

1. 'Physics Lab Manual', Department of Physics, KSRCT.

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

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|---|
| **50 CS 0P1  - Programming for Problem Solving Laboratory** |
| **Common to all Branches** |

| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| I | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

| **Objective(s)** | ● To enable the students to apply the concepts of C to solve simple problems<br>● To use selection and iterative statements in C programs<br>● To apply the knowledge of library functions in C programming<br>● To implement the concepts of arrays, functions, structures and pointers in C<br>● To implement the file handling operations through C |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apply how to read, display basic information and use selection and iterative statements<br>CO2: Demonstrate C program to manage collection of related data<br>CO3: Design and Implement different ways of passing arguments to functions, Recursion and implement pointers concepts<br>CO4: Develop a  C program to manage collection of different data using structures, Union, user-defined data types and preprocessor directives<br>CO5: Demonstrate C program to store and retrieve data using file concepts |

**LIST OF EXPERIMENTS**

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1. Implementation of Simple computational problems using various formulas.
2. Implementation of Problems involving Selection statements.
3. Implementation of Iterative problems e.g., sum of series.
4. Implementation of1D Array manipulation.
5. Implementation of2D Array manipulation.
6. Implementation of String operations.
7. Implementation of Simple functions and different ways of passing arguments to functions and Recursive Functions.
8. Implementation of Pointers
9. Implementation of structures and Union.
10. Implementation of Bit Fields, Typedef and Enumeration.
11. Implementation of Preprocessor directives.
12. Implementation of File operations.

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

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|---|---|---|---|---|---|---|---|---|---|---|
| 50 BC 002 -Business Communication and Value Science  II | | | | | | | | | | |
| Common to CB,AD | | | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | | |
|  | L | T | P |  | C | CA | ES | Total | | |
| II | 2 | 0 | 0 | 30 | 2 | 40 | 60 | 100 | | |

**Objective(s)**
- To equip the learners with lexical and syntactical proficiency in the professional and business scenario for better formal communication
- To facilitate the learners with the drafting skill of different types of letters for effective correspondence at the academic and work place
- To re-orient the learners to infer the fundamentals of effective communication in deciphering the managerial qualities for better presentation at the work place
- To groom the learners with corporate etiquettes and implement them ethically in the corporate / business setting.
- To make them aware about the socio-cultural and cross-cultural diversities for the appropriate use of value science at the work place.

**Course Outcomes**

**At the end of the course, the students will be able to**
CO1: Construct formal communication with appropriate syntactical statements and lexical proficiency in the given business contexts and situations
CO2: Organize and compose different types of letters of correspondence, emails and writing compositions
CO3: Infer and demonstrate the presentation skills and leadership qualities in making key decisions and
    provide effective feedback for efficient problem solving
CO4: Understand the professional etiquette and ethics in the corporate scenario for effective self-grooming at the work place.
CO5: Evaluate the cultural diversity at the workplace arena and understand the value science in business scenario.

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Essential Grammar - II**
Application of tenses – auxiliaries - correct usage and importance in formal communication - business vocabulary - vocabulary exercises through web-based applications – vocabulary exercises through web-based applications, usage and application through mock meetings - situational conversation: application of grammar and correct spoken English according to context/ situation and application in business scenario. [6]

**Written Communication – II**
Email writing- formal and Informal - email writing structure - Inquiry letters - Instruction letters - complaint letters - routine business letters - sales letters - technical writing - essay writing - paragraph writing. [4]

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**Fundamentals of Effective Communication**

Public speaking: fundamentals of effective public speaking – types: extempore speech, manuscript speech, and ways to enhance public speaking skills – storytelling - oral review - presentation skills: PowerPoint presentations - effective ways to structure the presentation - importance of body language - leadership skills - leader's role, responsibilities and skill required - understanding good leadership behaviors - learning the difference between leadership and management - gaining insight into your patterns, beliefs and rules - defining qualities and strengths of leadership - determining how well you perceive what's going on around you - learning about commitment and how to move things forward - making key decisions - handling your and other people's stress, empowering, motivating and inspiring others, leading by example - effective feedback - problem solving skill – confidence building. [7]

**Corporate / Business Etiquettes**

Corporate grooming and dressing - etiquettes in social and office setting - understand the importance of professional behavior at the work place - understand and Implement etiquettes in workplace - presenting oneself with finesse and making others comfortable in a business setting - Importance of first impression, grooming, wardrobe - Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities [4]

**Diversity and Inclusion**

Socio-cultural and cross-cultural sensitivities at the workplace: PwD and LGBT at the workplace - learning disabilities at the workplace - caste, class, regionalism, religion and poverty - the different identities of Indian employees and employers and how to include everyone - global diversity identities of race, religion,nationhood - appropriate social media use values sciences - values of a good manager - ethics in business - embodying organizational pridewithgrace. [9]

| | Total Hours | 30 |
|---|---|---|

| **Text book(s):** | | |
|---|---|
| 1. | Courtland L. Bovee, John V. Thill and Roshan Lal Raina , "Business Communication Today",13th Edition, Pearson, 2017 |
| 2. | Norman Lewis, "Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book", Penguin Random House India, 2020 |

| **Reference(s):** | |
|---|---|
| 1. | APAART: Speak Well 1 (English Language and Communication) |
| 2. | APAART: Speak Well 2 (Soft Skills) |
| 3. | Charles Marsh, David W. Guth, Bonnie Poovey Short, "Strategic Writing Multimedia Writing for Public Relations, Advertising, and More", 4th Edition, 2017 |
| 4. | Alan McCarthy and Felicity O'Dell, "English Vocabulary in Use, Preliminary and Advanced", 4th Edition , Cambridge University Press, 2017 |

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

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|---|---|---|---|---|---|---|---|---|---|
| **51 MA 020 – Mathematical Foundations of Data Science** | | | | | | | | | |
| **AD** | | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| II | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 | |
| **Objective(s)** | ● To introduce the concepts of linear algebra in the fields of communication systems and signal processing.<br>● To employ the numerical techniques for various mathematical operations and tasks such as the solution of linear equations and eigenvalue problems.<br>● To expose the knowledge of modeling the real-life problems as linear programming problems and optimization. | | | | | | | | |

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| | | At the end of the course, the student will be able to |
|---|---|---|
| **Course Outcomes** | | **At the end of the course, the student will be able to**<br>CO1: Apply the concepts of linear transformation and vectors spaces to solve real world applications<br>CO2: Solve the system of linear equations and eigen value problems numerically.<br>CO3: Apply linear programming techniques to optimize problems arising in data science.<br>CO4: Apply the suitable method to predict the optimum solution for transportation and assignment models.<br>CO5: Analyze the knowledge of graph theory and its related techniques. |

- To use transportation and assignment model techniques for effective decisions–making.
- To learn some basic types of graphs, connectivity and the complexity of the model can be viewed through graph.

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Linear Algebra**

Linear Algebra - Row reduction and Echelon forms – Vector equations – Linear combinations of vectors – Linear independence - Introduction to linear transformation – Matrix of a linear transformation – Transformation from $R^n$ to $R^m$. [9]

**Numerical Linear Algebra**

System of equations- Solution by Gauss Elimination, Gauss-Jordan and LU decomposition method – Gauss-Jacobi, Gauss-Seidal iteration method- Eigen values of a matrix by Jacobi and Power method. [9]

**Linear Programming Problems**

Mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two phase method - Big M method. [9]

**Optimization techniques**

Transportation problems - North West Corner Rule – Least Cost Method – Vogel's Approximation Method – MODI method - Assignment problems – Hungarian method – Travelling Salesman Problem. [9]

**Graph Theory**

Introduction to graph theory, directed and undirected graphs, special graph structures, graph representations and isomorphism of graphs, connectedness, components, Euler, Hamilton paths and cycles. [9]

**Total Hours: 45+15(Tutorial)** | **60**

**Text book(s):**

| 1. | David C. Lay, "Linear Algebra and its Applications", 5th Edition, Pearson Education, 2014. |
|---|---|
| 2. | Kanti Swarup, P.K.Gupta, Man Mohan "Operations Research", 2nd Edition, Sultan Chand& Sons, 2014. |

**Reference(s):**

| 1. | Gilbert Strang, Introduction to linear algebra, 5th Edition, ANE Books, 2016. |
|---|---|
| 2. | P.Kandasamy ,K.Thilagavathy and K.Gunavathy " Numerical Methods "S.Chand& Co., 2008. |
| 3. | H.A. Taha, "Operation Research", Pearson Education,10th Edition, 2017. |
| 4. | J.A. Bondy, U.S.R. Murty, "Graph Theory", Springer, 2013. |

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

| **K. S. Rangasamy College of Technology – Autonomous R2018** |
|---|
| **50 AD 201 - Computer Architecture** |
| **AD** |

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Approved in Academic Council Meeting held on 25/05/2024

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ● To understand the basic structure and operation of a computer system<br>● To impart the knowledge on the state of art of memory systems<br>● To explore the basic processing unit and I/O organization<br>● To analyze the parallel processing techniques<br>● To examine the components involved in the design of a embedded computer system |
|---|---|
| **Course Outcomes** | **At the end of the course, the student will be able to**<br>CO1: Identify the basic functional units of a computer system and the architecture of 8086 microprocessor<br>CO2: Illustrate the physical and virtual memory systems<br>CO3: Analyze the concept of basic processing unit and I/O organization<br>CO4: Examine the techniques applied for enhancing the performance of processor<br>CO5: Design a complete embedded computer system |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Basic Structure of Computers**

Functional units – Basic operational concepts – Memory locations and addresses – Memory operations – Introduction to 8086 Architecture – Addressing modes – Instruction set – RISC and CISC styles – Case study: Assembly language programs for 8086 microprocessor. [11]

**Memory System**

Semiconductor RAM Memories – Read only Memories – Direct Memory Access – Memory Hierarchy – Cache memories – Performance considerations – Virtual memory – Secondary storage [9]

**Basic Processing Unit & I/O Organisation**

Instruction Execution – Hardware Components – Hardwired control – Microprogrammed control – Bus operation – Bus arbitration – Interface circuits – Interconnection standards (PCI,SCSI,USB) – Accessing I/O devices – Interrupts [8]

**Parallel Processing**

Pipeline Organization – Pipelining Issues – Data dependencies – Memory delays – Branch delays – Performance Evaluation – Superscalar Operation – Shared memory Multiprocessors – Cache Coherence – Parallel programming for multiprocessors [9]

**Embedded Systems**

Embedded systems examples – Microcontroller chips for embedded applications – A simple microcontroller : Parallel and Serial I/O Interface , Counter/ Timer – Sensors and Actuators – Microcontroller families – Design Issues [8]

**Total Hours 45**

**Text Book(s):**

| 1. | Carl Hamacher, ZvonkoVranesicSafwatZaky and NaraigManjikian,"Computer Organisation and Embedded Systems" , 6thEdition, McGraw Hill International Edition, 2017. |
|---|---|
| 2. | Soumitra Kumar Mandal,"Microprocessors and Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 and 8051", 7th Edition, McGraw Hill India, 2013. |

**Reference(s):**

| 1. | William Stallings,"ComputerOrganisation& Architecture – Designing for Performance",10th Edition, Pearson Education,2016. |
|---|---|
| 2. | David A.Patterson and John L.Hennessy, "Computer Organisation& Design, the hardware / software interface", 5thEdition, Morgan Kaufmann, 2014. |
| 3. | Morris Mano M, "Computer System Architecture", 3rd Edition, Pearson Education, 2017. |
| 4. | Douglas E. Comer, "Essentials of Computer Architecture", 6th Edition, Pearson Education, 2012. |

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

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| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | 3 | 2 | 3 | 2 | | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | | |
| **CO3** | 3 | 2 | 3 | 2 | | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | | |
| **CO4** | 3 | 2 | 3 | | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | |
| **CO5** | 3 | 2 | 3 | | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 1 |

| K.S.Rangasamy College of Technology – Autonomous R2018 |
|---|
| **50 AD 202 - Python Programming** |
| **AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ● To understand the basic programming methodology<br>● To learn about the operators and control statements<br>● To implement modules and package concepts<br>● To handle exceptions arised during programming<br>● To know object-oriented programming concepts |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apprehend the basics of Python programming<br>CO2: Comprehend the decision making and looping in Python programs<br>CO3: Implement modules and Functions<br>CO4: Access files, identify errors and handle exceptions<br>CO5: Implement OOP concepts in Python Language |

**Introduction to Python Programming Language**

Introduction to Python Language - Strengths and Weaknesses - IDLE, Dynamic Types - Naming Conventions - String Values - String Operations, String Slices - String Operators - Numeric Data Types – Conversions -Built In Functions - Lists – Tuples – Sets – Dictionaries - Sorting Dictionaries [9]

**Control Statements and Operators**

Introduction - Arithmetic operators - Relational Operators – Logical Operators - Bit Wise Operators - Assignment operators - Control Flow and Syntax – Indenting – The if Statements – elif - Looping statements – for loop – while loop - break and continue [9]

**Functions and Modules**

Introduction- defining own Functions – Parameter passing - Keyword and Optional Parameters-Passing Collections to a Function-Variable Number of Arguments – Lambda- Scope – Recursion - Modules- import statement - Standard Modules - math, time – User definedmodules [9]

**File I/O and Exception Handling**

Introduction- Data Streams - Creating own data Streams - Access Modes - Writing Data to a File - Reading Data From a File - Additional File Methods- Exceptions – Types – Handling Exceptions - User Defined Exceptions [9]

**Object and Classes**

Classes in Python - Principles of Object Orientation - Creating Classes - Instance Methods - Class Variables – Constructor - Inheritance – Types of inheritance – Polymorphism – operator overloading, overriding [9]

| | **Total Hours** | **45** |
|---|---|---|

**Text book(s):**

| 1. | Ashok Kamathane, "Programming and Problem solving with Python", McGraw Hill, First Edition, 2017 |
|---|---|
| 2. | James Payne, "Beginning Python – using Python 2.6 and Python 3.1", Wiley India Pvt Ltd, 2010 |

**Reference(s):**

| 1. | Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Pvt Ltd, 2015 |
|---|---|
| 2. | Dr. R.Nageswara Rao "Core Python Programming", DreamTechPress,Second Edition,2018 |
| 3. | John Paul Mueller, "Beginning Programming with Python", Wiley India Pvt Ltd, 2014 |

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| 4. | Allen Downey, Jeffrey Elkner, Chris Meyers, " Learning with Python", DreamTech Press, 2015 |
|---|---|

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

| Module | Suggested Activities | Suggested Evaluation Methods |
|---|---|---|
| 1 | String and numeric data types | Debugging, Code Completion |
| | List, tuple and dictionary | Quiz |
| 2 | Hands-on Design or Problem-Solving Activity using control structures and operators | Debugging<br>Code Completion<br>Coding Challenge<br>Quiz |
| 3 | Python programs to employ functions to perform specific computations | Debugging<br>Code Completion<br>Coding Challenge<br>Quiz |
| | Python programs to import system modules and create own modules | |
| 4 | Python programs to perform I/O operations on files | Debugging<br>Code Completion<br>Coding Challenge<br>Quiz |
| | Python programs to identify errors and handle exceptions | |
| 5 | Python programs using classes and objects | Debugging<br>Code Completion<br>Coding Challenge<br>Quiz |
| | Python programs to apply various types of inheritance. | |
| | Python programs to perform overloading and overriding | |

| K.S.Rangasamy College of Technology – Autonomous R2018 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 AD 203 - Introduction to Database System** | | | | | | | |
| **AD** | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To familiarize the students with database concepts and its applications<br>● To learn the fundamentals of data models and to represent a database system using ER diagrams<br>● To study SQL and relational database design<br>● To gain the knowledge on relational algebra<br>● To learn the significance of data storage and transaction processing | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Design database and verifying their structural correctness<br>CO2: Apply relational algebra concepts to perform SQL queries<br>CO3: Write SQL queries for data manipulation<br>CO4: Build internal storage structures using different file and indexing techniques<br>CO5: Implement concepts of transaction processing, concurrency control techniques to databases | | | | | | | |

**Introduction to Databases**

Introduction to Database Systems - DBMS Applications - Purpose of DBMS - View of Data - Data Models - ER Model - Database System Architecture - Database Users and Administrators [9]

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| | | | [9] |
|---|---|---|---|

**Relational Algebra**

Relational Algebra - Unary Operations : Select, Project, Rename - Binary Operations: Union , Set Difference, Cartesian Product - Additional Relational Algebra Operations: Set-Intersection, Natural Join - Aggregate Functions     [9]

**Relational Database & SQL**

SQL Concepts : Basics of SQL, DDL, DML Commands – Integrity Constraints : primary key, foreign key, unique, not null, check, IN operator     [9]
Functions - Aggregate functions, Built in functions – Numeric, date, String functions

**Data Storage and Implementation**

RAID - File Organization - Organization of Records in Files - Index Structure for Files - Different types of Indexes     [9]

**Transaction Management**

Transaction Concepts - ACID Properties – Transaction States – Schedule - Serializability – Concurrency Control - Lock-Based Protocols - Two-Phase Locking Protocol     [9]

| | Total Hours | 45 |
|---|---|---|

**Text book(s):**

| 1. | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2020. |
|---|---|
| 2. | RamezElmasri and Shamkant B. Navathe, "Fundamental Database Systems", 7th Edition, Pearson Education, 2017. |

**Reference(s):**

| 1. | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", 4th Edition, McGraw-Hill, 2001. |
|---|---|
| 2. | Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing, 3rd Edition, 2014. |
| 3. | Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom, "Database System Implementation", Pearson Education, 2003. |
| 4. | Peter Rob and Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003. |

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

| **K.S.Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 MY 004 - Universal Human Values** | | | | | | | | |
| Semester | Hours / Week | | | Total Hrs | Credit C | Maximum Marks | | |
| | L | T | P | | | CA | ES | Total |
| II | 2 | 1 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | <ul><li>To identify the essential complementarily between 'values' and 'skills'</li><li>To ensure core aspirations of all human beings.</li><li>To achieve holistic perspective towards life and profession</li><li>To acquire ethical human conduct, trustful and mutually fulfilling human behaviour</li><li>To enrich interaction with Nature.</li></ul> | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Become more aware of themselves, and their surroundings<br>CO2: Responsible in life, and in handling problems with sustainable solutions<br>CO3: Maintain human relationships and human nature<br>CO4: Committed towards human values, human relationship and human society<br>CO5: Improve critical ability and apply it day-to-day life | | | | | | | |

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| **Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus. | |
|---|---|
| **Introduction to value Education**<br>Understanding value Education-Self exploration as the process for value education-Continuous Happiness and prosperity-the basic human aspirations-right understanding-relationship and physical facility –happiness and prosperity - current scenario – method to fulfill the basic human aspirations | [6] |
| **Harmony in the Human Being**<br>Understanding Human being as the Co-Existence of the self and the Body-Distinguishing between the needs of the self and the body-the body as an instrument of the self-understanding harmony in the self-harmony of the self with the body – programme to ensure self-regulation and health | [6] |
| **Harmony in the Family and Society**<br>Harmony in the Family –the basic unit of human interaction-values in human- to - human relationship –'Trust' the foundation value in relationship –'Respect'- as the right evaluation-understanding harmony in the society – vision for the universal human order. | [6] |
| **Harmony in the Nature/Existence**<br>Understanding harmony in the Nature-Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature – realizing existence as co-existence at all levels –the holistic perception of harmony in existence. | [6] |
| **Implications of the Holistic Understanding**<br>Natural Acceptance of human values- definitiveness of human conduct- a basis for humanistic education, humanistic constitution and universal human order- competence in professional ethics –holistic technologies, production systems and management models-typical case studies – strategies for transition towards value base life and profession | [6] |
| **Total Hours(30+15(Tutorial))** | **45** |

**Text Book(s):**

| 1. | A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 |
|---|---|
| 2. | Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 |

**Reference(s)**

| 1. | Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. |
|---|---|
| 2. | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |

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

| **K.S. Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD 2P1 - Python Programming Laboratory** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To perform operations on data structures<br>● To implement modules and package concepts<br>● To perform I/O operations in files<br>● To handle exceptions arised during programming<br>● To know object-oriented programming concepts | | | | | | | |

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Approved in Academic Council Meeting held on 25/05/2024

Chairman - Board of Studies
Dept. of Artificial Intelligence and Data Science
K.S.Rangasamy College of Technology
Tiruchengode - 637 215.

| | | At the end of the course, the students will be able to |
|---|---|---|
| **Course Outcomes** | | CO1: Perform operations in string, list, tuple and dictionary<br>CO2: Implement control structures and employ functions to perform specific computations<br>CO3: Create modules and perform I/O operations in files<br>CO4: Apply various types of inheritance<br>CO5: Apply overloading and overriding |

## LIST OF EXPERIMENTS

1. Python program to perform operations in string and numeric data types.
2. Python program to handle list, tuple and dictionary.
3. Python program to implement control structures and operators.
4. Python program to employ functions to perform specific computations
5. Python program to import system modules and create own modules
6. Python program to perform I/O operations in files
7. Python program to identify errors and handle exceptions
8. Python program to implement classes and objects
9. Python program to apply various types of inheritance
10. Python program to perform overloading and overriding

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

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD 2P2 - Database Systems Laboratory** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To understand data definitions and data manipulation commands<br>● To learn the use of nested and join queries<br>● To understand functions, procedures and procedural extensions of databases<br>● To expose the manipulation of data using PL/SQL blocks.<br>● To expose the concepts relating to built-in and aggregate functions. | | | | | | | |
| **Course Outcomes** | At the end of the course, the students will be able to<br>CO1: Implement the Data Definition Language commands, Data Manipulation Language, Data Control Language Commands and Transaction Control Language in RDBMS.<br>CO2: Construct simple SQL queries to retrieve data from multiple tables.<br>CO3: Design good relational database for data manipulation<br>CO4: Implement built-in functions and aggregate functions<br>CO5: Implement the database programming with Cursors,Triggers, Procedures and Functions in PL/SQL. | | | | | | | |

## LIST OF EXPERIMENTS

1. Data Definition Language (DDL) commands in RDBMS.
2. Data Manipulation Language (DML), Data Control Language (DCL) and Transaction Control Language (TCL) commands in RDBMS.
3. Implementation of Simple queries.
4. Database Design using ER modeling
5. Built-in Functions in SQL
6. Aggregate Functions in SQL
7. Simple PL/SQL Programs

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

| K.S. Rangasamy College of Technology– Autonomous R2018 |
|---|
| **51 MA 024 - Randomized Algorithms and Probabilistic Analysis** |
| **AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
|  | L | T | P |  | C | CA | ES | Total |
| III | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| **Objective(s)** | <ul><li>To acquire skills in handling situations involving probability and random variables</li><li>To familiarize the students about the concepts of distributions.</li><li>To develop the knowledge in various methods in hypothesis testing and design of experiments.</li><li>To understand the concept of random process and its application arise in sciences and engineering fields.</li><li>To learn the basic concepts of random process and Markov chains.</li></ul> |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Demonstrate the basic concepts of probability and random variables.<br>CO2: Apply discrete and continuous probability distributions to calculate the probability.<br>CO3: Test the statistical hypothesis using t test, F test and analyze the design of experiments using CRD, RBD.<br>CO4: Apply the stationary, ergodic and Markovian processes to solve machine learning problems<br>CO5: Apply random process methodology and tools in solving engineering problems. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| **Probability and Random Variables**<br>Axioms of probability – Conditional probability – Baye's theorem – Random variable – Probability mass function – Probability density function – Properties – Moments – Moments generating function and their properties. | [9] |
|---|---|
| **Standard Distributions**<br>Discrete Distributions: Binomial, Poisson and Geometric distributions – Continuous Distributions: Uniform, Exponential and Normal distributions. | [9] |
| **Testing of Hypothesis**<br>Test of significance: small samples – Student's t-test – Single mean – Difference of means – F-test – Analysis of Variance – Completely Randomized Design – One way classification – Randomized Block Design – Two-way classification. | [9] |
| **Classification of Random Processes**<br>Definitions and examples of first order, second order, strictly stationary, wide-sense stationary and ergodic processes – Markov process. | [9] |
| **Random Process Markov chains**<br>Random Walks – Eigen values and Rapid mixing – Expander graphs – Markov chain Monte Carlo – Approximate Counting – High-dimensional geometry and Statistics: Concentration of measure – Dimension reduction – Locality sensitive hashing – Nearest-neighbor search. | [9] |
| **Total Hours: 45+15(Tutorial)** | **60** |

| **Textbook(s):** |
|---|
| 1. Gupta,S.P., "Statistical Methods", Sultan Chand & sons 45th Edition, New Delhi, 2017. |
| 2. Veerarajan,T.,"Probability, Statistics and Random Processes", Tata McGraw-Hill 3rd Edition, New Delhi, 2008. |
| **Reference(s):** |

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Dept. of Artificial Intelligence and Data Science
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| | |
|---|---|
| 1. | Ross S, "A First Course in Probability", Pearson Education, 5th Edition, New Delhi, 2002. |
| 2. | Johnson R A, Miller& Freund's "Probability and Statistics for Engineers", Pearson Education, 6th Edition, New Delhi, 2000. |
| 3. | Michael Mitzenmacher and Eli Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 1st Edition, 2005. |
| 4. | David A.Levin, Yuval Peres and Elizabeth L.Wilmer, "Markov Chains and Mixing Times", American Mathematical Society, 2nd Edition, 2017. |

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

**K.S. Rangasamy College of Technology – Autonomous R2018**
**50 CS 002 –Data Structures**
**Common to CS,IT,EE,EC,AD**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|----------|---|---|---|-----------|--------|------|------|------|
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Objective(s)** | • To choose the appropriate data structure for a specified application<br>• To design and implement abstract data types such as linked list, stack , queue and trees<br>• To demonstrate various sorting , searching and graph algorithms<br>• To Learn and implement the hashing techniques<br>• To design a Priority Queue ADT and its applications |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Express the concept of Linear data structures, applications and its implementations<br>CO2: Appraise the knowledge of Tress with its operations<br>CO3: Recognize the concept of Sorting, Searching and its types<br>CO4: Review various implementations and operations of Priority Queue and Hashing Techniques<br>CO5: Apply Shortest Path and Minimum Spanning Tree algorithms and Biconnectivity |

**Note:**The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Lists, Stacks and Queues**
Abstract Data Type (ADT) – The List ADT – The Stack ADT – The Queue ADT [12]

**Trees**
Preliminaries – Binary Trees – The Search Tree ADT – Binary Search Trees – AVL Trees – Tree Traversals – B – Trees –B+Trees. [9]

**Sorting and Searching**
Preliminaries – Insertion Sort – Shell sort – Heap sort – Merge sort – Quick sort – External Sorting – Searching: Sequential search- Binary Search –Hashed list searches [7]

**Hashing and Priority Queues (Heaps)**
Hashing – Hash Function – Separate chaining – Open addressing – Rehashing – Extendible hashing Priority Queues (Heaps) – Model – Simple Implementations – Binary Heap – Applications of Priority Queues – d -Heaps. [7]

**Graphs**
Definitions – Topological Sort – Shortest-Path Algorithms – Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm, Kruskal's Algorithm – Applications of Depth-First Search – Undirected Graphs – Biconnectivity. [10]

**Total Hours  45**

**Text book:**

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| | | |
|---|---|---|
| 1. | M. A. Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia,2008. | |
| 2. | Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, "Data Structures using C", Pearson Education Asia, 2009. | |

**Reference(s) :**

| | |
|---|---|
| 1. | Rajesh K.Sukla," Data structure using C & C++", Wiley India,2012 |
| 2. | A. Tannenbaum, "Data Structure Using C", Pearson Education, 2003. |
| 3. | Goodrich &Tamassia, "Data Structures and Algorithms in C++", 2nd Edition, John Wiley & Sons, 2011 |
| 4. | Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford Higher Education, 2014. |

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

| Module | Suggested Activities | Suggested Evaluation Methods |
|---|---|---|
| 1 | Converting an algorithm from recursive to non-recursive using stack | Tutorials on applications of linear data structures. |
| | Demonstrating stack for Towers of Hanoi application | |
| | Developing any application (student's choice) using all the linear data structures | Checking output of programs implemented. |
| 2 | Implementing binary tree and tree traversals | Tutorials on trees |
| | Solving expressions using expression trees by determining infix, prefix and postfix expressions | Check output of programs implemented |
| | Developing any application using trees | Quiz on various topics of the unit |
| 3 | External learning - External sorting implementation | Tutorials on external sorting |
| | Implementation of all sorting techniques in C language | |
| | Demonstration of searching techniques under best and worst case inputs | Checking output of programs implemented |
| 4 | Implementation of Hashing | Tutorials on hashing |
| | | Check output of programs implemented |
| | Implementation of simple applications of Priority queue | Quiz on various topics of the module |
| 5 | Implementation of various shortest path algorithms | Tutorials on hashing |
| | | Check output of programs implemented |
| | Implementation of Minimum Spanning Tree | Quiz on various topics of the module |

| K.S. Rangasamy College of Technology– Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD 301 - Software Engineering** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 2 | 75 | 4 | 50 | 50 | 100 |
| **Objective(s)** | ●To gain knowledge about various software development lifecycle (SDLC) models.<br>●To learn how to elicit and formulate requirements.<br>●To be aware of designing a software considering the various perspectives of end user.<br>●To learn to develop a software component using coding standards and facilitate code reuse.<br>●To analyze the software using metrics and measurement and predict the complexity and the risk associated. | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Compare different process models | | | | | | | |

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CO2: Develop use cases for real-time problems.
CO3: Analyze and resolve information technology problems through the application of systematic approaches and diagnostic tools for end to end solutions.
CO4: Assess the quality of products and providing the real picture to the stakeholders
CO5: Select appropriate tools for testing web applications.

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Product and Process**

The Nature of Software – The changing nature of Software – The Software Process – Process models – Prescriptive Process Models – Specialized Process Models – Estimation for Software Projects – Project Scheduling – Software Configuration Management [9]

**Requirements Analysis and Specification**

Requirements Analysis – Software Requirements – Requirements Engineering – Eliciting Requirements – Developing Use Cases – Building the Requirements Model – Negotiating and Validating Requirements. [9]

**Analysis and Design**

Requirements Modeling: Scenarios, Information, Analysis Classes – Scenario Based Modeling – Data Modeling – Class-Based Modeling – Flow Oriented Models – Behavioral Models.
Design Process and Concepts – Design Model: Data Design Elements – Architectural Design – Component Level Design – Deployment Level Design – User Interface Design – Pattern-Based Design. [9]

**Software Testing**

Software Testing Strategies – System Testing – Debugging – White Box Testing – Black Box Testing – Model Based Testing – Testing for Specialized Environments, Architectures and Applications – Testing Object-Oriented and Web Based Applications – User Interface Testing – Configuration Testing – Security Testing – Performance Testing. [9]

**Software Engineering Tools**

Requirements Management Tools (e.g., IBM Rational Doors)
Design Tools (e.g., Sparx Enterprise Architect)
Development Tools: IDEs (e.g., Xcode, Eclipse, IntelliJ IDEA, NetBeans, Microsoft Visual Studio, Atom)
Source Control Management (e.g.,GitHub), Release Orchestration (e.g., OpenMake) [9]
Collaboration (e.g., Jira, Trello, Slack)
Testing Tools and Frameworks: Testing Tools (e.g., Junit, Selenium) - PaaS (e.g., PythonAnywhere, AWS Code9, Heroku).
selecting appropriate tools as per the software development.

**Total Hours: 45+30(Practical)    75**

**Textbook(s):**

| | |
|---|---|
| 1. | Roger S. Pressman, "Software Engineering: A Practitioner's Approach" , McGraw Hill International Edition, Eighth Edition, 2019. |
| 2. | Ian Sommerville, "Software Engineering", Tenth Edition, Pearson Education, 2015. |

**Reference(s):**

| | |
|---|---|
| 1. | Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010. |
| 2. | Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009. |
| 3. | Kelkar S.A., Software Engineering, Prentice Hall of India Pvt Ltd, 2007. |
| 4. | StephenR.Schach, Software Engineering, Tata McGraw-Hill Publishing Company Limited, 2007. |

| | 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 | |
| CO2 | | 3 | 3 | | | | | | | 3 | 3 | | 3 | 3 | |
| CO3 | | 2 | 3 | | 3 | | | | | | 2 | | 2 | 3 | |
| CO4 | 2 | | | | 3 | | | | | | | | 3 | 3 | |
| CO5 | | | 2 | | 3 | | | | 3 | 3 | 3 | | 3 | 3 | 3 |

| |
|---|
| **K.S. Rangasamy College of Technology – Autonomous R2018** |
| **50 AD 302 - Advanced Database Technologies** |
| **AD** |

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| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| Objective(s) | <ul><li>To familiarize the students with relational database concepts</li><li>To study the usage and applications of object oriented databases.</li><li>To acquire knowledge on distributed databases and its applications</li><li>To understand the emerging databases like  XML and web database</li><li>To learn about the working principle of blockchain systems</li></ul> |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Design and construct the SQL simple and complex queries<br>CO2: Model the real world data using object oriented database<br>CO3: Demonstrate the usage of distributed database<br>CO4: Organize the data using XML database for better interoperability<br>CO5: Describe the state-of-the-art, open research challenges, and future directions |

| | |
|---|---|
| **Relational Databases**<br>Introduction to SQL – Intermediate SQL – First Normal Form – Second Normal Form –Third Normal Form – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form | [9] |
| **Object Relational Databases**<br>Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL | [9] |
| **Distributed Databases**<br>Distributed Databases- Homogenous and Heterogeneous Databases - Distributed Data Storage - Distributed Transactions- Commit Protocols - Concurrency Control – Distributed Query Processing | [9] |
| **XML Databases**<br>XML Databases: XML Data Model – DTD – XML Schema – Storing XML in databases –   XML and SQL - XML Querying | [9] |
| **Blockchain Databases**<br>Overview – Blockchain Properties – Data Management in Blockchain – Smart Contract – Emerging Applications  - case study: MySQL, PostgreSQL Storing XML-in Databases - XML and SQL. | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| 1. | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2020. |
|---|---|
| 2. | RamezElmasri and Shamkant B. Navathe, "Fundamental Database Systems", 7th Edition, Pearson Education, 2017. |

**Reference(s):**

| 1. | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", 4th Edition, McGraw-Hill, 2001. |
|---|---|
| 2. | Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing, 3rd Edition, 2014. |
| 3. | Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom, "Database System Implementation", Pearson Education, 2003. |
| 4. | Peter Rob and Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003. |

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

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| K.S. Rangasamy College of Technology– Autonomous R2018 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 AD 303 - Java Programming** | | | | | | | |
| **AD** | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | <ul><li>To explore object oriented programming concepts, and apply them in solving problems</li><li>To introduce the concepts of interfaces, exception handling and multithreading</li><li>To create applications to store the data with the aid of files classes</li><li>To develop programs using Collection APIs</li><li>To analyze and develop applications with JDBC technology for real world problems</li></ul> |
|---|---|
| Course Outcomes | At the end of the course, the students will be able to<br>CO1: Express the concept of classes, objects and exhibiter usability through inheritance along with string and array<br>CO2: Extra polate coder education and access different operations through interfaces, multithreading with exception handling and perform remote method invocation<br>CO3: Appraise the importance of packages<br>CO4: Solve problems using java collection framework<br>CO5:Explore the database concepts and regular expressions with JDBC connectivity |

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| **Introduction** | |
|---|---|
| Object-Oriented Thinking: Object-Oriented concepts, data types, variables, operators, expressions, control statements, Methods and Classes, Arrays, String handling with String and String buffer, Inheritance : Inheritance basics, Member access, Types of inheritance, abstract classes, Constructors, use of super, final and  this keyword, polymorphism, method overriding. | [9] |
| **Java Concepts** | |
| Interfaces, Exception handling, Multithreaded programming-The Java Thread Model, The Main Thread,Creating a Thread, Creating multiple Threads, Thread priority, Synchronization, Remote Method Invocation (RMI). | [9] |
| **Packages** | |
| Packages : Defining a Package, CLASSPATH, Access protection, importing packages. I/O: The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization and De-serialization, Enumerations, wrapper classes, auto boxing and unboxing, Object cloning, generics. | [9] |
| **Collection Framework** | |
| (java.util) - Collections overview, Collection classes and Interfaces. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hashtable ,Properties, Stack, Vector. More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner | [9] |
| **Regular Expressions and Database Connectivity** | |
| Regular Expression: Matcher Class, Pattern class and Pattern Syntax Exception class, Regex Character Classes and Quantifiers, Metacharacters. Java Database Programming - Introduction, Relational Database Systems,DML, DDL, DCL and TCL, Java Database Connectivity : Introduction, Driver, Connectivity with Database, Statement, Prepared Statement | [9] |
| Total Hours | 45 |

| Textbook(s): | |
|---|---|
| 1. | Herbert Schildt, "Java : The complete Reference", Comprehensive coverage of the Java language, Oracle press, 10th Edition, Tata McGraw-Hill, 2017. |
| 2. | Y.Daniel Liang, "Introduction to Java Programming", Comprehensive Version, 10th Edition, Pearson |

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| | Education,2015 [JDBC only] |
|---|---|
| **Reference(s):** | |
| 1. | Java 7 Programming Black Book, Kogent Learning Solutions Inc, DreamTech Press, 2013. |
| 2. | Bert Bates and Kathy Sierra, "Head First Java", 2nd Edition, Publisher : O'Reilly's, 2009. |
| 3. | Jeffrey E. F. Friedl, "Mastering Regular Expressions", 3rd Edition, O'Reilly Media, Inc.,2006 |
| 4. | Online Resources : https://www.tutorialspoint.com, https://www.javatpoint.com, https://www.journaldev.com, https://beginnersbook.com |

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

| Module | Suggested Activities | Suggested Evaluation Methods |
|---|---|---|
| **1** | OOP concepts with real time examples | Think Pair Share(TPS) |
| | Demonstration of class and objects | Assignment |
| | Demonstration of types of Inheritance | Surprise Test |
| | Developing programs using string handling methods | Quiz |
| **2** | Assigning real time scenario of interface concepts | Assignment |
| | Executing program without exception handling | TPS Activity |
| | Differentiating ordinary problem solving method and thread based problem solving method | Quiz |
| | Accessing remote methods using RMI | Code Debugging |
| **3** | Create packages and accessing classes/methods | Quiz |
| | Classifying the IO streams and its classes by preparing chart / drawing block diagram | Technical Seminar |
| | Storing records such as primitive data and objects permanently using files | Flipped Class Room |
| | Providing assignment on auto boxing / un boxing | Assignment |
| | Demonstration on cloning objects | Quiz |
| **4** | Classifying the collection interfaces and its classes by preparing chart / drawing block diagram | Flipped Class Room |
| | Performing adding/searching/sorting of data using appropriate collection methods | Technical Seminar |
| | Learning the concept of legacy classes and more utility classes | Quiz |
| **5** | Assigning data such as email-id, phone numbers, etc. for validation using regular expressions | Think Pair Share |
| | Executing SQL Queries using database tables | Quiz |
| | Establishing database connectivity between Java and any Database | Flipped Class Room |

| K. S. Rangasamy College of Technology – AutonomousR2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 MY 002 -  Environmental Science** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 2 | 0 | 0 | 30 | 0 | 100 | - | 100 |
| **Objective(s)** | • To help the learners to analyze the importance of ecosystem and biodiversity. <br> • To familiarize the learners with the impacts of pollution and control. | | | | | | | |

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| | | • To enlighten the learners about waste and disaster management.<br>• To endow with an overview of food resources and human health.<br>• To enlighten awareness and recognize the social responsibility in environmental issues. |
|---|---|---|
| **Course Outcomes** | | **At the end of the course, the student will be able to**<br>CO1: Recognize the concepts and issues related to environment, ecosystem and biodiversity.<br>CO2: Analyze the source, effects, and control measures of pollution.<br>CO3: Enlighten of solid waste and disaster management.<br>CO4: Awareness about food resources, population and health issues.<br>CO5: Analyze the social issues and civic responsibilities. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Environment, Ecosystem and Biodiversity**

Environmental studies - Scope and multidisciplinary nature - Need for public awareness - Ecosystem - Food chain - Food web- Structure and function. Biodiversity - Values of biodiversity - Endangered and endemic species - Hot spots - India a mega biodiversity nation - Threats - Conservation - In-situ and ex-situ - Case studies. [6]

**Environmental Pollution**

Pollution - Air, water, soil, noise and nuclear - sources, effects and control measures - Impacts of mining. - Environment protection act- bio accumulation and bio magnification - Case studies. [6]

**Waste and Disaster Management**

Waste – wealth from waste - carbon foot print - Solid waste - e-waste - sources, effects and control measures. Disaster management - Earth quakes - Landslides - Floods - Cyclones - Tsunami - Disaster preparedness - Case studies. [5]

**Food Resources, Human Population and Health**

World food problems - over grazing and desertification - effects of modern agriculture. Population - Population explosion and its impacts - HIV/AIDS - Cancer- Role of IT in environment and human health - Case studies. [6]

**Social Issues and the Environment**

Unsustainable to sustainable development - Use of alternate energy sources - Wind - Geothermal - Solar - Tidal - energy calculation and energy audit - Rain water harvesting - Water shed management - Deforestation - Green house effect - Global warming - Climate change - Acid rain - Ozone layer depletion - Waste land reclamation. Consumerism and waste products - Role of an individual in conservation of natural resources - Case studies. [7]

| | **Total Hours** | **30** |
|---|---|---|

**Text Book(s):**

| 1. | Anubha Kaushik and C P Kaushik, "Perspectives in Environmental Studies ", New Age International Publishers, New Delhi, 6th edition , January 2018. |
|---|---|
| 2. | Tyler Miller. G, "Environmental Science", Cengage Publications, Delhi, 16th edition, 2018. |

**Reference(s):**

| 1. | Gilbert M.Masters and Wendell P. Ela, "Environmental Engineering And Science", PHI Learning Private Limited, New Delhi, 3rd Edition, 2013. |
|---|---|
| 2. | Rajagopalan. R, "Environmental Studies" Oxford University Press, New Delhi, 2nd edition, 2012. |
| 3. | Deeksha Dave and Katewa. S.S, "Environmental Studies", Cengage Publications, Delhi, , 2nd edition , 2013. |
| 4. | Cunningham, W.P. and Saigo, B.W.,"Environment Science", Mcgraw-Hill, USA. 9th edition, 2007. |

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

**K. S. Rangasamy College of Technology – Autonomous R2018**

| | 50 CS 0P2 - Data Structures Laboratory | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Common to CS,IT,EE,EC,AD** | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To design and implement simple linear and nonlinear data structures<br>● To strengthen the ability to identify and apply the suitable data structure for the given real world problem<br>● To program for storing data as tree structure and implementation of various traversal techniques<br>● To implement sorting and searching techniques<br>● To gain knowledge of graph applications | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Demonstrate the implementation of Linear Data structures and its applications<br>CO2: Investigate Balanced Parenthesis and Postfix expressions with the help of Stack ADT<br>CO3: Implement Non-Linear Data Structure<br>CO4: Implement sorting and searching techniques<br>CO5: Implement Shortest Path and Minimum Spanning Tree algorithm | | | | | | | |
| **List of Experiments** | | | | | | | | |

1. Implementation of List Abstract Data Type (ADT)

2. Implementation of Stack ADT

3. Implementation of Queue ADT

4. Implementation of stack applications:

    (a) Program for 'Balanced Parenthesis'
    (b) Program for 'Evaluating Postfix Expressions'
5. Search Tree ADT

6. Implementation of Internal Sorting

7. Develop a program for external sorting

8. Develop a program for various Searching Techniques.

9. Implementation of Shortest Path algorithm

10. Implementation of Minimum Spanning tree algorithm.

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

| **K.S.RangasamyCollege of Technology– Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD 3P1 - Java Programming Laboratory** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To develop programs using basic concepts ofJava<br>● To create applications using java concepts<br>● To provide the permanent storage for programs using files<br>● To design and develop the programs using collection APIs | | | | | | | |

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| | | |
|---|---|---|
| | • To develop applications with JDBC technology for real worldproblems | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Implement programs using object oriented concepts<br>CO2: Develop programs with the concept of interfaces, packages,exception handling and multi-threading<br>CO3: Implement the file operations using IO classes<br>CO4: Develop programs using Collections<br>CO5: Create applications with the database connectivity | |
| | **List of Experiments** | |

1. Class and `Objects

2. Interfaces

3. Packages

4. Multi Threading

5. Data storage using files

6. Collections

7. JDBC with Oracle / MongoDB

**Mini project:** Develop an application using the concepts of Interfaces, Packages and Collections along withJDBC.

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

| K. S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 TP 0P1 - Career Competency Development I** | | | | | | | |
| **Semester** | **Hours/Week** | | | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | **C** | **CA** | **ES** | **Total** |
| **III** | **0** | **0** | **2** | **0** | **100** | **00** | **100** |
| **Objective(s)** | • To help learners to enrich their grammatical correctness and vocabulary efficacy in the academic and professional contexts.<br>• To help the learners to frame syntactical structures of sentences and comprehend the meaning of reading passages effectively<br>• To help learners to adeptly sequence the information, draft letters and correct usage of foreign words with correct spelling and punctuation.<br>• To help the learners to introduce themselves and involve in situation conversations professionally<br>• To help learners to make various modes of presentations and express their opinion in a conducive way. | | | | | | |
| **Course Outcomes** | **At the end of the course, the student will be able to**<br>CO1: Reinforce the essential grammatical correctness and vocabulary efficacy in the  academic and professional contexts<br>CO2: Generate syntactical structures and infer the semantics in the reading passages effectively<br>CO3: Reorganize and compose the sequential information, letter drafts, and interpret  the appropriate usage of foreign words with correct spelling and punctuation<br>CO4: Demonstrate their introduction and relate to situational conversations adeptly<br>CO5: Exhibit various modes of presentations and organize their opinions in an expressive way | | | | | | |
| **Unit – 1** | **Written Communication – Part 1** | | | | | | **Hrs** |

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| | | |
|---|---|---|
| Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition - Change of Voice - Change of Speech - Synonyms & Antonyms - One Word Substitution - Using the Same Word as Different Parts of Speech - Odd Man Out<br>**Materials:** Instructor Manual, Word Power Made Easy Book | | 8 |
| **Unit – 2** | **Written Communication – Part 2** | |
| Analogies - Sentence Formation - Sentence Completion - Sentence Correction - Idioms & Phrases - Jumbled Sentences, Letter Drafting (Formal Letters) - Reading Comprehension(Level 1) - Contextual Usage -<br>**Materials:** Instructor Manual, Word Power Made Easy Book | | 6 |
| **Unit – 3** | **Written Communication – Part 3** | |
| Jumbled Sentences, Letter Drafting (Formal Letters) - Foreign Language Words used in English - - Spelling & Punctuation (Editing)<br>**Materials:** Instructor Manual, News Papers | | 4 |
| **Unit – 4** | **Oral Communication – Part 1** | |
| Self Introduction - Situational Dialogues / Role Play (Telephonic Skills) - Oral Presentations- Prepared -'Just A Minute' Sessions (JAM)<br>**Materials:** Instructor Manual, News Papers | | 6 |
| **Unit – 5** | **Oral Communication – Part 2** | 6 |
| Describing Objects / Situations / People, Information Transfer - Picture Talk - News Paper and Book Review<br>**Materials:** Instructor Manual, News Papers | | |
| **Total** | | **30** |

**Evaluation Criteria**

| S.No. | Particular | Test Portion | Marks |
|---|---|---|---|
| 1 | Evaluation 1<br>Written Test | 50 Questions – 30Questions from Unit 1 & 2, 20 Questions from Unit 5, (External Evaluation) | 50 |
| 2 | Evaluation 2<br>Oral Communication 1 | Self Introduction, Role Play & Picture Talk from Unit-3 (External Evaluation by English and MBA Dept) | 30 |
| 3 | Evaluation 3<br>Oral Communication 2 | Book Review & Prepared Speech from Unit-4 (External Evaluation by English and MBA Dept) | 20 |
| **Total** | | | **100** |

**Reference Books**

| 1. | Aggarwal, R.S. "A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi. |
|---|---|
| 2. | Word Power Made Easy by Norman Lewis W.R. GOYAL Publications |

**Note :**
- Instructor can cover the syllabus by Class room activities and Assignments(5 Assignments/week)
- Instructor Manual has Class work questions, Assignment questions and Rough work pages
- Each Assignment has 20 questions from Unit 1, 2 and Unit 5 and 5 questions from Unit 3 and 4
- Evaluation has to be conducted as like Lab Examination.

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

| **K.S.RangasamyCollege of Technology– Autonomous R2018** |
|---|
| **51 MA 025 - Statistical Methods for Data Science** |
| **AD** |

| Semester | Hours / Week | Total hrs | Credit | Maximum Marks |
|---|---|---|---|---|

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| | L | T | P | | C | CA | ES | Total |
|---|---|---|---|---|---|---|---|---|
| IV | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Objective(s)** | ● To acquire skills in handling situations involving primary, secondary data and to represent the data graphically.<br>● To learn basic statistics and how to use and monitor discrete data.<br>● To familiarize the students with various methods on non-parametric tests.<br>· To get exposed to various estimations and the basics of parametric inference.<br>· To provide exposure and ability to use statistical tools and programming language. |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Analyze and Interpret the knowledge about primary, secondary data and to represent the data graphically.<br>CO2: Apply the concepts in descriptive statistics to calculate measures of central tendency and measures of dispersion.<br>CO3: Make appropriate decisions using non-parametric inference and to validate different Non-parametric tests.<br>CO4: Apply the methods of estimation, moments of estimation and maximum likelihood estimator<br>CO5: Analyze statistical data using R programming language tools and techniques. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Statistics**

Definition of Statistics – Collection of Data: Internal and external data – Primary and secondary Data – Population and sample – Representative sample – Classification and tabulation of univariate data – Graphical representation – Frequency curves – Bivariate data – Summarization, marginal and conditional frequency distribution. [9]

**Descriptive Statistics**

Measures of Central tendency – Mean, Median and Mode – Moments – Measure of dispersion – Skewness and Kurtosis – Range – Quartile deviation – Karl Pearson's Coefficient of skewness – Bowley's Coefficient of skewness. [9]

**Non-parametric Inference**

Chi-square test for goodness of fit and independence of attributes – Sign test – Paired Sample Sign Test – Mann-Whitney U test – One Sample Run test – Kruskal Wallis test – Kolmogorov-Smirnov test. [9]

**Estimation**

Point estimation – Criteria for good estimates (un-biasedness, consistency) – Methods of estimation including maximum likelihood estimation – Basics of parametric inference: Method of Moments Estimator (MME) – Properties of MME – Likelihood: Maximum Likelihood Estimator (MLE) – Properties of MLE. [9]

**R Statistical Programming Language**

Introduction to R – Functions – Control flow and Loops – Working with Vectors and Matrices – Reading in Data – Writing Data – Working with Data – Manipulating Data – Simulation-Linear model – Data Frame – Graphics in R. [9]

**List of MATLAB Programs:**

1. Analyze and visualize the data using various statistical plots.
2. Calculate and compare measures of location for sample data.
3. Compute and compare measures of dispersion for sample data.
4. Obtain exact and approximate non parametric statistics on small data.
5. Estimate parameters and states.

**Total Hours: 45+15(Tutorial)    60**

| **Textbook(s):** | |
|---|---|
| 1. | Gupta S P, "Statistical Methods", Sultan Chand & sons, 45th Edition, New Delhi, 2017. |
| 2. | Gun A M, Gupta M K and Dasgupta B, "Fundamentals of Statistics (Volume I)", The Word Press, 1933 |

| **Reference(s):** | |
|---|---|
| 1. | Glen Cowan, "Statistical Data Analysis" Oxford Science Publications, New York, 1998 |
| 2. | Douglas C. Montgomery, George C. Runger, "Applied Statistics and Probability for Engineers", 6th Edition, John Wiley & Sons, 2016. |
| 3. | Arora P N and Arora S, "Statistics for Management", S.Chand& Company Ltd, 3rd Edition, New Delhi, 2008. |
| 4. | Garrett Grolemund, Hands-on Programming with R, Shroff Publishers & Distributors Pvt Ltd, 2018. |

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Chairman- Board of Studies
Dept. of Artificial Intelligence and Data Science
K.S.Rangasamy College of Technology
Tiruchengode - 637 215.

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

| K.S. Rangasamy College of Technology – Autonomous R2018 |
|---|
| **51 IT 001 - Design and Analysis of Algorithms** |
| **Common to CS, IT, AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| IV | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| **Objective(s)** | ● To design algorithms in both the science and practice of computing.<br>● To choose the appropriate data structure and algorithm design method for a specified Application<br>● To understand how the choice of data structures and algorithm design methods impacts the performance of programs.<br>● To solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking and branch and bound.<br>● To solve NP-hard and NP-complete problems. |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Classify the problem types and compare orders of growth to represent asymptotic notations.<br>CO2: Apply and inspect recursive and non-recursive algorithms by mathematical notations using sample algorithms.<br>CO3: Apply 'Brute Force' and 'Divide and conquer' design techniques for sorting and searching problems.<br>CO4: Construct analogous algorithms for graph related problems.<br>CO5: Apply 'Backtracking' and 'Branch and bound' techniques to solve NP-hard problems. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Basic Concepts of Algorithms**

Introduction - Fundamentals of Algorithmic Problem Solving - Important Problem types -Fundamentals of the analysis of algorithm efficiency - Analysis Framework - Asymptotic Notations and Basic Efficiency Classes - Recurrence relations: Methods for solving recurrence relations. [9]

**Lab Exercise:** Implement a Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted .The elements can be read from a file or can be generated using the random number generator.

**Mathematical Analysis of Algorithms**

Mathematical Analysis of Non-recursive Algorithms and Examples - Mathematical Analysis of Recursive Algorithms - Example: Fibonacci numbers - Empirical Analysis of Algorithms. [9]

**Lab Exercise:** Implementation of Binary search algorithm using Divide & Conquer method.

**Brute Force and Divide & Conquer Techniques**

Selection Sort and Bubble Sort - Brute-force string matching - Merge sort - Multiplication of Two n-Bit Numbers - Quick Sort - Binary Search - Binary tree Traversal and Related Properties. [9]

**Lab Exercise:** Implementation of Merge Sort algorithm using Divide & Conquer method.

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**Algorithm Design Paradigm**

Decrease and Conquer Technique: Insertion Sort - Depth first Search and Breadth First Search – Transform and Conquer Technique: Presorting - Dynamic Programming: Computing a Binomial Coefficient - Warshall's and Floyd's Algorithm - The Knapsack Problem and Memory Functions - Optimal Binary Search trees – Greedy Technique**:** Huffman trees.  [9]

**Lab Exercise:** Implement 0/1 Knapsack problem using Dynamic Programming.

**NP Hard and NP-Complete Problems**

P and NP problems - NP complete problems - Backtracking: N-Queen's Problem - Hamiltonian Circuit Problem Branch and Bound Techniques: Traveling salesman problem.  [9]

**Lab Exercise:** Implement N Queen's problem using Back Tracking.

| | | |
|---|---|---|
| | **Total Hours** | **45** |

| Text book(s): | |
|---|---|
| 1. | AnanyLevitin, "Introduction to the Design and Analysis of Algorithm", 3rd Edition, Tenth Impression, Pearson Education Asia, 2017. |
| 2. | T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", 3rd Edition, PHI Pvt. Ltd., 2012. |

| Reference(s): | |
|---|---|
| 1. | Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2010. |
| 2. | A.V.Aho, J.E. Hopcroft and J.D.Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, 2003. |
| 3. | Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms/ C++", 2nd Edition, Universities Press, 2007. |
| 4. | Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2011. |

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

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD 401 - Data Communication and Networks** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | <ul><li>To learn the concepts of protocol layering and communication</li><li>To explore the various components required to build networks</li><li>To learn the functions of network layer and the various routing protocols</li><li>To familiarize the functions and protocols of the Transport layer</li><li>To learn the working principles of application layer protocols</li></ul> | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Acquire knowledge about protocol layering and communication<br>CO2: Recognize the different error control techniques and LAN models in data link layer<br>CO3: Attain solutions to various problems in network addressing and routing<br>CO4: Explore the concepts of congestion control and flow control techniques<br>CO5: Learn the principles of application layer protocols | | | | | | | |
| **Note:**The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated. | | | | | | | | |

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**Introduction and Physical Layer**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit Switched Networks – Packet Switched Networks [9]

**Data Link Layer**

Introduction – Framing - Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – Block coding – CRC- Checksum– Hamming Codes -  HDLC – PPP - Wired LANs : Ethernet and IEEE 802.3 – Wireless LANs– IEEE 802.11 – Connecting Devices. [9]

**Network Layer**

Internet Protocol (IP) suite;IPv4 and IPv6 addressing and headers –Address Space - Classful Addressing - Classless Addressing - Next Generation IP –Transition from IPv4 to IPv6 –  Routing protocols - Distance-vector and Link-state approaches; Interior and Exterior Gateway Protocol concepts - Multicast Routing – Multicast Distance Vector- Network layer performance [9]

**Transport Layer**

Introduction -Transport Layer Protocols - User Datagram Protocol – Transmission Control Protocol – TCP Services-Features – Segment - TCP Connection -TCP congestion control – Data Compression - Quality of services (QOS) –Data Flow Characteristics - Flow control to improve QOS [9]

**Application Layer**

World Wide Web and HTTP - FTP- SFTP- Electronic Mail: SMTP, POP3, IMAP, MIME – Domain Name System- Cryptography and Network Security-Introduction–Confidentiality-Symmetric-Key Ciphers - Asymmetric-Key Ciphers [9]

| | Total Hours | 45 |
|---|---|---|

| Text book(s): | | |
|---|---|---|
| 1. | Behrouz A. Forouzan, "Data communication and Networking", 5th Edition, Tata McGraw Hill, 2013. |
| 2. | Behrouz A. Forouzan, "TCP/IP Protocol Suite", 4thEdition, Tata McGraw Hill, 2015. |

| Reference(s) : | | |
|---|---|---|
| 1. | James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Pearson Education, 2012. |
| 2. | Larry L.Peterson and Bruce S. Davie, "Computer Networks, A Systems Approach", 5th Edition, The Morgan Kaufman Series in Networking, 2011. |
| 3. | Andrew S. Tanenbaum, "Computer Networks", 4th Edition, PHI, 2003. |
| 4. | William Stallings, "Data and Computer Communication", 10th Edition, Pearson Education, 2013. |

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

**K.S.Rangasamy College of Technology – Autonomous R2018**

**50 AD 402 - Operating Systems**

**AD**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| IV | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |
| **Objective(s)** | ● To understand the services provided by and the design of an operating system.<br>● To analyze the components of an operating systems have a thorough knowledge of process management.<br>● To understand different approaches to memory management.<br>● To analyze and explain the algorithms used in Virtual Memory Management.<br>● To discuss the OS Architectures used in Mobile OS. | | | | | | | |

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| | **At the end of the course, the student will be able to** |
|---|---|
| **Course Outcomes** | CO1: Recognize the basics of operating systems and its components<br>CO2: Examine the scheduling algorithms and critical section problem.<br>CO3: Acquire the knowledge of  Deadlock and Storage Management<br>CO4: Outline the memory management scheme and File concept.<br>CO5: Awareness about the latest trends in building Mobile OS. |

**Note:**The hours given against each topic are of indicative.  The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required.  The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Basic Concepts**<br>Introduction - Operating System Structure – Operating System Operation– Protection and Security–Distributed Systems– Operating System Services – System Calls – System Programs - Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication. | [9] |
| **Process Management**<br>Threads – Overview – Threading issues - CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Real Time Scheduling - The Critical-Section Problem – Synchronization Hardware – Semaphores – Classic problems of Synchronization. | [9] |
| **Deadlocks and Memory Management**<br>Deadlocks – System Model – Deadlock Characterization – Methods for handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks – Main Memory–Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Structure of page table. | [9] |
| **Virtual Memory  and File System Structure**<br>Virtual Memory  – Demand Paging – Process creation – Page Replacement – Allocation of frames – Thrashing – File System Interface – File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection –  File System Structure – Disk Structure – Disk Scheduling – Disk Management | [9] |
| **Mobile Operating Systems**<br>ARM and Intel architectures – Power Management – Mobile OS Architectures – Underlying OS – Kernel structure and native level programming – Runtime issues – Approaches to power management | [9] |
| **Total Hours: 45+15(Tutorial)** | **60** |

| **Text book(s):** | |
|---|---|
| 1. | Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10thEdition, John Wiley & Sons (ASIA) Pvt. Ltd, 2018. |
| 2. | Source Wikipedia, "Mobile Operating Systems", General Books LLC, 2010. |

| **Reference(s) :** | |
|---|---|
| 1. | Harvey M. Deitel, "Operating Systems", 3rd Edition, Pearson Education Pvt. Ltd, 2007. |
| 2. | Andrew S. Tanenbaum, "Modern Operating Systems", 4th  Edition, Prentice Hall of India Pvt. Ltd, 2016. |
| 3. | Pramod Chandra P. Bhatt, "An Introduction to Operating Systems, Concepts and Practice",4th Edition,PHI,2014. |
| 4. | Milan Milenkovic, "Operating systems: Concepts and design", McGraw-Hill; 2nd edition,1992. |

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

| **K.S.Rangasamy College of Technology – Autonomous R2018** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 AD 403 – Data Warehousing and Data Mining** | | | | | | | |
| **AD** | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |

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| IV | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Objective(s)** | ● To serve as an introductory course to under graduate students to learn the fundamental concepts and modern techniques for data mining<br>● To focus on the key tasks of data mining, including data preparation and of data warehousing with special emphasis on architecture<br>● To design, analyze and solve key tasks of data mining, including data preparation, classification, clustering, and association rule mining<br>● To explore the fundamental concepts outliers<br>● To focus on the applications of data mining. |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Identify the suitable data mining functionalities to find the similarity and dissimilarity between data.<br>CO2: Solve real-time problems using data pre-processing techniques and design warehouse models for organizational requirements.<br>CO3: Apply the different pattern mining methods to extract frequent item sets in a transactional dataset.<br>CO4: Analyze the diverse classifiers and clustering techniques, apply the same to large datasets.<br>CO5: Analyze the outlier analysis techniques to solve real world problems. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction**

Introduction, Data Mining, Kinds of data & pattern, Technologies, Applications, Issues, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity. [9]

**Data Preprocessing, Data Warehousing**

Data Preprocessing, Overview, Cleaning, Integration, Reduction, Transformation, Data Discretization, Data Warehouse: Basic Concepts, Data Warehouse Modeling, Data Warehouse Design and Usage, Data Warehouse Implementation [9]

**Pattern Mining**

Basic Concepts, Frequent Itemset Mining Methods, Infrequent Itemset Mining Methods - Pattern Evaluation Methods, Pattern Mining: A Road Map, Pattern Mining in Multilevel, Multidimensional Space. [9]

**Classification and Clustering**

Classification, Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Bayesian Belief Networks, Classification by Backpropagation, Clustering, Cluster Analysis, Types of Clustering -Partitioning Methods, Hierarchical Methods. [9]

**Outlier Detection and Data Mining Trends**

Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends. [9]

**Total Hours 45**

| **Text book(s):** | |
|---|---|
| 1. | Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers, 2012. |
| 2. | Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill, Thirteenth Reprint 2008. |

| **Reference(s):** | |
|---|---|
| 1. | David Hand, Heikki Manila, Padhraic Symth, "Principles of Data Mining", PHI 2012. |
| 2. | Margaret H.Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2006 |
| 3. | Alex Berson, Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", McGraw-Hill Edition, 2007. |
| 4. | Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007 |

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

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO4** | 2 | 3 | 2 | 3 | 3 | | | | 2 | 2 | 2 | 2 | 2 | | 3 |
| **CO5** | 2 | 2 | 3 | 3 | 3 | | | | 2 | 2 | 2 | 2 | 2 | | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **K.S.Rangasamy College of Technology – Autonomous R2018** | | | | | | | |
| **50 MY 014 – Start-ups and Entrepreneurship** | | | | | | | |
| **Common to all Branches** | | | | | | | |
| **Semester** | Hours / Week | | | Total | Credit | Maximum Marks | | |
| | L | T | P | hrs | C | CA | ES | Total |
| **IV** | 2 | 0 | 0 | 30 | - | 100 | - | 100 |

| | |
|---|---|
| **Objective(s)** | ● To provides practical proven tools for transforming an idea into a product or service that creates value for others. <br> ● To build a winning strategy, how to shape a unique value proposition, prepare a business plan <br> ● To impart practical knowledge on business opportunities <br> ● To inculcate the habit of becoming entrepreneur <br> ● To know the financing, growth and new venture & its problems |
| **Course Outcomes** | **At the end of the course, the student will be able to** <br> CO1: Transform ideas into real products, services and processes, by validating the idea, testing it, and turning it into a growing, profitable and sustainable business. <br> CO2: Identify the major steps and requirements in order to estimate the potential of an innovative idea as the basis of an innovative project. <br> CO3: Reach creative solutions via an iteration of a virtually endless stream of world-changing ideas and strategies, integrating feedback, and learning from failures along the way. <br> CO4: Apply the 10 entrepreneurial tools in creating a business plan for a new innovative venture. <br> CO5: Apply methods and strategies learned from interviews with startup entrepreneurs and innovators. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction to Entrepreneurship & Entrepreneur** <br> Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management and Future of Entrepreneurship. <br> The Entrepreneur:Meaning, the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system. | [6] |
| **Business Opportunity Identification and Preparing a Business Plan** <br> Business ideas, methods of generating ideas, and opportunity recognition, Idea Generation Process, Feasibility study, preparing a Business Plan: Meaning and significance of a business plan, components of a business plan. | [6] |
| **Innovations** <br> Innovation and Creativity - Introduction, Innovation in Current. Environment, Types of Innovation, School of Innovation, Analysing the Current Business Scenario, Challenges of Innovation, Steps of Innovation Management, Experimentation in Innovation Management, Participation for Innovation, Co-creation for Innovation, Proto typing to Incubation. Blue Ocean Strategy-I, Blue Ocean Strategy-II. Marketing of Innovation, Technology Innovation Process | [6] |
| **Financing & Launching the New Venture** <br> Importance of new venture financing, types of ownership, venture capital, types of debt securities, determining ideal debt-equity mix, and financial institutions and banks. <br> Launching the New Venture: Choosing the legal form of new venture, protection of intellectual property, and formation of the new venture | [6] |
| **Managing Growth & Rewards in New Venture** <br> Characteristics of high growth new ventures, strategies for growth, and building the new ventures. <br> Managing Rewards: Exit strategies for Entrepreneurs, Mergers and Acquisition, Succession and exit strategy, managing failures - bankruptcy | [6] |
| **Total Hours** | 30 |

| | |
|---|---|
| **Text book(s):** | |
| 1. | Stephen Key, "One Simple Idea for Startups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company" 1st Edition, Tata McGrawhill Company, New Delhi, 2013. |

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| | 2. | Charles Bamford and Garry Bruton, "ENTREPRENEURSHIP: The Art, Science, and Process for Success", 2nd Edition, Tata McGrawhill Company, New Delhi, 2016. |

| **Reference(s) :** | | |
| 1. | Philip Auerswald, "The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy", Oxford University Press, 2012. |
| 2. | Janet Kiholm Smith; Richard L. Smith; Richard T. Bliss, "Entrepreneurial Finance: Strategy, Valuation, and Deal Structure, Stanford Economics and Finance", 2011 |
| 3. | Edward D. Hess, "Growing an Entrepreneurial Business: Concepts and Cases", Stanford Business Books, 2011 |
| 4. | Howard Love, "The Start-Up J Curve: The Six Steps to Entrepreneurial Success", Book Group Press, 2011 |

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

| **K.S.Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 GE 001 – National Cadet Corps(Air Wing)** | | | | | | | | |
| Semester | Hours / Week | | | Total Hrs | Credit C | Maximum Marks | | |
| | L | T | P | | | CA | ES | Total |
| IV | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |

| **Objective(s)** | ● Develop character , camaraderie,<br>● Inculcate discipline, secular outlook<br>● Enrich the spirit of adventure, sportsman spirit<br>● Ideals of selfless service amongst cadets by working in teams<br>● Improve qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets. |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.<br>CO2: Demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling<br>CO3: Illustrate various forces and moments acting on aircraft<br>CO4: Outline the concepts of aircraft engine and rocket propulsion<br>CO5: Design, build and fly chuck gliders/model airplanes and display static models |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**NCC Organization & National Integration**
NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF-Indo-Pak War-1971-Operation Safed Sagar. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration [9]

**Drill&WeaponTraining**
Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION). Main Parts of a Rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing (WITH PRACTICE SESSION) [9]

**Principles of Flight**
Laws of motion-Forces acting on aircraft–Bernoulli's theorem-Stalling-Primary control surfaces – secondary control surfaces-Aircraft recognition. [9]

**Aero Engines** [9]

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Introduction of Aero engine-Types of engine-piston engine-jet engines-Turboprop engines-Basic Flight Instruments-Modern trends.

**Aero Modeling**

History of aero modeling-Materials used in Aero-modeling-Types of Aero-models – Static Models-Gliders-Control line models-Radio Control Models-Building and Flying of Aero-models.   [9]

| | Total Hours | 45 |
|---|---|---|

**Text Book(s):**

| 1. | "National Cadet Corps- A Concise handbook of NCC Cadets" by Ramesh Publishing House, New Delhi,2014. |
|---|---|
| 2. | "NCC OTA Precise" by DGNCC, New Delhi,2014 |

**Reference(s)**

| 1. | "Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi,2019 |
|---|---|
| 2. | "Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi,2017 |

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

| K.S.Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 GE 002 – National Cadet Corps (Army Wing)** | | | | | | | | |
| Semester | Hours / Week | | | Total Hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 2 | 0 | 2 | 60 | 3 | 50 | 50 | 100 |
| **Objective(s)** | ● Develop character , camaraderie,<br>● Inculcate discipline, secular outlook<br>● Enrich the spirit of adventure, sportsman spirit<br>● Ideals of selfless service amongst cadets by working in teams<br>● Improve qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets. | | | | | | | |
| **Course Outcomes** | At the end of the course, the students will be able to<br>CO1: Display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.<br>CO2:DemonstrateHealth Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders.<br>CO3: Basic knowledge of weapons and their use and handling.<br>CO4:Aware about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils<br>CO5: Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles | | | | | | | |

**Note:**Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**NCC Organization & National Integration**

NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt.   [6]

National Integration - Unity in diversity- contribution of youth in nation building- national integration council-Images and Slogans on National Integration.

**Basic Physical Training & Drill**   [6]

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Basic physical Training – various exercises for fitness( with Demonstration)-Food – Hygiene and Cleaniness.Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.( WITH DEMONSTRATION)

**Weapon Training**

Main Parts of a Rifle- Characteristics of .303 rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing( WITH PRACTICE SESSION) - Characteristics of 5.56mm rifle- Characteristics of 7.62mm SLR-LMG- carbine machine gun – pistol. [6]

**Social Awareness and Community Development**

Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility [6]

**Specialized Subject (ARMY)**

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews. [6]

| | Total Hours | 30 |
|---|---|---|

**Text Book(s):**

| 1. | National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014 |
|---|---|
| 2. | Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi ,2014 |

**Reference(s)**

| 1. | "Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi,2019 |
|---|---|
| 2. | "Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi,2017 |

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD 4P1 - Networking Laboratory** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To learn the socket programming for client-server communication<br>● To analyze and implement flow control mechanisms<br>● To demonstrate the working of error control techniques<br>● To design unicast and multicast routing algorithms<br>● To acquire knowledge on application layer protocol | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Implement socket programming for client-server communication<br>CO2: Analyze and implement flow control mechanisms<br>CO3: Implement error detection and correction techniques<br>CO4: Compare the performance of different transport layer protocols.<br>CO5: Implement and analyze unicast and multicast routing protocol | | | | | | | |
| **LIST OF EXPERIMENTS** | | | | | | | | |
| 1. Implement a HTTP web client program to download a web page using TCP sockets | | | | | | | | |

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Tiruchengode - 637 215.

2. Implement  application  using TCP / UDP sockets

   i)Echo Client  and echo server  ii)Chat  iii)Video Conferencing  iv)File Transfer

3. Implementation of bit stuffing

4. Implementation of parity checker

5. Simulation of  error detection code

6. Simulation of error correction code

7. Simulation of transport layer Protocol and congestion control techniques

8. Performance evaluation of unicast routing protocol

9. Performance evaluation of  multicast routing protocol

10. Design and implement application layer protocol

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

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|---|---|---|---|---|---|---|---|
| **50 AD 4P2 – Data Mining Laboratory** | | | | | | | |
| **AD** | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To understand the data sets and data preprocessing. <br> ● To analyze data, choose relevant models and algorithms for respective applications. <br> ● To demonstrate the working of algorithms for data mining tasks such association rule mining, classification, and clustering. <br> ● To obtain practical experience working with all real data sets. <br> ● To develop a research interest towards advances in data mining | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to** <br> CO1: Create a training data set using data mining tools. <br> CO2: Perform and interpret different distribution using R. <br> CO3: Apply data mining techniques and methods to mine frequent itemsets in large data sets. <br> CO4: Identify appropriate data mining algorithms to solve real world problems. <br> CO5: Classify the data objects using unsupervised learning technique. | | | | | | | |
| **LIST OF EXPERIMENTS** | | | | | | | |

1. Create a training data set using Weka tool.
2. Apply pre-processing techniques to the training data set.
3. Implementation of  statistical measures using R.
4. Data visualization using R.
5. Visualize and explore big tabular datasets using vaex library.
6. Implementation Apriori algorithm.
7. Implementation of FP-growth algorithm.
8. Implementation of Decision tree algorithm.
9. Implementation of Bayesian classification algorithm.
10. Implementation of K-means algorithm.
11. Implementation of Association rule mining using MATLAB
12. Implementation of Supervised Learning Algorithms using MATLAB

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13. Implementation of Unsupervised Learning Algorithms using MATLAB
14. Implementation of Outlier Detection Algorithms using MATLAB
**SUGGESTED SOFTWARE TOOLS: R, RapidMiner, WEKA, MATLAB**

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

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|---|---|---|---|---|---|---|---|
| **50 TP 0P2 – Career Competency Development II** | | | | | | | |
| **Semester** | **Hours/Week** | | | | **Credit** | **Maximum Marks** | |
|  | **L** | **T** | **P** | **C** | **CA** | **ES** | **Total** |
| **IV** | **0** | **0** | **2** | **0** | **100** | **00** | **100** |
| **Objective (s)** | ● To help the learners to paraphrase the reading passages, to draft continuous writing and review texts in the academic and professional contexts<br>● To help the learners to acquire the phonetic skills of the language and express themselves precisely for effective professional presentations<br>● To help the learners to enrich their verbal reasoning and ability to match the employability requirements of the corporates<br>● To help the learners to comprehend the preliminary level of aptitude skills required to attend placement and competitive online exams<br>● To help the learners to comprehend the Pre - Intermediate level of aptitude skills required to attend placement and competitive online exams | | | | | | |
| **Course Outcomes** | **At the end of the course, the student will be able to**<br>CO1: Interpret and infer the meaning in the reading passages, organize continuous writing and review texts both academically and professionally.<br>CO2: Adapt to and demonstrate the phonetic skills accurately for effective presentations professionally.<br>CO3: Interpret the various concepts of verbal reasoning and relate for the concepts to the requirements of the competitive exams and employability<br>CO4: Infer the concepts of preliminary level of aptitude skills pertaining to competitive exams and company recruitments.<br>CO5: Infer the concepts of pre-intermediate level of aptitude skills pertaining to competitive exams and company recruitments. | | | | | | |

| **Unit–1** | **Written Communication–Part3** | **Hrs** |
|---|---|---|
| Reading Comprehension Level 2 (Paraphrasing Poems) - Letter Drafting - Email Writing – Paragraph Writing - Newspaper and Book Review Writing - Skimming and Scanning - Interpretation of Pictorial Representations.<br>**Practices:** Sentence Completion-SentenceCorrection-JumbledSentences-Synonyms&Antonyms – Using the Same Word as Different Parts of Speech-Editing<br>**Materials:** Instructor Manual, Word power Made Easy Book, News Papers | | 6 |
| **Unit–2** | **Oral Communication–Part3** | |
| Self-Introduction-Miming (Body Language)-Introduction to the Sounds of English-Vowels, Diphthongs & Consonants, Introduction to Stress and Intonation - Extempore - News Paper and Book Review- Technical Paper Presentation.<br>**Material:** Instructor Manual, News Papers | | 4 |
| **Unit–3** | **Verbal Reasoning–Part1** | |

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| | | 8 |
|---|---|---|
Analogies-Alphabet Test-Theme Detection-Family Tree-Blood Relations (Identifying relationships among group of people) -Coding &Decoding-Situation Reaction Test -Statement & Conclusions
**Material:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal

**Unit–4      Quantitative Aptitude –Part1**                                                                                6

ProblemonAges-Percentages-ProfitandLoss-Simple&CompoundInterest-Averages-Ratio, Proportion
**Material:** Instructor Manual, Aptitude Book

**Unit–5      Quantitative Aptitude –Part2**                                                                                6

Speed, Time&WorkandDistance-PipesandCisterns-MixturesandAllegations-Races-ProblemonTrains - Boats and Streams
**Practices**: Puzzles, Sudoku, Series Completion, Problemon Numbers
**Material:** Instructor Manual, Aptitude Book

| | **Total** | **30** |
|---|---|---|

## Evaluation Criteria

| S.No. | Particular | Test Portion | Marks |
|---|---|---|---|
| 1 | Evaluation1 - Written Test | 15Questions EachfromUnit1,3,4&5(External Evaluation) | 50 |
| 2 | Evaluation2 – Oral Communication | Extempore & Miming–Unit 2 (External Evaluation by English, MBA Dept.) | 30 |
| 3 | Evaluation3 - Technical Paper Presentation | Internal Evaluation by the Dept. | 20 |
| | | **Total** | **100** |

## Reference Books

1. Aggarwal,R.S.“AModernApproachtoVerbalandNon-verbalReasoning”,RevisedEdition2008,Reprint2009,S.Chand &CoLtd.,NewDelhi.
2. Abhijit Guha,“QuantitativeAptitude”,TMH,3$^{rd}$edition
3. Objective Instant Arithmetic by M.B.Lal &Goswami Upkar Publications.
4. Word Power Made Easy by Norman LewisW.R.GOYAL Publications

**Note:**
- Instructor can cover the syllabus by Classroom activities and Assignments(5Assignments/week)
- Instructor Manual has Classwork questions, Assignment questions and Rough work pages
- Each Assignment has 20 questions from Unit1,3,4and Unit 5and 5 questions from Unit 2.
- Evaluation has to be conducted as like Lab Examination.

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

| **K.S.Rangasamy College of Technology– Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD 501 - Artificial Intelligence for Industry 4.0** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To develop the basic understanding of the building blocks of AI. <br> ● To enhance the knowledge and skills of AI in solving real time problems. <br> ● To identify the different technologies, problem settings, and their applications to solve Multi-disciplinary problems. <br> ● To understand the impact, applications and tools of Industry 4.0. <br> ● To analyze the applications of Industry 4.0 to implement artificial intelligent systems | | | | | | | |

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| | **At the end of the course, the students will be able to** |
|---|---|
| **Course Outcomes** | CO1: Classify the applications of AI to implement intelligent agents.<br>CO2: Apply the various technologies which are more appropriate for different types of learning tasks in multiple domains.<br>CO3: Solve real-world problems using Machine Learning, Big Data and IoT.<br>CO4: Apply necessary tools to meet Industry 4.0 standards.<br>CO5: Develop a small AI system in a team environment. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction**<br>Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality-Technologies in augmented reality . | [9] |
| **Artificial Intelligence**<br>Artificial Intelligence: Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI - Environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI-NLP in AI,-Computer Vision. | [9] |
| **Big Data and IoT**<br>Terminologies - Essential of Big Data in Industry 4.0 - Big Data Merits and Advantages - - Big Data Processing Frameworks - Big Data Applications - Big Data Tools - Big Data Domain Stack : Big Data in Data Science - Big Data in IoT - Big Data in Machine Learning - Big Data in Databases - Big Data Use cases : Big Data in Social Causes - Big Data for Industry - Big Data Roles and Skills - Big Data Roles - Internet of Things (IoT) : Introduction to IoT - Architecture of IoT - Technologies for IoT - Developing IoT Applications | [9] |
| **Impact, Applications and Tools of Industry 4.0**<br>Impact of Industry 4.0 on Society: Impact on Business, Government, People – Applications: IoT Applications – Manufacturing – Healthcare – Education – Aerospace and Defence – Agriculture – Transportation and Logistics – Tools: Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics | [9] |
| **Applications of AI to Industry 4.0**<br>Smart factories, Predictive Analytics, Predictive maintenance,Computer vision,Cyber-physical systems, Industrial robots and Inventory Management | [9] |
| **Total Hours** | **45** |

**Textbook(s):**

| 1 | P. Kaliraj, T. Devi, "Higher Education for Industry 4.0 and Transformation to Education 5.0". |
|---|---|
| 2 | Alasdair Gilchrist. Industry 4.0: The Industrial Internet of Things, Apress Publications, 2016. |

**Reference(s):**

| 1 | SudipMisra, "Introduction to Industry 4.0 and Industrial Internet of Things",IIT Kharagpur. |
|---|---|
| 2 | A Complete Guide to Industry 4.0- Udemy Course |
| 3 | Rashmi Agrawal, Marcin Paprzycki, Neha Gupta, "Big Data, IoT, and Machine Learning Tools and Applications", 1st Edition, CRC Press, 2020. |
| 4 | Aydin Azizi,"Applications of Artificial Intelligence Techniques in Industry 4.0",Kindle Edition, 2018. |

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

| **K.S.Rangasamy College of Technology – Autonomous R2018** |
|---|
| **50 AD 502 – Distributed Computing** |
| **AD** |

| Semester | Hours / Week | Total hrs | Credit | Maximum Marks |
|---|---|---|---|---|

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| | L | T | P | | C | CA | ES | Total |
|---|---|---|---|---|---|---|---|---|
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Objective(s)** | • To understand the foundations of distributed systems.<br>• To learn issues related to clock Synchronization and the need for global state in distributed systems.<br>• To learn distributed mutual exclusion and deadlock detection algorithms.<br>• To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.<br>• To learn the characteristics of peer-to-peer and distributed shared memory systems. |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Explicate the foundations and issues of distributed systems<br>CO2: Identify the various synchronization issues and global state for distributed systems.<br>CO3: Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems<br>CO4: Describe the agreement protocols and fault tolerance mechanisms in distributed systems.<br>CO5: Identify the features of peer-to-peer and distributed shared memory system |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction**
Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications. Logical Time: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP. [9]

**Message Ordering and Group Communication**
Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) – Total order. Global state and snapshot recording algorithms: Introduction –System model and definitions –Snapshot algorithms for FIFO channels [9]

**Distributed Mutex Algortihmand Deadlock**
Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model. [9]

**Recovery and Consensus**
Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. Consensus and agreement algorithms: Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures. [9]

**Distributed Shared Memory**
Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion. [9]

| | **Total Hours** | **45** |
|---|---|---|

**Text book(s):**

| 1. | Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011. |
|---|---|
| 2. | George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education, 2012. |

**Reference(s):**

| 1. | Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007. |
|---|---|
| 2. | Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994. |
| 3. | Tanenbaum A.S., Van Steen M., Distributed Systems: Principles and Paradigms, Pearson Education, 2007. |
| 4. | Liu M.L., Distributed Computing, Principles and Applications, Pearson Education, 2004. |

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| 5. | Nancy A Lynch, Distributed Algorithms, Morgan Kaufman Publishers, USA, 2003. |

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

## K.S.Rangasamy College of Technology – Autonomous R2018
### 50 AD 503 – Compiler Design
**AD**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|----------|---|---|---|-----------|--------|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

**Objective(s)**
- To teach concepts of language translation and phases of compiler design
- To describe the common forms of parsers
- To inculcate knowledge of parser by parsing LL parser and LR parser
- To demonstrate intermediate code using technique of syntax directed translation
- To Illustrate the various optimization techniques for designing various optimizing compilers

**Course Outcomes**

**At the end of the course, the students will be able to**
CO1: Apply the compiler construction tools and describes the Functionality of each stage of compilation process
CO2: Construct Grammars for Natural Languages and find the Syntactical Errors/Semantic errors during the compilations using parsing techniques
CO3: Apply the different representations of intermediate code.
CO4: Analyze the syntax of code generation algorithms.
CO5: Classify the various optimization techniques.

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction to Compilers**
Definition of compiler, interpreter and its differences, the phases of a compiler, Lexical Analysis — Role of Lexical Analyzer — Input Buffering — Specification of Tokens — Recognition of Tokens —regular expressions, finite automata, from regular expressions to finite automata, Minimizing DFA, (LEX) lexical analyzer generator. [9]

**Syntax Analysis**
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 Parser - LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC. [12]

**Intermediate Code Generation**
Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking. [8]

**Run-Time Environment and Code Generation**
Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator. [8]

**Code Optimization**
Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm. [8]

| | **Total Hours** | **45** |

**Text book(s):**

| 1. | Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles,Techniques and Tools, Second Edition, Pearson Education, 2015. |
| 2. | V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers,2016. |

**Reference(s):**

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| | 1. | Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2017. |
|---|---|---|
| | 2. | Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan KaufmannPublishers - Elsevier Science, India, Indian Reprint 2018. |
| | 3. | Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan KaufmannPublishers Elsevier Science, 2017. |
| | 4. | Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", PearsonEducation, 2008. |

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

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD 504 - Machine Learning** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ● To understand the need for machine learning for solving problem<br>● To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning<br>● To understand the machine learning theory and implement linear and non-linear learning models<br>● To implement distance-based clustering techniques, build tree and rule based models<br>● To apply reinforcement learning techniques for solving real-time applications |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Distinguish between, supervised, unsupervised and semi -supervised learning<br>CO2: Apply the apt linear model for any given problem<br>CO3: Suggest supervised, unsupervised or semi-supervised learning algorithms for assessing the distance-based analysis<br>CO4: Design ensemble model to improve accuracy rate for real world datasets<br>CO5: Apply reinforcement learning strategy for real-time applications |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Foundations of Learning**

Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation generalization tradeoff – bias and variance [9]

**Linear Models**

Linear classification – univariate linear regression – multivariate linear regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures – support vector machines – generalization and overfitting – regularization – validation [9]

**Distance-Based Models**

Nearest neighbor models – K-means – clustering around medoids – silhouttes – hierarchical clustering – k-d trees – locality sensitive hashing – non-parametric regression [9]

**Ensemble Learning**

Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking. [9]

**Reinforcement Learning**

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal-difference learning – active reinforcement learning – exploration – learning an action utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control [9]

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|  | | Total Hours | 45 |
|---|---|---|---|

**Text book(s):**

| 1. | Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data",Cambridge University Press, 2012. |
|---|---|
| 2. | Andreas Muller,Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists",4th Edition,O'Reilly,2018. |

**Reference(s) :**

| 1. | T. M. Mitchell, "Machine Learning", McGraw Hill, 1997. |
|---|---|
| 2. | EthemAlpaydin, "Introduction to Machine Learning", 3rd  Edition, MIT Press, 2014. |
| 3. | D. Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012. |
| 4. | Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques",3rd Edition, Morgan Kaufmann Publishers,2012. |

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

| **K.S. Rangasamy College of Technology – Autonomous R2018** |
|---|
| **50 AD 5P1- Compiler Design Laboratory** |
| **AD** |

| **Semester** | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
|  | **L** | **T** | **P** |  | **C** | **CA** | **ES** | **Total** |
| V | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

| **Objective(s)** | ● To implement the phase of compiler<br>● To implement the control flow and data flow of a typical program<br>● To acquire optimization of a given program<br>● To implement storage allocation strategies<br>● To develop assembly language program into source language program. |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apply the different phases of compiler using tools.<br>CO2: Analyze the control flow and data flow of a typical program.<br>CO3: Analyze the optimization of a given program.<br>CO4: Design the data flow and storage allocation strategies.<br>CO5: Create an assembly language program equivalent to a source language program. |

### LIST OF EXPERIMENTS

1. Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C
3. Implementation of Lexical Analyzer using Lex Tool
4. Syntax Analysis to recognize a valid Arithmetic Expression using YACC
5. Syntax Analysis to recognize a valid variable using YACC
6. Implementation of type checking
7. Implementation of stack storage allocation strategy
8. Construction of DAG
9. Back End Compiler
10. Implementation of Simple Code Optimization Techniques

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

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| CO5 | 3 | 2 | 3 | 3 | 3 | | | | 3 | | | | | 2 | |

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**50 AD 5P2- Machine Learning Laboratory**

**AD**

| Semester | Hours / Week | | | Total hrs | Cred it | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | **L** | T | P | | **C** | CA | ES | Tot al |
| V | 0 | 0 | 4 | 6 0 | 2 | 60 | 40 | 100 |

| Objective(s) | <ul><li>To impart necessary knowledge on python needed for data science</li><li>To implement statistics measures using R</li><li>To acquire knowledge on regression models</li><li>To implement classification models.</li><li>To develop programming skills required to build real world applications.</li></ul> |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Predict the class of a dataset using python programming<br>CO2: Implement statistics measures and visualize the data using R<br>CO3: Implement regression algorithm to predict the model.<br>CO4: Implement classification techniques to predict the model<br>CO5: Implement clustering techniques to solve real world problems |

**LIST OF EXPERIMENTS**

1. Write a program in Python to predict the class of the flower based on available attributes

2. Implementation of Statistics and Visualization

3. Implementation of Linear Regression

4. Implementation of Logistic Regression

5. Implementation of Naive Bayesian Classifier

6. Implementation of Decision Trees

7. Implementation of Support Vector Machine

8. Implementation of Neural Networks

9. Implementation of Ensemble Learning

10. Implementation of Clustering Algorithms

11. Implementation of Regression using MATLAB

12. Implementation of Ensemble Learning using MATLAB

13. Implementation of Backpropagation using MATLAB

**SUGGESTED SOFTWARE TOOLS: R, MATLAB**

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

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|---|---|---|
| **50 TP 0P3 - Career Competency Development III** | | |
| **Semester** | **Hours/Week** | **Credit** | **Maximum Marks** |

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| | L | T | P | C | CA | ES | Total |
|---|---|---|---|---|---|---|---|
| **V** | 0 | 0 | 2 | 0 | 100 | 00 | 100 |

| **Objective(s)** | ● To help the learners to enrich the written and oral communication skills in the academic and professional contexts<br>● To help the learners to enrich their verbal and logical reasoning ability to meet out the employability requirements of the companies<br>● To help the learners to comprehend the Intermediate level of aptitude skills required to attend placement and competitive online exams<br>● To help the learners to enhance their knowledge in the quantitative aptitude skills in algebraic and linear equations.<br>● To help the learners to augment the core technical and coding skills of their respective domains to compete in coding contests |
|---|---|
| **Course Outcomes** | **At the end of the course, the student will be able to**<br>CO1: Examine the written and oral communication skills in the academic and professional contexts<br>CO2: Interpret the concepts of verbal reasoning and relate for the concepts to the requirements of the competitive exams and employability<br>CO3: Infer the concepts of intermediate level of aptitude skills pertaining to competitive exams and company recruitments.<br>CO4: Assess their comprehension in the quantitative aptitude skills in algebraic and linear equations.<br>CO5: Review the core technical and coding skills of their respective domains to compete in coding Contests |

| **Unit–1** | **Written and Oral Communication– Part1** | Hrs |
|---|---|---|
| Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate- Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions<br>**Practices:** Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech-Interpretation of Pictorial Representations-Editing-GD-Debate.<br>**Materials:** Instructor Manual, Word power Made Easy Book, News Papers | | 6 |
| **Unit–2** | **Verbal & Logical Reasoning–Part1** | |
| Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences – identifying Strong Arguments and Weak Arguments-Statements and Conclusions-Cause and Effect-Deriving Conclusions from Passages - Seating Arrangements. **Practices:** Analogies - Blood Relations - Statement &Conclusions.<br>**Materials:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal | | 8 |
| **Unit–3** | **Quantitative Aptitude–Part3** | |
| Probability-Calendar-Clocks-Logarithms -Permutations and Combinations<br>**Materials:** Instructor Manual, Aptitude Book | | 6 |
| **Unit–4** | **Quantitative Aptitude–Part4** | |
| Algebra-Linear Equations-Quadratic Equations –Polynomials.<br>**Practices:** Problem on Numbers -Ages-Train<br>-Time and Work -Sudoku–Puzzles.<br>**Materials:** Instructor Manual, Aptitude Book | | 6 |
| **Unit–5** | **Technical & Programming Skills–Part1** | |
| CoreSubject–1,23<br>**Practices:** Questions from Gate Material.<br>**Materials:** Text Book, Gate Material | | 4 |
| | Total | 30 |

Evaluation Criteria

| S. No. | Particular | Test Portion | Marks |
|---|---|---|---|
| 1 | Evaluation1 Written Test | 15Questions each from Unit1,2,3,4&5(External Evaluation) | 50 |
| 2 | Evaluation2-<br>Oral Communication | GD and Debate<br>(External Evaluation by English, MBA Dept & External Trainers) | 30 |

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| | | Internal Evaluation by the Dept. | | |
|---|---|---|---|---|
| 3 | Evaluation3– Technical Paper Presentation | Internal Evaluation by the Dept. | | 20 |
| | | | **Total** | **100** |

**Reference Books**
1. Aggarwal,R.S."A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008,Reprint 2009,S.Chand& Co Ltd., New Delhi.
2. Abhijit Guha,"QuantitativeAptitude",TMH,3$^{rd}$edition
3. Objective Instant Arithmetic by M.B.Lal & Goswami Upkar Publications.
4. Word Power Made Easy by Norman Lewis W.R.GOYAL Publications

**Note:**
- Instructor can cover the syllabus by Classroom activities and Assignments(5Assignments/week)
- Instructor Manual has Classwork questions, Assignment questions and Roughwork pages
- Each Assignment has 20 Questions from Unit1,2,3,4 and 5 and 5 Questions from Unit 1
- Evaluation has to be conducted as like Lab Examination.

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD 601 – Data Analytics and Modeling Techniques** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | • To understand the R basics for solving problem<br>• To study about data manipulation techniques and visualization techniques<br>• To understand the the types of machine machine learning theory and implement linear and non-linear learning models<br>• To learn how to create and build R Package<br>• To understand how to use Github for solving real-time applications | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apply R coding to YAML and Markdown Language<br>CO2: Compare data visualization technique using different plots<br>CO3: Analyze the performance of different classification and clustering algorithms<br>CO4: Build and check an R package<br>CO5: Use Git in RStudio | | | | | | | |

**Note:**The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction**
R Basics – Using R as a calculators – Functions – Factors – Dataframes – R packages – Dealing with missing values – Data pipelines – Coding and Naming Conventions – Programming and Integration of workflow and documentation – creating an R Markdown/knitr document in Studio – YAML Language - Markdown Language – Running in R code in Markdown Documents [9]

**Data Manipulation**
Reading and Formatting Datasets – Manipulating data with dplyr – Visualizing Data – Basic Graphics – ggplot2 package – Facets – Scaling – Working with Large Datasets – Subsampling – Hex and 2D Density Plots [9]

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**Supervised and Unsupervised Learning**

Machine Learning – Supervised Learning – Regression vs Classification – Inference vs Prediction – Linear Regression – Logistic Regression – Validating Models - Sampling Approaches – Supervised Learning Packages – Naïve Bayes - Unsupervised Learning – Dimensionality Reduction – Clustering – Association Rules – Importing data – Exploring the Data – Fitting Models [9]

**R Package**

Expressions – Basic data type – Data Structures – Control Structures – Functions – Recursive functions – Working with vectors and lists – Building an R package-creating an R package – Description – Namespaces – Checking the Package – Roxygen [9]

**Version Control**

Version Control abd Repositories – Using Git in RStudio – GitHub – Collaborating on GitHub – Profiling and Optimization – Profiling – Parallel Execution – Bayesian Linear Regression – Formulas and their Model Matrix [9]

|  | | Total Hours | 45 |
|---|---|---|---|

| Text book(s): | |
|---|---|
| 1. | Thomas Mailund and Aarhus, "Beginning Data Science in R 4: Data Analysis, Visualization, and Modelling for the Data Scientist",Apress Media, 2022 |
| 2. | Andreas Muller,Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists",4th Edition,O'Reilly,2018. |

| Reference(s): | |
|---|---|
| 1. | Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012. |
| 2. | Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O" Reilly, 2011. |
| 3. | Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008. |
| 4. | Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012. |

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD 602 – Big Data Framework** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|  | L | T | P |  | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| Objective(s) | ● To acquire basic concepts of Big Data, Characteristics of Big Data.<br>● To explore the big data architecture and data patterns in different types of Databases.<br>● To analyze the process involved in Data Acquisition, and Big Data Frameworks.<br>● To comprehend the Real-time Analysis and Interactive Queuing.<br>● To expertise in serving Databases, SQL, No SQL and Python Web Application Framework. | | | | | | | |
| Course Outcomes | At the end of the course, the students will be able to<br>CO1: Attain the concept of Big Data, Analytics Flow of Big Data, Analytics Patterns and Big Data Stack<br>CO2: Realize the Analytics Architecture Components, Design Styles, MapReduce Patterns and Different types of Databases.<br>CO3: Familiarize the Data Acquisition Considerations, Message Frameworks, Collection Systems and Batch Analysis.<br>CO4: Comprehend the importance of Stream Processing, In-Memory Processing and Spark.<br>CO5: Expertise the SQL, NoSQL , Python Web Application Framework Django and Data Visualization Framework and Libraries. | | | | | | | |

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| Note:The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall depend on the number of hours indicated. |
|---|

**Big Data Concepts**

Introduction to Big Data - Characteristics of Big Data - Domain Specific Examples of Big Data –Analytics Flow for B Data - Mapping Analytics Flow to Big Data Stack – case studies - Analytics Patterns  -Big Data Stack - Setting up E Data Stack - Hortonworks Data Platform - Cloudera CDH Stack - Amazon Elastic MapReduce (EMR) – Azure HDInsight. [9]

**Big Data Patterns**

Analytics Architecture Components & Design Styles - MapReduce Patterns – NoSQL - Key-Value Databases – Document Databases - Column Family Databases - Graph Databases. [9]

**Big Data Frameworks**

Data Acquisition Considerations - Publish - Subscribe Messaging Frameworks - Big Data Collection Systems – Messaging Queues - Custom Connectors – HDFS - Batch Analysis - Hadoop and MapReduce – examples – Pig Study - Apache Oozie - Apache Spark - Apache Solr- Map Reduce.Generating the inverted index using MapReduc [9]

**Realtime Analysis and Interactive Queuing**

Stream Processing - Storm Case Studies - In-Memory Processing - Spark Case Studies - Spark SQL –Hive – Amazon Redshift - Google BigQuery. [9]

**Serving Databases and Web Frameworks**

Relational (SQL) Databases - Non-Relational (NoSQL) Databases - Python Web Application Framework – Django - Case Study: Django application for viewing weather data - Spark MLlib - H2O-Data Visualisation – Frameworks a Libraries. [9]

| | Total Hours | 45 |
|---|---|---|

| Text book(s): | | |
|---|---|---|
| 1. | ArshdeepBahga and Vijay Madisetti, "Big Data Science and Analytics – A Hands-on Approach", ArshdeepBahga and Vijay Madisetti Publishers, 2016. |
| 2. | ZaighamMahmood, "Data Science and Big Data Computing – Framework and Methodologies", Springer International Publishing, Switzerland, 2016. |

| Reference(s): | |
|---|---|
| 1. | Donald Miner and Adam Shook, "MapReduce Design Patterns", O'Reilly Publishers, USA, 2013. |
| 2. | Sridhar Alla, "Big Data Analytics with Hadoop 3", Packt Publishing, Mumbai 2018. |
| 3. | Thomas Erl, WajidKhattak, Paul Buhler "Big Data Fundamentals: Concepts Drivers: Concepts, Drivers and Techniques",Pearson,2016. |
| 4. | Anil Maheswari, "Big Data", McGraw Hill, 2nd Edition,2019. |

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD 603 – Web Technology** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 1 | 0 | 4 | 75 | 3 | 50 | 50 | 100 |
| **Objective(s)** | ● To provide knowledge of web design using HTML and CSS, client-side and server-side scripting<br>● To understand the fundamentals of various MySQL Queries and Database access<br>● To demonstrate the Web Hosting using local web servers<br>● To understand the fundamentals PHP<br>● To demonstrate the Web Hosting using local web servers | | | | | | | |

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| | **At the end of the course, the students will be able to** |
|---|---|
| **Course Outcomes** | CO1: Categorize the issues in designing a web page by utilizing HTML 5 <br> CO2: Design the website using the properties of CSS and Bootstrap <br> CO3: Create Web Page with dynamic styles and validate the HTML form data using Java Script and jQuery <br> CO4: Design the webpage using server-side scripting <br> CO5: Create a Web Page to store, retrieve and process the data using database connectivity |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction to HTML** [3]
Introduction to HTML, Essential Tags, Tags and Attributes, Text Styles and Text Arrangements, Text, Effects, Exposure to Various Tags, Colour and Background of Web Pages, Lists and their Types, Attributes of Image Tag, Hypertext, Hyperlink and Hypermedia, Links, Anchors and URLs, Links to External Documents, Different Section of a Page and Graphics, Creating Table, Frame, Form and Style Sheet.

**Stylesheet** [3]
Introduction, Cascading Style Sheets (CSS), CSS Syntax, Inserting CSS: Inline, Internal, External, ID and Class Selectors, Colours, Backgrounds, Borders, Text, Font, List, Table, CSS Box Model, Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin, Positioning: Relative, Float, Absolute; CSS3 Borders, Box Shadows, Text Effects and shadow, Basics of Responsive Web Designs, Media Queries, Introduction to Bootstrap.

**Java Script and jQuery** [3]
Java Script: Objects, Methods, Events and Functions, Operators, Data Types, Literals, Array and Dialog Boxes, Dynamically Changing Text, Style, Content, jQuery: Fundamentals of jQuery, Loading and using jQuery, Library files, Call-back functions, jQuery Selectors, jQuery Events, jQuery Effects, jQuery with AJAX.

**Server-Side Scripting** [3]
Web Servers (Apache and IIS), Introduction to PHP, Basic Programming Concepts of PHP: Variables, Data types, Constants, Scope of Variables, Type of Variables, Operators, Arrays, Control Structures, Looping, Functions: User Defined Functions, Built-in Function, Array Functions, Date and Time Functions, String Functions, PHP Server Variables, Working with form, Uploading files to Web Server using PHP, Session Handling.

**Web Services**
Working with PHP and MySQL, Connecting to Database, Creating, Selecting, Deleting, Updating Records in a table, Inserting Multiple Data. Installation and usages of CodeIgniter, WordPress. [3]

| | **Total Hours** | **15** |
|---|---|---|

**Text book(s):**

| 1. | Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Fifth Edition, Pearson Education, 2021. |
|---|---|
| 2. | Thomas A. Powell, "HTML & CSS: The Complete Reference, Fifth Edition", 5th Edition, Mc Graw Hill, 2017. |

**Reference(s):**

| 1. | Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective", Pearson Education, 2017. |
|---|---|
| 2. | Robert. W. Sebesta, "Programming the World Wide Web", Fifth Edition, Pearson Education, 2016. |
| 3. | Marty Hall and Larry Brown, "Core Web Programming" Third Edition, Volume I and II, Pearson Education, 2018. |
| 4. | Bates, "Developing Web Applications", Wiley, 2006. |

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

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| | | | | | | | | | | | | | | | |
|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 2 | 2 | 3 | 3 | | 3 | | | 2 | 3 | | | 3 | 2 |
| **CO4** | 3 | 2 | | 2 | 2 | | 3 | | | 2 | 2 | | | 3 | 2 |
| **CO5** | 3 | 2 | | 2 | 3 | | | | | 2 | 3 | | | 3 | |

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|---|---|---|---|---|---|---|---|---|
| **50 AD 604 – Data Science** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | <ul><li>To impart necessary knowledge needed for data science.</li><li>To gain knowledge on data pre-processing</li><li>To acquire knowledge on programming tools</li><li>To implement classification models.</li><li>To develop programming skills required to build data science applications.</li></ul> |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Classify the characteristics of big data.<br>CO2: Demonstrate the tools needed for data science.<br>CO3: Collect, explore, clean, and manipulate data.<br>CO4: Implement models such as k-nearest Neighbors, Naive Bayes, linear regression, and decision trees.<br>CO5: Build data science applications using Python based toolkits. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction to Data Science**<br>Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting | [9] |
| **Introduction to Programming Tools for Data Science**<br>**Toolkits using Python:** Matplotlib, NumPy, Pandas, Seaborn, Scikit-learn, NLTK<br>**Visualizing Data:** Bar Charts, Line Charts, Scatterplots | [9] |
| **Data Preprocessing**<br>Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction) | [9] |
| **Machine Learning**<br>Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning –Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification algorithms- Naïve Bayes, K-Nearest Neighbors, Support Vector Machines (SVM), decision trees,random forest trees, Overview of Deep Learning | [9] |
| **Case Studies**<br>Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis. | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Joel Grus, "Data Science from Scratch: First Principles with Python", 2nd Edition, O'Reilly Media,2019 |
| 2. | AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media,2017 |
| **Reference(s):** | |
| 1. | Jain V.K., "Data Sciences", Khanna Publishing House, Delhi. |
| 2. | Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi. |
| 3. | Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi. |
| 4. | Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi. |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

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| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | 2 | | | | 3 | |
| CO2 | 3 | 3 | 2 | 3 | 3 | | 3 | | | 2 | 3 | 3 | | 3 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 3 | | 3 | | | 2 | 3 | 3 | | 3 | 2 |
| CO4 | 3 | 2 | | 2 | 2 | | 3 | | | 2 | 3 | 2 | | 3 | 2 |
| CO5 | 3 | 2 | | 2 | 3 | | | | | 2 | 3 | 3 | | 3 | |

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|---|
| **50 AD 6P1- Data Science Laboratory** |
| **AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** | |
| VI | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 | |

| **Objective(s)** | ● To impart necessary knowledge on python needed for data science<br>● To implement statistics measures using R<br>● To acquire knowledge on regression models<br>● To implement classification models.<br>● To develop programming skills required to build real world applications. |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Predict the class of a dataset using python programming<br>CO2: Implement statistics measures and visualize the data using R<br>CO3: Implement regression algorithm to predict the model.<br>CO4: Implement classification techniques to predict the model<br>CO5: Implement data science techniques for social media data |

**LIST OF EXPERIMENTS**

1. Write a program in Python to predict the class of a dataset

2. Implementation of Statistics and Visualization in R

3. Implementation of Linear Regression

4. Implementation of Logistic Regression

5. Implementation of Naive Bayesian Classifier

6. Implementation of Decision Trees

7. Implementation of Support Vector Machine

8. Implementation of Neural Networks

9. Implementation of Sentiment Analysis

10. Implementation of Object Detection

11. Implementation of Text Data Analysis

12. Implementation of Sentiment Analysis using MATLAB

13. Implementation of Object Detection using MATLAB

14. Implementation of Text Data Analysis using MATLAB

**SUGGESTED SOFTWARE TOOLS: RapidMiner, WEKA, ANACONDA, MATLAB**

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

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K.S.Rangasamy College of Technology
Tiruchengode - 637 215.

## 50 AD 6P2- Big Data Framework Laboratory

**AD**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| VI | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

| Objective(s) | ● To impart necessary knowledge on Hadoop<br>● To implement File Management tasks in Hadoop<br>● To acquire knowledge on map, reduce program<br>● To implement Pig Latin scripts.<br>● To implement Hive Databases. |
|---|---|
| Course Outcomes | **At the end of the course, the students will be able to**<br>CO1: Install Hadoop and implement file management<br>CO2: Implement File Management tasks in Hadoop<br>CO3: Analyze report using Map Reduce program<br>CO4: Implement Pig Latin scripts<br>CO5: Implement Hive Databases |

**LIST OF EXPERIMENTS**

1. Installation of Hadoop
2. File Management tasks in Hadoop
3. Word Count MapReduce program to understand Map Reduce Paradigm
4. Weather Report POC-MapReduce Program to analyze time-temperature statistics and generate report with max/min temperature
5. Implementing Matrix Multiplication with Hadoop MapReduce
6. Pig Latin scripts to sort, group, join, project, and filter data.
7. Hive Databases,Tables, Views, Functions and Indexes

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

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## 50 TP 0P4 - Career Competency Development IV

| Semester | Hours/Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|
| | **L** | **T** | **P** | **C** | **CA** | **ES** | **Total** |
| **VI** | **0** | **0** | **2** | **0** | **100** | **00** | **100** |

| Objective(s) | ● To help the learners to enrich the advanced written and oral communication skills in the academic and professional contexts<br>● To help the learners to augment their advanced verbal and logical reasoning ability to meet out the employability requirements of the companies<br>● To help the learners to comprehend the advanced level of aptitude skills in the concepts of Geometry<br>● To help the learners to enhance the data interpretation and analytical skills in varied methods.<br>● To help the learners to enrich the technical and programming skills to be focused on better employability, codeathons and hackathons |
|---|---|
| Course Outcomes | **At the end of the course, the student will be able to**<br>CO1: Examine and correlate the written and oral communication skills in the academic and professional contexts<br>CO2: Predict and discriminate advanced verbal and logical reasoning ability to meet out the employability requirements of the companies |

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| | CO3: Infer the concepts of advanced level of aptitude skills on Geometry pertaining to competitive exams and company recruitments.<br>CO4: Illustrate the data interpretation and analytical skills in varied methods.<br>CO5: Formulate the technical and programming skills to be focused on better employability, codeathons and hackathons | |
|---|---|---|
| **Unit–1** | **Written and Oral Communication– Part2** | **Hrs** |
| | Self-Introduction–GD–Personal Interview Skills<br>**Practices** on Reading Comprehension Level 2 – Paragraph Writing – Newspaper and Book Review Writing –SkimmingandScanning–InterpretationofPictorialRepresentations–SentenceCompletion-SentenceCorrection–JumbledSentences–Synonyms&Antonyms–UsingtheSameWordasDifferentPartsofSpeech –Editing. **Materials:** Instructor Manual, Word power Made Easy Book, News Papers | 4 |
| **Unit–2** | **Verbal & Logical Reasoning –Part2** | |
| | Analogies – Blood Relations – Seating Arrangements – Syllogism – Statements and Conclusions, Cause and Effect – Deriving Conclusions from Passages – Series Completion (Numbers, Alphabets & Figures) – Analytical Reasoning–Classification–Critical Reasoning **Practices**: Analogies–Blood Relations–Statement & Conclusions. **Materials:** Instructor Manual, Verbal Reasoning by R.S.Aggarwal | 8 |
| **Unit–3** | **Quantitative Aptitude– Part–5** | 6 |
| | Geometry–StraightLine–Triangles–Quadrilaterals–Circles–Co-ordinateGeometry–Cube–Cone –Sphere. **Materials:** Instructor Manual, Aptitude book | |
| **Unit–4** | **Data Interpretation and Analysis** | 6 |
| | DataInterpretationbasedonText–DataInterpretationbasedonGraphsandTables.GraphscanbeColumnGraphs, Bar Graphs, Line Charts, Pie Chart, Graphs representing Area, Venn Diagram & Flow Charts. **Materials:** Instructor Manual, Aptitude Book | |
| **Unit–5** | **Technical & Programming Skills–Part2** | |
| | Core Subject– 4,5,6 **Practices:** Questions from Gate Material. **Materials:** Text Book, Gate Material | 6 |
| | Total | 30 |

Evaluation Criteria

| S.No. | Particular | Test Portion | Marks |
|---|---|---|---|
| 1 | Evaluation1WrittenTest | 15Questions each from Unit1,2,3,4&5(External Evaluation) | 50 |
| 2 | Evaluation2–<br>Oral Communication | GD and HR Interview<br>(External Evaluation by English, MBA Dept.) | 30 |
| 3 | Evaluation 3 –<br>Technical Interview | Internal Evaluation by the Dept.–3 Core Subjects | 20 |
| | | Total | 100 |

**Reference Books**

1. Aggarwal, R.S."A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008 ,Reprint2009, S.Chand & Co Ltd., NewDelhi.
2. Abhijit Guha, "Quantitative Aptitude", TMH,3$^{rd}$edition
3. Objective Instant Arithmetic by M.B.Lal &Goswami Upkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL Publications

**Note:**
- Instructor can cover the syllabus by Classroom activities and Assignments(5Assignments/week)
- Instructor Manual has Classwork questions, Assignment questions and Rough Work pages
- Each Assignment has 20 questions from Unit 1,2,3,4,5 and 5 questions from Unit 1(Oral Communication) & Unit 5(Programs)
- Evaluation has to be conducted as like Lab Examination.

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

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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO5** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |

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</div>

**50 AD 701 – Data Visualization Techniques**

<div align="center">

**AD**

</div>

| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Objective(s)** | ● To understand the fundamental concepts of data visualization.<br>● To recognize the various types of data.<br>● To learn the various visualization methods.<br>● To know the text visualization.<br>● To understand the recent trends in data visualization. |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Design dashboards for data visualization process<br>CO2: Interpret the visualization of multivariate data<br>CO3: Apply visualization technique in tree, graph and networks.<br>CO4: Analyze the visualization of the text document.<br>CO5: Apply visualization in real-time application environment. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction**<br>Visualization – visualization process – role of cognition – Pseudocode conventions – Scatter plot - Data foundation: Types of data - Structure within and between records - Data preprocessing – Human perceptions and information processing – Visualization foundations - Characteristics of dashboards – Key goals in visual design process – Dashboard display media – Designing dashboards for usability – Meaningful organization – Maintaining consistency – Aesthetics of dashboards – Testing for usability | **[9]** |
| **Spatial and Geospatial, Time oriented data and Multivariate data**<br>One, two, three-dimensional data – Dynamic data – Combining techniques - Visualization of spatial data - Visualization of point data - Visualization of line data - Visualization of area data - Issues in Geospatial data Visualization –Characterizing and visualizing Time oriented data- Point, Line and region-based techniques for multivariate data. | **[9]** |
| **Tree, Graph, Networks**<br>Displaying hierarchical structure – Displaying Arbitrary Graphs/Networks – Other issues. Visualization techniques for Tree- Graph and Networks | **[9]** |
| **Text and Document**<br>Levels of text representation – Vector space model – Single Document Visualization – Document collection visualization- Extended text visualization. | **[9]** |
| **Current Trends**<br>Design – Virtual Reality: Interactive Medical Application – Tactile Maps for visually challenged People – Animation Design for Simulation | **[9]** |
| **Total Hours** | **45** |

**Textbook(s):**

| 1. | Matthew O. Ward. , Georges Grinstein and Daniel Keim., "Interactive Data Visualization: Foundations, Techniques, Applications", 2nd Edition, CRC Press, 2015. |
|---|---|
| 2. | Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", O'Reilly, 2nd Edition, 2013. |

**Reference(s):**

| 1. | Colin Ware "Information Visualization Perception for Design",3rd edition, Morgan Kaufman 2012. |
|---|---|

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| | 2. | Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, "Readings in Information Visualization Using Vision to think", Morgan Kaufmann Publishers, 1999. |
|---|---|---|
| | 3. | Chaomei Chan, "Information Visualization",Beyond the horizon, 2nd edition, Springer Verlag, 2004. |
| | 4. | Pauline Wills, "Visualisation: A Beginner's Guide", Hodder and Stoughlon, 1999. |

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

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|---|---|---|---|---|---|---|---|---|
| 50 AD 702 – Cloud Computing | | | | | | | | |
| AD | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To understand the fundamental concepts of cloud computing.<br>● To recognize how to design and implement cloud-based applications.<br>● To learn cloud computing delivery model IaaS.<br>● To know the fundamental concept of PaaS.<br>● To understand the architecture of SaaS. | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1:Explore various cloud programming models<br>CO2:Provide cost-cutting on IT infrastructure for mid-level to large scale industries.<br>CO3:Deliver hardware and software tools to users over the internet.<br>CO4:Install and run applications on their own computers or in their own data centers<br>CO5:Use Cloud Computing Reference Architecture for developing clouds. | | | | | | | |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction of delivery models in Cloud Computing**<br>Introduction to cloud delivery models, List various cloud delivery models-Advantages of delivery models in cloud-trade-off in cost to install versus flexibility-Cloud service model architecture. | **[9]** |
| **Infrastructure as a Service (IaaS)**<br>Introduction to Infrastructure as a Service delivery model- characteristics of IaaS- Architecture- examples of IaaS-Applicability of IaaS in the industry. | **[9]** |
| **Platform as a Service (PaaS)**<br>Introduction to Platform as a Service delivery model- characteristics of PaaS- patterns- architecture and examples of PaaS- Applicability of PaaS in the industry. | **[9]** |
| **Software as a Service (SaaS)**<br>Introduction to Software as a Service delivery model- characteristics of SaaS- Architecture- examples of SaaS-Applicability of SaaS in the industry. | **[9]** |
| **Cloud computing Reference Architecture (CCRA)**<br>Introduction to Cloud computing reference architecture (CCRA)- benefits of CCRA- Architecture overview-versions and application of CCRA for developing clouds. | **[9]** |
| **Total Hours** | **45** |
| **Text book(s):** | |

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| 1. | Barrie Sosinsky, "Cloud Computing Bible", Wiley, 2011. |
| 2. | Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology & Architecture", Pearson, 2014 |

**Reference(s):**

| 1. | Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms",Wiley, 2011 |
| 2. | Nikos Antonopoulos, Lee Gillam, "Cloud Computing: Principles, Systems and Applications",Springer,2012 |
| 3. | Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley, 2010 |
| 4. | Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloudwith SLAs", Emereo Pty Limited, 2008. |

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

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|---|---|---|---|---|---|---|---|---|---|---|
| **50 AD 703 - Business Analytics** |||||||||||
| **AD** |||||||||||
| Semester | Hours / Week ||| Total hrs | Credit | Maximum Marks ||||
|  | L | T | P |  | C | CA | ES | Total ||
| **VII** | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 ||

| **Objective(s)** | • To understand the Analytics Life Cycle.<br>• To comprehend the process of acquiring Business Intelligence<br>• To understand various types of analytics for Business Forecasting<br>• To model the supply chain management for Analytics.<br>• To apply analytics for different functions of a business |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Solve the real-world business problems and model with analytical solutions<br>CO2: Identify the business processes for extracting Business Intelligence<br>CO3: Apply predictive analytics for business fore-casting<br>CO4: Apply analytics for supply chain and logistics management<br>CO5: Use analytics for marketing and sales. |

| **Introduction to Business Analytics**<br>Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration | [9] |
|---|---|
| **Business Intelligence**<br>Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions | [9] |
| **Business Forecasting**<br>Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models –Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics. | [9] |
| **HR & Supply Chain Analytics**<br>Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year. | [9] |
| **Marketing & Sales Analytics**<br>Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales | [9] |
| **Total Hours** | **45** |

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**Text book(s)**

| | |
|---|---|
| 1. | R Evan James, "Business Analytics", 2nd Edition, Pearson, 2017. |
| 2. | R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley, 2016. |

**Reference(s):**

| | |
|---|---|
| 1. | Philip Kotler and Kevin Keller, "Marketing Management", 15th Edition, PHI, 2016. |
| 2. | Ramesh Sharda, Dursun Delen, and Efraim Turban "Business Intelligence, Analytics, and Data Science", 2016. |
| 3. | VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010 |
| 4. | Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018. |

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

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|---|---|---|---|---|---|---|---|---|---|
| **50 AD 704 - Deep Learning** | | | | | | | | | |
| **AD** | | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 | |

| **Objective(s)** | ● To impart necessary knowledge on perceptron learning<br>● To implement oracle database connectivity using python<br>● To acquire knowledge on CNN and RNN models<br>● To create dashboards using Tableau.<br>● To impart knowledge on LSTM autoencoders. |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Implement of Multilayer Neural Network using Keras<br>CO2: Implement text generation using LSTM<br>CO3: Reuse of a pre-trained model on a new problem using transfer learning<br>CO4: Implement sentiment Analysis using RNN<br>CO5: Use LSTM and autoencoders for different applications |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Basics of Neural Networks**<br>Basic concept of Neurons –McCulloch Pitts Neuron, Thresholding logic - Perceptron learning Algorithm – Multilayer Perceptrons - Machine Learning-Supervised and Unsupervised Learning-Regression and Classification-K-Means Clustering | **[9]** |
| **Introduction to Deep Learning**<br>History of Deep learning - Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Momentum based and Nesterov Accelerated Gradient Descent – Regularization – Dropout | **[9]** |
| **Convolutional Neural Networks**<br>Convolutional Neural Networks Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – LeNet, AlexNet, GoogLeNet, ResNet | **[9]** |
| **Deep Learning Architectures**<br>Long Short Term Memory, Gated Recurrent Units, Encoder/Decoder Architectures – Autoencoders – Standard-Sparse – Denoising –Contractive- Variational Autoencoders – Adversarial Generative Networks | **[9]** |

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**Applications of Deep Learning**
Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Sentence Classification using Convolutional Neural Networks **[9]**

| | | |
|---|---|---|
| | **Total Hours** | **45** |

| Textbook(s): | |
|---|---|
| 1. | Ian Good Fellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2017. |
| 2. | Francois Chollet, "Deep Learning with Python", Manning Publications, 2018. |

| Reference(s): | |
|---|---|
| 1. | Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress , 2017. |
| 2. | RagavVenkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press,2018 |
| 3. | Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018. |
| 4. | Seth Weidman, "Deep learning from scratch: Building with Python from first principles ",O'Reilly, 2019 |

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

| **K.S.Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AC 001 – Research Skill Development - I** | | | | | | | | |
| Semester | Hours / Week | | | Total Hrs | Credit C | Maximum Marks | | |
| | L | T | P | | | CA | ES | Total |
| VII | 1 | 0 | 0 | 15 | 0 | 100 | - | 100 |
| **Objective(s)** | ● To learn about the effective usage of powerpoint presentation<br>● To prepare presentation with various effects<br>● To visualize the data in the presentation<br>● To acquire knowledge about data sources<br>● To investigate the research articles based on various applications | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Develop presentation with visual effects<br>CO2: Prepare a presentation with supporting data<br>CO3: Attain the importance of research and data collection<br>CO4: Analyze the various sources of research articles<br>CO5: Interpret the tools and methods in preparing manuscript | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

| | |
|---|---|
| **Preparing a Presentation**<br>Presenting data using Power Point- Power Point preparation and presentation, Design principles for creating effective PowerPoint slides with visuals displaying data. -  Profile, - Problem, and a set of basic Excel charts, use to create a presentation. | [4] |
| **Creating effective slides using PowerPoint**<br>Create effective lides using PowerPoint.  Tools within Power Point, structure story line, create story boards, identify primary elements of slide design, display data and finalize slide presentation. | [4] |
| **Research Designs and Data Sources**<br>Overview of the topics:  process of data collection and analysis. Starting with a research question - Review of existing data sources- Survey data collection techniques- Importance of data collection- Basic features affect data analysis when dealing with sample data. Issues of data access and resources for access. | [3] |

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| | | |
|---|---|---|
| **Measurements and Analysis Plan**<br>Importance of well-specified research question and analysis plan: various data collection strategies - Variety of available modes for data collection – review of literature - Tools at hand for simple analysis and interpretation. | | [4] |
| | **Total Hours** | **15** |

**Text Book(s):**

| | |
|---|---|
| 1. | Judy Jones Tisdale. Effective Business Presentations. Gulf Coast Books LLC. ISBN-13: 978-0130977359, 2004. |
| 2. | Frauke Kreuter. Framework for Data Collection and Analysis,2018. https://www.coursera.org/learn/data-collection-framework |

**Reference(s)**

| | |
|---|---|
| 1. | Kothari, C.R. and Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International Publishers, 2013 |
| 2. | Srivastava, T.N. and Rego, S., "Business Research Methodology", Tata McGrawHill Education Pvt. Ltd., Delhi, 2019. |

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | | 3 | 2 | | | | 2 | 3 | 3 | | | 3 | 2 |
| **CO 2** | 3 | 3 | 1 | 2 | 2 | | 2 | | 2 | 3 | 2 | 1 | | 3 | 1 |
| **CO 3** | 3 | 3 | 2 | 2 | | | 2 | | 1 | 3 | | 1 | 3 | 3 | 3 |
| **CO 4** | 3 | 3 | 3 | 2 | | 2 | 1 | 2 | | 3 | 2 | 2 | 3 | 2 | 1 |
| **CO 5** | 3 | 3 | 2 | 2 | | 2 | 1 | | 2 | 3 | 2 | 2 | 3 | 2 | 1 |

| **K.S. Rangasamy College of Technology – Autonomous R2018** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 AD 7P1- Data Visualization Laboratory** | | | | | | | |
| **AD** | | | | | | | |
| **Semester** | Hours / Week | | | Total hrs | Credi t | Maximum Marks | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| VII | 0 | 0 | 4 | 6 0 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To impart necessary knowledge on data visualization tools<br>● To implement statistics measures using R<br>● To acquire knowledge on regression models<br>● To create dashboards using Tableau.<br>● To impart knowledge on EDA and data visualization. | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Install data analysis and visualization tool<br>CO2: Implement Oracle Database Connectivity using Python<br>CO3: Implement regression algorithm to predict the model.<br>CO4: Analyze data visualization using different visualization tools<br>CO5: Apply the various EDA and visualization techniques, and present an analysis<br>     report | | | | | | | |
| **LIST OF EXPERIMENTS** | | | | | | | |
| 1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI. | | | | | | | |
| 2. Visualization of Spreadsheet Models | | | | | | | |
| 3. Oracle Database Connectivity using Python | | | | | | | |
| 4. Visualization of Semi-Structured Data | | | | | | | |

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5. Regression using DVC, Pycaret and MLflow

6. Introduction to Tableau and Aggregation Methods in Tableau

7. Visual Encodings and Basic Dashboards in Tableau

8. Interactive Plots in Python

9. Use a case study on a data set, apply the various EDA and visualization techniques, and present an analysis report.

10. Implementation of data preprocessing using MATLAB

11. Implementation of data visualization using MATLAB

12. Implementation of Exploratory Data Analysis using MATLAB

**SUGGESTED SOFTWARE TOOLS: R, ANACONDA, MATLAB, Power BI, Tableau**

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD 7P2- Deep Learning Laboratory** | | | | | | | | |
| **AD** | | | | | | | | |
| **Semester** | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| VII | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |
| **Objective(s)** | ● To impart necessary knowledge on perceptron learning<br>● To implement oracle database connectivity using python<br>● To acquire knowledge on CNN and RNN models<br>● To create dashboards using Tableau.<br>● To impart knowledge on LSTM autoencoders. | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Implement of Multilayer Neural Network using Keras<br>CO2: Implement text generation using LSTM<br>CO3: Reuse of a pre-trained model on a new problem using transfer learning CO4: Implement sentiment Analysis using RNN<br>CO5: Use LSTM and autoencoders for different applications | | | | | | | |
| **LIST OF EXPERIMENTS** | | | | | | | | |

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1. Implementation of Multilayer Neural Network using Keras and Data Augmentation on MNIST dataset.

2. CNN Implementation on MNIST Dataset.

3. Transfer Learning of pretrained models on MNIST dataset

4. Transfer Learning on Plant Village dataset for Plant Disease Detection

5. Sentiment Analysis using Recurrent Neural Networks (RNN)

6. Text Generation using LSTM

7. Denoising and Dimensionality Reduction for Medical MNIST dataset using Autoencoders

8. Transfer Learning of pretrained models on MNIST dataset using MATLAB

9. Sentiment Analysis using MATLAB

**SUGGESTED SOFTWARE TOOLS: Google Colab, MATLAB, ANACONDA**

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD 7P3  -  Project Work  - Phase I** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 0 | 0 | 4 | 60 | 2 | 100 | 00 | 100 |
| **Objective(s)** | ● To impart practical knowledge to the students<br>● To apply the gained engineering concepts  in their project work<br>● To provide an exposure to the students to collect and review the research articles, journals, and conference proceedings relevant to their project work<br>● To design an innovative project work<br>● To implement the project with the recent IT tools | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Identify engineering problems relevant to the domain and perform related literature survey<br>CO2: Analyze and identify an appropriate methodology to solve the problem<br>CO3: Do experimentation / simulation / programming / fabrication, collect and interpret data<br>CO4: Prepare and present their technical report with relevant project work details<br>CO5: Demonstrate their responsibility as an individual and as a leader in a team | | | | | | | |
| **Note:**The hours given against each topic are of indicative.  The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required.  The marks allotted for questions in the examinations shall not depend on the number of hours indicated. | | | | | | | | |

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| | | Project Work Phase-I shall be evaluated by the project review committee ( Project coordinator, Project Guide and HOD/Subject experts in the department ) |
|---|---|---|
| **Methodology** | | ● Three reviews shall be conducted with subject expert and the student(s) shall make a presentation on the progress made by him / her / them during the reviews |
| | | ● Student(s) shall submit a project technical report comprising of title, problem statement, importance of work, modifications, proof of concept, methodology and review of literature during the 3rd review |
| | | ● The total marks obtained in the three reviews shall be reduced to 100 marks and rounded to the nearest integer |
| | | ● The schedule will be announced by the Project Coordinator and Head of the Department |

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

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|---|---|---|---|---|---|---|---|
| **50 TP 0P5 - Career Competency Development V** | | | | | | | |
| **Common to All Branches** | | | | | | | |
| Semester | Hours/Week | | | Credit | Maximum Marks | | |
| | L | T | P | C | CA | ES | Total |
| VII | 0 | 0 | 2 | 0 | 100 | 00 | 100 |

| **Objective(s)** | ● To help the learners to practice the written and oral communication skills in the academic and professional contexts<br>● To help the learners to practice the verbal and logical reasoning ability to meet out the requirements of both competitive exams and companies<br>● To help the learners to practice effectively the aptitude modules for company based recruitments and competitive exams<br>● To help the learners to practice effectively the data interpretation and analysis modules for company based recruitments and competitive exams<br>● To help the learners to hone the technical and programming skills for better employability |
|---|---|
| **Course Outcomes** | **At the end of the course, the student will be able to**<br>CO1: Reinforce the written and oral communication skills in the academic and professional contexts<br>CO2: Discriminate and assess the verbal and logical reasoning ability to meet out the employability requirements of the companies<br>CO3: Relate the aptitude modules for company based recruitments and competitive exams effectively<br>CO4: Compare and illustrate the data interpretation and analysis modules effectively for company based recruitments and competitive exams<br>CO5: Formulate and integrate the technical and programming skills to be focused on better employability and code contests. |

| Unit – 1 | Written and Oral Communication | Hrs |
|---|---|---|
| | Self Introduction – GD – HR Interview Skills – Corporate Profile Review<br>Practices on Company Based Questions and Competitive Exams Materials:<br>Instructor Manual | 6 |

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| Unit – 2 | Verbal & Logical Reasoning | 6 |
|---|---|---|
| Practices on Company Based Questions and Competitive Exams<br>Materials: Instructor Manual | | |
| Unit – 3 | Quantitative Aptitude | 6 |
| Practices on Company Based Questions and Competitive Exams Materials:<br>Instructor Manual | | |
| Unit – 4 | Data Interpretation and Analysis | 6 |
| Practices on Company Based Questions and Competitive Exams<br>Materials: Instructor Manual | | |
| Unit – 5 | Programming & Technical Skills – Part 3 | 6 |
| Data Structure - Arrays – Linked List – Stack – Queues – Tree – Graph<br>Practices on Algorithms and Objective Type Questions<br>Materials: Instructor Manual | | |
| | Total | 30 |

| Evaluation Criteria | | | |
|---|---|---|---|
| S.No. | Particular | Test Portion | Marks |
| 1 | Evaluation 1<br>Written Test | 15 Questions each from Unit 1, 2,3, 4 & 5<br>( External Evaluation) | 60 |
| 2 | Evaluation 2 -<br>Oral Communication | GD and HR Interview<br>(External Evaluation by English, MBA Dept.) | 20 |
| 3 | Evaluation 3 –<br>Technical Interview | Internal Evaluation by the Dept. – 3 Core Subjects | 20 |
| | | Total | 100 |

Reference Books
1. Aggarwal, R.S. "A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
2. Abhijit Guha, "Quantitative Aptitude", TMH, 3rd edition
3. Objective Instant Arithmetic by M.B. Lal & GoswamiUpkar Publications.
4. Word Power Made Easy by Norman Lewis W.R. GOYAL PUBlications

Note:
● Instructor can cover the syllabus by Class room activities and Assignments (5 Assignments/week)
● Instructor Manual has Class work questions, Assignment questions and Rough work pages
● Each Assignment has 20 questions for Unit 1,2,3,4 & 5 and Unit 5 and 5 questions from Unit 5(Algorithms) & Unit 1(Oral Communication)
● Evaluation has to be conducted as like Lab Examination.

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

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|---|---|---|---|---|---|---|---|
| **50 AC 002 – Research Skill Development - II** | | | | | | | |
| Semester | Hours / Week | | | Total Hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 1 | 0 | 0 | 15 | 0 | 100 | - | 100 |

| | |
|---|---|
| **Objective(s)** | ● To identify the ethics in preparing research paper<br>● To organize manuscript for submission<br>● To attain knowledge for filing Patent<br>● To apply for copyright<br>● To develop and deploy Mobile App. in play store |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Prepare a manuscript for journal publication.<br>CO2: Apply the manuscript for publication<br>CO3: Interpret the process of obtaining copyright and patent<br>CO4: Analyze the various provisions to share the application<br>CO5: Create and publish the mobile application in the digital store |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus.

| | |
|---|---|
| **Preparation of Manuscript**<br>Data necessary before writing a paper: the context in which the scientist is publishing. Learning and identification of research community - advantages of scientific journal publication and manuscript preparation - ethical values in publishing. | [3] |
| **Writing the paper**<br>Writing research paper - structure of the paper - usage of bibliographical tools - abstract preparation and to do a peer review for the abstract of the others, as in real academic life. Plagiarism of the prepared manuscript. | [2] |
| **Copyright**<br>Copyright law in India-Meaning of copyright-Classes of works for copyright protection -Ownership of Copyright-Assignment of copyright-Intellectual Property Rights (IPR) of Computer Software-Copyright Infringements-Procedure for registration | [2] |
| **Patents**<br>Patent System In India -Types of Patent Applications-patentable invention - Not patentable-Appropriate office for filing -Documents required Publication and Examination of Patent Applications -Grant of Patent-Infringement of Patents -E-filing of Patent applications | [3] |
| **Deploying Mobile App. in play sto**re<br>Introduction to Application Stores – Play Store, App Store, Microsoft Store, Creating App – Android, iOS, UWP, Defining Manifest, Certifying App, Create Store Listing, Sharing Screenshots, Sharing App Credentials for Testing. | [5] |
| **Total Hours** | **15** |

| **Text Book(s):** | |
|---|---|
| 1. | Mathis Plapp. How to Write and Publish a Scientific Paper (Project-Centered Course). https://www.coursera.org/learn/how-to-write-a-scientific-paper#instructors |
| 2. | Rajkumar S. Adukia ,Handbook On Intellectual Property Rights In India,2007 |
| 3. | Dr. M. Kantha Babu ,"Text book on Intellectual Property Rights",2019. |

| **Reference(s)** | |
|---|---|
| 1. | Kothari, C.R. and Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International Publishers, 2013 |
| 2. | Srivastava, T.N. and Rego, S., "Business Research Methodology", Tata McGrawHill Education Pvt. Ltd., Delhi, 2019. |
| 3. | https://support.google.com/googleplay/android-developer/answer/9859152 |
| 4. | https://developer.apple.com/ios/submit/ |
| 5. | https://docs.microsoft.com/en-us/windows/uwp/publish/app-submissions |

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

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**50 AD 8P1 - Project Work - Phase II**

**AD**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|----------|---|---|---|-----------|--------|-----|-----|-----|
| | L | T | P | | C | CA | ES | Total |
| VIII | 0 | 0 | 16 | 240 | 8 | 60 | 40 | 100 |

| **Objective(s)** | • To impart practical knowledge to the students<br>• To apply the gained engineering concepts in their project work<br>• To provide an exposure to the students to collect and review the research articles, journals, and conference proceedings relevant to their project work<br>• To design an innovative project work<br>• To implement the project with the recent IT tools |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Identify engineering problems relevant to the domain and carry out a literature survey for its support<br>CO2: Apply algorithm and design techniques in the project and experience their outcome in their own real time project scenario<br>CO3: Do experiment / simulate / program / fabricate, collect and interpret data<br>CO4: Document the results in the form of technical report / presentation<br>CO5: Develop the management skills to achieve the project goal by working as a team and demonstrate the technical skills acquire to provide feasible solution for real-life problems |
| **Methodology** | The objective of Project Work & Dissertation is to enable the student to extend further investigative a study on the project<br>● Three reviews shall be conducted by project review committee ( Project coordinator, Project Guide and HOD/Subject experts in the department )<br>● Student(s) shall make a presentation on the progress made by him / her / them during the reviews<br>● Student(s) shall submit a project technical report comprising of title, problem statement, importance of work, methodology, experimental work and outcome of the work carried out during the 3rd review<br>● The work carried out may be either under the guidance of a supervisor from the department or jointly with a supervisor drawn from other department / academic institution / R& D laboratory / Industry<br>● The project reviews (R1+R2+R3+R4) shall carry a maximum of 60 marks<br>● The project report shall be submitted as per the approved guidelines given by the college, the viva-voce examination shall carry 40 marks<br>● Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination. |

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

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|---|---|---|---|---|---|---|---|
| 50 AD E11 – Software Quality Assurance and Testing | | | | | | | |
| AD | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | • To understand the fundamentals of testing, test planning and design <br> • To study the various types of testing in the life cycle of the software product. <br> • To build design concepts for system testing and execution <br> • To learn the software quality assurance metrics, defects and prevention techniques <br> • To learn the techniques for quality assurance and applying for applications | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to** <br> CO1: Understand the fundamentals of testing, test planning and design <br> CO2: Learn the system testing and test execution process. <br> CO3: Learn the different types of system test categories <br> CO4: Identify defect prevention techniques and software quality assurance metrics. <br> CO5: Apply techniques of quality assurance for typical applications. | | | | | | | |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction to Testing Concepts**

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection – White Box and Black Box, Test Planning and Design, Test Tools and Automation, Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group , System Test Team Hierarchy- Team Building [9]

**System Testing**

System Testing - System Integration Techniques-Incremental - Top Down- Bottom up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables - acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test [9]

**System Test Categories**

System test categories - Taxonomy of System Tests, Interface Tests - Functionality Tests - GUI Tests - Security Tests - Feature Tests - Robustness Tests - Boundary Value Test - Power Cycling Tests - Interoperability Tests - Scalability Tests - Stress Tests - Load and Stability Tests - Reliability Tests – Regression Tests-Regulatory Tests. [9]

**Software Quality**

Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model. [9]

**Software Quality Assurance**

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement [9]

| | Total Hours | 45 |
|---|---|---|

**Textbook(s):**

| 1. | Software Testing And Quality Assurance-Theory and Practice, KshirasagarNakPriyadarshi Tripathy, John Wiley & Sons Inc,2008. |
|---|---|
| 2. | Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005. |

**Reference(s):**

| 1. | Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004. |
|---|---|
| 2. | Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011. |

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| | 3. | Dorothy Graham, Mark Fewster, "Experiences of Test Automation: Case Studies of Software Test Automation", Pearson Education, 2012. |
| | 4. | Boris Beizer, "Software Testing Techniques", Dream Tech Press, 2009. |

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

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|---|
| **50 AD E12– Object Oriented Analysis and Design** |
| **AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | <ul><li>To know the fundamentals of object modeling.</li><li>To understand and differentiate Unified Process from other approaches.</li><li>To design with static UML diagrams</li><li>To design with the UML dynamic and implementation diagrams</li><li>To improve the software design with design patterns</li></ul> |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Express software design with UML diagrams<br>CO2: Design software applications using OO concepts.<br>CO3: Identify various scenarios based on software requirements<br>CO4: Transform UML- based software design into pattern-based design using design patterns<br>CO5: Understand the various testing methodologies for OO software |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Unified Process and Use Case Diagrams**

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases     [9]

**Static UML Diagrams**

Class Diagram–– Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams     [9]

**Dynamic and Implementation UML Diagrams**

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram – When to use activity diagrams - Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams     [9]

**Design Patterns**

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion Controller-Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code     [9]

**Testing**

Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans     [9]

| | **Total Hours** | **45** |

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## Textbook(s):

| | |
|---|---|
| 1 | Craig Larman, ―Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development‖, Third Edition, Pearson Education, 2005. |
| 2 | Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999 |

## Reference(s):

| | |
|---|---|
| 1 | Erich Gamma and Richard Helm, Ralph Johnson, John Vlissides, ―Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995. |
| 2 | Martin Fowler, ―UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003. |
| 3 | James Rumbaugh, Ivar Jacobson, Grady Booch "The Unified Modeling Language Reference Manual",Addison Wesley, 1999. |
| 4 | Hans-Erik Eriksson, Magnus Penker, Brain Lyons, David Fado, "UML Toolkit", OMG Press WileyPublishing Inc., 2004 |

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

## K. S. Rangasamy College of Technology – Autonomous R2018
### 50 AD E13 - C# and .NET
### AD

| Semester | Hours / Week | | | Total hrs. | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| Objective(s) | ● To gain the fundamental skills in C# programming Language<br>● To understand the concepts of the .NET and its platform<br>● To develop web pages using ASP.NET platform<br>● To implement the data manipulation concept using Razor Pages<br>● To enhance the knowledge in Model-View-Controller architecture |
|---|---|
| Course Outcomes | **At the end of the course, the students will be able to**<br>CO1: Know the basic concepts of C#<br>CO2: Understand the Object-Oriented concepts in C#<br>CO3: Ability to develop web pages using ASP.NET platform<br>CO4: Implement the data manipulation concept using Razor Pages<br>CO5: Integrate the concept of MVC in ASP.NET platform |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus.

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**Introduction to C#**
Introduction C# – Understanding .NET – Overview of C# – Literals – Variables – Data Types – Operators – Expressions – Branching – Looping – Methods – Arrays – Strings – Structures – Enumerations.                    [8]

**Object-Oriented Programming in C#**
Classes – Objects – Inheritance – Methods – Polymorphism – Interfaces – Operator Overloading – Delegates – Events – Errors – Exceptions – Collections – Managing Filesystem.                    [8]

**ASP.NET Core Web Application using Razor Pages**
Introduction to ASP.NET Core Web Application – Environment Setup – Project Layout – Static and Default Files - Enabling and Defining Razor Pages – Shared Layouts – Using code-behind files.
[10]

**Data Manipulation using Razor Pages**
Introduction to ADO.NET – Connection Class with Authentication – Command Class – DataReader Class – DataAdapter Class – DataSet – OnGet –OnPost – OnPostDelete – OnPostEdit – OnPostView – REST API – Model and Controller for REST API.                    [10]

**Model-View-Controller (MVC) in ASP.NET Core**
Introduction to MVC – Setting up an ASP.NET Core MVC Website – MVC Routing – Controllers and Actions – Model – Views – Parameters Passing – View Helpers – Model Validation.                    [9]

| | **Total Hours 45** |
|---|---|

**Text book(s):**

| | |
|---|---|
| 1. | Mark J. Price, "C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development", 4th Edition, Packt Publishing Limited, 2019. |
| 2. | Dino Esposito, "Programming ASP.NET Core", 1st Edition, Pearson Education Inc., 2018 |

**Reference(s):**

| | |
|---|---|
| 1. | Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012. |
| 2. | Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012. |
| 3. | Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010 |
| 4. | Robinson et al, "Professional C#", 3rd Edition, Wrox Press, 2004. |

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

| **K. S. Rangasamy College of Technology – Autonomous R2018** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **50 AD E14 – User Interface Design** | | | | | | | | | |
| **AD** | | | | | | | | | |
| Semester | Hours/Week | | | Total Hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 | |
| **Objective(s)** | ● To understand the definition and principles of UI/UX Design in order to design with intention.<br>● To achieve a deep understanding of the entire life-cycle of design the process, purpose, and tools.<br>● To learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making.<br>● To discover the industry-standard tools and specific project deliverables in UI/UX.<br>● To explain why you made design decisions, through presentations of assignments and your personal portfolio. | | | | | | | | |

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| | At the end of the course, the student will be able to |
|---|---|
| **Course Outcomes** | CO1: Establish the baseline principles of UI design as a form of effective human communication.<br>CO2: Make use of practical communication-based guide to interaction and visual design.<br>CO3: Integrate the concepts of Communication-based design process from interaction to visual design.<br>CO4: Apply the material design principles and its components used to create a user interface.<br>CO5: Design a simple user interface by applying the advanced material components. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction**<br>UI Is Communication Concept - Communication Design Principles- UI Design Situation - Core Principles of UI Is Communication - Effective Communication - Intuitive UI- Necessary and Unnecessary Consistency - Unintuitive UI- Inductive UI- Deductive UI. | [9] |
| **Interaction and Visual Design**<br>Interactions -Controls -Commands - Labels and Instructions – Feedback - Task Steps and Navigation - Surfaces - Errors and Notifications - Dynamic Elements - Importance of Visual Design- Graphic Designers – Layout -- Typography and Text – Color -Affordances-Icons and Glyphs-Animations and Transitions- Demanding Attention. | [9] |
| **Communication Design Process**<br>Communicating to People - Emotional Connection – Personality -Attributes-GoodTone-MotivatingUsers-MinimizingEffort-Forgiveness- Building Trustworthiness -CourageousDesign-communication-drivendesignprocess-Basicdesignprocess–Mistakes- Planningphase-Design phase-Refinement phase. | [9] |
| **Material Design and Components**<br>Material Design: Introduction, Principles. Material Environment: Surfaces. Elevation. Light and Shadows. Basic Components : App bars Bottom and Top, Bottom Navigation, Buttons, Cards, Text Fields, Navigation Drawer. | [9] |
| **Advanced Components**<br>Advanced Components: Backdrop, Check boxes, Chips, Date Pickers, Dialogs, Dividers, Image List, Lists, Menus, Progress Indicators, Radio Buttons, Sheets– Bottom and Side, Sliders, Snackbars, Switches, Tabs, ToolTips, Time Pickers. | [9] |
| **Total Hours** | **45** |

| **Text books(s):** | |
|---|---|
| 1. | McKay, Everett N. "UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication", Newnes, 2013. |
| 2. | Wilbent. O.Galitz ,"The Essential Guide to User Interface Design",2nd Edition, John Wiley& Sons Reprint ,2007 |

| **Reference(s):** | |
|---|---|
| 1. | https://material.io/components. |
| 2. | Ben Sheiderman, "Design the User Interface", Pearson Education, 3rd Edition,1998. |
| 3. | Alan Dix et al, " Human - Computer Interaction ", Prentice Hall, 1993. |
| 4. | Alan Cooper, "The Essential of User Interface Design", Wiley – Dream Tech Ltd., 2002. |

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

| **K.S. Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD E15 - Intelligent Database Systems** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| V | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

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| | | ● To Introduce database development lifecycle and conceptual modelling |
|---|---|---|
| **Objective(s)** | | ● To learn relational database design using conceptual mapping and normalization |
| | | ● To learn data model and querying in object relational and No-SQL databases |
| | | ● To deploy analytical databases for OLAP and OLTP. |
| | | ● To understand some key concepts of data science. |

| **Course Outcomes** | **At the end of the course, the students will be able to** |
|---|---|
| | CO1: Interpret the database development lifecycle and apply conceptual modeling |
| | CO2: Apply the conceptual –to-relational mapping and normalization to design relational database |
| | CO3: Apply the data model and querying in Object-relational and No-SQL databases. |
| | CO4: Design and deploy operational databases for OLTP (online transaction processing) and design and deploy analytical databases for OLAP (online analytical Processing). |
| | CO5: Interpret some key concepts of data science. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Conceptual Data Modeling**

Database Environment-Database System Development Life Cycle- Requirements- Collections- Database Design- Entity Relationship Model-Enhanced ER Model- UML Class diagrams [9]

**Relational Database Design and Normalization**

ER and EER –to relational mapping-Update anomalies – Functional Dependencies- Inference Rules-Minimal Cover-Properties of relational Decomposition- Normalization (Up to BCNF) [9]

**Object Relational and NoSQL Databases**

Mapping-EER to ODB Schema –Object identifier-Reference-Types-row types-UDTs –Sub Types and Super Types-User-Defined Routines-Collection Types-Object Query Language; No-SQL:CAP Theorem-Document-based: MongoDB data model and CRUD operations: Column-based: Hbase Data model and CRUD operations. [9]

**XML**

Semi-structured data and XML - Oxygen XML Editor - XPath and XQuery - FLWOR expressions - NoSQL databases and web applications – MongoDB - Documents and collections - CAP theorem vs. ACID - The Express server-side framework - Database CRUD actions and HTTP verbs - The REST API and RESTful web services. [9]

**Data Virtualization**

Data virtualization - The Cisco Information Server - Query optimization - Database failure and recovery – RAID - Distributed databases - Object databases - Cloud computing - Data science - Data mining- Big Data, Hadoop, and MapReduce. [9]

**Total Hours  45**

**Text book(s):**

| 1. | Ramaz Elmasri, Shamkant B.Navathe, Fundamentals of Database Systems,7th Edition, Pearson,2017 |
|---|---|
| 2. | NenadJukic, Susan Vrbsky, and SvetlozarNestorov, "Database Systems: Introduction to Databases and Data Warehouses", Prospect Press, 2017 |

**Reference(s):**

| 1. | Ralph Kimball and Margy Ross, "The Kimball Group Reader: Relentlessly Practical Tools for Data Warehousing and Business Intelligence", Wiley, 2015 |
|---|---|
| 2. | Thomas M.Connolly, Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, 6th Edition, Global Edition, Pearson Education,2015. |
| 3. | S Sumathi, S Esakkirajan," Fundamentals of Relational Database Management Systems" (Studies in Computational Intelligence), Springer-Verlag, 2007 |
| 4. | Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Windom, "Database Systems: The Complete Book, 2nd edition", Pearson Prentice Hall, 2009 |

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

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| CO5 | 2 | 3 | 3 | 3 | 3 | | | 2 | 2 | 2 | 2 | 2 | | |
|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

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**50 AD E21 – Information Retrieval and Web Search**

**AD**

| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
|----------|---|---|---|-----------|--------|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ⬧ To learn about information retrieval and performance evaluation<br>⬧ To analyze the query language and operations.<br>⬧ To familiarize the text operations and indexing<br>⬧ To explore the role of web search and search engine<br>⬧ To investigate the searching the web and libraries |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apply the concepts of information retrieval<br>CO2: Analyze the behavior of Query languages and operations<br>CO3: Apply methods for text operations, indexing and searching<br>CO4: Develop the SOAP Related Technologies<br>CO5: Explore the recent apply the concept of Web Search Engines |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction**

Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval- Algebraic and Probabilistic Models – Retrieval Performance Evaluation. [9]

**Query Languages and Operations**

Languages – Key Word-based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis – Text and Multimedia Languages. [9]

**Text Operations, Indexing and Searching**

Document Preprocessing – Clustering – Text Compression - Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching – User Interface and Visualization – Human Computer Interaction [9]

**Web Search**

Web Services: WSDL –Representing Data Types: XML Schema –Communicating Object Data: SOAP Related Technologies - Search engines: Spidering, meta crawlers, directed spildering, Link analysis (eg hubs and authorities, Google PageRank), shopping agents. [9]

**Searching the Web and Libraries**

Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Meta searchers – Online IR systems –Digital Libraries – Architectural Issues – Document Models, Representations and Access [9]

| | **Total Hours** | **45** |
|---|---|---|

**Text book(s):**

| 1. | Ricardo Baeza-Yate, Berthier Ribeiro-Neto, "Modern Information Retrieval", Pearson Education Asia, 2nd edition,2019. |
|---|---|
| 2. | White Belt Mastery" Web Development for beginners" Narrated by William Battle, 2nd edition, Nov 2015. |

**Reference(s):**

| 1. | B.MPS, A.Kumar — A Primar on the Web Information Retrieval Paradigmǁ, JATIT, March 2017 |
|---|---|
| 2. | N. Langville and D. Meyer —Science of search engine rankings ǁ, Chapter 1, Princeton Pubs,2016 |
| 3. | Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, "Introduction to Information Retrieval, online version available", Cambridge University Press, 2008. |

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| 4. | ChengXiangZhai, "Statistical Language Models for Information Retrieval", Morgan &Claypool Publishers, 2008. |

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

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**50 AD E22- Social Network and Mining**

**AD**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|----------|---|---|---|-----------|--------|------|------|-------|
|          | L | T | P |           | C      | CA   | ES   | Total |
| VI       | 3 | 0 | 0 | 45        | 3      | 40   | 60   | 100   |

| **Objective(s)** | ● To Gain knowledge about the current Web development and emergence of Social Web.<br>● To Study about the modeling, aggregating<br>● To Learn knowledge representation of Semantic Web<br>● To Learn about the extraction and mining tools for Social networks<br>● To Gain knowledge on Web personalization and Web Visualization of Social networks |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apply knowledge for current Web development in the era of Social Web<br>CO2: Identify Model, aggregate and represent knowledge for Semantic Web.<br>CO3: Design extraction and mining tools for Social networks.<br>CO4: Develop personalized web sites and visualization for Social networks.<br>CO5: Design Web personalization and Visualization for Social networks. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction to Social Network Analysis**

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web - 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 [9]

**Modelling, Aggregating and Knowledge Representation**

Ontology and their role in the Semantic Web - Ontology-based Knowledge Representation - Ontology languages for the Semantic Web – RDF and OWL - Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations [9]

**Extraction and Mining Communities in Web Social Networks**

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 & Mining - Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities [9]

**Predicting Human Behavior and Privacy Issues**

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 - Combining Trust and Reputation. [9]

**Visualization and Applications of Social Networks**

Graph Theory- Centrality- Clustering - Node-Edge Diagrams, Matrix representation, Visualizing Online Social Networks, Visualizing Social Networks with Matrix-Based Representations- Matrix + Node-Link Diagrams, [9]

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Hybrid Representations - Applications - Covert Networks - Community Welfare - Collaboration Networks - CoCitation Networks

| | | Total Hours | 45 |
|---|---|---|---|

**Text book(s):**

| | |
|---|---|
| 1. | Peter Mika, —Social networks and the Semantic Web, Springer, 1st edition 2007. |
| 2. | BorkoFurht, —Handbook of Social Network Technologies and Applications, Springer, 1st edition, 2010. |

**Reference(s):**

| | |
|---|---|
| 1. | GuandongXu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking Techniques and applications, Springer, 1st edition, 2011. |
| 2. | Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectivelyǁ, IGI Global Snippet, 2008. |
| 3. | Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, —Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modellingǁ, IGI Global Snippet, 2009. |
| 4. | John G. Breslin, Alexander Passant and Stefan Decker, —The Social Semantic Webǁ, Springer, 2009. |

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

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|---|
| **50 AD E23 - Business Intelligence** |
| **AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ● To identify technology and processes associated with Business Intelligence framework<br>● To study the concepts of data warehousing and data Integration techniques<br>● To apply the multi-dimensional data modeling techniques and its business metrics<br>● To design an enterprise dashboard using open source/MS Office<br>● To understand the applications of BI and Cloud Computing |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Design and implement OLTP, OLAP, data warehouse and BI concepts.<br>CO2: Use the ETL concepts, tools and techniques to perform Extraction, Transformation, and Loading of data.<br>CO3: Outline the definitions, concepts, information visualization and techniques of multi-dimensional data modeling.<br>CO4: Design an enterprise dashboard using open source/MS Office and decision making<br>CO5: Apply big data technologies in business intelligence using cloud computing and creating a new opportunity for entrepreneurship for analytics |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction**

Introduction to Digital Data - Introduction - Types of Data - Introduction to OLTP and OLAP-OLTP vs OLAP - Different OLAP Architectures - Data Models for OLTP and OLAP - OLAP Operations on Multidimensional Data - BI Definitions and Concepts - BI Component Framework - Data Warehousing Concepts and its Role in BI - BI Infrastructure Components - Impact of BI - BI Users - BI Roles and Responsibilities - Business Intelligence Applications - Best Practices BI/DW        [9]

**Data Integration**

Introduction to Data Warehouse - Data Integration - Data Integration Technologies - Data Quality- Data Profiling - Kettle Software: Introduction to ETL using Pentaho Data Integration.        [9]

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**Multi-Dimensional Data Modeling**

Introduction - Data Modeling Basics – Types – Techniques - Fact and Dimension Tables - Dimensional Models - Introduction to Measures and Metrics - Introduction to Business Metrics and KPIs - KPI Usage in Companies - Creating Cubes using Microsoft Excel - SPSS Tools [9]

**Enterprise Reporting**

Reporting Perspectives - Enterprise Reporting Characteristics - Malcolm Baldrige Framework - Balanced Scorecard - Enterprise Dashboard - Balanced Scorecard vs. Enterprise Dashboard - Enterprise Reporting using MS Access / MS Excel. [9]

**BI Applications and Case Studies**

Understanding BI and Mobility - BI and Cloud Computing - BI for ERP System - Social CRM and BI - Case Study: Good Lift HealthCare group - TentoTen Retail Stores. [9]

| | **Total Hours** | **45** |

| Text book(s): | | |
|---|---|---|
| 1. | RN Prasad and Seema Acharya, "Fundamental of Business Analytics", Wiley India, 2011. | |
| 2. | Wilfriend Grossman and Stefanie Rinderle-MA," Fundamentals of Business Analytics", Wiley India,2015 | |
| **Reference(s):** | | |
| 1. | John Boyer, Bill Frank, Brian Green, Tracy Harris, and Kay Van De Vanter, "Business Intelligence Strategy: A Practical Guide for Achieving BI Excellence", IBM Corporation, 2010. | |
| 2. | Swain Scheps, "Business Intelligence for Dummies", Wiley Publishing Inc, 2008 | |
| 3. | Cindi Howson, "Successful Business Intelligence:Secrets to making BI a killer App", McGraw Hill,2008. | |
| 4. | Elizabeth Vitt, Michael Luckevich, StaciaMisner, "Business Intelligence: Making Better Decisions Faster", Microsoft Press, 2002. | |

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

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD E24 – Natural Language Processing** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To learn the fundamentals of natural language processing<br>● To apply the word level analysis in the given text<br>● To understand the use of CFG and PCFG in NLP<br>● To understand the role of semantics of sentences and pragmatics<br>● To apply the NLP techniques to IR applications | | | | | | | |
| **Course Outcomes** | **At the end of the course, the student will be able to:**<br>CO1:Classify the different language modeling<br>CO2: Design an innovative application using NLP components<br>CO3: Implement a rule based system to tackle morphology/syntax of a language<br>CO4: Design a tag set used for statistical processing for real-time applications<br>CO5: Compare and contrast the use of different statistical approaches for different types of NLP applications. | | | | | | | |

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**Introduction**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Text Normalization, Minimum Edit Distance [9]

**Word Level Analysis**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Named Entities and Named Entity Tagging, HMM Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models. [9]

**Syntactic Analysis**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures. [9]

**Semantics and Pragmatics**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods. [9]

**Discourse Analysis and Lexical Resources**

Discourse Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC), Lexicons for Sentiment, Affect, and Connotation- NLP Applications:  Information extraction, Question Answering Systems, Chatbots & Dialogue Systems, Automatic Speech Recognition and Text-to-Speech [9]

| | Total Hours | 45 |
|---|---|---|

| **Text book(s):** | |
|---|---|
| 1. | Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2022. |
| 2. | Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python‖, First Edition, O_Reilly Media, 2009. |

| **Reference(s):** | |
|---|---|
| 1. | Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019. |
| 2. | Rajesh Arumugam, RajalingappaShanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application". PACKT publisher, 2018. |
| 3. | Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012 |
| 4. | NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010. |

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

| **K.S. Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD E25 - Database and Web Application Security** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |

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| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
|---|---|---|---|---|---|---|---|---|

| | |
|---|---|
| **Objective(s)** | ● To understand the need for machine learning for solving problem<br>● To reveal the underlying in web application.<br>● To identify and aid in fixing any security vulnerabilities during the web development process.<br>● To understand the security principles in developing a reliable web application<br>● To understand the security of web applications |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Characterize the database threats and its counter measures<br>CO2: Identify the various types of threats and mitigation measures of web applications.<br>CO3: Identify the vulnerabilities in the web applications.<br>CO4: Use industry standard tools for web application security<br>CO5: Apply penetration testing to improve the security of web applications. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Database Security**

Introduction includes threats, vulnerabilities and breaches, Basics of database design, DB security – concepts, approaches and challenges, types of access controls, Oracle VPD, Discretionary and Mandatory access control – Principles, applications and poly-instantiation, Database inference problem, types of inference attacks, distributed database, security levels, Security in relational data model [9]

**Web Application Security Fundamentals**

Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classifying andPrioritizing Threads, Browser Security Principles: Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection. [9]

**Web Application Vulnerabilities**

Understanding vulnerabilities in traditional client server application and web applications, client statemanipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http headerinjection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery. [9]

**Web Application Mitigations**

Http request , http response, rendering and events , html image tags, image tag security, issue, java script on error , Javascript timing , port scanning , remote scripting , running remote code, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation. [9]

**Secure Website Design and Web Application Security**

Secure website design: Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management , SensitiveData, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditingand Logging, Design Guidelines, Forms and validity, Technical implementation.Clickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security - IPv6 impact on web security. [9]

| | **Total Hours** | 45 |
|---|---|---|

**Text book(s):**

| 1. | Michael Gertz and SushilJajodia, "Handbook of Database Security— Applications and Trends", Springer, 2008. |
|---|---|
| 2. | Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011. |

**Reference(s) :**

| 1. | Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding andExploiting Security Flaws. John Wiley Sons, 2011 |
|---|---|
| 2. | Bryan and Vincent, "Web Application Security, A Beginners Guide ", McGraw-Hill, 2011 |
| 3. | BhavaniThuraisingham, "Database and Applications Security", Integrating Information Security and Data Management, Auerbach Publications, 2005. |
| 4. | Alfred Basta, Melissa Zgola, "Database Security", Course Technology, 2012. |

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

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| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | 2 | 3 | 3 | 3 | | | | 2 | | | | | 2 | 3 |
| **CO4** | 2 | 2 | 3 | 2 | 3 | | 2 | | | 3 | | | | | |
| **CO5** | 2 | 2 | 3 | 3 | 2 | | | 2 | | | 3 | | | | |

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|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**K.S. Rangasamy College of Technology – Autonomous R2018**

**50 AD E31 - Pattern Recognition**

**AD**

| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ⬚ To learn about supervised and unsupervised pattern classifiers<br>⬚ To analyze the different clustering concepts<br>⬚ To familiarize the different feature extraction and selection techniques<br>⬚ To explore the role of Hidden Markov models and SVM<br>⬚ To investigate the application of fuzzy logic and genetic algorithm in pattern recognition |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Interpret the mathematics related to Pattern recognition<br>CO2: Analyze the behavior of Clustering and Classification<br>CO3: Apply methods for feature extraction and selection<br>CO4: Develop the models using support vector machines<br>CO5: Explore the recent advances in pattern recognition |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Pattern Classifier**

Introduction and Mathematical preliminaries -- Overview of Pattern recognition – Discriminant functions – Supervised learning –Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Pattern classification by distance functions – Minimum distance pattern classifier. [9]

**Clustering**

Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm –Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters. [9]

**Feature Extraction and Structural Pattern Recognition**

KL Transforms – Feature selection through functional approximation – Binary selection -Elements of formal grammars - Syntactic description - Stochastic grammars - Structural representation. [9]

**Hidden Markov Models and Support Vector Machine**

State Machines – Hidden Markov Models – Training – Classification – Support vector Machine –Feature Selection. [9]

**Recent Advances**

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception. [9]

**Total Hours 45**

| **Text book(s):** ||
|---|---|
| 1. | M Narasimha Murthy and V Susheela Devi, "Pattern Recognition", Springer,2011. |
| 2. | Richard O. Duda, Peter E. Hard, David G. Stork , " Pattern Recognition", Second Edition,  JohnWiley& Sons, 2021 |

| **Reference(s):** ||
|---|---|
| 1. | C M Bishop, "Pattern Recognition and Machine Learning", Springer, 2010. |
| 2. | David Barber," Bayesian Reasoning and Machine Learning",Cambridge University Press, 2019 |
| 3. | Richard O. Duda, " Pattern Classification", 2nd Edition, JohnWiley& Sons, 2000. |
| 4. | Valliappa Lakshmanan, Martin Goerner, Ryan Gillard, " Practical Machine Learning for Computer Vision: End to End Machine Learning for Images", O'Reilly Media, Inc, USA, 2021 |

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

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 50 AD E32 - Predictive Modeling and Data Analytics | | | | | | | | |
| AD | | | | | | | | |
| Semester | Hours / Week | | | Total hrs. | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| Objective(s) | ● To learn, how to develop models to predict categorical and continuous outcomes<br>● To know the use of the binary classifier and numeric predictor nodes to automate model selection<br>● To learn how to interpret data for modeling.<br>● To learn how to combine two or more models to improve prediction<br>● To understand how to select suitable package for predictive modeling | | | | | | | |
| Course Outcomes | **At the end of the course, the students will be able to**<br>CO1: Understand the process of formulating business objectives, data collection<br>CO2: Compare the underlying predictive modeling techniques<br>CO3: Understand the process modeling<br>CO4: Select appropriate predictive modeling approaches to identify cases to progress<br>CO5: Apply predictive modeling approaches using a suitable package such as SPSS Modeler | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus.

| | |
|---|---|
| **Introduction**<br>Introduction to Data Mining Introduction, what is Data Mining? Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining. | [9] |
| **Modeling Techniques**<br>Data Understanding and Preparation Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. | [9] |
| **Modeling Process**<br>Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling data, Data Caching, Partitioning data, Missing Values. | [9] |
| **Modeling Approach**<br>Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks. | [9] |
| **Advanced Analytics**<br>Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison. | [9] |
| **Total Hours** | **45** |

| Text book(s): | |
|---|---|
| 1. | Max Kuhn - Kjell Johnson, "Applied Predictive Modeling", Springer, 2018. |
| 2. | Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014. |
| **Reference(s):** | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Vijay Kumar – Mangey Ram, "Predictive Analytics Modelling and Optimization", Springer 2019 | | | | | | | | | | | | | | | |
| 2. | Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012 | | | | | | | | | | | | | | | |
| 3. | Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014 | | | | | | | | | | | | | | | |
| 4. | Anasse Bari, Mohammad Chaouchi, Tommy Jung, "Predictive Analytics for Dummies",2nd Edition, 2017. | | | | | | | | | | | | | | | |

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

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|---|---|---|---|---|---|---|---|---|
| 50 AD E33 – Reinforcement Learning | | | | | | | | |
| AD | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| Objective(s) | ● To understand the need for reinforcement learning and Markov decision process<br>● To study the evaluation of dynamic programming and Monte Carlo methods<br>● To understand the temporal difference learning and prediction<br>● To implement the functional approximation methods in Reinforcement Learning<br>● To apply the policy gradient methods and policy approximation |
|---|---|
| Course Outcomes | **At the end of the course, the students will be able to**<br>CO1: Understand the reinforcement learning, its scope and Markov decision process<br>CO2: Evaluate and iterate dynamic programming and implement Monte Carlo methods<br>CO3: Predict temporal difference learning and evaluate its optimality<br>CO4: Implement on policy prediction with approximation and non-linear function approximation<br>CO5: Apply policy approximation and policy gradient theorem |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction**

Reinforcement Learning – Examples – Elements of Reinforcement Learning – Limitations and Scope – The Agent – Environment Interface – Goals and Rewards – Returns and Episodes – Unified Notation for Episodic and Continuing Tasks – Policies and Value Functions – Optimal Policies and Optimal Value Functions – Optimality and Approximation. [9]

**Dynamic Programming and Monte Carlo Methods**

Policy Evaluation, Improvement, Iteration – Value Iteration – Asynchronous Dynamic Programming - Generalized Policy Iteration - Efficiency of Dynamic Programming – Monte Carlo Prediction – Monte Carlo Estimation of Action Values, Control, Control without Exploring Starts – Off policy Prediction via Importance Sampling – Incremental Implementation - Off policy Monte Carlo Control – Discounting aware Importance Sampling – Per-decision Importance Sampling. [9]

**Temporal Difference Learning**

TD Prediction – Advantages of TD Prediction Methods – Optimality of TD(0) –Sarsa: On-policy TD Control – Q-learning: Off-policy TD Control – Expected Sarsa– Maximization Bias and Double Learning – Games, After states and Other Special Cases – n-step TD Prediction, Sarsa, Off Policy Learning – Per-decision Methods with Control Variates – The n-step Tree Backup Algorithm – A Unifying Algorithm. [9]

**Function Approximation Methods**

On-policy Prediction with Approximation – Value-function Approximation – The Prediction Objective(VE) – Stochastic-gradient and Semi-gradient Methods – Linear Methods – Feature Construction for Linear Methods – Selecting Step-Size Parameters Manually – Nonlinear Function Approximation: Artificial Neural Networks – Least-Squares TD – Memory-based Function Approximation – Kernel-based Function Approximation [9]

**Policy Gradient Methods** [9]

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Policy Approximation and its Advantages – The Policy Gradient Theorem – Reinforce: Monte Carlo Policy Gradient – Reinforce with Baseline – Actor–Critic Methods – Policy Gradient for Continuing Problems – Policy Parameterization for Continuous Actions.

| | Total Hours | 45 |
|---|---|---|

**Text book(s):**

| 1. | Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", 2nd Edition, MIT Press, 2019 |
|---|---|
| 2. | Marco Wiering and Martijn van Otterlo. "Reinforcement learning: State–of–the-Art (Adaptation,learning, and optimization 12)", Springer, 2012 |

**Reference(s) :**

| 1. | Alberto Leon-Garcia, "Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, Prentice Hall, 2008 |
|---|---|
| 2. | Russell, Stuart J and Peter Norvig "Artificial intelligence: a modern approach", 4th Edition, Pearson Education Limited, 2020. |
| 3. | Goodfellow, Ian, YoshuaBengio, and Aaron Courville "Deep learning" MIT press, 2016. |
| 4. | https://onlinecourses.nptel.ac.in/noc19_cs55/preview |

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

| **K.S. Rangasamy College of Technology – Autonomous R2018** |||||||||
|---|---|---|---|---|---|---|---|---|
| **50 AD E34– Web Intelligence** |||||||||
| **AD** |||||||||

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ● To perceive the basics of web analytics<br>● To develop customer-centric approach in dealing with data<br>● To recognize the standards of web intelligence reports<br>● To absorb analytics for business situations<br>   ● To design the real time reports for customer data |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Interpret the concepts and terminologies related to web analytics<br>CO2: Analyze various parameters used for web analytics and their impact<br>CO3: Use tools and techniques in web analytics.<br>CO4: Demonstrate tracking data on websites, web data insights and conversions<br>CO5: Apply the tracking mechanism to solve real world datasets and prepare reports |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| **Introduction**<br>Web Analytics – Basics – Traditional Ways – Expectations – Data Collection – Clickstream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing – Outcomes data – Competitive data – Search Engine Data**.** | [9] |
|---|---|
| **Customer-Centric Approach**<br>Qualitative Analysis – Customer Centricity – Site Visits – Surveys – Questionnaires – Website Surveys – Post visits – Creating and Running- Benefits of surveys – Critical components of successful strategy | [9] |
| **Web Analytics**<br>Web Analytic concepts – URLS – Cookies – Time on site – Page views – Understand standard reports – Website content quality – Navigation reports (top pages, top destinations, site overlay). – Search Analytics – Internal search, SEO and PPC – Measuring Email and Multichannel Marketing - Competitive intelligence and Web 2.0 Analytics – | [9] |

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| | | |
|---|---|---|
| Segmentation – Connectable reports | | |
| **Customer Analytics**<br>Google Analytics: Analytics - Cookies - Accounts vs Property - Tracking Code -Tracking Unique Visitors - Demographics - Page Views & Bounce Rate Acquisitions - Custom Reporting, Customer Analytics | | [9] |
| **Web Intelligence Tracking**<br> Goals & Funnels – Filters - Ecommerce Tracking - Real Time Reports - Customer Data. Alert - Adwords Linking - Adsense Linking -Attribution Modeling - Segmentation - Campaign Tracking - Multi-Channel Attribution. | | [9] |
| | **Total Hours** | **45** |

| | Text book(s): | |
|---|---|---|
| **1.** | Michael Beasley, "Practical Web Analytics for User Experience: How Analyticscan help you Understand your Users", Morgan Kaufmann, 2013. |
| **2.** | Magy Seif El-Nasr, Anders Drachen, Alessandro Canossa, eds., "Game Analytics:Maximizing the Value of Player Data", Springer, 2013. |

| | Reference(s) : |
|---|---|
| **1.** | Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science Of Customer Centricity ", 1st edition, Sybex, 2009 |
| **2.** | Bing Liu, "Web Data Mining: Exploring Hyperlinks, Content, and Usage Data", 2 nd Edition, Springer, 2011 |
| **3.** | Justin Cutroni, "Google Analytics", O'Reilly, 2010 |
| **4.** | Eric Fettman, Shiraz Asif, FerasAlhlou , "Google Analytics Breakthrough", JohnWiley & sons, 2016. |

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 3 | 2 | | | | | | | 3 | | |
| **CO2** | 2 | 2 | 3 | 3 | 3 | | 2 | | | | | | | 2 | 3 |
| **CO3** | 2 | 2 | 3 | 3 | 3 | | | | | 2 | | | | 2 | 3 |
| **CO4** | 2 | 2 | 3 | 2 | 3 | | | 2 | | | 3 | | | | |
| **CO5** | 2 | 2 | 3 | 3 | 2 | | | | 2 | | | 3 | | | |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD E35 - Mining Massive Datasets** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VI | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ⯁ To learn about data mining functionalities.<br>⯁ To analyze the large amounts of data using map-reduce.<br>⯁ To familiarize the data streams and its linking analysis.<br>⯁ To explore the data streams using different algorithms.<br>⯁ To investigate the application of mining social-network graphs. | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Analyze suitable statistical modeling techniques to solve real world problems.<br>CO2: Apply MapReduce algorithms to find similar items<br>CO3: Apply data streams techniques to mine real world data.<br>CO4: Analyze the diverse clustering techniques and mining methods<br>CO5: Map the overall structure and interrelation of social network members | | | | | | | |

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| | |
|---|---|
| **Data Mining**<br>Introduction to Data Mining - Statistical Modeling - Machine Learning - Computational Approaches to Modeling - Feature Extraction - Statistical Limits on Data Mining - Bonferroni's Principle - Hash Functions - Indexes - Indexes - Secondary Storage - The Base of Natural Logarithms - Power Laws. | [9] |
| **MapReduce and Finding Similar Items**<br>MapReduce - Algorithms Using MapReduce - Extensions to MapReduce - Complexity Theory for MapReduce, Applications of Near-Neighbor Search - Shingling of Documents - Locality-Sensitive Hashing for Documents - Distance Measures. | [9] |
| **Mining Data Streams and Link Analysis**<br>The Stream Data Model - Sampling Data in a Stream - Filtering Streams - Counting Distinct Elements in a Stream - Estimating Moments - Counting Ones in a Window - Decaying Windows, Link Analysis - PageRank. | [9] |
| **Frequent Item sets and Clustering**<br>The Market-Basket Model - Market Baskets and the A-Priori Algorithm - Limited-Pass Algorithms - Counting Frequent Items in a Stream - Clustering - Hierarchical Clustering - K-means Algorithms - The CURE Algorithm. | [9] |
| **Mining Social Network Graphs**<br>Social Networks as Graphs – Clustering of Social-Network Graphs - Direct Discovery of Communities - Partitioning of Graphs - Finding Overlapping Communities - Simrank - Counting Triangles - Neighborhood Properties of Graphs. | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 3rd Edition, 2014. |
| 2. | Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques",3rd Edition, Morgan Kaufmann Publishers,2012. |

**Reference(s):**

| | |
|---|---|
| 1. | Christopher Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag New York. 2006. |
| 2. | Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012. |
| 3. | Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics", John Wiley & sons, 2012. |
| 4. | Pete Warden, "Big Data Glossary", O'Reilly, 2011. |

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD E41 – Data Analytics for Industry 4.0** | | | | | | | | |
| **AD** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| **VII** | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To enhance and exposed the Big Data Analytics and Data Science.<br>● To identify the different ways of Data Integration and Big Data Systems tools.<br>● Be familiar with business statistical methods.<br>● To identify the usage of big data for education 4.0<br>● To learn various applications of big data in data analytics for industry 4.0 | | | | | | | |

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Tiruchengode - 637 215.

| Course Outcomes | At the end of the course, the students will be able to<br>CO1: To Introduce the Big Data Analytics and Data Science.<br>CO2: Explore tools and practices for working with Data Integration and Big Data Systems.<br>CO3: Implement the different business Statistical Methods for Big Data Analytics.<br>CO4: Recognize the importance of Big Data for Education 4.0.<br>CO5: Classify the various Applications using Big Data and Business Analytics. |
|---|---|

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction to Big Data Analytics and Data Science**<br>Data: Terminologies – Data Evolution - Data Formats and sources - Big Data Analytics - Big Data concepts - Big Data Components – Big Data Characteristics – Big Data vs. Statistics vs. Data Mining – Big Data Approaches - Data Lifecycle - Data Science: A Definition – Data Analysis - Data Analytics types - Data in the business - Data Analytics Process, Implementation and Measurement. | [9] |
| **Data Integration and Big Data Systems**<br>Data Integration – Data Integration Solutions – ETL – Data Integration Methodologies – Big Data Processing: Architecture – Traditional vs Big Data Framework – Big Data related technologies – Big Data Industry 4.0 Applications | [9] |
| **Business Statistical Methods for Big Data Analytics**<br>Statistical methods and analytics techniques used across business – Statistical methods and analytics techniques used in sales and marketing – Data types generated in sales and marketing function – Statistical Methods and Analytical Techniques – Statistical Methods and Analytics Techniques used in Supply Chain Management – Analytics use case in SCM | [9] |
| **Big Data for Education 4.0**<br>Education 4.0 in India - Digital Revolution of Education 4.0 – Education 4.0 – Requirements of Education 4.0 in Industry – Benefits of Education 4.0 for Business Sector – Influence of Industrial Revolution 4.0 on Higher Education – Conceptual Framework of Big Data for Industry 4.0 – Need for Big Data Analytics in Education | [9] |
| **Applications using Big Data and Business Analytics**<br>Big Data Analytics and Business Analytics: An introduction – Business Analytics – Business Analytics vs. Business Intelligence – Business Intelligence – Challenges of Big Data and Business Analytics – Applications of Big Data – Big Data Analytics in Finance Industry – Applications of Big Data Analytics in Education – Big Data in Biomedical Research – Applications in Biomedicine – Applications in Healthcare. | [9] |
| **Total Hours** | **45** |

**Text book(s)**

| | |
|---|---|
| 1. | P.Kaliraj, T.Devi "Big Data Applications in Industry 4.0",Auerbach Publications, First Edition, 2022. |
| 2. | P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012. |

**Reference(s):**

| | |
|---|---|
| 1. | Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012. |
| 2. | David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013. |
| 3. | Michael Berthold, David J. Hand, —Intelligent Data Analysis‖, Springer, Second Edition, 2007. |
| 4. | Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013 |

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

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| | 50 AD E42 - Design of Artificial Intelligence Products | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **AD** | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To understand the Operations and Applications of AI<br>● To identify various algorithms for Problem Solving<br>● To study the different decision-making process for planning<br>● To implement suitable policies for QP Learning<br>● To classify the latest technologies in AI product design | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Build an AI system<br>CO2: Solve the problems in AI through various search algorithms<br>CO3: Plan the design process of AI<br>CO4: Apply the Q-Learning concepts in AI product design<br>CO5: Analyze the recent advancements in the design of AI products | | | | | | | |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction**<br>What is AI? - AI Operation and Application- How to Build an AI: What Is Required to Build an AI System? - Applications of AI - Defining intelligence using Turing Test - Making machines think like humans - Building rational agents - General Problem Solver - Building an intelligent agent. | **[9]** |
| **Problem Solving in Artificial Intelligence**<br>Search Algorithms in AI- PEAS in Artificial Intelligence- A* Search Algorithm- problems, problem spaces and search- general problem solving- defining problem as a state space search. | **[9]** |
| **Planning**<br>Plan of Attack- The Bellman Equation- The "Plan"- Markov Decision Process- Policy vs Plan- Q-Learning Intuition- Temporal Difference- Grid world Set Up- Q-Learning Visualization | **[9]** |
| **Q-Learning**<br>Deep Q-Learning Intuition – Acting- Experience Replay- Action Selection Policies- Probability Primer- Markov Decision Process- Prediction and Control by Dynamic Programing- Function Approximation Methods | **[9]** |
| **A3C**<br>The three A's in A3C- Actor-Critic- Asynchronous- Advantage- LSTM Layer- What is Deep Learning? - The Neuron-The Activation Function-Convolutional neural networks. | **[9]** |
| **Total Hours** | **45** |

| | Textbook(s): |
|---|---|
| 1. | Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd Edition,2009. |
| 2. | 'Artificial-Intelligence-with-Python', sebastian raschka and vahid mirjalili ,3rd edition, December 2019. |

| | Reference(s): |
|---|---|
| 1. | Artificial Intelligence with Python – 2nd Edition by Alberto Artasanchez & Prateek Joshi |
| 2. | Artificial Intelligence Basics - by Tom Taulli |
| 3. | https://www.geeksforgeeks.org/a-search-algorithm/?ref=lbp |
| 4. | https://www.udemy.com/course/artificial-intelligence-az/ |

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

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|---|---|---|---|---|---|---|---|
| **50 AD E43 - Blockchain System through Predictive Analytics** | | | | | | | |
| **AD** | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Objective(s)** | • Be able to state core blockchain concepts, the benefits, and the limitations of blockchain technologies.<br>• Understand the technical underpinnings of blockchain technology.<br>• Make decisions about the use (or not) of blockchain technology in systems, and support decisions with relevant arguments.<br>• Determine real world challenges that blockchain technologies may assist in solving.<br>• To provide conceptual understanding of how blockchain technology can be used to innovate and improve business processes. |
| **Course Outcomes** | **At the end of the course, the students will be able to:**<br>CO1: Explain the fundamental characteristics of blockchain using bitcoin.<br>CO2: Demonstrate the application of hashing and public key cryptography in protecting the blockchain.<br>CO3: Explain the elements of trust in a Blockchain: validation, verification, and consensus.<br>CO4: Develop smart contracts in Ethereum framework.<br>CO5: Perform a transaction in bitcoin testnets. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction**<br>Basic Cryptographic primitives used in Blockchain –Secure- Collision-Resistant hash functions -Digital signature - Public key cryptosystems – Zeroknowledge proof systems - Need for Distributed Record Keeping – Modelling faults and adversaries- Byzantine Generals problem - Consensus algorithms and their scalability problems - Why Nakamoto Came up with Blockchain based cryptocurrency. | [9] |
| **Technologies Borrowed in Blockchain**<br>Technologies Borrowed in Blockchain –hash pointers- Consensus- Byzantine Models of fault tolerance- Digital cash etc.- Bitcoin blockchain - Wallet – Blocks - Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions. | [9] |
| **Models For Blockchain**<br>Models f-GARAY model -RLA Model -Proof of Work (PoW) as random oracle -Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models ( PoW + PoS) - Bitcoin scripting language and their use | [9] |
| **Ethereum**<br>Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity -Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges- Using smart contracts to enforce legal contracts- Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts | [9] |
| **Hyperledger Fabric**<br>Hyperledger fabric- the plug and play platform and mechanisms in permissioned block chain - Beyond Cryptocurrency – applications of block chain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of block chain as a technology and myths vs reality of blockchain technology | [9] |
| **Total Hours** | 45 |

| **Text book(s)** | |
|---|---|
| 1. | S.Shukla,M.Dhawan,S.Sharma,S. Venkatesan "Blockchain Technology:Cryptocurrency and Applications", Oxford University Press 2019 . |
| 2. | Arvind Narayanan, Joseph Bonneau,Edward Felten,Andrew Miller and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction",Princeton University Press,2016 |
| **Reference(s):** | |

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| 1. | Joseph Bonneau et al, SoK: "Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy,2015 |
|---|---|
| 2. | J.A.Garay et al, "The bitcoin backbone protocol - analysis and applications",EUROCRYPT 2015,Volume 2. |
| 3. | R.Pass et al, "Analysis of Blockchain protocol in Asynchronous networks", EUROCRYPT 2017. |
| 4. | Pass et al," Fruitchain- a fair blockchain", PODC 2017 |

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD E44 - Kernal Methods for Machine Learning** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
|  | L | T | P |  | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To familiarize the learners with the concepts and techniques of the basic mathematical theory of kernel methods <br> ● To understand how the differentiability of a kernel is inherited by the functions of its RKHS <br> ● To develop skills required for mapping the input data into a different space <br> ● To gain knowledge of supervised learning with kernels <br> ● To compare different methods used for finding hidden and interesting patterns | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to** <br> CO1: Present the basic mathematical theory of kernel methods <br> CO2: Investigate how the differentiability of a kernel is inherited by the functions of its RKHS <br> CO3: Apply kernel methods to map the input data into a different space <br> CO4: Solve the nonlinearity present in the dataset <br> CO5: Discover hidden and interesting patterns in unlabeled data | | | | | | | |

**Note:** The hours given against each topic are of indicative.  The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required.  The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| **Introduction** <br> Basics of Machine Learning – Kernal – Methods – Kernal Methods in Machine Learning – Applications of Kernal Methods – Kernal methods and neural networks – Nonlinear model – Linear Model – Simple kernel examples | **[9]** |
|---|---|
| **Kernels and Reproducing Kernel Hilbert Spaces (RKHS)** <br> Positive definiteness kernal - Reproducing Kernel Hilbert Spaces - Aronszjan theorem - Regularizing with RKHS norms - The kernel trick - string kernels - shift-invariant kernels.- Mercer kernels, large-scale kernel learning, | **[9]** |
| **Methods of Kernel** <br> Principle Component Analysis - Support Vector Machine - Gaussian Process - Canonical Correlation Analysis - Spectral Clustering - Adaptive Filter - Kernel Perceptron - Monolithic Kernel | **[9]** |
| **Supervised learning with kernels** <br> The representer theorem - Kernel ridge regression - Empirical risk minimization - A tiny bit of learning theory - Focus on support vector machines - Kernels for generative models - Kernels for graphs - Kernels on graphs | **[9]** |
| **Unsupervised learning with kernels** <br> Kernel K-means - spectral clustering - Mercer kernels - shift-invariant kernels - Kernels for generative models - Multiple kernel learning - shift-invariant kernels - deep kernel learning. | **[9]** |
| **Total Hours** | **45** |
| **Textbook(s):** | |

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Tiruchengode - 637 215.

| | |
|---|---|
| 1. | N. Cristianini and J. Shawe-Taylor, "Kernel Methods for Pattern Analysis", Cambridge University Press, 2004. |
| 2. | B. Scholkopf et A. Smola, "Learning with kernels", MIT Press, 2002. |
| **Reference(s):** | |
| 1. | N. Aronszajn, "Theory of reproducing kernels", Transactions of the American Mathematical Society, 68:337-404, 1950. |
| 2. | V. Vapnik, "Statistical Learning Theory", Wiley, 1998. |
| 3. | C. Berg, J.P.R. Christensen et P. Ressel, "Harmonic analysis on semi-groups", Springer, 1994. |
| 4. | B. Scholkopf, K. Tsuda et J.-P. Vert, "Kernel methods in computational biology", MIT Press, 2004. |

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

| K.S.Rangasamy College of Technology – Autonomous R2018 |
|---|
| **50 AD E45 - Game Theory for Decision Analysis** |
| **AD** |

| Semester | Hours / Week | | | Total hrs. | Cred it | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| VII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ● To learn the basics of Game Theory<br>● To know the how the information affecting games<br>● To understand the cooperation in games<br>● To know the values of individual and Group in games<br>● To understand Misreading probabilities |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Understand the process solving games.<br>CO2: Understand the process of dealing with information.<br>CO3: Understand how game theory treats bargaining.<br>CO4: Identify the purpose of auctions in game.<br>CO5: Apply reference point to influence choice |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

| **Introduction**<br>Game Theory Basics, Percentages, Zero Sum Games, Mixed Strategies, Pure Strategies and Domination, Nonzero Sum Games | **[9]** |
|---|---|
| **Information Affecting Games**<br>Perfect and Imperfect Information, Incomplete Information, Signaling the Imperfect Information, Nuanced Messages | **[9]** |
| **Cooperation**<br>Overview, Bargaining Games, Fair Division Games, Cooperative Games, Group Decision Games | **[9]** |
| **Individual and Group Values**<br>Introduction, Individual vs. Group Benefit, Common Tragedy, Threshold, Dilemma, Free Rider Problem, Auction and Eliciting Values | **[9]** |
| **Behavior in Games**<br>Biology and Games, Aligning Theory with Behavior, Behavioral Decision Theory, Strategic Behavior in the Lab, Quirky Behavior, Repeated Games | **[9]** |
| **Total Hours** | **45** |

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| | Textbook(s): |
|---|---|
| 1. | Michael Maschler, Eilson Solan, Shmuel Zamir, "Game Theory", Cambridge University Press, 2020 |
| 2. | Edward C. Rosenthal, "The Complete Idiot's Guide to Game Theory", Alpha Books, 2011 |
| | Reference(s): |
| 1. | Steven Tadelis, "Cambridge University Press", Princeton University Press, 2013 |
| 2. | Avinash K. Dixit, "The Art of Strategy: A Game Theorist's Guide to Success in Business and Life", W. W. Norton & Company, 2010 |
| 3. | William Spaniel, "Game Theory 101: The Complete Textbook", 2011 |
| 4. | Albert Rutherford, "Learn Game Theory: A Primer to Strategic Thinking and Advanced Decision-Making", Amazon Digital Services LLC, 2021 |

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

| K. S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD E51- Blockchain Technology** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total | Credit | Maximum Marks | | |
| | L | T | P | hrs | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | • To understand the basics of Blockchain<br>• To learn Different protocols and consensus algorithms in Blockchain<br>• To learn the Blockchain implementation frameworks<br>• To understand the Blockchain Applications<br>• To experiment with the Hyperledger Fabric, Ethereum networks | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to:**<br>CO1: Understand the growth of Blockchain<br>CO2: Learn Different protocols in Blockchain<br>CO3: Identify the Blockchain implementation frameworks<br>CO4: Understand the Blockchain Applications<br>CO5: Learn the emerging trends in Blockchain | | | | | | | |
| **Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.** | | | | | | | | |

| **Introduction to Blockchain**<br>Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in the blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization Routes to decentralization- Blockchain and full ecosystem decentralization Smart contracts Decentralized Organizations- Platforms for decentralization. | [12] |
|---|---|
| **Introduction to Cryptocurrency**<br>Bitcoin Digital Keys and Addresses - Transactions - Mining - Bitcoin Networks and Payments -Wallets Alternative Coins - Theoretical Limitations - Bitcoin limitations - Name coin - Prime coin - Zcash-Smart Contracts - Ricardian Contracts- Deploying smart contracts on a blockchain | [6] |

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| | | |
|---|---|---|
| **Ethereum**<br>Introduction - The Ethereum network Components of the Ethereum ecosystem - Transactions and messages Ether cryptocurrency/tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks Setting up a private net - Starting up the - private network | | [5] |
| **Web3 and Hyper Ledger**<br>Introduction to Web3 Contract Deployment POST Requests - Development Frameworks - Hyperledger as a Protocol - The Reference Architecture - Hyperledger Fabric - Distributed Ledger- Corda. | | [12] |
| **Emerging Trends**<br>Kadena - Ripple - Rootstock - Quorum - Tendermint - Scalability - Privacy - Other Challenges - Blockchain Research - Notable Projects - Miscellaneous Tools. | | [10] |
| | **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017. |
| 2. | Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014. |

**Reference(s):**

| | |
|---|---|
| 1. | Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017. |
| 2. | Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. |
| 3. | Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015 |
| 4. | Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and<br><br>Blockchain", Packt Publishing |
| 5. | Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020. |

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

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|---|---|---|---|---|---|---|---|---|---|
| **50 AD E52 – Geographical Information Analysis** | | | | | | | | | |
| **AD** | | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | |
| | L | T | P | | C | CA | ES | Total | |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 | |
| **Objective(s)** | ● To introduce the fundamentals and components of Geographic Information System<br>● To provide details of spatial data structures and input, management and output processes.<br>● To understand the data input and raster data input given to the Geo Information.<br>● To expose the data analysis tools in GIS.<br>● To know the applications of GIS. | | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Understand Computer systems and data formats.<br>CO2: Understand basics of Geo information<br>CO3: Understand the role of complex network systems that handles Geo-information.<br>CO4: Explore the tools used in Data analysis.<br>CO5: Understand scripting languages and database. | | | | | | | | |

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| **Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated. | |
|---|---|
| **Fundamentals of GIS**<br>Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open-source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements. | **[9]** |
| **Spatial Data Models**<br>Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models - OGC standards - Data Quality. | **[9]** |
| **Data Input and Topology**<br>Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser –Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping. | **[9]** |
| **Data Analysis**<br>Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation. | **[9]** |
| **Applications**<br>GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies. | **[9]** |
| **Total Hours** | 45 |

| **Text book(s):** | |
|---|---|
| 1. | Kang – Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition,2017. |
| 2. | Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007. |
| **Reference:** | |
| 1. | Lo. C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems,Prentice-Hall India Publishers, 2006 |
| 2. | Abraham Silberschatz, Henry F. Korth and S.Sudharshan, —Database System Conceptsǁ, Sixth edition, McGraw Hill, 2011 |
| 3. | Regina, Leo Hsu —PostGIS in Actionǁ, Oreilly & Associates Inc., ISBN-13: 9781935182269, ISBN-10: 1935182269, 2011 |
| 4. | Spatial Databases, Shashi Shekhar, Pearson Education India, 2007 |

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

| **K.S.Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD E54 - Data Centric Computing** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| **VIII** | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To Introduce data centric computing and processing rows, tables, lists.<br>● To learn structured data and trees.<br>● To learn predicting growth and Halloween analysis.<br>● To explore the role of pyret to python. | | | | | | | |

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| | | | |
|---|---|---|---|
| | ● ·To understand some concepts of programming with state. | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apply the concepts of data centric computing<br>CO2: Analyze the behavior of structured data<br>CO3: Apply methods for algorithms in predicting growth<br>CO4: Develop the functions and processing lists<br>CO5: Explore the concept of hash table in programming with state | | |

| | |
|---|---|
| **Introduction to Data-Centric Computing**<br>Introduction -Naming Values-Repeated Expression to Functions-Conditional and Booleans-Composing Functions-Introduction to Tabular Data-Processing Rows-Processing Tables-From Tables to Lists-Processing Lists | [9] |
| **Structured Data**<br>Introduction to structured Data-Collection of Structured Data-Lists and Sets as Collective Data-Recursive Data-Trees-Functions as Data-Partial Domains-Staging | [9] |
| **Algorithms**<br>Predicting Growth-Sets Appeal-Making Sets Grow on Trees-Halloween Analysis-Sharing and Equality-Graphs-Representation-Depth and Breadth First Traversals | [9] |
| **Fyret to Python**<br>Expressions, Functions and Types-Returning Values from Functions-Conditionals- Creating and Processing Lists- Data with Components-Traversing Lists | [9] |
| **Programming with State**<br>Modifying Structured Data-Modifying Variables-Revisiting Lists-Revisiting Variables-Hash Tables-Dictionaries-Algorithms that Exploit State-Set Membership by Hashing Redux-Dynamic Programming | [9] |
| **Total Hours** | **45** |

**Text book(s)**

| | |
|---|---|
| 1. | Kathi Fisler, Shriram Krishnamurthi, Benjamin S. Lerner, Joe Gibbs Politz "A Data-Centric Introduction to Computing" cic-world.org .August 28th, 2022 |
| 2. | David Joner "Introduction Computing" 1st Edition, Mc Graw Hill Education |

**Reference(s):**

| | |
|---|---|
| 1. | Michael J. Carey& Stefano Ceri "Data-Centric Systems and Applications" Springer. |
| 2. | Axel FeldmannElliot Lockerman,"Livia: Data-Centric Computing Throughout the Memory Hierarchy" |
| 3. | Viacheslav Dubeyko " File system in Data – Centric Computing " |
| 4. | Prof. Pooja Shelke , Dr. Asish Sasankar "Data Centric Security Approach: A way to Cloud Computing Security & Privacy" |

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

| K.S.Rangasamy College of Technology–Autonomous R2018 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 AD E54 - Ethics for Data** | | | | | | | |
| **AD** | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To develop the self confidence in the society | | | | | | | |

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| | | | |
|---|---|---|---|
| | ● To learn ethical theories in Engineering<br>● To explore a code of ethics in social experimentation<br>● To learn rights and safety of IPR<br>● To enhance knowledge about social issues | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Understand the human values and ethics in society<br>CO2: Realize the Gilligan theory in ethical Engineering<br>CO3: Realize code of ethics in Engineering<br>CO4: Analyze risk benefits and reducing in IPR<br>CO5:  Understand code of conduct in global issues | | |

**Note:** The hours given against each topic are of indicative.  The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required.  The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Human Values Moral values and Ethics**<br>Integrity-Work Ethic-Service Learning-Civic virtue-Respect for others – Living Peacefully – Caring – Sharing – Honesty – Courage-Valuing time –  Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality-Introduction to yoga and meditation for professional excellence and Stress management. | **[9]** |
| **Engineering Ethics Senses of 'Engineering Ethics'**<br>Variety of moral issues-Types of inquiry-Moral dilemmas – Moral Autonomy – Kohiberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self – interest –<br>Customs and Religion – Uses of Ethical Theories. | **[9]** |
| **Engineering as social experimentation**<br>Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics A  Balanced Outlook on Law. | **[9]** |
| **Safety, Responsibilities and rights**<br>Safety and Risk – Assessment of Safety and Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective  Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Right – Employee Right – Intellectual Property Rights (IPR) – Discrimination. | **[9]** |
| **Global Issues**<br>Multinational Corporations – environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineering – Engineers as Expert Witnesses and Advisors Moral Leadership – Code of Conduct – Corporate Social Responsibility. | **[9]** |
| **Total Hours** | **45** |

| Textbook(s): | |
|---|---|
| 1. | Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi,2017. |
| 2. | Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2018. |

| Reference(s): | |
|---|---|
| 1. | Charles B. Fleddermann, —Engineering Ethics, Pearson Prentice Hall, New Jersey, 2014. |
| 2. | Laura P. Hartman and Joe Desjardins, —Business Ethics: Decision Making for Personal Integrity and Social Responsibility Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013. |
| 3. | World Community Service Centre, Value Education, Vethathiri publications, Erode, 2019. |
| 4. | John R Boatright, —Ethics and the Conduct of Business, Pearson Education, New Delhi, 2015 |

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

| |
|---|
| **K.S. Rangasamy College of Technology – Autonomous R2018** |
| **50 AD E55 – Social Media Analytics** |

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| AD | | | | | | | |
|---|---|---|---|---|---|---|---|
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| VIII | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| Objective(s) | ● To familiarize the learners with the concepts and techniques of social media analytics<br>● To enable the learners with the key concepts in social media metrics<br>● To develop skills required for social media analytic tools<br>● To gain knowledge of Sentiment analysis and text mining using the predictive tools in social media<br>● To use Recommender system and collaborative filtering in prescriptive analytics of social media |
|---|---|
| Course Outcomes | At the end of the course, the students will be able to<br>CO1: Identify the prevalent types of social media in use<br>CO2: Use the tools developed in the emerging domain of social media analytics, like google analytics<br>CO3: Apply an understanding of social networks, the metric used and analyze networks using NodeXL<br>CO4: Perform sentiment analysis and predictive analytics to obtain insights from data<br>CO5: Compare techniques in prescriptive analytics using R |

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| **Introduction to social media**<br>Social Media Data, Social Media Intelligence & Listening, Social Media Monitoring Metrics, Types of Social Media tools, Theories in Media Research, Long Tail, electronic word-of-mouth (eWOM), Power Law& Popularity<br>Hands-on: Social Media Data Analysis using Excel Introduction to social media<br>Social Media Data, Social Media Intelligence & Listening, Social Media Monitoring Metrics, Types of Social Media tools, Theories in Media Research, Long Tail, electronic word-of-mouth (eWOM), Power Law& Popularity<br>Hands-on: Social Media Data Analysis using Excel | [9] |
|---|---|
| **Social Media Analytics**<br>Types of Social Media Analytics, Knowing your customers – Seven-layer Approach, Location Analytics, Action Analytics, Mobile/App Analytics, Google Analytics<br>Hands-on: Location Analytics & Social Media Traffic Analysis using Google Analytics | [9] |
| **Social Network Analysis**<br>Introduction to Networks, Common network terms, Network structure, Types of Networks, Egocentric Networks, Network analysis metrics, Strong and Weak Ties, Clustering and Grouping<br>Hands-on: Social Network Analysis using NodeXL | [9] |
| **Text Analytics in Social Media**<br>Text Analytics data types, Deployment models, Purpose of text analytics, Text analytics value creation cycle, Text Mining algorithms,<br>Hands-on: Sentiment Analysis using R | [9] |
| **Recommender Systems in Social Media**<br>Overview – Association rule mining – Collaborative filtering – User-based similarity – Item-based similarity<br>**Hands-on:** Recommender System | [9] |
| **Total Hours** | 45 |

| Text book(s): | |
|---|---|
| 1. | Gohar F. Khan, "Seven Layers of Social Media Analytics: Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data", Amazon Digital Services, 2015. |
| 2. | Derek Hansen Ben Shneiderman Marc Smith ItaiHimelboim ,"Analysing Social Media Networks with Node XL", Morgan Kaufmann, 2nd Edition, 2019. |

| Reference(s) | |
|---|---|
| 1. | Huan Liu, Mohammad Ali Abbasi, and Reza Zafarani, "Social Media Mining: An Introduction", Cambridge University Press, 1st Edition, 2014. |
| 2. | Krish Krishnan & Shawn P. Rogers, "Social Data Analytics: Collaboration for the Enterprise", 8th Edition, Morgan Kaufmann, 2014. |
| 3. | Sharan Kumar Ravindran, Vikram Garg, "Mastering Social Media Mining with R", Packt Publishing Limited, 2015. |

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

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|---|
| **50 AD L01 - Data Analytics** |
| **AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| - | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | <ul><li>To be exposed to big data process and tools</li><li>To learn the different ways of data analytical models</li><li>To be familiar with data streams</li><li>To explore the concepts of mining and clustering techniques</li><li>To acquire the Hadoop frameworks and visualization</li></ul> |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Apply the statistical analysis methods on big data<br>CO2: Compare and contrast various soft computing models<br>CO3: Design distributed file systems<br>CO4: Apply clustering techniques on big data<br>CO5: Demonstrate different visualizations techniques |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction** [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

**Data Analysis** [9]
Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction

**Mining Data Streams** [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 - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.

**Frequent Itemsets and Clustering** [9]
Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K-Means – Clustering high dimensional data – CLIQUE and PROCLUS

**Frameworks and Visualization** [9]
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques

| | **Total Hours** | **45** |
|---|---|---|

| **Text book(s):** | |
|---|---|
| 1. | Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. |
| 2. | AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets",Cambridge University Press, 2012. |
| **Reference(s) :** | |

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Approved in Academic Council Meeting held on 25/05/2024

| | | |
|---|---|---|
| 1. | Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics", John Wiley & sons, 2012. | |
| 2. | Pete Warden, "Big Data Glossary", O'Reilly, 2011. | |
| 3. | Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, Reprinted 2008. | |
| 4. | Donald Miner, "Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems", O'Reilly Media, 2012. | |

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

| K.S. Rangasamy College of Technology –Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD L02 - Machine Learning using R** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| - | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | ● To acquire knowledge on R for Machine Learning.<br>● To know supervised Machine Learning Algorithms<br>● To gain hands on coding of popular ML algorithms on classic data sets<br>● To evaluate the effectiveness of model<br>● To know unsupervised Machine Learning Algorithms |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Demonstrate a practical understanding of the key theoretical concepts of modern computational/ analytic methods from machine/statistical learning and data mining.<br>CO2: Apply supervised machine learning methods to build predictive models<br>CO3: Evaluate the effectiveness of predictive model<br>CO4: Apply unsupervised machine learning methods to build predictive models<br>CO5: Select the appropriate dimensionality reduction method for large datasets. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction** [9]
R for Machine Learning - Machine Learning vs Statistical Modelling - Supervised vs Unsupervised Learning - Supervised Learning -Classification - Unsupervised Learning - Clustering

**Supervised Learning I** [9]
K-Nearest Neighbors - Decision Trees - Random Forests - Reliability of Random Forests - Advantages and Disadvantages of Decision Trees

**Supervised Learning II** [9]
Regression Algorithms - Model Evaluation - Model Evaluation: Overfitting & Underfitting - Understanding Different Evaluation Models

**Unsupervised Learning** [9]
K-Means Clustering - Advantages and Disadvantages - Hierarchical Clustering - Advantages and Disadvantages - Measuring the Distances Between Clusters - Single Linkage Clustering - Algorithms for Hierarchy Clustering - Density-Based Clustering

**Dimensionality Reduction and Collaborative Filtering** [9]
Dimensionality Reduction: Feature Extraction and Selection - Collaborative Filtering and its Challenges

**Total Hours 45**

**Text book(s):**
| 1. | EthemAlpaydin, "Introduction To Machine Learning" 3rd Edition, PHI Learning Pvt. Ltd, 2014. |
|---|---|

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| 2. | Brett Lantz, "Machine Learning with R" , 3rd Edition, Packt publishing Ltd, 2019. |

**Reference(s) :**

| 1. | Tom M. Mitchell, —Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013. |
| 2. | Stephen Marsland, —Machine Learning: An Algorithmic Perspective‖, CRC Press, 2009. |
| 3. | Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques",3rd Edition, Morgan Kaufmann Publishers,2012. |
| 4. | Andreas Muller,Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists",4th Edition,O'Reilly,2018. |

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

| **K.S. Rangasamy College of Technology –Autonomous R2018** |
|---|
| **50 AD L03 - Python for Data Science** |
| **AD** |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total | |
| - | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 | |

| **Objective(s)** | ● To impart basic knowledge needed in python <br> ● To gain knowledge on object oriented concepts <br> ● To acquire knowledge on the libraries in python <br> ● To implement data science concepts in python. <br> ● To plot and visualize the data using python |
|---|---|
| **Course Outcomes** | **At the end of the course, the students will be able to** <br> CO1: Recognize the fundamentals of python. <br> CO2: Analyze the significance of python program development environment by working on real world examples <br> CO3: Develop program to implement the concepts of arrays using Numpy <br> CO4: Implement numerical programming and data handling through Pandas <br> CO5: Demonstrate the usage of various functions to solve numerical and visualization Problems |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction to Python** [9]

Structure of Python Program-Underlying mechanism of Module Execution-Branching and Looping-Problem Solving Using Branches and Loops-Functions - Lists and Mutability- Problem Solving Using Lists and Functions

**Lab Exercises**
1. Demonstrate usage of branching and looping statements    2.    Demonstrate Recursive functions
3. Demonstrate Lists

**Sequence Datatypes and Object-oriented programming** [9]

Sequences, Mapping and Sets- Dictionaries- -Classes: Classes and Instances-Inheritance-Exceptional Handling-Introduction to Regular Expressions using "re" module.

**Lab Exercises**
1. Demonstrate Tuples, Sets and Dictionaries    2 Demonstrate inheritance and exceptional handling
3. Demonstrate use of "re".

**Using Numpy** [9]

Basics of NumPy-Computation on NumPy-Aggregations-Computation on Arrays-Comparisons, Masks and Boolean Arrays-Fancy Indexing-Sorting Arrays-Structured Data: NumPy's Structured Array.

**Lab Exercises**
1. Demonstrate Aggregation                    2.    Demonstrate Indexing and Sorting

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**Data manipulation with Pandas** [9]

Introduction to Pandas Objects-Data indexing and Selection-Operating on Data in Pandas-Handling Missing Data-Hierarchical Indexing - Combining Data Sets- Aggregation and Grouping-Pivot Tables-Vectorized String Operations -Working with Time Series-High Performance Pandas- and query()

**Lab Exercises**
1. Demonstrate handling of missing data  2. Demonstrate hierarchical indexing
3. Demonstrate usage of Pivot table

**Visualization and Matplotlib** [9]

Basic functions of matplotlib-Simple Line Plot, Scatter Plot-Density and Contour Plots-Histograms, Binnings and Density-Customizing Plot Legends, Colour Bars-Three-Dimensional Plotting in Matplotlib.

**Lab Exercises**
1. Demonstrate Scatter Plot                2. Demonstrate 3D plotting

|  |  | **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Jake VanderPlas, "Python Data Science Handbook - Essential Tools for Working with Data", O'ReilyMedia, 2016. |
| 2. | Zhang.Y ,"An Introduction to Python and Computer Programming", Springer Publications,2016. |

| **Reference(s) :** | |
|---|---|
| 1. | Joel Grus, "Data Science from Scratch First Principles with Python", O'Reilly Media,2016 |
| 2. | T.R.Padmanabhan, "Programming with Python",Springer Publications,2016 |
| 3. | "CS41 - The Python Programming Language", Stanfordpython.com, 2019. [Online]. Available: ps://stanfordpython.com/#overview. |
| 4. | "Python for Data Science", Cognitive Class, 2019. [Online]. Available: https://cognitiveclass. ai/courses/python-for-data-science/. |

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

| **K.S. Rangasamy College of Technology – Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD L04 - Introduction to Deep Learning** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To understand the basic principles of Artificial Neural Networks<br>● To learn the basic concepts of Deep learning<br>● To gain knowledge about Convolutional Neural Networks<br>● To familiarize the different deep learning architectures<br>● To realize the applications of Deep Learning | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Realize the basics of neural networks and machine learning<br>CO2: Explain the fundamentals of Deep learning implementation<br>CO3: Design and implement Convolutional neural network to solve real world problems<br>CO4: Analyze different deep learning architectures<br>CO5: Explore the suitable method of Deep Learning in different applications | | | | | | | |

**Note:** The hours given against each topic are of indicative.  The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required.  The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Artificial Neural Networks** [9]

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Basic concept of Neurons –McCulloch Pitts Neuron, Thresholding logic - Activation function - Perceptron learning Algorithm – Multilayer Perceptrons - Machine Learning - Supervised and Unsupervised learning - Regression and Classification

**Basics of Deep Learning** [9]
History of Deep learning - Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Regularization – Dropout - Building an Artificial Neural Network

**Convolutional Neural Networks** [9]
Convolutional Neural Networks Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – LeNet, AlexNet - Building a Convolutional Neural Network

[9]
**Deep Learning Architectures**
Long Short Term Memory, Gated Recurrent Units, Encoder/Decoder Architectures – Autoencoders – Standard-Sparse – Denoising – Contractive - Variational Autoencoders – Adversarial Generative Networks

[9]
**Applications of Deep Learning**
Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision tasks

| | **Total Hours** | **45** |
|---|---|---|

| **Text book(s):** | | |
|---|---|
| 1. | Ian Good Fellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2017. |
| 2. | Francois Chollet, "Deep Learning with Python", Manning Publications, 2018. |
| **Reference(s):** | |
| 1. | Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress , 2017. |
| 2. | Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press,2018 |
| 3. | Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018. |
| 4. | Seth Weidman, "Deep learning from scratch: Building with Python from first principles ",O'Reilly, 2019 |

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

| **K.S. Rangasamy College of Technology – Autonomous R2018** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 AD L05 - Robotic Process Automation** | | | | | | | |
| **AD** | | | | | | | |
| Semester | Hours / Week | | | Total hrs. | Cre dit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| | 1 | 0 | 4 | 75 | 3 | 50 | 50 | 100 |
| **Objective(s)** | ● To enable the students to learn how Robotic Process Automation that helps organizations. <br>● To understand the activities supported in RPA <br>● To create and use controls in UiPath RPA tools. <br>● To perform data manipulation with string in UiPath Studio <br>● To automate repeatable tasks that previously required humans to perform | | | | | | | |

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| | At the end of the course, the students will be able to |
|---|---|
| **Course Outcomes** | CO1: Recognize the principles of Robotic Process Automation<br>CO2: Identify the key RPA tools and workflows used in intelligent automation.<br>CO3: Implement the functionalities of data manipulation and scrapping.<br>CO4: Analyzing the process of automation in documents.<br>CO5: Implement the concept of automation in different UI elements |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction to Robotic Process Automation:**
Introduction to Robotic Process Automation - UiPath's Robotic Automation Framework - UiPath Tool Installation and Setup – UiPath Workflow Designer Panels - Types of Workflows, Sequences, Flowcharts and State Machines     [3]

**Data Manipulation and Scrapping:**
Data Manipulation Variables, Datatypes - Analyzing the process and aggregate datasets in the database and Usage, Managing Arguments – Data Scrapping - Debug Workflow - Error Handlings                                    [3]

**Recording and Advanced UI Interaction:**
Introduction to Recording - Recording Types - Automatic Recording - Automatic Recording with Basic and Desktop - Automatic Recording with Web - Manual Recording - Input Methods - Screen Scraping - Data Scraping.     [3]

**Selectors, Image and Text Automation:**
Introduction Selectors - Selectors with Wildcards - Full versus Partial Selectors - UiPath Explorer - About Image and Text Automation - Mouse and Keyboard Activities - Text Activities - OCR Activities - Image Activities.      [3]

**Excel, PDF and Email Automation:**
Excel Activities - Data Tables Activities - Data Extraction from PDF - PDF Activities - Email Automation - Email Activities – Orchestrator UI Interface - Connecting the Local Robot to Orchestrator – Schedules - Managing Logs.
                                                                                                                                        [3]

| | **Total Hours: 15 hours** |
|---|---|

**Text book(s):**

| 1. | Alok Mani Tripathi, "Learning Robotic Process Automation, 1st Edition, 2018. |
|---|---|
| 2. | Vaibhav Jain, "Crisper Learning: for UiPath", Fourth Edition, 1st Edition, 2018. |

**Reference(s) :**

| 1. | https://www.uipath.com/rpa/academy/training |
|---|---|

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

| **K.S. Rangasamy College of Technology –Autonomous R2018** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AD L06 – Visualization Techniques** | | | | | | | | |
| **AD** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| - | 1 | 0 | 4 | 75 | 3 | 50 | 50 | 100 |

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| | | |
|---|---|---|
| **Objective(s)** | ● Understand the basic concepts of Data base and data visualization tool<br>● Be familiar with Microsoft Data Analytics and knowledge about visual analytics<br>● Develop a Data modelling with a tool<br>● Apply Sematic Model in visualization tool and familiar with basic constructs of DAX formulas<br>● Learn some important DAX Formulas and apply in case study | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Understand the basics concepts of data visualization and its tool<br>CO2: Understand the Microsoft Data Analytics and Visual Analytics<br>CO3: Apply Data Model<br>CO4: Build And Modify Semantic Model and apply the basic knowledge about DAX formulas<br>CO5: Understand the DAX Formulas and apply in some key areas. | |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**INTRODUCTION** [3]
Data -Data Analysis-Microsoft EXCEL -Power BI-Business Intelligence (BI)- Power BI Desktop (Power Query, Power Pivot, Power View)- Power BI Service- Power BI Mobile Flow - Overview of data visualization - Data Abstraction

**MICROSOFT DATA ANALYTICS AND VISUAL ANALYTICS** [3]
Discover data analysis-Overview of data analysis- Roles in data- Tasks of a data analyst- Building with Power BI - Use Power BI-Building blocks of Power BI- Tour and use the Power BI service - Networks and Trees – Heat Map - Map Color.

**MODELLING DATA** [3]
Power BI Desktop models- Star schema design - Analytic queries -Configure report visuals - Power BI model framework- Power BI model fundamentals -develop an import model - develop a Direct Query model- develop a composite model -model framework.

**SEMANTIC MODEL AND DAX FORMULAS** [3]
Work with tables -Create a date table - Work with dimensions - Data granularity - Work with relationships and cardinality - Model data in Power BI Desktop –DAX Formulas-datatypes-functions-operators-variables.

**DAX FORMULAS APPLICATION AND CASE STUDY** [3]
Create simple measures- Create compound measures - Create quick measures calculated columns with measures – Case Study : Integration of Data Visualization with Hadoop -Visualization Dashboard Creations for Finance.

**Total Hours 15**

**Text book(s):**

| | |
|---|---|
| 1. | Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. |
| 2. | Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012. |

**Reference(s) :**

| | |
|---|---|
| 1. | Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics", John Wiley & sons, 2012. |
| 2. | Pete Warden, "Big Data Glossary", O'Reilly, 2011. |
| 3. | Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, Reprinted 2008. |
| 4. | Donald Miner, "Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems", O'Reilly Media, 2012. |

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

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# K.S. Rangasamy College of Technology (Autonomous)



**Curriculum & Syllabi**
**for**
**Honors Degree**

# B. Tech. Artificial Intelligence and Data Science
## (Honors – Data Science)
### (For batch admitted in 2021-2025)

# R 2018

**Accredited by NAAC with 'A++' grade,**
**Approved by AICTE, Affiliated to Anna University, Chennai.**

**KSR Kalvi Nagar, Tiruchengode – 637 215.**
**Namakkal District, Tamil Nadu, India.**

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Approved in Academic Council Meeting held on 25/05/2024

Chairman - Board of Studies
Dept. of Artificial Intelligence and Data Science
K.S.Rangasamy College of Technology
Tiruchengode - 637 215.

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
## HONORS DEGREE IN DATA SCIENCE
### CURRICULUM & SYLLABI

| S.NO | COURSE CODE | COURSE TITLE | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|------|-------------|--------------|----------|---|---|---|-----|---------|
| | | | | L | T | P | | |
| 1. | 50 AD H01 | Data and Information Security | PE | 3 | 0 | 0 | 3 | 3 |
| 2. | 50 AD H02 | Data Storage and Management in cloud | PE | 3 | 0 | 0 | 3 | 3 |
| 3. | 50 AD H03 | Web Mining | PE | 3 | 0 | 0 | 3 | 3 |
| 4. | 50 AD H04 | Text and Speech Analysis | PE | 3 | 0 | 0 | 3 | 3 |
| 5. | 50 AD H05 | Image and Video Analytics | PE | 3 | 0 | 0 | 3 | 3 |
| 6. | 50 AD H06 | HealthCare Analytics | PE | 3 | 0 | 0 | 3 | 3 |
| | | | Total | 18 | 0 | 0 | 18 | 18 |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **50 AD H01 - Data and Information Security** | | | | | | | |
| **AD** | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | | |
| | L | T | P | | C | CA | ES | Total |
| | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| **Objective(s)** | • To understand the basics of Information Security<br>• To know the legal, ethical and professional issues in Information Security<br>• To equip the students' knowledge on digital signature<br>• To know the basics about email security<br>• To understand the web security protocols |
|---|---|
| **Course Outcomes** | **On the successful completion of the course, students will be able to**<br>CO1**:** Understand the basics of data and information security<br>CO2: Learn the legal, ethical and professional issues in information security<br>CO3: Explore the various authentication schemes to simulate different applications<br>CO4: Understand various security practices and system security standards<br>CO5 :Elaborate the Web security protocols for E-Commerce applications |

| **INTRODUCTION**<br>History, What is Information Security?- Critical Characteristics of Information- NSTISSC Security Model-Components of an Information System- Securing the Components-Balancing Security and Access- The SDLC- The Security SDLC | **[9]** |
|---|---|
| **SECURITY INVESTIGATION**<br>Need for Security- Business Needs- Threats- Attacks- Legal- Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix- Policy-Security policies- Confidentiality policies- Integrity policies and Hybrid policies | **[9]** |
| **DIGITAL SIGNATURE AND AUTHENTICATION**<br>Digital Signature and Authentication Schemes: Digital signature-Digital Signature Schemes and their Variants-Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services | **[9]** |
| **E-MAIL AND IP SECURITY**<br>E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management. | **[9]** |
| **WEB SECURITY**<br>Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure communication-Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing. | **[9]** |
| **Total Hours** | **45** |

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Tiruchengode - 637 215.

| | Text book(s) | |
|---|---|---|
| 1. | Michael E Whitman and Herbert J Mattord, "Principles of Information Security, Course Technology, 6th Edition, 2017. | |
| 2. | Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017. | |
| | **Reference(s):** | |
| 1. | Harold F. Tipton, Micki Krause Nozaki,, "Information Security Management Handbook, Volume 6, 6th Edition, 2016. | |
| 2. | Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw- Hill, Seventh Edition, 2012. | |
| 3. | Matt Bishop, "Computer Security Art and Science, Addison Wesley Reprint Edition, 2015. | |
| 4. | Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, . McGraw-Hill Education, 2015. | |

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

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|---|---|---|---|---|---|---|---|---|
| 50 AD H02- Data Storage and Management in Cloud | | | | | | | | |
| AD | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● To understand the basics of storage technology<br>● To recognize the cloud storage architecture.<br>● To introduce about the network storage.<br>● To learn about hybrid storage solutions.<br>● To know the concept of information storage on cloud. | | | | | | | |
| **Course Outcomes** | **On the successful completion of the course, students will be able to**<br>CO1: Explore various storage technologies<br>CO2: Provide the storage system architecture and algorithm for mapping and operations.<br>CO3: Gain the knowledge about network storage.<br>CO4: Learn about hybrid storage solution and virtualization.<br>CO5: Elaborate on information storage in cloud. | | | | | | | |

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| | INTRODUCTION | |
|---|---|---|
| | Introduction to Storage Technology: Data proliferation, evolution of various storage technologies, Overview of storage infrastructure components, Information Lifecycle Management, Data categorization. | [9] |
| | **STORAGE SYSTEM ARCHITECTURE** | |
| | Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, RAID levels & parity algorithms, hot sparing, Front end to host storage provisioning, mapping and operation | [9] |
| | **INTRODUCTION TO NETWORKED STORAGE** | |
| | JBOD,DAS, NAS, SAN & CAS evolution and comparison. Applications, Elements, connectivity, standards, management, security and limitations of DAS, NAS, CAS & SAN. | [9] |
| | **HYBRID STORAGE SOLUTIONS** | |
| | Virtualization: Memory, network, server, storage & appliances. Data center concepts & requirements, Backup & Disaster Recovery: Principles Managing & Monitoring: Industry management standards (SNMP, SMI-S, CIM), standard framework applications, Key management metrics (Thresholds, availability, capacity, security, performance). | [9] |
| | **INFORMATION STORAGE ON CLOUD** | |
| | Concept of Cloud, Cloud Computing, storage on Cloud, Cloud Vocabulary, Architectural Framework, Cloud benefits, Cloud computing Evolution, Applications & services on cloud, Cloud service providers and Models, Essential characteristics of cloud computing, Cloud Security, and integration. | [9] |
| | **Total Hours** | **45** |

| | Text book(s) | |
|---|---|---|
| 1. | Anthony T. Velete, Toby J.Velk, and Robert Eltenpeter, Cloud Computing : A practical Approach, TMH Pub. 6. Saurabh , Cloud Computing : Insight into New Era | |

| | Reference(s) | |
|---|---|---|
| 1. | G. Somasundaram & Alok Shrivastava (EMC Education Services) editors; Information Storage and Management: Storing, Managing, and Protecting Digital Information; Wiley India. |
| 2. | Ulf Troppens, Wolfgang Mueller-Friedt, Rainer Erkens, Rainer Wolafka, Nils Haustein; Storage Network explained : Basic and application of fiber channels, SAN, NAS, iSESI, INFINIBAND and FCOE, Wiley India. |
| 3. | John W. Rittinghouse and James F. Ransome; Cloud Computing : Implementation , Management and Security, CRC Press, Taylor Frances Pub |
| 4. | Nick Antonopoulos, Lee Gillam; Cloud Computing: Principles, System & Application, and Springer. |

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

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|---|---|---|---|---|---|---|---|---|
| **50 AD H03 - Web Mining** | | | | | | | | |
| **AD** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | ● Introduces basic concepts, tasks, methods, and techniques in web mining<br>● Develop an understanding of the web mining process and issues, learn various techniques for data mining<br>● Learn the techniques in solving data mining problems using tools | | | | | | | |

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| | | | |
|---|---|---|---|
| | ● Know the classification and prediction techniques for web mining<br>● Understand the techniques in solving data mining problems using data mining tools and systems. | | |
| **Course Outcomes** | CO1 :Gain the knowledge of basic concepts data mining and its functionalities<br>CO2: Familiar with data mining and knowledge discovery process<br>CO3 :Learn various techniques for web usage mining process and techniques<br>CO4 :Learn classification and prediction algorithms for web data mining<br>CO5 :Apply the techniques in solving data mining problems using data mining tools and systems | | |

**INTRODUCTION**

Introduction what is Data Mining - Relational Databases - Data Warehouses - Transactional Databases - Advanced Database Systems - Data Mining Functionalities - Interestingness of a pattern Classification of Data Mining Systems - Major issues in Data Mining [9]

**DATA MINING AND KNOWLEDGE DISCOVERY**

Data Mining And Knowledge Discovery The KDD process and methodology - Data preparation for knowledge discovery - Overview of data mining techniques - Market basket analysis - Classification and prediction – Clustering - Memory-based reasoning - Evaluation and Interpretation. [9]

**WEB USAGE MINING**

Web Usage Mining Process And Techniques Data collection and sources of data- Data preparation for usage mining - Mining navigational patterns - Integrating e-commerce data - Leveraging site content and structure - User tracking and profiling - E-Metrics: measuring success in e-commerce Privacy issues. [9]

**CLASSIFICATION**

Classification and Prediction Concepts and Issues regarding Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification - Classification by Back-propagation - Classification Based on Concepts from Association Rule Mining. [9]

**APPLICATIONS**

Web Mining Applications and Other Topics Data integration for e-commerce - Web personalization and recommender systems - Web content and structure mining - Web data warehousing - Review of tools, applications, and systems. [9]

| Total Hours | 45 |
|---|---|

**Text book(s)**

| 1. | Michael Berry and Gordon Linoff, "Data Mining Techniques for Marketing, Sales, and Customer Relationship Management", Second Edition, John Wiley, 2004 |
|---|---|
| 2. | Ralph Kimball and Richard Merz, "The Data Web house Toolkit", John Wiley, 2000 |

**Reference(s):**

| 1. | Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data", Springer; 1st ed. 2007. Corr. 2nd printing edition (30 May 2007) |
|---|---|
| 2. | Ian Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", 3rd Ed., Morgan Kaufmann, 2011 |
| 3. | Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press. 2008. |
| 4. | Gordon Linoff and Michael Berry, "Mining the Web: Transforming Customer Data into Customer Value" John Wiley & Sons, 2001. |

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

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| 50 AD H04 - Text and Speech Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AD** | | | | | | | |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total | |
| | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 | |

| **Objective(s)** | ● Understand natural language processing basics<br>● Apply classification algorithms to text documents<br>● Build question-answering and dialogue systems<br>● Develop a speech recognition system<br>● Develop a speech synthesizer |
|---|---|
| **Course Outcomes** | **On the successful completion of the course, students will be able to**<br>CO1: Explain existing and emerging deep learning architectures for text and speech processing<br>CO2: Apply deep learning techniques for NLP tasks, language modelling and machine translation<br>CO3: Explain coreference and coherence for text processing<br>CO4: Build question-answering systems, chatbots and dialogue systems<br>CO5: Apply deep learning models for building speech recognition and text-to-speech systems |

| **NATURAL LANGUAGE BASICS**<br>Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model. | **[9]** |
|---|---|
| **TEXT CLASSIFICATION**<br>Vector Semantics and Embeddings - Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models. | **[9]** |
| **QUESTION ANSWERING AND DIALOGUE SYSTEMS**<br>Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems. | **[9]** |
| **TEXT-TO-SPEECH SYNTHESIS**<br>Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems. | **[9]** |
| **AUTOMATIC SPEECH RECOGNITION**<br>Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems. | **[9]** |
| **Total Hours** | 45 |

**Text book(s)**

| 1. | Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022. |
|---|---|

**Reference(s):**

| 1. | Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018. |
|---|---|
| 2. | Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008. |
| 3. | Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009. |
| 4. | Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY. |

| | 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 |
| **CO2** | 3 | | 3 | | 3 | | | | 2 | 2 | | 2 | 3 | | 2 |
| **CO3** | 2 | 2 | | 3 | | | | | 3 | | | 3 | 2 | 3 | |
| **CO4** | 2 | | | | | | | | 2 | 3 | 2 | 2 | 2 | 3 | 3 |
| **CO5** | | 3 | 2 | 2 | 2 | | | | 3 | 3 | | | | 2 | 2 |

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|---|---|---|---|---|---|---|---|---|
| **50 AD H05 - Image and Video Analytics** | | | | | | | | |
| **AD** | | | | | | | | |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| | **3** | **0** | **0** | **45** | **3** | **40** | **60** | **100** |

| Objective(s) | ● To understand the basics of image processing techniques for computer vision.<br>● To learn the techniques used for image pre-processing.<br>● To discuss the various object detection techniques.<br>● To understand the various Object recognition mechanisms.<br>● To elaborate on the video analytics techniques. |
|---|---|
| **Course Outcomes** | **On the successful completion of the course, students will be able to**<br>CO1: Understand the basics of image processing techniques for computer vision and video analysis.<br>CO2: Explain the techniques used for image pre-processing.<br>CO3: Develop various object detection techniques.<br>CO4: Understand the various face recognition mechanisms.<br>CO5: Elaborate on deep learning-based video analytics. |

| **INTRODUCTION**<br>Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures. | [9] |
|---|---|
| **IMAGE PRE-PROCESSING**<br>Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration. | [9] |
| **OBJECT DETECTION USING MACHINE LEARNING**<br>Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures. | [9] |
| **FACE RECOGNITION AND GESTURE RECOGNITION**<br>Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- Deep Face solution by Facebook-FaceNet for Face Recognition- Implementation using Face Net- Gesture Recognition. | [9] |
| **VIDEO ANALYTICS**<br>Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3. | [9] |
| **Total Hours** | **45** |

| Text book(s) | |
|---|---|
| 1. | Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013. |
| 2. | Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V) |

| Reference(s): | |
|---|---|
| 1. | Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London |
| 2. | Limited,2011. |
| 3. | Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012. |
| 4. | D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003. |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | 2 | 2 | 2 | | | | 3 | 3 | 2 | | 2 | 2 | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 2 | 2 | 3 | 3 | 3 | | | | 3 | 2 | | 2 | 2 | | |
| CO3 | | 2 | 2 | 2 | 3 | | | | 2 | 2 | | 3 | | 2 | 3 |
| CO4 | | 2 | 3 | 2 | 3 | | | | 2 | 2 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 2 | | 3 | 2 | | | | | | | | 3 | | |

| | | |
|---|---|---|
| **K.S. Rangasamy College of Technology – Autonomous R2018** | | |
| **50 AD H06 - HealthCare Analytics** | | |
| **AD** | | |

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** | |
| | **3** | **0** | **0** | **45** | **3** | **40** | **60** | **100** | |

| | |
|---|---|
| **Objective(s)** | • Understand the health data formats, health care policy and standards<br>• Learn the significance and need of data analysis and data visualization<br>• Understand the health data management frameworks<br>• Learn the use of machine learning and deep learning algorithms in healthcare<br>• Apply healthcare analytics for critical care applications |
| **Course Outcomes** | CO1:Use machine learning and deep learning algorithms for health data analysis<br>CO2: Apply the data management techniques for healthcare data<br>CO3: Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications<br>CO4: Design health data analytics for real time applications<br>CO5: Design emergency care system using health data analysis |

**INTRODUCTION TO HEALTHCARE ANALYSIS**
History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach. **[9]**

**ANALYTICS ON MACHINE LEARNING**
Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection **[9]**

**HEALTHCARE MANAGEMENT**
IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database –Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare. **[9]**

**HEALTHCARE AND DEEP LEARNING**
Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System. **[9]**

**CASE STUDIES**
Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis. **[9]**

| Total Hours | 45 |
|---|---|

**Text book(s)**

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.

**Reference(s):**

1. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
2. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
3. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
4. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

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

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | | | | 2 | | | | 2 | 2 | | 2 | 3 | 2 | |
| **CO4** | 2 | 2 | 3 | 3 | | | | | 2 | 3 | | | 3 | 2 | 2 |
| **CO5** | | 2 | 2 | | | | | | 3 | 3 | | 2 | 2 | 2 |

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