# Francis Xavier Engineering College

**(An Autonomous Institution)**
**Tirunelveli 627003**

## Department of Computer Science and Business Systems


TATA CONSULTANCY SERVICES

Curriculum and syllabi - R 2021-UG
(Batch 2022 – 2026 Onwards)
**CHOICE BASED CREDIT SYSTEM AND OBE**

After 6th BOS

## Vision of the Department

To become a center of excellence in Computer Technology and to generate young Engineers with enriched knowledge to serve industries with high values and social responsibilities.

## Mission of the Department

- To provide world class teaching learning environment and to offer computing education programs.
- To inculcate varied skill sets that meets global industry standards and to practice moral values.
- To enrich moral and ethical values to lead and serve the society.

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# Programme Educational Outcomes (PEOs)

| |
|---|
| PEO1**:** To apply problem solving skills in Computer science and Business Management by applying Engineering fundamentals. |
| PEO2: To improve communication skills, business management skills, professional ethics, team work and to innovate technologies for the betterment of society. |
| PEO3: To exhibit leadership qualities, interpersonal skills and adapting to a rapidly changing environment by applying knowledge in technology abstraction and common business principles. |
| PEO4: To develop professional and ethical attitude, effective communication skills, moral values and an ability to relate engineering issues to social welfare in contemporary areas in Computer Science and Business systems. |

# Programme Specific Objectives (PSOs)

| |
|---|
| PSO1: Enriched knowledge in Business Management and human ethics. |
| PSO2: The students will have effective knowledge in software engineering principles and solving scientific and business problems. |
| PSO3: The students will explore **e**merging technologies in Information and Communication Technologies (ICT), Business Analytics and Machine Learning to innovate ideas and solutions to existing/novel Business applications. |

# Programme Outcomes (POs)

**Engineering Graduates will be able to:**

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

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

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

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

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

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

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

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

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

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

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

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

**Mapping with PO Vs PEO, PSO**

| PO | PEO1 | PEO2 | PEO3 | PEO4 |
|---|---|---|---|---|
| **1** | 3 | 3 | 3 | 3 |
| **2** | 3 | | | |
| **3** | 3 | | | 2 |
| **4** | 3 | | | |
| **5** | | 3 | | |
| **6** | | 3 | | 3 |
| **7** | | | | 3 |
| **8** | | | | 3 |
| **9** | | 2 | 3 | |
| **10** | | 3 | | 2 |
| **11** | | 3 | 2 | |
| **12** | | 3 | 2 | 2 |
| **PSO1** | 2 | 2 | 3 | |
| **PSO2** | 3 | 2 | | 2 |
| **PSO3** | | 3 | | |

**FRANCIS XAVIER ENGINEERING COLLEGE**

**B.Tech – COMPUTER SCIENCE AND BUSINESS SYSTEMS REGULATIONS 2021**

| CREDITS PER SEMESTER | | | | | | | | | | TOTAL CREDITS | CREDITS IN % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No | CATEGORY | I | II | III | IV | V | VI | VII | VIII | | |
| 1 | HSSM | 3 | 2 | 4 | 4 | | | | | 13 | 7.83 |
| 2 | BS | 12 | 4 | 4 | | | | | | 20 | 12.05 |
| 3 | ES | 5 | 15 | | | | | | | 20 | 12.05 |
| 4 | PC | | | 16 | 15 | 13 | 11 | 12 | | 67 | 40.36 |
| 5 | PE | | | | | 6 | 6 | 6 | | 18 | 10.84 |
| 6 | OE | | | | | 3 | 3 | 3 | | 9 | 5.42 |
| 7 | EEC | | | 1 | 4 | 1 | 3 | | 10 | 19 | 11.45 |
| TOTAL | | 20 | 21 | 25 | 23 | 23 | 23 | 21 | 10 | 166 | 100 |

**Minimum Number of Credits to be acquired:166**

HSSM -Humanities and Social Sciences including Management

BS - Basic Science

ES - Engineering Sciences

PC - Professional Core

PE - Professional Elective

OE – Open Elective/Programme Specific Elective for Expandable Scope

EEC -Employability Enhancement Course

**FRANCIS XAVIER ENGINEERING COLLEGE**

**B.Tech – COMPUTER SCIENCE AND BUSINESS SYSTEMS REGULATIONS 2021**

**Choice Based Credit System and Outcome Based Education**

**I-VIII Semester Curriculum and Syllabi**

**SEMESTER I**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21MA1201 | Matrices and Advanced Calculus | BS | 4 | 3 | 1 | 0 | 4 |
| 2 | 21PH1301 | Physics For Engineers | BS | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CY1401 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 4 | 21CS1501 | Problem Solving and Logical Thinking using C | ES | 3 | 2 | 1 | 0 | 3 |
| **Theory cum Practical Course** | | | | | | | | |
| 1 | 21HS1102 | Business Communication and Value Science-I | HSSM | 3 | 2 | 0 | 1 | 3 |
| **Practical Courses** | | | | | | | | |
| 1 | 21PY1311 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| 2 | 21CS1511 | Programming Practice Laboratory Using C | ES | 4 | 0 | 0 | 4 | 2 |
| | | | Total | 24 | 13 | 2 | 9 | 20 |

**SEMESTER II**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21HS2102 | Business Communication and Value Science – II | HSSM | 2 | 2 | 0 | 0 | 2 |
| 2 | 21MA2201 | Partial Differential Equation and Application of Fourier Series | BS | 4 | 3 | 1 | 0 | 4 |
| 3 | 21EE2503 | Fundamentals of Electrical and Electronics Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| **Theory cum Practical Courses** | | | | | | | | |
| 1 | 21CS2501 | Introduction to Computing Using Python | ES | 5 | 3 | 0 | 2 | 4 |
| 2 | 21ME1513 | Computer Aided Engineering Graphics | ES | 5 | 3 | 0 | 2 | 4 |
| **Practical Courses** | | | | | | | | |
| 1 | 21EE2511 | Fundamentals of Electrical and Electronics Engineering Laboratory | ES | 4 | 0 | 0 | 4 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | 21CS2512 | Computer Hardware and Software Tools Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| Mandatory Courses | | | | | | | | |
| 1 | 21GE2M01 | Indian Constitution and Cultural Heritage** | MC | 0 | 1 | 0 | 0 | 0 |
| | | | Total | 27 | 15 | 1 | 12 | 21 |

***This course is applicable for students admitted in 2023 – 2024 academic year**

**** This course is applicable only for students admitted in 2021 – 2022 & 2022 – 2023 academic year**

**SEMESTER III**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| Theory Courses | | | | | | | | |
| 1 | 21MA3205 | Probability and Statistics | BS | 4 | 3 | 1 | 0 | 4 |
| 2 | 21CB3601 | Object Oriented Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CB3602 | Software Engineering Methodologies | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | 21HS4101 | Principles of Management | HSSM | 3 | 3 | 0 | 0 | 3 |
| 5 | 21PT3902 | Soft skills –Verbal Ability | EEC | 1 | 0 | 0 | 2 | 1 |
| Theory cum Practical Courses | | | | | | | | |
| 1 | 21CB3603 | Digital principles and Computer Organization | PC | 5 | 3 | 0 | 2 | 4 |
| 2 | 21AI3603 | Data Structures | PC | 5 | 3 | 0 | 2 | 4 |
| Mandatory Courses | | | | | | | | |
| 1 | 21HS1103 | Tamil Heritage* | MC | 1 | 1 | 0 | 0 | 1 |
| Practical Course | | | | | | | | |
| 1 | 21CB3611 | Object Oriented Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | Total | 29 | 19 | 1 | 10 | 25 |

**SEMESTER IV**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| Theory Courses | | | | | | | | |
| 1 | 21CB4901 | Introduction to Innovation, IP Management and Entrepreneurship | EEC | 3 | 3 | 0 | 0 | 3 |
| 2 | 21CS4601 | Database Management Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | 21IT4601 | Introduction to Algorithms | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | 21CB4601 | Formal Languages and Automata Theory | PC | 4 | 3 | 1 | 0 | 4 |
| 5 | 21HS3101 | Ethics And values | HSSM | 3 | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | 21GE2M02 | Environmental and Sustainable Engineering | MC | 2 | 2 | 0 | 0 | 0 |
| 7 | 21PT3901 | Soft skills –Aptitude I | EEC | 1 | 0 | 0 | 2 | 1 |
| **Theory cum Practical Courses** | | | | | | | | |
| 1 | 21CS4604 | Operating System Concepts | PC | 4 | 2 | 0 | 2 | 3 |
| **Mandatory Courses** | | | | | | | | |
| 1 | 21HS2103 | Technology In Tamil Culture* | MC | 1 | 1 | 0 | 0 | 1 |
| **Practical Course** | | | | | | | | |
| 1 | 21CS4611 | Database Management Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | Total | 28 | 20 | 1 | 8 | 23 |

**SEMESTER V**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21CB5601 | Computational Statistics | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 21CB5602 | Introduction to Business Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CS5602 | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | 21CB5XXX | Professional Elective I | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 21CB5XXX | Professional Elective II | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | 21OE5XXX | Open Elective I | OE | 3 | 3 | 0 | 0 | 3 |
| 7 | 21PT3904 | Soft skills –Reasoning | EEC | 1 | 0 | 0 | 2 | 1 |
| **Practical Course** | | | | | | | | |
| 1 | 21CB5611 | Computational Statistics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 2 | 21CS5611 | Computer Networks Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | Total | 27 | 18 | 0 | 10 | 23 |

**SEMESTER VI**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21CB6601 | Business Strategy | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 21CB6XXX | Professional Elective III | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CB6XXX | Professional Elective IV | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | 21OE6XXX | Open Elective II | OE | 3 | 3 | 0 | 0 | 3 |
| 5 | 21PT3903 | Soft skills –Aptitude II | EEC | 1 | 0 | 0 | 2 | 1 |
| **Theory cum Practical Courses** | | | | | | | | |
| 1 | 21CB6602 | Statistical Modeling | PC | 5 | 3 | 0 | 2 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | 21CB6603 | Legal Aspects of Information Security | PC | 5 | 3 | 0 | 2 | 4 |
| **Practical Courses** | | | | | | | | |
| 1 | 21CB6911 | Project Phase – I | EEC | 4 | 0 | 0 | 4 | 2 |
| | | | Total | 27 | 18 | 0 | 10 | 23 |

**SEMESTER VII**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21IT5707 | Design Thinking | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 21CB7602 | Artificial Intelligence and Logical Thinking | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CB7XXX | Professional Elective V | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | 21CB7XXX | Professional Elective VI | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 21OE7XXX | Open Elective III | OE | 3 | 3 | 0 | 0 | 3 |
| **Theory cum Practical Courses** | | | | | | | | |
| 1 | 21CB7601 | Machine Learning for Finance | PC | 5 | 3 | 0 | 2 | 4 |
| **Practical Courses** | | | | | | | | |
| 1 | 21CB7611 | Artificial Intelligence Lab | PC | 4 | 0 | 0 | 2 | 2 |
| | | | Total | 24 | 18 | 0 | 4 | 21 |

**SEMESTER VIII**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Practical Courses** | | | | | | | | |
| 1 | 21CB8911 | Project Work/Internship cum project/ Startup | EEC | 20 | 0 | 0 | 20 | 10 |
| | | | Total | 20 | 0 | 0 | 20 | 10 |

**Minimum Number of Credits to be Acquired:166**

## Humanities and Social Sciences Including Management

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21HS1102 | Business Communication Value Science –I | HSSM | 3 | 2 | 0 | 2 | 3 |
| 2 | 21HS2102 | Business Communication and Value Science –II | HSSM | 2 | 2 | 0 | 0 | 2 |
| 3 | 21HS3101 | Ethics And values | HSSM | 3 | 3 | 0 | 0 | 3 |
| 4 | 21HS4101 | Principles of Management | HSSM | 3 | 3 | 0 | 0 | 3 |

## List Basic Science Courses

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21MA1201 | Matrices and Advanced Calculus | BS | 4 | 3 | 1 | 0 | 4 |
| 2 | 21PH1301 | Physics For Engineers | BS | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CY1401 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 4 | 21MA2201 | Partial Differential Equation and Application of Fourier Series | BS | 4 | 3 | 1 | 0 | 4 |
| 5 | 21MA3205 | Probability and Statistics | BS | 4 | 3 | 1 | 0 | 4 |
| **Practical Courses** | | | | | | | | |
| 1 | 21PY1311 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 |

## List of Engineering Science Courses

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21CS1501 | Problem Solving and Logical Thinking Using C | ES | 3 | 2 | 1 | 0 | 3 |
| 2 | 21EE2503 | Fundamentals of Electrical and Electronics Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| **Theory cum Practical Courses** | | | | | | | | |
| 1 | 21ME1513 | Computer Aided Engineering Graphics | ES | 5 | 3 | 0 | 2 | 4 |
| 2 | 21CS2501 | Introduction To Computing Using Python | ES | 4 | 3 | 0 | 2 | 4 |
| **Practical Courses** | | | | | | | | |
| 1 | 21CS1511 | Programming Practice Lab Using C | ES | 4 | 0 | 0 | 4 | 2 |
| 2 | 21EE2511 | Fundamentals of Electrical and Electronics Engineering | ES | 4 | 0 | 0 | 4 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Laboratory | | | | | | |
| 3 | 21CS2512 | Computer Hardware and Software Tools Laboratory | ES | 4 | 0 | 0 | 4 | 2 |

**List of Employability Enhancement Course**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| Theory Courses | | | | | | | | |
| 1 | 21PT3902 | Soft skills –Verbal Ability | EEC | 2 | 0 | 0 | 2 | 1 |
| 2 | 21PT3901 | Soft skills –Aptitude I | EEC | 2 | 0 | 0 | 2 | 1 |
| 3 | 21PT3904 | Soft skills –Reasoning | EEC | 2 | 0 | 0 | 2 | 1 |
| 4 | 21PT3903 | Soft skills –Aptitude II | EEC | 2 | 0 | 0 | 2 | 1 |
| 5 | 21CB4901 | Introduction to Innovation, IP Management and Entrepreneurship | EEC | 3 | 3 | 0 | 0 | 3 |
| **Practical Courses** | | | | | | | | |
| 1 | 21CB6911 | Project Work (Phase-I) | EEC | 4 | 0 | 0 | 4 | 2 |
| 3 | 21CB8911 | Project Work/Internship cum project/ Start up | EEC | 20 | 0 | 0 | 20 | 10 |

**List of Professional Core**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21CB3601 | Object Oriented Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 21CB4601 | Formal Languages and Automata Theory | PC | 4 | 3 | 1 | 0 | 4 |
| 3 | 21CB3602 | Software Engineering Methodologies | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | 21CS4601 | Database Management Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 5 | 21IT4601 | Introduction to algorithms | PC | 3 | 3 | 0 | 0 | 3 |
| 6 | 21CB5601 | Computational Statistics | PC | 3 | 3 | 0 | 0 | 3 |
| 7 | 21CB5602 | Introduction to business Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 8 | 21CS5602 | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 9 | 21CB6601 | Business Strategy | PC | 3 | 3 | 0 | 0 | 3 |
| 10 | 21IT5707 | Design Thinking | PC | 3 | 3 | 0 | 0 | 3 |
| 11 | 21CB7602 | Artificial Intelligence and Logical Thinking | PC | 3 | 3 | 0 | 0 | 3 |
| **Practical Courses** | | | | | | | | |
| 1 | 21CB3611 | Object Oriented Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 2 | 21CS4611 | Database Management Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3 | 21CB5611 | Computational Statistics Laboratory | **PC** | **4** | **0** | **0** | **4** | **2** |
| 4 | 21CS5611 | Computer Networks Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 5 | 21CB7611 | Artificial Intelligence Lab | PC | 4 | 0 | 0 | 4 | 2 |
| **Theory cum Practical Courses** | | | | | | | | |
| 1 | 21AI3603 | Data Structures | PC | 5 | 3 | 0 | 2 | 4 |
| 2 | 21CB3603 | Digital principles and Computer Organization | PC | 5 | 3 | 0 | 2 | 4 |
| 3 | 21CS4604 | Operating System Concepts | PC | 4 | 2 | 0 | 2 | 3 |
| **4** | 21CB6602 | Statistical Modeling | PC | 5 | 3 | 0 | 2 | 4 |
| **5** | 21CB6603 | Legal Aspects of Information Security | PC | 5 | 3 | 0 | 2 | 4 |
| **6** | 21CB7601 | Machine Learning for Finance | PC | 5 | 3 | 0 | 2 | 4 |

**List of Mandatory Courses**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21GE2M02 | Indian Constitution and Cultural Heritage | MC | 2 | 2 | 0 | 0 | 0 |
| 2 | 21GE2M01 | Environmental and Sustainable Engineering | MC | 2 | 2 | 0 | 0 | 0 |
| 3 | 21 | Tamil Heritage* | MC | 1 | 1 | 0 | 0 | 1 |
| 4 | 21 | Technology In Tamil Culture* | MC | 1 | 1 | 0 | 0 | 1 |

**List of Professional Electives Courses**

| S.No | Course Code | Course Name | Semester | L | T | P | C | Stream/Domain |
|---|---|---|---|---|---|---|---|---|
| **Professional Elective I** | | | | | | | | |
| 1 | 21CB5701 | Big Data Technologies and Analytics | 5 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB5702 | Business Analytics | 5 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB5703 | Marketing Research | 5 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB5704 | Cloud application Development | 5 | 3 | 0 | 0 | 3 | Full Stack Development |
| **Professional Elective II** | | | | | | | | |
| 1 | 21CB5705 | Data Mining for Business Intelligence | 5 | 3 | 0 | 0 | 3 | Data Analytics |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | 21AI5703 | Healthcare Analytics | 5 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB5706 | Micro and Macro Economics | 5 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB5707 | Web Technologies | 5 | 3 | 0 | 0 | 3 | Full Stack Development |
| **Professional Elective III** | | | | | | | | |
| 1 | 21AI3602 | Data Science Essentials | 6 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB6701 | Enterprises Systems | 6 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB6702 | Industrial Psychology | 6 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CS5703 | IoT and its applications | 6 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21AI7707 | Cognitive Science and Analysis | 6 | 3 | 0 | 0 | 3 | Advanced Technology |
| **Professional Elective IV** | | | | | | | | |
| 1 | 21CS7711 | Data Analytics Using R | 6 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB6703 | Marketing Analytics | 6 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB6704 | Human Resource Management for Business | 6 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB6705 | Mobile Application Development | 6 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21CS7709 | Deep Learning Essentials | 6 | 3 | 0 | 0 | 3 | Advanced Technology |
| **Professional Elective V** | | | | | | | | |
| 1 | 21CB7701 | Natural Language Processing | 7 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB7702 | Financial Analytics | 7 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB7703 | Entrepreneurship Development | 7 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21IT7706 | Agile Methodologies and DEvops | 7 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21IT6711 | Quantum Computing | 7 | 3 | 0 | 0 | 3 | Advanced Technology |
| **Professional Elective VI** | | | | | | | | |
| 1 | 21CB7704 | Text and media analytics | 7 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB7705 | Computational finance & modeling | 7 | 3 | 0 | 0 | 3 | Business Analytics |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3 | 21IT6707 | Software project management | 7 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CS7705 | Blockchain Technologies | 7 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21CS5704 | Virtual and Augmented Reality | 7 | 3 | 0 | 0 | 3 | Advanced Technology |

**List of Open Electives Courses**

| S.No | Course Code | Course Name | Sem | L | T | P | C | Offered By |
|---|---|---|---|---|---|---|---|---|
| **Open Elective – I** | | | | | | | | |
| 1 | 21CB5801 | Digital Forensics | 5 | 3 | 0 | 0 | 3 | CSBS |
| 2 | 21CB5802 | Big Data Technologies | 5 | 3 | 0 | 0 | 3 | CSBS |
| 3 | 21CB5803 | Cloud, Microservices and Applications | 5 | 3 | 0 | 0 | 3 | CSBS |
| 4 | 21CB5804 | Network Science and Applications | 5 | 3 | 0 | 0 | 3 | CSBS |
| 5 | 21CB5805 | Analytics of Things | 5 | 3 | 0 | 0 | 3 | CSBS |
| **Open Elective – II** | | | | | | | | |
| 6 | 21CB6801 | Data mining and analytics | 6 | 3 | 0 | 0 | 3 | CSBS |
| 7 | 21CB6802 | Privacy and Security in IoT | 6 | 3 | 0 | 0 | 3 | CSBS |
| 8 | 21CB6803 | Fundamentals of Fog and Edge Computing | 6 | 3 | 0 | 0 | 3 | CSBS |
| 9 | 21CB6804 | IoT Architectures and Protocols | 6 | 3 | 0 | 0 | 3 | CSBS |
| 10 | 21CB6805 | Business process management | 6 | 3 | 0 | 0 | 3 | CSBS |
| **Open Elective – III** | | | | | | | | |
| 11 | 21C87801 | Software Design Architecture | 7 | 3 | 0 | 0 | 3 | CSBS |
| 12 | 21CB7802 | Human Computer Interaction | 7 | 3 | 0 | 0 | 3 | CSBS |
| 13 | 21CB7803 | Game Designing | 7 | 3 | 0 | 0 | 3 | CSBS |
| 14 | 21CB7804 | Blockchain and cryptocurrency technologies | 7 | 3 | 0 | 0 | 3 | CSBS |
| 15 | 21CB7805 | Cryptology and Analysis | 7 | 3 | 0 | 0 | 3 | CSBS |

**R2021 - Specialization in Big Data**

| S.No | Course Code | Course Name | L | T | P | C | H |
|---|---|---|---|---|---|---|---|
| **Theory Course** | | | | | | | |
| 1 | 21CB4S01 | Big Data Frameworks | 3 | 0 | 0 | 3 | 3 |
| | | Elective | 3 | 0 | 0 | 3 | 3 |
| **Theory cum Practical Courses** | | | | | | | |
| 1 | 21CB6S01 | Mining Massive Data | 2 | 0 | 4 | 4 | 4 |
| 2 | 21CB7S01 | Big data computing for Business Analytics | 2 | 0 | 4 | 4 | 4 |
| **Practical Course** | | | | | | | |
| 1. | 21CB8S11 | Project work | 0 | 0 | 8 | 4 | 8 |
| | | Total | 10 | 0 | 16 | 18 | 22 |
| **Elective Courses** | | | | | | | |
| 1 | 21CB7S01 | Exploratory Data Analysis | 3 | 0 | 0 | 3 | 3 |
| 2 | 21CB7S02 | Information Visualization | 3 | 0 | 0 | 3 | 3 |
| 3 | 21CB7S03 | Predictive Analytics in Business | 3 | 0 | 0 | 3 | 3 |

**List of value - added courses**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Value Added Courses** | | | | | | | | |
| 1 | 21CB1V01 | IT Software Solutions for Business Using Power BI | VAC | 2 | 0 | 0 | 4 | 2 |
| 2 | 21CB2V01 | Predictive Analytics in Digital Marketing | VAC | 2 | 0 | 0 | 4 | 2 |
| 3 | 21CB3V01 | Web Application Development using Angular JS. | VAC | 2 | 0 | 0 | 4 | 2 |
| 4 | 21CB4V01 | Software testing using Selenium | VAC | 2 | 0 | 0 | 4 | 2 |
| 5 | 21CB5V01 | Mobile Application Development using Flutter | VAC | 2 | 0 | 0 | 4 | 2 |

## I – V SEMESTER SKILL CURRICULUM AND SYLLABI

| S.No | Skill Code | Skill Name | Semester | Contact Periods | C |
|---|---|---|---|---|---|
| 1. | 21CB1SK01 | Working with Multimedia Softwares | 01 | 60 | 2 |
| 2. | 21CB2SK01 | Front End Web Development | 02 | 60 | 2 |
| 3. | 21CB3SK01 | Data Visualization Using Tableau | 03 | 60 | 2 |
| 4. | 21CB4SK01 | Business Analytics with R Studio | 04 | 60 | 2 |
| 5. | 21CB5SK01 | Data Exploration Using Python | 05 | 60 | 2 |

## LIST OF NPTEL COURSES

| S.NO. | COURSE NAME | REGISTRATION LINK | DURATION |
|---|---|---|---|
| 1 | Reinforcement Learning | https://nptel.ac.in/courses/106106143 | 12 Weeks |
| 2 | Deep Learning | https://nptel.ac.in/courses/106106184 | 12 Weeks |
| 3 | Natural Language Processing | https://nptel.ac.in/courses/106105158 | 12 Weeks |
| 4 | Introduction To Machine Learning | https://nptel.ac.in/courses/106106139 | 12 Weeks |
| 5 | Data Science For Engineers | https://nptel.ac.in/courses/106106179 | 12 Weeks |
| 6 | Introduction To Internet Of Things | https://nptel.ac.in/courses/106105166 | 12 Weeks |
| 7 | Cloud Computing | https://nptel.ac.in/courses/106105167 | 12 Weeks |
| 8 | Python For Data Science | https://nptel.ac.in/courses/106106212 | 12 Weeks |

## Semester I

### Theory Courses

| 21MA1201 | MATRICES AND ADVANCED CALCULUS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Preamble:**

The course consists of topics in Matrices, Differential calculus, Integral calculus, Differential Equations and Vector calculus with applications to various engineering problems. This course will cover the following main topics: Cayley Hamilton Theorem, Linear differential equations of second order with constant coefficients, Methods of Variation parameter, Taylor's expansion of two variables, Maxima and Minima for two variables, Area and Volume in multiple integrals, Green's theorem and Gauss divergence theorem.

**Prerequisites for the course:**

Students should have basic knowledge about matrices, differentiation and integration

**Objectives**

1. To apply advanced matrix knowledge to Engineering problems
2. To familiarize with the applications of differential equations.
3. To familiarize with the functions of several variables
4. To have Knowledge in Multiple integrals
5. To improve their ability in Vector calculus.

| UNIT I | MATRICES | 9+3 |
|---|---|---|

Matrices - Characteristic equation – Eigen values and Eigen vectors of a symmetric and non symmetric matrix – Properties of Eigen values and Eigen vector – Cayley – Hamilton theorem and its applications

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Eigen values , Eigen Vectors and Cayley Hamilton Theorem and Add MATLAB and for application Add Power method to find Eigen value & Eigen vector

| UNIT II | ORDINARY DIFFERENTIAL EQUATIONS | 9+3 |
|---|---|---|

Differential Equations – Complementary Function – Particular Integral - Linear equations of second order with constant coefficients of types exponential, trigonometry, polynomial and its combination forms - Methods of Variation of parameter - Engineering Applications.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Linear differential equations of different types and Method of Variation parameters.

| UNIT III | FUNCTIONS OF SEVERAL VARIABLES | 9+3 |
|---|---|---|

Function of two variables – Partial derivatives – Taylor's expansion for two variables – Maxima and Minima for two variables – Jacobians of two and three variables – Euler's theorem for homogeneous function.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Taylor's series, Jacobians, Maxima and Minima for two variables

| UNIT IV | MULTIPLE INTEGRALS | 9+3 |
|---|---|---|

Definite Integrals – Properties of definite integrals - Double integration in Cartesian coordinates – Area as a double integral in Cartesian coordinates – Triple integration in Cartesian coordinates – Volume as a Triple Integral

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Area , Triple integration and Volume

| UNIT V | VECTOR CALCULUS | 9+3 |
|---|---|---|

Vector dot product and Vector cross product - Gradient, divergence, curl – Solenoidal and irrotational fields –Unit normal vector - Angle between two surfaces - Directional derivatives – Green's theorem, Gauss divergence theorem (without proof) – Engineering Applications.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Angle between two surfaces, Green's theorem, Gauss divergence theorem.

| | |
|---|---|
| **Total Periods** | **45 + 15 = 60 Periods** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| **1. Descriptive Questions** | 1. Assignment<br>2. Online Quizzes | **1. Descriptive Questions** |

**Outcomes**

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

CO1: Find the eigen values, eigen vectors, inverse and the positive powers of a square matrix (Apply)

CO2: Identify the suitable method to solve second and higher order differential equations (Apply)

CO3: Find the maxima and minima for a given function with several variables, through by finding stationary points (Apply)

CO4: Compute area and volume using double and triple integration. (Apply)

CO5: Apply the concepts of Differentiation and Integration to Vectors. (Apply)

**Text Books**

1. B. S. Grewal, " Higher Engineering Mathematics", 43rd edition, 2017.
2. James Stewart, Calculus – Early Transcendals, 8th Edition, 2016.

**Reference Books**


1. A Textbook of Engineering Mathematics(Dr. A.P.J. Abdul Kalam Technical University, Lucknow) (For . Gautam Bhudh technical Universities ,Lucknow) January 2020
2. K. Ganesan, Sundarammal Kesavan, K. S. Ganapathy Subramanian & V. Srinivasan, "Calculus and Solid Geometry", Revised Edition, 2017


**Web Resources**

1. https://youtu.be/hbk01uhgsos
2. https://archive.nptel.ac.in/content/storage2/111/105/111105122/MP4/mod01lec01.mp4
3. Eigen values and eigen vectors - https://youtu.be/h5urBuE4Xh
   Cayley Hamilton theorem -https://youtu.be/WROFJ15hk00
4. ODE - https://youtu.be/Im242eBqaxw
5. Functions of several variables -https://youtu.be/PA82F91e1vs
6. Integration - https://youtu.be/bVui07yHjzE,
   Multiple integrals -https://youtu.be/3BbrC9JcjOU

   Volume as Triple integral - https://youtu.be/w_KiHgultbM
7. Vector calculus - https://youtu.be/v3ZC4Mo1fS0i
   Gauss divergence theorem https://youtu.be/U9LDcmKUGS0

**CO Vs PO Mapping and CO Vs PSO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 1 | 1 | 1 | | | 1 | 1 | | | 1 | | | |
| **2** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **3** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **4** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **5** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1 (CO 1) : (Apply)**

1) Compute the eigen values and eigen vectors for the Symmetric matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

2 ) Find $A^{-1}$ and $A^4$ using Cayley Hamilton Theorem for the matrix A= $\begin{bmatrix} 1 & -1 & 4 \\ 3 & 2 & -1 \\ 2 & 1 & -1 \end{bmatrix}$.

**COURSE OUTCOME 2 (CO 2) : (Apply)**

1) Solve $(D^2 - D + 1)y = sin\ sin\ 2x\ + e^{-4x}$

2) Solve $(D^2 + a^2)\ y = tan\ tan\ ax$ by using method of variation of parameters.

**COURSE OUTCOME 3(CO 3) : (Apply)**

1. Find the extreme values of the function $f(x, y)$= $x^3 + y^3 - 12x - 3y + 20$.
2. Calculate the maxima and minima of the function $f(x, y) = x^3y^2$ (1-x-y).

**COURSE OUTCOME 4(CO 4) : (Apply)**

1) Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

2) Find $\int_0^a \int_0^b \int_0^c xyz\ dz\ dy\ dx$

**COURSE OUTCOME 5(CO 5) : (Apply)**

1. Find the directional derivative of $\emptyset = xy^2 + yz^3$at the point (2,-1,1) in the direction of $\vec{\imath} + 2\vec{j} + 2\vec{k}$.
2. Using Green's theorem , find $\int_c (x^2 - y^2)dx + 2xydy$ where C is the boundary of the rectangle in the XOY-plane bounded by the lines $x = 0, x = a, y = 0, y = b$.
3. Verify Gauss divergence theorem for $\vec{F} = 4xz\vec{\imath} - y^2\vec{j} + yz\vec{k}$ over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$.

| 21PH1301 | PHYSICS FOR ENGINEERS (Common to AI&DS, CSE, CSBS, IT, ECE & EEE) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **Preamble** | | | | | |

The aim of this course is to impart fundamental knowledge in materials and related basic physical concepts.Which are essential in understanding and explaining engineering devices.It encompasses the application of the basic principles of physics to the development of various engineering fields.

**Prerequisites for the course**

Basic theoretical concepts of Physics in XI and XII.

**Objectives**

1. To impart knowledge about electrical properties of materials.
2. To instill knowledge on physics of Semiconductor and device applications.
3. To enable the students to gain knowledge on magnetic properties.
4. To establish a sound grasp of knowledge on different optical properties of materials ,optical displays and applications.
5. To inculcate an idea of significance of nano structures, quantum confinement and ensuring nano device applications .

| UNIT I | ELECTRICAL PROPERTIES OF MATERIALS | 9 |
|---|---|---|

Classical free electron theory – Expression for electrical conductivity – Thermal conductivity– Wiedemann -Franz law –Merits and Demerits – Quantum theory - Fermi- Dirac statistics – Density of energy states.

| UNIT II | SEMICONDUCTORS PHYSICS | 9 |
|---|---|---|

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors –Extrinsic semiconductors – N-type & P-type semiconductors (Qualitative)– variation of Fermi level with temperature and impurity concentration – Hall effect and devices.-Ohmic contacts-Schottky diode.

| UNIT III | MAGNETIC PROPERTIES OF MATERIALS AND ITS DEVICE | 9 |
|---|---|---|

Magnetism in materials – magnetic field and induction – magnetization – magnetic permeability and susceptibility– Classification of Magnetic materials– Domain Theory - M versus H behavior - Hard and Soft magnetic materials–examples and uses–Magnetic Principle in computer data storage - Magnetic Resonance Imaging. - quantum interference devices-GMR devices

| UNIT IV | OPTICAL PROPERTIES OF MATERIALS AND ITS DEVICES | 9 |
|---|---|---|

Classification of Optical Materials–carrier generation and recombination processes– Absorption, Emission and Scattering of light in metals, Insulators and Semiconductors –Light detectors- Solar cell–LED–Organic LED–Laser Diodes– Optical Data Storage Techniques.

| UNIT V | NANOMATERIALS AND ITS DEVICES | 9 |
|---|---|---|

Quantum Confinement Quantum structures – Density of states in quantum well, quantum wire and quantum dot structure –Band gap of nanomaterials –Tunneling: Single electron phenomena and single electron transistor- Quantum dot Laser- Carbon Nanotubes - Properties and Applications- Spintronic devices and applications.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| Descriptive | 1. Assignment<br>2. Online Quizzes<br>3. Problem-Solving Activities | Descriptive |

**Outcomes**

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

| | |
|---|---|
| **CO 1** | Expound the basics of classical and quantum electron theories. **Understand** |
| **CO 2** | Explain the basic properties of semiconductors including the band gap, charge carrier concentration and doping. **Understand** |
| **CO 3** | Develop the concepts of magnetic properties and their engineering applications. **Apply** |
| **CO 4** | Apply the knowledge of optoelectronic devices and circuits to implement engineering applications. **Apply** |
| **CO 5** | Learn the concepts of nano materials and compare its properties with those of bulk materials. **Apply** |

**Text Books**

1. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw- Hill Education (Indian Edition), 2019
2. S. Salivahanan,A. Rajalakshmi"Physics for Electronics Engineering and Information Science" - Tata Mc-Graw Hill Education,29 January 2018.

**Reference Books**

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019
2. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
3. Laszlo Solymar ,Walsh,Donald,Syms and Richard R.A., Electrical properties of materials ,OXford Univ.press(Indian Edition )2015
4. B.Rogers, J.Adams and S.Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2014.
5. Parag K.Lala, Quantum Computing : A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.

**Web Resources**

1. UNIT 1 -https://www.britannica.com/science/Fermi-Dirac-statistics
2. UNIT 2&4 -https://onlinecourses.nptel.ac.in/noc23_mm02/preview
3. UNIT 2- http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1
4. UNIT 3- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4934330/

5. UNIT 1 TO 5- https://easyengineering.net/ph8253-physics-for-electronics-engineering/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 1 | | | 1 | 1 | 1 | | | | 1 | | |
| 2 | 3 | 2 | 1 | | | 1 | 1 | 1 | | | | 1 | | |
| 3 | 3 | 2 | 1 | | | 1 | 1 | 1 | | | | 1 | | |
| 4 | 3 | 2 | 1 | | | 1 | 1 | 1 | | | | 1 | | |
| 5 | 3 | 2 | 1 | | | 1 | 1 | 1 | | | | 1 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:** Expound the basics of classical and quantum electron theories. (Understand)

1. The thermal conductivity of copper at 300 K is 470.4 $Wm^{-1}K^{-1}$.Calculate the electrical conductivity of copper at 300 K. (Lorentz number = $2.45x10^{-8}$)
2. On the basis of classical free electron theory derive an expression for the electrical conductivity.
3. Explain fermi dirac distribution for electrons in a metal and discuss the effect of temperature on fermi function.

**COURSE OUTCOME 2:** Explain the basic properties of semiconductors including the band gap, charge carrier concentration and doping. . **Understand**

1. Derive an expression for the number of electrons in the conduction band of an intrinsic semiconductor.
2. Show that for a n-type semiconductor the hall Coefficient is given by $RR=+\frac{1}{pe}$. Describe an experimental setup to measure the Hall voltage.
3. Describe ohmic contact with its energy band diagram.

**COURSE OUTCOME 3:** Develop the concepts of magnetic properties and their engineering applications. **Apply**

1. How will you differentiate magnetic materials based on their properties

2. Iron has a relative permeability of 5000. Calculate its magnetic susceptibility.
3. How magnetic principle is used in computer data storage.

**COURSE OUTCOME 4:** Apply the knowledge of optoelectronic devices and circuits to implement engineering applications. **Apply**

1. An LED emits green light of wavelength (λ) = 5511.11 $A^0$. Find out the value of $E_g$.
2. Compare the working principle of LED with solar cell.
3. Explain the construction and working of solar cells.

**COURSE OUTCOME 5**: Learn the concepts of nano materials and compare its properties with those of bulk materials . **Apply**

1. Using the concept of DOS (Density of State) expounds the different quantum confinements.
2. Using the single electron transistor interrupts the phenomena of a single electron.
3. Show the variation using the density of states in nanostructures for different dimensions.

| 21CY1401 | ENGINEERING CHEMISTRY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like electrochemistry, corrosion prevention methods, significance of alloys, benefits of renewable energy sources, engineering materials, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of engineering chemistry.

**Prerequisites for the course**

Basic theoretical concepts of Chemistry in higher secondary level.

**Objectives**

1. To inculcate sound understanding of water quality parameters and water treatment techniques.
2. To make the students familiar with the principles of electrochemistry and corrosion.
3. To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
4. To have a thorough understanding on the principles and generation of energy in batteries, nuclear reactors, solar cells, windmills, fuel cells and supercapacitors .
5. To make the students learn the basics of polymer chemistry, composites and nanomaterials.

| UNIT I | WATER AND ITS TREATMENT | 9 |
|---|---|---|

Hardness of water – Types – Expression of hardness – Units – Estimation of hardness of water by EDTA –Municipal water treatment- Boiler troubles (scale and sludge) – Treatment of boiler feed water – Internal treatment (phosphate and calgon conditioning)-External treatment – Ion exchange process- Desalination of brackish water - Reverse Osmosis.

| UNIT II | ELECTROCHEMISTRY AND CORROSION | 9 |
|---|---|---|

Electrodes- types, Cells- types, Construction (Daniel cell) - Electrode potential- Photo electrochemical cell-working and applications – Nernst equation and its applications- Emf series & its applications.

Corrosion- Causes- Types- Chemical, Electrochemical corrosion (galvanic, differential aeration), Corrosion control – Material selection and design aspects – Electrochemical protection – Sacrificial Anode cathodic Protection method.

| UNIT III | PHASE RULE AND ALLOYS | 9 |
|---|---|---|

Phase rule: Introduction, definition of terms with examples, One component system -Water system - Reduced Phase rule - Two component systems - Lead-Silver system – Pattinson's process.

Alloys: Introduction- Properties of alloys- Significance of alloying, Nichrome and Stainless steel (18/8) – Heat treatment of steel - Annealing - Tempering - Normalising - Hardening and Quenching - Surface hardening methods - Carburising - Nitriding.

| UNIT IV | ENERGY SOURCES AND STORAGE DEVICES | 9 |
|---|---|---|

Nuclear fission - Nuclear fusion - Differences between nuclear fission and fusion - Nuclear chain reactions - Nuclear energy - Light Water Nuclear Power Plant - Solar energy conversion - Solar cells - Wind energy.

Batteries & Fuel cells: Types of batteries – Primary battery (dry cell) Secondary battery (lead acid battery) Lithium ion battery – Electric Vehicles – working principles, Fuel cells – $H_2$-$O_2$ fuel cell and microbial fuel cell; Supercapacitors: Storage principle, types and examples.

| UNIT V | ENGINEERING MATERIALS | 9 |
|---|---|---|

Polymers: Classification of Polymers – Preparation, properties and uses of Teflon and Nylon 6,6-Benefits and Applications. Composites: Introduction: Definition & Need for composites; Properties and applications of Polymer matrix composites and hybrid composites.

Nanomaterials: Types of nanomaterials;properties and uses of nanoparticle, nanocluster, nano rod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, chemical vapour deposition and electrochemical deposition methods. Applications of nanomaterials in medicine, agriculture, energy and electronics.

| | **Total Periods** | **45** |
|---|---|---|

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| WRITTEN TEST | ASSIGNMENT & ONLINE QUIZZES | WRITTEN TEST |

**Outcomes**

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

| | |
|---|---|
| **1** | Infer the quality of water parameters from quality parameter data and propose suitable methodologies to treat water. (Understand) |
| **2** | Identify and apply the basic principles of electrochemistry, corrosion and corrosion control. (Apply) |
| **3** | Apply the knowledge of phase rule and alloys for material analysis. (Apply) |
| **4** | Recognise different forms of energy resources and apply them in suitable energy sectors. (Apply) |
| **5** | Identify and apply basic concepts of polymer science, composites and nanotechnology in designing the synthesis of materials for engineering and technology applications. (Apply) |

**Text Books**

1. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2018 (Unit I,II,III,IV,V).

**Reference Books**

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2018.
4. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
5. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
6. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

Web Resources

1. NPTEL Coursehttps://www.digimat.in/nptel/courses/video/121106014/L01.html
2. Mod-06 Lec-36 Fundamentals of Electrochemical Techniques

https://www.youtube.com/watch?v=l2ENx_Y0dNU

3. Heat treatment of steel https://www.youtube.com/watch?v=3IQz9LAPuIA
4. Renewable energy resources https://youtu.be/mh51mAUexK4
5. Nanomaterialshttps://youtu.be/qUEbxTkPIWI

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2** | 3 | 2 | 2 | 1 | | 1 | 1 | | | | | 1 | | |
| **3** | 3 | 1 | 1 | 1 | | 1 | 1 | | | | | 1 | | |
| **4** | 3 | 2 | 2 | 1 | | 1 | 1 | | | | | 1 | | |
| **5** | 3 | 2 | 2 | 1 | | 1 | 1 | | | | | 1 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: Students will be able to infer the quality of water parameters from quality parameter data and propose suitable methodologies to treat water. (Understand)**

1. How is the exhausted resin regenerated in an ion exchanger?
2. Suggest your valuable ideas to protect the boiler from corrosion.

**COURSE OUTCOME 2: Students will be able to identify and apply the basic principles of** electrochemistry, corrosion and corrosion control**. (Apply)**

1. Compare the mechanisms involved in electrochemical cells and electrolytic cells.
2. How corrosion is prevented by sacrificial anode cathodic protection methods.

**COURSE OUTCOME 3: Students will be able to** apply the knowledge of phase rule and alloys for material analysis**. (Apply)**

1. Illustrate phase, component and degree of freedom with example
2. Will stainless steel rust? Justify.

**COURSE OUTCOME 4: Students will be able to** recognise different forms of energy resources and apply them in suitable energy sectors. **. (Apply)**

1. Is it safe to utilize wind energy for domestic purposes? How are commercial wind farms developed and how can I get a wind farm on my property?
2. Critically analyze nuclear power technology in terms of environmental and health safety. Draw a general layout of the Light water nuclear reactor and explain its components.

**COURSE OUTCOME 5: Students will be able to** identify and apply basic concepts of polymer science, composites and nanotechnology in designing the synthesis of materials for engineering and technology applications. **(Apply)**

1. What do you feel the repercussions are for extended life through utilization of nanotechnology?
2. Give an account of the preparation properties and uses of Teflon and nylon 6,6.

| 21CS1501 | PROBLEM SOLVING AND LOGICAL THINKING USING C | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**Preamble**

This course aims to provide the students with a foundation in computer programming. The focus is to develop the basic problem solving skills in students, and to improve their proficiency in applying the basic knowledge of programming to solve problems.This will enable the students to develop modular applications related to the field of engineering.

**Prerequisites for the course**

- NIL

**Objectives**

1. To learn the basic constructs of C Programming.
2. To learn arrays and strings concepts of C Programming.
3. To learn functions in C and use pointers for storing data in the main memory efficiently.
4. To learn structures and union concepts of C Programming
5. To learn file processing functions and further develop applications in C

| UNIT I | INTRODUCTION TO PROBLEM SOLVING AND BASICS OF C PROGRAMMING | 10 |
|---|---|---|

Introduction to Computer Software-Generations of programming languages- problem solving and logical thinking- Algorithm- Flowcharts - practical examples- Characteristics of C-uses of C- Structure of a 'C' program – Files used in C programs- Compiling and executing C programs - C Tokens- Character Sets in C- Keywords- Identifiers- Using comments in C

**SUGGESTED ACTIVITIES**

- Discussion on Logical and Algorithmic thinking
- Demonstration of concepts using Algorithms and Flowcharts

**SUGGESTED EVALUATION METHODS**

- Write basic programs in C based on algorithm and flowchart
- Quiz on problem solving and basics of C programming

| UNIT II | DECISION CONTROL STATEMENTS AND ARRAYS | 10 |
|---|---|---|

Data Types- Variables- Constants- Managing Input and Output operations in C- Operators and Expressions- Type Conversion- Type casting- Decision Making: Branching and Iterative statements- Nested Loops-break and continue statements- Arrays: Declaration, Initialization- Operations- One dimensional Arrays- Two Dimensional Arrays- Multidimensional Arrays.

**SUGGESTED ACTIVITIES**

- Demonstrate the use of data types and operators
- Comparison study on the types of decision making and looping statements
- Comparison study with examples on the types of arrays

**SUGGESTED EVALUATION METHODS**

- Demonstration of programs using Nested if and Nested loops
- Demonstration of programs using arrays and its operations
- Quiz on data types, operators, statements, loops and arrays

| UNIT III | FUNCTIONS, STRINGS AND POINTERS | 10 |
|---|---|---|

Functions: Declaration and prototyping- Definition- Types- Call and Return statement- Parameter passing methods- Recursion and types. Strings: String operations- Arrays of Strings –Pointers: Declaration- Definition- Pointer Arithmetic- Null pointers- Pointers and Arrays- Pointers and Functions- Pointers and Strings- Pointers to Pointers, Dynamic Memory Allocation

**SUGGESTED ACTIVITIES**

- Discussion on array of pointers, function pointers and array of function pointers
- Comparison study on the types of dynamic memory allocation
- Solve problems on pointers to arrays,pointers to functions and pointers to pointers

**SUGGESTED EVALUATION METHODS**

- Demonstration of programs usingpre defined, user defined and recursive functions
- Demonstration of programs using String manipulation functions
- Quiz on basics of functions, strings and pointers

| UNIT IV | STRUCTURE, UNION AND ENUMERATED DATA TYPES | 8 |
|---|---|---|

Structure: Declaration and Initialization- Nested Structures- Array of Structures- Structures and functions- pointers to structures- Self-referential structures. Unions: Declaration and Initialization- Arrays of union variables- unions inside structures- Enumerated data types

**SUGGESTED ACTIVITIES**

- Discussion and comparison of Structures and Unions
- Solve problems by using nested structures and union inside structures

**SUGGESTED EVALUATION METHODS**

- Demonstration of programs using pointers to structures and self referential structures
- Demonstration of programs using enumerated data types and its operations

| UNIT V | FILE PROCESSING AND PRE PROCESSOR DIRECTIVES | 7 |
|---|---|---|

Introduction to Files – Using Files in C- Read data from files- Write data to files- Error Handling during file operations- Command line arguments- Random file functions- Pre processor Directives: Introduction-Types- Unconditional directives- Conditional Directives- examples

**SUGGESTED ACTIVITIES**

- Assignment on modes of operations using files in C
- Discussion on types of pre-processor directives

**SUGGESTED EVALUATION METHODS**

- Demonstration of programs using file operations
- Demonstration of programs using pre-processor directives

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|

| | | |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROGRAMING AND PROBLEM SOLVING QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES<br>3.PROBLEM-SOLVING ACTIVITIES | 1.DESCRIPTIVE QUESTIONS<br>2. PROGRAMING AND PROBLEM SOLVING QUESTIONS |

**Course Outcomes**

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

**CO1** Apply algorithmic thinking to understand, define and solve problems (Apply)
**CO2**Write simple programs in C using basic constructs, loops and arrays (Apply)
**CO3**Use strings, functions and pointers in C to solve complex problems (Apply)
**CO4**Write programs in C using structures and union to store different data (Apply)
**CO5** Apply file operations and advanced features to develop real time solutions (Apply)

**Text Books**

1. Reema Thareja, "Programming in C",, Second edition, 2016
2. Beecher K. Computational Thinking: A beginner's guide to Problem-solving and Programming. BCS Learning & Development Limited, 2017.

**Reference Books**

1. Byron Gottfried "Programming With C" Fourth Edition, McGrawHill, 2018.
2. Yashvant P. Kanetkar. "Let Us C", BPB Publications, 2016.

**Web Resources**

1. https://www.programiz.com/c-programming
2. https://nptel.ac.in/courses/106105171/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. https://www.tutorialspoint.com/cprogramming/index.htm
5. https://www.w3schools.com/c/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 3 | | | 2 | | | | | | | 1 | | |
| **2** | 3 | 3 | 3 | | | 2 | | | | | | | 1 | | |
| **3** | 3 | 3 | 3 | | | 2 | | | | | | | 2 | | |
| **4** | 3 | 3 | 3 | | | 2 | | | | | | | 2 | | |
| **5** | 3 | 3 | 3 | | | 2 | | | | | | | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |

| | | | | | |
|---|---|---|---|---|---|
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1): (Apply)**

Write algorithm and draw flowchart

1. To count the even numbers between 1 and 200 and print the sum
2. To calculate the simple interest and compound interest
3. To calculate sum of the digits of a number and check if "sum" is an Armstrong number

**Course Outcome 2 (CO2): (Apply)**

1. Write a program to print the grade of a student based on his marks using switch case.
2. Write a program to print the following pattern

```
1
22
333
4444
55555
```

3. Write a program to input the elements of a two dimensional array. Then from this array make two arrays: one that stores all the odd elements of the array and other that stores all the even elements of the array

**Course Outcome 3 (CO3): (Apply)**

1. Write a program using function to calculate 'x' to the power of 'y' where 'y' can be positive or negative.
2. Write a program to read a paragraph. Then count the number of words, number of lines, number of vowels and number of sentences in it
3. Find the output of the following:

```
main(){
char *str="ABCDEFGH";
(*str++);        // what will happen if str++; is given here??
printf("%s",str);    }
```

**Course Outcome 4 (CO4): (Apply)**

1. What will be the output of the C program?

```
#include<stdio.h>
int main() {
enum numbers
{
n1 = 1.5, n2 = 0, n3, n4, n5, n6
};
printf("%d %d\n", n1, n2);
}
```

2. How many bytes in memory taken by the following C structure?

```
#include <stdio.h>
struct test {
 int k;
char c;
};
```

**Course Outcome 5 (CO5): (Apply)**

1. Write a program to create a file and store 20 names in it. Write a program to read the names in the file in the reverse order without reopening the file
2. Write a program that reads the file name and text of 20 words as command line arguments. Write the text into a file whose name is given as the file name

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **UNIT I- INTRODUCTION TO PROBLEM SOLVING AND BASICS OF C PROGRAMMING** | | |
| 1 | Introduction to Computer Software, Generations of programming languages | 1 |
| 2 | Problem solving and logical thinking | 1 |
| 3 | Algorithm | 2 |
| 4 | Flowcharts, practical examples | 2 |
| 5 | Characteristics of C, uses of C, Structure of a 'C' program | 1 |
| 6 | Files used in C programs, Compiling and executing C programs | 1 |
| 7 | C Tokens, Character Sets in C | 1 |
| 8 | Keywords, Identifiers, Using comments in C | 1 |
| **UNIT II- DECISION CONTROL STATEMENTS AND ARRAYS** | | |
| 9 | Data Types, Variables, Constants, Managing Input and Output operations in C | 1 |
| 10 | Operators and Expressions | 1 |
| 11 | Type Conversion- Type casting | 1 |
| 12 | Decision Making: Branching and Iterative statements | 1 |
| 13 | Iterative statements, Nested Loops | 1 |
| 14 | Iterative statements , break and continue statements | 1 |
| 15 | Arrays: Declaration, Initialization- Operations | 1 |
| 16 | One dimensional Arrays | 1 |
| 17 | Two Dimensional Arrays | 1 |
| 18 | Multidimensional Arrays | 1 |
| **UNIT-III FUNCTIONS, STRINGS AND POINTERS** | | |
| 19 | Functions: Declaration and prototyping, Definition, Types | 1 |
| 20 | Call and Return statement- Parameter passing methods | 1 |

| | | |
|---|---|---|
| 21 | Recursion and types. | 1 |
| 22 | Strings: String operations, Arrays of Strings | 2 |
| 23 | Pointers: Declaration, Definition, Pointer Arithmetic, Null pointers | 1 |
| 24 | Pointers and Arrays | 1 |
| 25 | Pointers and Functions | 1 |
| 26 | Pointers and Strings, Pointers to Pointers | 1 |
| 27 | Dynamic Memory Allocation | 1 |
| **UNIT-IVSTRUCTURE, UNION AND ENUMERATED DATA TYPES** | | |
| 28 | Structure: Declaration and Initialization | 1 |
| 29 | Nested Structures, Array of Structures | 1 |
| 30 | Structures and functions | 1 |
| 31 | Pointers to structures | 1 |
| 32 | Self-referential structures | 1 |
| 33 | Unions: Declaration and Initialization, Arrays of union variables | 1 |
| 34 | Unions inside structures | 1 |
| 35 | Enumerated data types | 1 |
| **UNIT-V FILE PROCESSING AND PRE PROCESSOR DIRECTIVES** | | |
| 36 | Introduction to Files, Using Files in C | 1 |
| 37 | Read data from files, Write data to files | 1 |
| 38 | Error Handling during file operations | 1 |
| 39 | Command line arguments, Random file functions | 1 |
| 40 | Pre processor Directives: Introduction, Types | 1 |
| 41 | Unconditional directives | 1 |
| 42 | Conditional Directives, examples | 1 |

**Theory cum Practical Course**

| | | | | | |
|---|---|---|---|---|---|
| **21HS1102** | **BUSINESS COMMUNICATION AND VALUE SCIENCE-I** (Only for CSBS) | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **1** | **3** |

**Prerequisites for the course**

- NIL

**Objectives**

1. Understand what life skills are and their importance in leading a happy and well- adjusted life
2. Motivate Students to look within and create a better version of self
3. Introduce them to key concepts of values, life skills and business communication

| **MODULE I** | **HUMAN VALUES** | **12** |
|---|---|---|

Listening – motivational talk on Values – importance of Values: Reading - Values-Self exploration-Values of individuals: Speaking - Presentation on favourite personality and the skills and values they demonstrate-interviewing a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them-Writing: newspaper report on an IPL Match –record conversation between a celebrity and an interviewer

| **Suggested Activities:** | **Evaluation Method** |
|---|---|
| **1.** Exploring own strengths and weaknesses using SWOT analysis<br>**2.** Presentation on any favorite personality highlighting their skills and values<br>**3.** Writing a report on IPL match<br>**4.** Framing a conversation with a celebrity | ❖ **Activities 1 and 2** will be evaluated for content and presentation skills<br>❖ **Activities 3 and 4** will be evaluated through written submission. |

| **MODULE II** | **GRAMMAR AND LANGUAGE DEVELOPMENT** | **12** |
|---|---|---|

Writing -Parts of Speech- Applications of tenses-Sentence formation, sentence structure, Vocabulary Development - show sequence-Voices-Questioning-Vocabulary: Word formation-Synonyms, antonyms -compound words-single word substitution.

| **Suggested Activities:** | **Evaluation Method** |
|---|---|
| **1.** Parts of speech- Exercises<br>**2.** Tense in sentences- Exercises<br>**3.** Synonyms & Antonyms<br>**4.** Single word substitution - Exercises<br>**5.** Compound words | **Activities 1 to 5** will be evaluated through google form tests/ written tests. |

| **MODULE III** | **ESSENTIALS OF TECHNICAL COMMUNICATION** | **12** |
|---|---|---|

Writing – basic email writing skills – sample emails ; Writing - Email: Formal and informal emails-words from General Service List(GSL)by west, Vocabulary Development - Academic word List(AWL)-Technical specific terms related to the field of technology –Writing - phrases, idioms, significant abbreviations-formal business vocabulary

| **Suggested Activities:** | **Evaluation Method** |
|---|---|
| **1.** Formal and informal email writing<br>**2.** Idioms and Phrases<br>**3.** Abbreviations | a. Email writing will be evaluated under<br>➔ Format<br>➔ Sentence formation<br>b. **Activities 2 and 3** will be evaluated through form tests/ written tests. |

| **MODULE IV** | **BASIC WRITING SKILLS** | **12** |
|---|---|---|

Reading - Reading articles- Writing - Summary writing, story writing-writing your comprehensive CV- Listening – Importance of listening - difference between hearing and listening - Listening to podcast – Speaking - Create a podcast on a topic

| **Suggested Activities:** | **Evaluation Method** |
|---|---|
| 1. Writing a summary on suggested topics<br>2. Writing a summary / story based on a personal experience<br>3. Submitting a podcast on any technical or general topic | **Activities 1 to 3** will be evaluated for<br>Content, structure and innovation on topic selected |

| **MODULE V** | **APPLICATION OF LIFE SKILLS** | **12** |
|---|---|---|

Listening - Life skills: - Picture based and newspaper based learning activities - Movie based learning - identifying skills and values - critical life skills –Reading - appreciation of diversity-Community service-work with an NGO Speaking - make a presentation – Writing – Necessity of life skills in personal and work life.

| **Suggested Activities:** | **Evaluation Method** |
|---|---|
| i) Narrating the most important message learnt from a movie.<br>ii) Going for a field visit with the support of any NGO | **Activity 1** will be evaluated for content and clarity in delivering the thought<br>**Activity 2** will be evaluated based on the report submitted on the field visit |

| | |
|---|---|
| **Total Periods** | **60** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (30 Marks)** | **Lab Exercises / activities (20 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|---|
| 1.Multiple Choice Questions<br>2.Descriptive Questions | 1.Multiple Choice Questions<br>2.Descriptive Questions | 1.Multiple Choice Questions<br>2.Descriptive Questions |

**Outcomes**

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

**CO.1** Recognize the need for life skills and values

**CO.2** Understand the grammar and language development

**CO.3** Understand the basic tenets of communication

**CO.4** To develop writing skills

**CO.5** Apply life skills to different situations

**Text Books**

1. Business Communication Today by Bovee, Thill, Raina
2. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics
3. APAART: Speak Well 1 (English Language and Communication)
4. APAART: Speak Well 2 (Soft Skills)

**Reference Books**

1. Alan Mc'carthy and O'dell,"English Vocabulary in use"
2. Dr.Saroj Hiremath," Business Communication"

**Web Resources**

1. Train your mind to perform under pressure- Simon sinek

https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/

2. Brilliant way one CEO rallied his team in the middle of layoffs

https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html

3. Will Smith's Top Ten rules for success

https://www.youtube.com/watch?v=bBsT9omTeh0

| S. No | List of Experiments | CO |
|---|---|---|
| 1. | Writing a report on IPL 2021 | CO 1 |
| 2. | Oral Presentation on any favorite personality highlighting their skills and values. | CO 1 |
| 3. | Identifying and presenting 10 commonly used words in day to day conversations. | CO 2 |
| 4. | Presentation of Grammar topic using PPT | CO 2 |
| 5. | Email writing | CO 3 |
| 6. | Presentation on any 10 Idioms and phrases | CO 3 |
| 7. | Writing a summary on suggested topics | CO 4 |
| 8. | Submitting a Podcast presentation on any technical or general topic | CO 4 |
| 9. | Video submission on narrating a message learnt from a movie. | CO 5 |

| | | |
|---|---|---|
| 10. | Presentation on working in an NGO for a day | CO 5 |
| | Total Periods | **30Th+30Lab** |

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 2 | | 1 | | 3 | | 2 | 2 | 2 | | | |
| 2 | | | | | | | | 3 | 2 | 3 | | 2 | | | |
| 3 | | | | 1 | | | 2 | 3 | | 2 | 2 | 2 | | | |
| 4 | | | | 1 | | 1 | 1 | 3 | | 2 | 2 | 2 | | | |
| 5 | | | | | | 1 | 1 | 3 | 1 | 1 | 2 | 2 | | | |

**SUGGESTED COURSE LEVEL ASSESSMENT QUESTIONS:**

COURSE OUTCOME 1 (CO 1) : Recognize the need for life skills and values

1) Listen to the presentation of your favorite personality and highlight their skills and values.
2) Introduce yourself in a professional way highlighting Strengths & Weaknesses.
3) Interview with a maid, watchman, sweeper and cab driver and write their values.
4) Write a report on an IPL match .
5) Frame dialogue between a celebrity and yourself

COURSE OUTCOME 2 (CO 2) : Understand the grammar and language development

1) Identify the parts of speech from the sentences given.
2) Fill in the blanks with the appropriate tenses in the sentences or paragraph given.
3) Convert the voices into active or passive.
4) Fill the word formation in the given boxes.
5) State the synonyms and antonyms for the highlighted words.
6) Expand the given abbreviations.
7) Write the one word substitution for the following sentences.

COURSE OUTCOME 3 (CO 3) :Understand the basic tenets of communication

1) Draft a formal and informal Email.
2) Pick out the GSL and AWL words from the sentences given.
3) Write the importance of GSL and AWL words for academic study.
4) Define technical terms that are used in technology.
5) Write the explanation of the technical terms from the lists given.

COURSE OUTCOME 4 (CO 4) : To develop writing skills

1) Listen to the technical talks and write down the merits and demerits of the product discussed.
2) Watch the video, evaluate the concept and express your solutions to the problem.
3) Read the given article and note down the problems stated.
4) Write down solutions for the problems faced while using a product.

5) Draft a white paper writing for the given situation..
6) Write launch notes for a product.
7) Convert the given statement to another form of the tenses as directed.
8) Pick out the suitable synonym for the underlined word in order to minimize plagiarism.
9) Fill in the blank with the suitable phrasal verb.

COURSE OUTCOME 5 (CO 5) : Apply life skills to different situations

1) Watch the video on Types of listening and answer the questions.
2) Make a presentation on the importance of Emotional Intelligence.
3) Read the given article on High level cognition and answer the questions.
4) Read the article on social behaviour and redraft it in your own style.
5) Comprehend the passage and give your inputs for decision making.
6) Watch the video and articulate your emotions using appropriate words.
7) Write a note on optimism and pessimism.
8) Fill in the blank with the suitable modal verb.

**Practical Courses**

| **21PY1311** | **PHYSICS AND CHEMISTRY LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **4** | **2** |

**Preamble**

The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and develop their practical applications in engineering materials by using the principles in the right way to implement in modern technology.

**Prerequisites**

Basic practical concepts of Physics and Chemistry in higher secondary level.

**Objectives (Physics)**

- To analyze the instrumental techniques used in measuring data.
- To interrogate the competency and understanding of the basic concepts found in experimental Physics.
- To learn about the electronic mechanisms and their usage in a practical manner.
- To learn the interpretation of experimental data using the equipment in the physics laboratory.
- To investigate the errors in experimental measurements and techniques.

Objectives (Chemistry)

- To make the students acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To develop an understanding about the range and uses of analytical methods in chemistry.
- To explain the concept of corrosion, its causes, and its environmental consequences.
- To acquaint students with knowledge of molecular weight determination and polymer solubility.
- To interpret chemical and physical phenomena through experimental investigations.

| **PHYSICS** | | |
|---|---|---|
| **S. No** | **List of Experiments** | **CO** |
| 1 | Determination of specific resistance of a given coil of wire – Carey Foster's Bridge. | **3** |
| 2 | Determination of band gap of a Semiconductor (Forbidden energy band gap kit). | **1** |
| 3 | Determination of planck's constant and work function using the principle of photoelectric effect | **5** |
| 4 | Determination of Young's modulus of the material-Non Uniform bending method. | **5** |
| 5 | Determination of thermal conductivity of a bad conductor – Lee's Disc method. | **4** |
| 6 | Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer. | **1** |
| 7 | Determination of wavelength of spectral lines using grating – Spectrometer. | **2** |
| **CHEMISTRY** | | |
| 1 | Determination of total, temporary & permanent hardness of water by EDTA method. | **1,5** |
| 2 | Corrosion experiments – weight loss method. | **3,5** |
| 3 | Estimation of iron content of the given solution using potentiometer. | **2** |
| 4 | Conductometric titration of strong acid vs strong base. | **2** |

| | | |
|---|---|---|
| 5 | Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer. | **4** |
| 6 | Estimation of HCl using $Na_2CO_3$ as primary standard and determination of alkalinity in water sample. | **1,5** |
| 7 | Determination of strength of given hydrochloric acid using pH meter. | **2** |

**List of Projects ( PHYSICS)**

| S. No. | List of Projects | Related Experiment | CO |
|---|---|---|---|
| 1 | To study Infrared radiation emitted by different sources using phototransistors. | 3 | 5 |
| 2 | To study the variations, in current flowing in a circuit containing a LDR, because of a variation:<br>(a) In the power of the incandescent lamp, used to 'illuminate' the LDR. (Keeping all the lamps at a fixed distance).<br>(b) In the distance of an incandescent lamp, (of fixed power), used to 'illuminate' the LDR. | 2 | 1 |
| 3 | Design a circuit for cool automatic timer controlled Light which controls vehicle traffic passing through the intersection of two or more roadways by giving a visual indication to drivers when to proceed, when to slow , and when to stop using LED and 4017 counter IC along with the 555 timer. | 2 | 1 |
| 4 | Design and implement a circuit which anyone can make at home to save their home from thefts using the light has high intensity, monochromatic, directional and coherent in nature. | 7 | 2 |
| 5 | Construct a household circuit consisting of three bulbs using a dual switching method. | 1 | 3 |
| 6 | Using ultrasonic sensor, design a ultrasonic distance finder using 8051 | 6 | 1 |
| 7 | Design a water level indicator by connecting a Buzzer, resistor and transistor in series and connect this in parallel to LED. | 2 | 1 |

**List of Projects (CHEMISTRY)**

| | | | |
|---|---|---|---|
| 1 | Water Analysis : Analysis of perennial Thamirabarani River water samples collected from various locations (before and after blending of industrial waste water).<br>i) Determination of various physical and chemical parameters ( Hardness, pH,TDS, Alkalinity) of different water samples.<br>ii) From the result, give a detailed report about the water sample whether it is fit/unfit for domestic and industrial purposes. | 1, 6,7 | 1,5 |

| | | | |
|---|---|---|---|
| 2. | Water Quality Monitoring : Analysis of ground water samples collected from various districts ( Tirunelveli, Madurai, Tuticorin, Kanyakumari, Tenkasi etc.,).<br>i) Determination of various physical and chemical parameters ( Hardness, pH, TDS, Alkalinity) of different water samples.<br>ii) From the result, give a detailed report about the water sample whether it is fit/unfit for domestic and industrial purposes. | 1,6,7 | 1,5 |
| 3. | Household Plumbing Deterioration Monitoring : Study of Conductivity of domestic water (Home) by Arduino method to track the deterioration of household plumbing.<br>i) From the observations give a detailed report about the existence of various ions in water.<br>ii) Give an explanatory report on tracking the deterioration in household plumbing. | 2 | 3,5 |
| 4 | Air quality monitoring : Study of air pollution in Nellai smart city in the early morning, noon and evening due to CO/CO2 emissions by Arduino method.<br>i) From the observations give a detailed report about the impact of air pollution on human health.<br>ii) Deduce an explanatory report on environmental impact due to CO/CO2 emissions. | 4 | 5 |
| 5. | Food adulteration : Investigation of adulterants in various food stuffs (milk, chilli powder, turmeric powder, wheat flour, honey and ghee) by Chemical methods.<br>i) Give a report on the presence of adulterants in the given food samples.<br>ii) From the observations give a brief report about the impact of food adulteration on human health. | 1 | 5 |

| | |
|---|---|
| **Lab Assessment** | |
| **Lab Components Assessments (50 Marks)** | **End Semester Exams (50 Marks)** |

**Outcomes( Physics)**

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

| | |
|---|---|
| **CO1** | Analyzation of new instruments and real time application in engineering materials. (Analyse) |
| **CO2** | Applying the basic concepts of physics in the experiments by interrogating the data.(Apply) |
| **CO3** | Applying basic knowledge to design circuits using basic components. (Apply) |
| **CO4** | Acquire the basic enlightenment of the experimental data for interpretation (Apply) |
| **CO5** | Solve problems individually using critical thinking collaboratively. (Analyse) |

| **Outcomes(Chemistry)** | |
|---|---|
| **CO1** | Analyze the water quality related parameters quantitatively. (Analyse) |
| **CO2** | Explain the use of equipment for the measurement of conductance, electrode potential, pH of solutions, and viscosity. (Apply) |
| **CO3** | Analyze the probable corrosion, corrosion rate, and corrosion mechanism of the metallic material in the given environment (Analyze) |
| **CO4** | Analyze polymerization data and predict the conversion and molecular weight, which will lead to critical thinking about how to improve the setup for better polymerization.(Analyze) |
| **CO5** | Apply the knowledge of practical to enhance the quality of the environment .(Apply) |

**Reference Books (Physics)**

- Physics Laboratory Manual, Department of Physics, Francis Xavier Engineering College, Tirunelveli.
- A Textbook of Engineering Physics Practical ,UNIVERSITY SCIENCE PRESS (An Imprint of Laxmi Publications Pvt. Ltd.)2nd edition.

**Reference Books (Chemistry)**

J.Mendham, R.C. Denney, J.D.Barnes, M.Thomas and B.Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (5th edition 2009).

**Web Resources**

**Virtual Lab -** https://bop-iitk.vlabs.ac.in/basics-of-physics/List%20of%20experiments.html
Young's Modulus- https://vlab.amrita.edu/?sub=1&brch=280&sim=550&cnt=1
**Virtual Lab -** https://www.vlab.co.in/ba-nptel-labs-physical-sciences
Numerical Aperture - https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1

**Web Resources (Chemistry)**

1. **Water Quality standards -https://www.youtube.com/watch?v=OlGllOZlIyI**
2. **Corrosion experiments – weight loss method**
   **https://www.youtube.com/watch?v=SMlgTWfdHb8**

**PHYSICS MAPPING**

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**CHEMISTRY MAPPING**

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**COURSE LEVEL ASSESSMENT QUESTIONS - PHYSICS**

**COURSE OUTCOME 1:** The students will be able to analyzation of new instruments and real time application in engineering materials. (Analyse)

1. Determination of band gap of a Semiconductor (Forbidden energy band gap kit).
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.

**COURSE OUTCOME 2:** The students will be able to apply the basic concepts of physics in the experiments by interrogating the data.(Apply)

1. Determination of wavelength of spectral lines using grating – Spectrometer.

**COURSE OUTCOME 3:** The students will be able to apply basic knowledge to design circuits using basic components. (Apply)

**1.** Design a circuit for finding unknown resistance and specific resistance of a given coil of wire.

**COURSE OUTCOME 4:** The students will be able to acquire the basic enlightenment of the experimental data for interpretation (Apply)

1. Determine the thermal conductivity of a given bad conductor (Glass) using Lee's disc method. (Given: M= 800 $X10^{-3}$ Kg, S = 370 $JKg^{-1}K^{-1}$).

**COURSE OUTCOME 5:** The students will be able to solve problems individually using critical thinking collaboratively. (Analyse)

1. Determination of planck's constant and work function using the principle of photoelectric effect
2. Find the Young's modulus of the material of a beam using Non-Uniform bending method. (Given : Thickness of the beam d = 6.35 mm)

**COURSE CONTENT AND LECTURE SCHEDULE - PHYSICS**

| S.NO | TOPIC | NO OF WEEKS REQUIRED |
|---|---|---|
| 1 | Determination of specific resistance of a given coil of wire – Carey Foster's Bridge. | **1** |
| 2 | Determination of band gap of a Semiconductor (Forbidden energy band gap kit). | **1** |
| 3 | Determination of planck's constant and work function using the principle of photoelectric effect. | **1** |
| 4 | Determination of Young's modulus of the material-Non Uniform bending method. | **1** |
| 5 | Determination of thermal conductivity of a bad conductor – Lee's Disc method. | **1** |
| 6 | Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer. | **1** |
| 7 | Determination of wavelength of spectral lines using grating – Spectrometer. | **1** |

**COURSE LEVEL ASSESSMENT QUESTIONS - CHEMISTRY**

**COURSE OUTCOME 1:** Analyze the water quality related parameters quantitatively. (Analyse)

2. Estimate the amount of total alkalinity present in 500ml of the given water sample. You are provided with a standard NaOH solution of strength 0.01N.

What is the permissible limit of alkalinity in drinking water?

**COURSE OUTCOME 2:** Explain the use of equipment for the measurement of conductance, electrode potential, pH of solutions, and viscosity. (Apply)

**1.** Determine the amount of NaOH present in 1000 ml of the given sample solution by pH metry. What is the pH of a blood sample?

**COURSE OUTCOME 3:** Analyze the probable corrosion, corrosion rate, and corrosion mechanism of the metallic material in the given environment (Analyze)

1. Determine the rate of corrosion of the given material by weight loss method.

**COURSE OUTCOME 4:** Analyze polymerization data and predict the conversion and molecular weight, which will lead to critical thinking about how to improve the setup for better polymerization.(Analyze)

1. Determine the molecular weight of polyvinyl alcohol by using Ostwald's Viscometer.

**COURSE OUTCOME 5:**Apply the knowledge of practical to enhance the quality of the environment .(Apply)

1. Estimate the amount of total hardness present in 250ml of the given water sample by EDTA method. You are provided with a standard hard water of strength 0.01N. What is the permissible limit of hardness in drinking water?

**COURSE CONTENT AND LECTURE SCHEDULE - CHEMISTRY**

| S.NO | TOPIC | NO OF WEEKS REQUIRED |
|---|---|---|
| 1 | Determination of total, temporary & permanent hardness of water by EDTA method. | 1 |
| 2 | Corrosion experiments – weight loss method | 1 |
| 3 | Estimation of iron content of the given solution using potentiometer | 1 |
| 4 | Conductometric titration of strong acid vs strong base | 1 |

| | | |
|---|---|---|
| 5 | Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer | 1 |
| 6 | Estimation of HCl using $Na_2CO_3$ as primary standard and determination of alkalinity in water sample | 1 |
| 7 | Determination of strength of given hydrochloric acid using pH meter. | 1 |

| **21CS1511** | **Programming Practice Lab using C** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

Preamble

The goal of the practice lab is to provide the students with foundation in computer programming to enhance the problem-solving skills related to the field of engineering. It enables the algorithmic approach among the students to solve real world problems thus providing the base to learn other new programming languages

Prerequisites for the course

- NIL

Objectives

- To develop C programs using conditional and looping statements
- To be able to use arrays and strings in C
- To build modular programs using functions in C
- To explicitly manage memory using pointers in C
- To develop applications in C using structures and files

| S. No | List of Experiments | CO |
|---|---|---|
| 1 | Programs using simple statements | CO1 |
| 2 | Programs using decision making statements | CO1 |
| 3 | Programs using looping statements | CO1 |
| 4 | Programs using one dimensional and two-dimensional arrays | CO2 |
| 5 | Programs using strings. | CO2 |
| 6 | Programs using user defined functions and recursive functions | CO3 |
| 7 | Programs using functions and pointers | CO3 |

| | | |
|---|---|---|
| 8 | Programs using structures and pointers | CO4 |
| 9 | Programs using structures and unions | CO4 |
| 10 | Programs using file concept | CO4 |

| S.No. | List of Projects | Related Experiment | CO |
|---|---|---|---|
| 1. | Vaccine Status Registration System | Ex. 1 to 10 | CO5 |
| 2. | Toll Bill Management system | Ex. 1 to 10 | CO5 |
| 3. | Voting Eligibility system | Ex. 1 to 10 | CO5 |
| 4. | Cricket Scorecard Display system | Ex. 1 to 10 | CO5 |
| 5. | Medical History Viewing System | Ex. 1 to 10 | CO5 |
| 6. | Bus/ Flight Ticket Reservation System | Ex. 1 to 10 | CO5 |
| 7. | Vehicle Parking Control System | Ex. 1 to 10 | CO5 |
| 8. | Canteen Menu Management System | Ex. 1 to 10 | CO5 |
| 9. | Grocery Checklist Management System | Ex. 1 to 10 | CO5 |
| 10. | Diary Management System | Ex. 1 to 10 | CO5 |
| 11. | Retail Shop Inventory Management System | Ex. 1 to 10 | CO5 |
| 12. | Pharmacy Inventory System | Ex. 1 to 10 | CO5 |
| 13. | Library Book Management System | Ex. 1 to 10 | CO5 |
| 14. | Student Subject Selection System | Ex. 1 to 10 | CO5 |
| 15. | Student Leave Application System | Ex. 1 to 10 | CO5 |

Suggestive Assessment Methods

| Lab Components Assessments (50 Marks) | End Semester Exams (50 Marks) |
|---|---|
| 1. Exercises (Hacker rank score)<br>2. Project File (Progress Score)<br>3. Viva voce | 1. Record note<br>2. Exercises<br>3. Viva voce |

Course Outcomes

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

| | |
|---|---|
| CO1 | Implement program using control statements |
| CO2 | Implement arrays and perform string operations |
| CO3 | Develop reusable modules, store data in main memory effectively using pointers |

| | |
|---|---|
| CO4 | Form heterogeneous data using structures, union and files |
| CO5 | Build a project based on the required concepts learnt in C |

Laboratory Requirements

- C compiler
- System with windows
- Internet

Reference Books

1. Reema Thareja, "Programming in C",Oxford University Press, Second edition, 2016

Web Resources

1. https://www.hackerrank.com/
2. https://www.codechef.com/selflearning?itm_medium=navmenu&itm_campaign=learncp
3. https://www.hackerearth.com/practice/basic-programming/input-output/basics-of-input-output/tutorial/

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | 1 | | |
| 2 | 3 | 3 | 3 | | | | | | | | | | 1 | | |
| 3 | 3 | 3 | 3 | | | | | | | | | | 2 | | |
| 4 | 3 | 3 | 3 | | | | | | | | | | 2 | | |
| 5 | 2 | 2 | 2 | | | 1 | | | 2 | 2 | 2 | 1 | 3 | | |

BLOOMS LEVEL ASSESSMENT PATTERN

| BLOOMS CATEGORY | Model Exam | END SEM EXAM |
|---|---|---|
| REMEMBER | | |
| UNDERSTAND | | |
| APPLY | 50 | 100 |
| ANALYZE | | |
| EVALUATE | | |
| CREATE | 50 | |

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1: (Blooms Category: Apply) (Problem Source: Code chef)

Problem Statement:

Pooja would like to withdraw X $US from an ATM. The cash machine will only accept the transaction if X is a multiple of 5, and Pooja's account balance has enough cash to perform the withdrawal

transaction (including bank charges). For each successful withdrawal the bank charges 0.50 $US dollars. Calculate Pooja's account balance after an attempted transaction.

Input Constraints:

Positive integer 0 < X <= 2000 - the amount of cash which Pooja wishes to withdraw.

Nonnegative number 0<= Y <= 2000 with two digits of precision – To represent Pooja's initial account balance.

Output Constraints:

Output the account balance after the attempted transaction, given as a number with two digits of precision. If there is not enough money in the account to complete the transaction, output the current bank balance.

Example:

| TYPE | INPUT | | OUTPUT |
|---|---|---|---|
| Successful Transaction | 30 | 120.00 | 89.50 |
| Incorrect Withdrawal Amount (not multiple of 5) | 42 | 120.00 | 120.00 |
| Insufficient funds | 300 | 120.00 | 120.00 |

COURSE OUTCOME 2: (Blooms Category: Apply) (Problem Source: Code chef)

Problem Statement:

Write a program that takes in a letter class ID of a ship and display the equivalent string class description of the given ID. Use the table below.

| Class ID | Ship Class |
|---|---|
| B or b | Battle Ship |
| C or c | Cruiser |
| D or d | Destroyer |
| F or f | Frigate |

Input Constraints:

The first line contains an integer T, the total number of test cases. Then T lines follow, each line contains a character. 1 ≤ T ≤ 1000

Output Constraints:

For each test case, display the Ship Class depending on ID, in a new line.

Example:

| INPUT | OUTPUT |
|---|---|
| 3<br>B<br>C<br>D | Battleship<br>Cruiser<br>Destroyer |

COURSE OUTCOME 3: (Blooms Category: Apply) (Problem Source: Hacker rank)

Problem Statement:

Functions are a bunch of statements grouped together. A function is provided with zero or more arguments, and it executes the statements on it. Based on the return type, it either returns nothing

(void) or something. For example, a function to read four variables and return the sum of them can be written as

```
int sum_of_four(int a, int b, int c, int d) {
int sum = 0;
        sum += a;
        sum += b;
        sum += c;
        sum += d;
        return sum;                }
```

+= : Add and assignment operator. It adds the right operand to the left operand and assigns the result to the left operand. So a += b is equivalent to a = a + b;

Task

Write a function int max_of_four(int a, int b, int c, int d) which reads four arguments and returns the greatest of them. Note that it is not built in max function in C. Code that will be reused is often put in a separate function that returns the greater of the two values.

Input Constraints:

Input will contain four integers( one on each line)

Output Constraints:

Print the greatest of the four integers.

Sample Input:3 4 6 5

Sample Output: 6

COURSE OUTCOME 4: (Blooms Category: Apply) (Problem Source: Hacker rank)

Problem Statement:

You are transporting some boxes through a tunnel, where each box is a parallelepiped, and is characterized by its length, width and height. The height of the tunnel feet and the width can be assumed to be infinite. A box can be carried through the tunnel only if its height is strictly less than the tunnel's height. Find the volume of each box that can be successfully transported to the other end of the tunnel. Note: Boxes cannot be rotated.

Input Constraints:

The first line contains a single integer, denoting the number of boxes. Lines follow with three integers on each separated by single spaces, and which are length, width and height in feet of the box.

Output Constraints:

For every box which has a height lesser than 41 feet, print its volume in a separate line.

| SAMPLE INPUT | SAMPLE OUTPUT |
|---|---|
| 4<br>5 5 5<br>1 2 40<br>10 5 41<br>7 2 42 | <br><br>125<br>80 |

COURSE CONTENT AND LECTURE SCHEDULE

| S.NO | TOPIC | NO OF HOURS REQUIRED FOR EXERCISES | NO OF HOURS REQUIRED FOR PROJECT |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Simple Statements | 2 | 1 |
| 2 | Decision Making Statements | 2 | 1 |
| 3 | Looping Statements | 2 | 1 |
| 4 | One Dimensional And Two Dimensional Arrays | 2 | 1 |
| 5 | Strings | 2 | 1 |
| 6 | Functions: User Defined Functions And Recursive Functions | 2 | 1 |
| 7 | Functions And Pointers | 2 | 1 |
| 8 | Structures And Pointers | 2 | 1 |
| 9 | Structures And Unions | 2 | 1 |
| 10 | Files Concept | 2 | 1 |
| 11 | Project Implementation & Integration | 0 | 15 |
| | Total | 20 | 25 |
| | Total Hours Required | 45 | |

**Semester II**

| 21HS2102 | Business Communication and Value Science – II | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**Preamble:**

This course offers students the ability to create a professional, mutually respectful atmosphere and to understand the professional responsibility. It also focuses on the ability to communicate efficiently in a business environment and function effectively on multidisciplinary teams ensuring that the personality of an employee reflects a positive & professional image by understanding Ethical and Professional Responsibility.

**Prerequisites for the course**

- Business Communication and Value Science – 1

**Objectives**

1. To augment students overall communication and interpersonal skills by engaging them in group activities.
2. To expertise on public speaking skills.
3. To deal positively with criticism and so as to effectively present their personalities

| MODULE I | Essential Grammar – II | 6 |
|---|---|---|

Writing - Articles, prepositions, reported speech, Auxiliaries - Reading - correct usage and importance in formal communication, Business Vocabulary - Vocabulary exercises through web-based applications

| Suggested Activities: | Evaluation Method |
|---|---|
| **1.** Application of tenses - Exercises<br>**2.** Usage of Auxiliaries- Exercises<br>**3.** Auxiliaries in formal conversations - Exercises<br>**4.** Business vocabulary - Exercises | Activities 1 to 4 will be evaluated through google form tests/ written tests. |

| MODULE II | Written Communication -II | 7 |
|---|---|---|

Writing - Email writing- Formal and Informal email writing structure, Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc. Technical writing, Essay writing, Paragraph writing

| Suggested Activities: | Evaluation Method |
|---|---|
| **1.** Drafting an informal email to a friend<br>**2.** Drafting a formal email to the HR Manager<br>**3.** Writing an essay on "Youngsters 2022" | Submission: Fast form Document<br>Submitted document will be assessed for<br>➢ Format<br>➢ Language and Style<br>➢ Sentence Construction |

| MODULE III | Vocabulary- II | 5 |
|---|---|---|

Reading - Vocabulary exercises through web-based applications, Listening – Vocabulary usage and application through mock meetings. Speaking - Situational Conversation: Writing - Application of grammar and correct spoken English according to context/ situation and application in business scenario.

| Suggested Activities: | Evaluation Method |
|---|---|
| **1.** Conducting a mock meeting in the class<br>**2.** Application of grammar according to the given situation<br>**3.** Practicing business conversations | Activities 1 to 3 will be assessed for<br>a) Language<br>b) Pronunciation<br>c) Intonation |

| MODULE IV | Fundamentals of Effective Communication | 5 |
|---|---|---|

Listening - Public Speaking: fundamentals of effective public speaking, types- Extempore speech, manuscript speech: Writing - Presentation Skills: PowerPoint presentations, Effective ways to structure the presentation, importance of body language: Speaking - Leadership Skills, Leader's Role, Responsibilities and Skill Required. Understanding good Leadership behaviours: 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: Reading - 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

| Suggested Activities: | Evaluation Method |
|---|---|
| **1.** Speaking on any emerging trend.<br>**2.** Presenting a technical topic in the class using ppt<br>**3.** Briefing in the important leadership skill for becoming and an inspiring leader | Activities 1 to 3 will be evaluated for<br>❖ Language & Fluency<br>❖ Creation of Slides<br>❖ Content delivery |

| MODULE V | Corporate / Business Etiquettes | 7 |
|---|---|---|

Reading / writing - Corporate grooming & dressing: etiquettes in social & office Setting Understand the importance of professional behaviour at the workplace, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business Computer Science and Business Systems setting. Speaking - Importance of first impression, Grooming, Wardrobe, Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities. Listening - Interpersonal Skills and Communication Skills: types & its importance Problem Solving Skill: Problem solving skill, Confidence building.

| Suggested Activities: | Evaluation Method |
|---|---|
| **1.** Attending a mock interview<br>**2.** Presenting oneself in front of the class with proper corporate grooming<br>**3.** Introducing oneself to higher officials in business setting | Activities 1 to 3 will be assessed for<br>➔ Business Etiquettes<br>➔ Language<br>➔ Body Language<br>➔ Sentence Construction |

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

**Suggestive Assessment Methods**

| **Continuous Assessment Test (30 Marks)** | **Formative Assessment Test (10 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. Multiple Choice Questions<br>2. Descriptive Questions | 1. Multiple Choice Questions<br>2. Descriptive Questions | 1. Multiple Choice Questions<br>2. Descriptive Questions |

**Outcomes**

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

CO.1 Speak fluently in English without errors in the sentence construction.

CO.2 Present themselves as effective English communicators.

CO.3 Differentiate between vocabulary used as adjectives, verbs and adverbs and be able to use the 60-70 words for their daily conversation

CO.4 Overcome the fear of speaking and will be aware of the 3 types of public speaking necessary according to the contemporary requirements.

CO.5 Deal with the deeper parameters of working in teams like team motivation, multicultural team activity and team conflict resolution.

**Text Books**

1. Business Communication Today by Bovee, Thill, Raina
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)

**Reference Books**

1. Strategic Communication by Charles Marsh
2. English vocabulary in use – Alan Mc'carthy and O'dell
3. Business Communication – Dr. Saroj Hiremath

**Web Resources**

1. Tenses: https://english.eagetutor.com/spoken-english-grammar/the-work-of-tenses-in-english-grammar
2. E-mail etiquettes : https://openoregon.pressbooks.pub/technicalwriting/chapter/1-2-e-mail/
3. Business Dialogue: https://www.fluentu.com/blog/business-english/business-english-dialogues/
4. Public Speaking: http://uilis.unsyiah.ac.id/oer/files/original/435f2bc09c366c416e7178386ca43173.pdf

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 1 | | 1 | 2 | | 2 | 3 | 1 | 2 | | | |
| 2 | | | | 2 | | 1 | | | 1 | 3 | 1 | 2 | | | |
| 3 | | | | 1 | | | | 3 | 1 | 3 | 2 | 2 | | | |
| 4 | | | | | | 1 | 2 | 3 | 1 | 3 | 1 | 2 | | | |
| 5 | | | | | | 1 | 2 | 3 | 1 | 3 | 1 | 2 | | | |

**SUGGESTED COURSE LEVEL ASSESSMENT QUESTIONS:**

COURSE OUTCOME 1 (CO 1) : Speak fluently in English without errors in the sentence construction.

1) Read the given passage aloud, correcting the mistakes in tenses.
2) Converse with your friend using auxiliaries on the recent article that affected you.
3) Imagine conversing with a colleague about the do's and don'ts in the office using auxiliaries.
4) Listen to the lecture and identify the use of auxiliary in the video.
5) Read the given instructions and explain it using business vocabulary.

COURSE OUTCOME 2 (CO 2) : Present themselves as effective English communicators.

1) Draft an email to your HR citing your resignation from the company.
2) Draft an email to an old friend inviting him for the school alumni meet.
3) Draft an email to the Hotel management complaining about the rude approach of a staff member during your stay there.
4) Draft a sales email canvassing a product.
5) Write an essay in about 250 words describing a technical/non - technical topic.

COURSE OUTCOME 3 (CO 3) : Differentiate between vocabulary used as adjectives, verbs and adverbs and be able to use the 60-70 words for their daily conversation

1) Conduct a mock meeting to improve the performance of students in the semester.
2) Start a conversation with your friend regarding next week IV.
3) Build a conversation between you and your HOD seeking permission for OD
4) Converse with a fellow mate according to the given situation using correct Grammar and pronunciation.
5) Imagine the given business scenario and initiate the conversation suggesting a solution.

COURSE OUTCOME 4 (CO 4) : Overcome the fear of speaking and will be aware of the 3 types of public speaking necessary according to the contemporary requirements.

1) Narrate a story/ Review a book that influenced your life.
2) Speak about the changes that occurred in your life because of Corona.
3) Present a technical topic using PPT.
4) Describe the admired skill in your favorite leader that you attempt to follow.
5) Present an honest feedback about the recent education system.

COURSE OUTCOME 5 (CO 5) : Deal with the deeper parameters of working in teams like team motivation, multicultural team activity and team conflict resolution.

1) List any five important ethics in Engineering.
2) Point out five ways to make a good impression at the first encounter.
3) Name the corporate etiquettes you follow in your workplace
4) Brief out the importance of honing interpersonal skills and communication Skills.

Highlight the importance of any 5 problem solving skills with examples

| 21MA2201 | PARTIAL DIFFERENTIAL EQUATION AND APPLICATIONS OF FOURIER SERIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Preamble:**

The course consists of topics in Complex Integration, Partial Differential Equations and Laplace Transforms with applications to various engineering problems. This course will cover the following main topics: Construction of analytic function, Taylors and Laurent's series, Poles and Residues, Half range sine series, Harmonic analysis, Fourier Series Solutions of one dimensional wave and heat flow equation and Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients.

**Prerequisites for the course**

21MA1201 - Matrices and Advanced Calculus

**Objectives**

1. To introduce to the concept of Analytical function
2. To familiarize with Complex integration
3. To introduce Fourier series analysis which is central to many applications in engineering field and its use in solving boundary value problems
4. To acquaint the student with PDE and Fourier series techniques in solving wave and heat flow problems used in various situations.
5. To improve the knowledge of Laplace transforms.

| UNIT I | ANALYTIC FUNCTIONS | 9+3 |
|---|---|---|

Definition of Analytic Function – Cauchy Riemann equations – Properties of analytic functions – Harmonic function – Harmonic Conjugate - Construction of analytic function by Milne Thomson's method and bilinear transformation - transformation $w = 1/z$ .

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Construction of analytic function by Milne Thomson's method and bilinear transformation.

| UNIT II | COMPLEX INTEGRATION | 9+3 |
|---|---|---|

Complex numbers and its conjugate - Cauchy's integral theorem (without proof) – Cauchy's integral formulae and its higher order derivatives (without proof) and its applications – Taylors and Laurent's series – Types of Singularities – Poles and Residues – Cauchy's residue theorem (without proof).

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Taylor's series, Laurent's series and Cauchy's residue theorem.

| UNIT III | FOURIER SERIES | 9+3 |
|---|---|---|

Dirichlet's conditions – General Fourier series – Change of Intervals - Odd and even functions – Half range sine series – Half range cosine series - Root mean square value – Harmonic analysis for Fourier series - Engineering Applications.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Fourier series of Odd and even functions, Half range sine and cosine series, Harmonic analysis.

| UNIT IV | PDE AND APPLICATIONS OF FOURIER SERIES | 9+3 |
|---|---|---|

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – Fourier Series Solutions of one dimensional equation of heat conduction - Engineering Applications.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Fourier Series Solutions of one dimensional wave equation and heat conduction equation.

| UNIT V | LAPLACE TRANSFORMS | 9+3 |
|---|---|---|

Properties of Laplace Transform – Inverse transforms – Convolution theorem (Without Proof) – Partial fraction - Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only - Engineering Applications.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Laplace transform using partial fraction, Convolution theorem and solving ODE.

| | |
|---|---|
| **Total Periods** | **45 + 15 = 60 Periods** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| **1. Descriptive Questions** | 1.Assignment<br>2. Online Quizzes | **1. Descriptive Questions** |

**Outcomes**

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

CO1 : Apply Cauchy-Riemann equations to problems of fluid mechanics, thermodynamics and electro-magnetic fields. ( Apply)

CO2: Solve complex valued integral functions using residues. (Apply)

CO3: Construct the Fourier series expansion of the periodic function. (Apply)

CO4: Solve the problems of one dimensional wave and heat equation. (Apply)

CO5: Apply Laplace Transform technique to solve the given ordinary differential equation. (Apply)

**Text Books**

1. B. S. Grewal, " Higher Engineering Mathematics", 45rd edition, 2017.
2. Kreyszig.E, "*Advanced Engineering Mathematics*", John Wiley & Sons. Singapore, 15th edition, 2017.

**Reference Books**

1. A Textbook of Engineering Mathematics(Dr. A.P.J. Abdul Kalam Technical University, Lucknow) (For . Gautam Bhudh technical Universities ,Lucknow) January 2020
2. Advanced Engineering Mathematics , H. K. DASS, S. CHAND and Company Limited, New Delhi, 22nd revised edition, 2018.

**Web Resources**

1. https://youtu.be/LGxE_yZYigI
2. Analytic functions - https://youtu.be/b5VUnapu-qshttps://youtu.be/8jPr6rGstYk
3. Complex Integration - https://youtu.be/4yC4IXcMKJg
4. Fourier series - https://youtu.be/LGxE_yZYigI
5. Applications of fourier series - https://youtu.be/YfGHNdVeyB4
6. Laplace Transform - https://youtu.be/c9NibpoQjDk

**CO Vs PO Mapping and CO Vs PSO Mapping:**

| CO | PO1 | PO 2 | PO 3 | PO 4 | PO5 | PO6 | PO7 | PO8 | PO9 | P O 10 | P O 11 | P O 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **2** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **3** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **4** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **5** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1 (CO 1) : (Apply)**

1. Construct an analytic function whose imaginary part is $v = e^x(x\ cos\ cosy - y\ sin\ siny)$
2. Find the bilinear transformation that maps the points Z =0, -1 ,$i$ on to the points $i, 0, \infty$.

**COURSE OUTCOME 2 (CO 2) : (Apply)**

1) Solve $\int \frac{e^{2z}}{(z+1)^4} dz$ using Cauchy's Integral formula where C is $|z| = 2$.

2) Compute $\int \frac{2z-1}{z(z+1)(z-3)} dz$ using Cauchy's Residue theorem where C is $|z| = 2$.

**COURSE OUTCOME 3 (CO 3) : (Apply)**

1) Construct Fourier series for $f(x) = x$ in $(-\pi, \pi)$.
2) Construct Fourier series for $f(x) = x^2$ in $(-l, l)$.

**COURSE OUTCOME 4 (CO 4) : (Apply)**

1) Identify the PDE $u_{xx} = a^2 u_{tt}$
2) A tightly stretched string with fixed end points $x = 0, x = l$ is initially at rest in its equilibrium position. If it is vibrating, giving each point a velocity $\lambda x(l - x)$. Find the displacement of the string at any time 't'.

**COURSE OUTCOME 5 (CO 5) : (Apply)**

1) Solve $\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = 2$, given $x = 0$ and $\frac{dx}{dt} = 5$ for $t = 0$ using Laplace transform method.
2) Find the Laplace transform for $\frac{coscosat - coscosbt}{t}$.

| 21EE2503 | FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Prerequisites for the course**

- Engineering Physics
- Engineering Mathematics

**Course Objectives**

**The course will enable students to:**

1. Know the basic concepts of electric circuits and analysis and introduction to measurement and metering equipments for electric circuits
2. Gain knowledge on the basic operation of electric machines and transformers.
3. Have an Introduction of semiconductor devices and its applications.
4. To understand the fundamentals of digital electronics.
5. Learn about the basics of communication systems.

| UNIT I | ELECTRICAL CIRCUITS | 9 + 2 |
|---|---|---|

Ohms Law – Kirchoff's Laws – Steady State Solution of DC Circuits –Mesh and Node Analysis- Introduction to AC Circuits – Operating Principles of Moving Coil and Moving Iron Instruments, Dynamometer type Wattmeter and Induction type energy meter.

| UNIT II | ELECTRICAL MACHINES | 7 |
|---|---|---|

DC Generator - DC Motor - Single Phase Transformer - single phase induction Motor: Construction, Principle of Operation, EMF Equation and Applications.

| UNIT III | SEMICONDUCTOR DEVICES AND APPLICATIONS | 8 |
|---|---|---|

Characteristics of PN Junction Diode and Zener Diode– Half wave and Full wave Rectifier –Bipolar Junction Transistor: CB, CE, CC Configurations and Characteristics.

| UNIT IV | DIGITAL ELECTRONICS | 10 |
|---|---|---|

Number System –Conversions- Introduction to logic families-RTL, DTL, TTL- Logic Gates -Laws of Boolean algebra– Half and Full Adders – Flip-Flops: RS, D, T and JK –Registers and Counters.

| UNIT V | BASICS OF COMMUNICATION SYSTEMS | 9 |
|---|---|---|

Types of Signals: Analog and Digital Signals – Modulation: Amplitude and Frequency Modulation-Demodulation-Communication Systems: Radio, TV, Microwave, Satellite (Block Diagram Approach only)

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTION QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. ASSIGNMENT<br>2. ONLINE QUIZZES<br>3. PROBLEM –SOLVING ACTIVITIES | 1. DESCRIPTION QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Course Outcomes**

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

**CO1:** Understand and apply the basics of electric circuits, analysis, measurement and metering for electric circuits.

**CO2:** Understand the basic operation of electric machines and transformers

**CO3:** Understand the utilization of semiconductor devices.

**CO4:** Understand the fundamentals of digital circuits.

**CO5:** Understand the basics of communication systems.

**Text Books**

1. R. Muthusubramanian, S.Salivahanan and K A Muraleedharan, "Basic Electrical, Electronics and Computer Engineering", 2nd ed., Tata McGraw Hill, 2012.
2. R.S Sedha, "Applied Electronics", S. Chand & Co., 2008.

**Reference Books**

1. Mittle and V. N. Mittle, "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 2005.
2. T K Nagsarkar and M S Sukhija, "Basics of Electrical Engineering", Oxford press 2005.

**Web Resources**

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/105/108105155/
3. https://nptel.ac.in/courses/108/105/108105132/
4. https://nptel.ac.in/courses/117/102/117102061/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | | | |
| 2 | 3 | 2 | | | | 2 | | | | | | 2 | 3 | | |
| 3 | 3 | | | | | | | | | | | | | | |
| 4 | 3 | 3 | 2 | | | | | | | | | | 2 | | |
| 5 | 3 | | | | | 2 | | | | | | 2 | | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 30 | 30 | 05 | 05 | 20 |
| UNDERSTAND | 20 | 20 | 10 | 10 | 20 |
| APPLY | 20 | 20 | 05 | 05 | 20 |
| ANALYZE | 20 | 20 | 05 | 05 | 20 |
| EVALUATE | 10 | 10 | | | 20 |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:** Understand and apply the basics of electric circuits, analysis, measurement and metering for electric circuits.

1. Calculate the equivalent resistances for the two resistance 7 ohms and 12 ohms connected in series.
   a. 7 ohms
   b. 9 ohms
   c. 12 ohms
   d. 19 ohms
2. Which equipment is used to measure the current?
   a. ammeter
   b. voltmeter
   c. wattmeter
   d. energymeter

**COURSE OUTCOME 2:** Understand the basic operation of electric machines and transformers

1. Which is the outermost covering of D.C machine?
   a. Yoke
   b. armature
   c. field winding
   d. commutator
2. Which is the static device?
   a. transformer
   b. DC generator
   c. DC motor

d. Induction motor

**COURSE OUTCOME 3:** Understand the utilization of semiconductor devices.

1. The device which is used to convert the alternating current into direct current is known as
   a. chopper
   b. rectifier
   c. motor
   d. transistor
2. Which device is also known as voltage regulator?
   a. Zener diode
   b. PN diode
   c. motor
   d. transistor

**COURSE OUTCOME 4:** Understand the fundamentals of digital circuits.

1. Which number system has a base 16
   a. Hexadecimal
   b. Octal
   c. Binary
   d. Decimal
2. Which of these sets of logic gates are known as universal gates?
   a.XOR, NAND, OR
   b. OR, NOT, XOR
   c. NOR, NAND, XNOR
   d. NOR, NAND

**COURSE OUTCOME 5:** Understand the basics of communication systems.

1. _____is defined as the process by which some characteristics (i.e. amplitude, frequency, and phase) of a carrier are varied in accordance with a modulating wave
   a. modulation
   b. demodulation
   c. demultiplexing
   d. none of these
2. _____is the equipment which converts physical message, such as sound, words, pictures etc., into corresponding electrical signal.
   a. transmitter
   b. receiver
   c. channel
   d. none

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| | **UNIT I – ELECTRICAL CIRCUITS** | |
| 1 | Ohm's Law | 1 |
| 2 | Kirchoff's Laws | 1 |
| 3 | Steady State Solution of DC Circuits | 1 |
| 4 | Mesh and Node analysis | 1 |
| 5 | Introduction to AC Circuits | 1 |
| 6 | Waveforms and RMS Value | 1 |
| 7 | Power and Power factor, Single Phase Circuits | 1 |
| 8 | Operating Principles of Moving Coil Instruments | 1 |
| 9 | Operating Principles of Moving Iron Instruments (Ammeters and Voltmeters) | 1 |
| 10 | Dynamometer type Watt meters | 1 |
| 11 | Energy meters | 1 |
| | **UNIT-II-ELECTRICAL MACHINES** | |
| 12 | Construction of DC Motor | 1 |
| 13 | Principle of Operation of DC Motor, Basic Equations of DC Motor | 1 |
| 14 | Types of DC Motor and Applications of DC Motor | 1 |
| 15 | Construction of DC Generator | 1 |
| 16 | Principle of Operation of DC Generator, Types of DC Generator and Applications | 1 |
| 17 | Single Phase Transformer Construction, working principle and EMF equation | 1 |
| 18 | Single Phase Induction motor | 1 |
| | **UNIT-III SEMICONDUCTOR DEVICES AND APPLICATIONS** | |
| 19 | Characteristics of PN Junction Diode | 1 |
| 20 | Zener Diode and its Characteristics | 1 |
| 21 | Half wave Rectifiers | 1 |
| 22 | Full wave Rectifiers | 1 |
| 23 | Voltage Regulation | 1 |

| | | |
|---|---|---|
| 24 | CB Configurations and Characteristics | 1 |
| 25 | CE Configurations and Characteristics | 1 |
| 26 | CC Configurations and Characteristics | 1 |
| **UNIT-IV DIGITAL ELECTRONICS** | | |
| 27 | Binary Number System-Decimal, Octal, Hexadecimal, Binary Number system | 1 |
| 28 | Logic Gates-AND,OR,NOT,NAND,NOR | 1 |
| 29 | Boolean Algebra | 1 |
| 30 | Introduction to logic families-RTL, DTL, TTL | 2 |
| 31 | Half Adders and Full Adders | 1 |
| 32 | Flip-Flops | 2 |
| 33 | Registers | 1 |
| 34 | Counters | 1 |
| **UNIT V-BASICS OF COMMUNICATION SYSTEMS** | | |
| 35 | Types of Signals | 1 |
| 36 | Analog and Digital Signals | 1 |
| 37 | Modulation and Demodulation | 2 |
| 38 | Principles of Amplitude and Frequency Modulations | 2 |
| 39 | Communication Systems: Radio, TV | 1 |
| 40 | Communication Systems: Microwave | 1 |
| 41 | Satellite (Block Diagram Approach only). | 1 |

**Theory cum Practical Courses**

| 21CS2501 | Introduction to Computing using Python (Common for AI&DS,CSE,CSBS,ECE,EEE,IT) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 1 | 4 |

**Preamble**

This course provides learners an insight into Python programming, and develop programming skills to manage the development of software systems. It covers programming environments, important instructions, data representations, intermediate level features, image processing, exception handling and file data processing of Python.

**Prerequisites for the course**

- Problem Solving Techniques, Logical Thinking

**Objectives**

1. To know the features of Python.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and use function calls.
4. To use Python data structures – strings, lists, tuples, dictionaries.
5. To work with files in Python.
6. To work with images.

| UNIT I | INTRODUCTION TO PYTHON PROGRAMMING | 4 |
|---|---|---|

Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements - Operators – Boolean Values – Operator Precedence – Expression - Conditionals: if, if-else, if elif else Constructs

| UNIT II | LOOPS, FUNCTIONS AND LISTS | 6 |
|---|---|---|

Loop Structures/Iterative Statements –Loop Control Statements – List – Adding Items to a List – Finding and Updating an Item – Nested Lists –List Concatenation – List Slices – List Methods – List Loop – Mutability. Function Call and Returning Values – Fruitful Function – Parameter Passing – Local and Global Scope – Recursive Functions.

| UNIT III | STRING, ARRAYS, TUPLES | 7 |
|---|---|---|

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions. –Using Arrays with Numpy: Vectors and operations - vector properties and characteristics, Pandas - Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value.

| UNIT IV | DICTIONARY, FILES | 6 |
|---|---|---|

Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary.
Introduction to Files – File Modes – Opening and Closing Files – Reading and Writing Files

| UNIT V | EXCEPTION HANDLING, IMAGE PROCESSING | 7 |
|---|---|---|

Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.
Image Processing - Image File Formats, Image-Manipulation Operations, The Properties of Images, Python Image Library(PIL)- Converting an Image to Black and White/Grayscale, Blurring an Image, Edge Detection and Reducing the Image Size.

| Total Periods | 30 Theory +30 Lab |
|---|---|

**Laboratory Requirements**

- 60 Systems with windows / LINUX operating system with python IDLE or equivalent.

| **Suggestive Assessment** | | |
|---|---|---|
| **Continuous Assessment Test (30 Marks)** | **Lab Components Assessments (20 Marks)** | **End Semester Exams (50 Marks)** |
| 1. DESCRIPTIVE QUESTIONS | 1. LAB EXPERIMENTS<br>2. MODEL EXAMINATION | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

**CO1:** Write Python programs for solving problems using conditional statements.

**CO2:** Write Python programs for solving problems using looping statement and list and decompose a Python program into functions.

**CO3:** Represent data using Python strings, arrays, tuples, dictionaries and solve computational problems using them and use Numpy and Pandas libraries in real time applications.

**CO4:** Develop programsto read and write data from/to files in Python and handle exceptions while dealing with data.

**CO5:** Apply the power of graphics for processing images.

**Text Books**

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition,Shroff/O'Reilly Publishers, 2016

**Reference Books**

1. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.

**Web Resources**

1. Python for Data science - https://onlinecourses.nptel.ac.in/noc20_cs36/course (Unit III – Numpy, Pandas)
2. https://www.geeksforgeeks.org/image-processing-in-python-scaling-rotating-shifting-and-edge-detection/ (Unit V)

**List of experiments**

| S.NO | NAME OF EXPERIMENTS | CO |
|---|---|---|
| **1** | Basic Python Programming<br>a) Alice buys a toy with a selling price of 100 rupees. There is a discount of x percent on the toy. Develop a python program to find the amount Alice needs to pay for it. | **CO1** |
| 2 | Python Programs using conditionals – if, if – else, if – elif – else statements<br>b) Write a program that takes cost price and selling price as input and displays whether the transaction is a **Profit** or a **Loss** or **Neither.**<br>a) Chef considers the climate HOT if the temperature is **above** 2020, otherwise he considers it COLD. You are given the temperature *C*, write a python program to find whether the climate is HOT or COLD.<br>b) Write a Python Program to read the unit of electricity consumed in a house and calculate the amount to be paid for the electricity consumed. The bill amount should be calculated as per the given specification:<br>a. For 0 to 100 units the per unit is ₹ 0/-<br>b. For 0 to 200 units, for the first 100 unit the per unit cost is zero and the next 100 units, the consumer shall pay ₹ 1.5 per unit.<br>c. For 0 to 500 units, the consumer shall pay ₹ 0 for the first 100 units, for the next 100 units the consumer shall pay ₹ 2 per unit, for the next 300 units the unit cost is ₹3.00/- | CO1 |

| | | |
|---|---|---|
| 3 | Python Programs using looping statements<br>a) Implement Python Script to generate first N natural numbers.<br>b) Implement Python Script to check given number is palindrome or not.<br>c) Implement Python script to print factorial of a number.<br>d)Implement Python Script to check given number is Armstrong or not.<br>e) Square the Digits :<br>Given a two digit number, calculate the sum of square of the digits. Repeat the same for the output till any of the number in series repeats. Output should be the first number that repeats in the process.<br>Sample :<br>Input :<br>13<br>Explanation : ('^' denotes power in this explanation)<br>Step 1 : 1^2 + 3^2 = 1 + 9 = 10<br>Step 2 : 1^2 + 0^2 = 1 + 0 = 1<br>Step 3: 1^2 = 1<br>1 repeats hence output should be "1"<br>Output:<br>1<br><br>Input:<br>7<br>Explanation:<br>Step 1 : 7 ^2 = 49<br>Step 2 : 4^2 + 9^2 = 16 + 81 = 97<br>Step 3 : 9^2 + 7^2 = 81 + 49 = 130<br>Step 4: 1^2 + 3^2 + 0^2 = 1+ 9 + 0 = 10<br>Step 5 : 1^2 + 0^2 = 1 + 0 = 1<br>Step 6: 1^2 = 1<br>1 repeats hence output should be "1"<br>Output:<br>1 | CO2 |

| | | |
|---|---|---|
| 4 | Python Programs using Functions<br>a) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 and 2000.<br>b) Have the function CodelandUsernameValidation(**str**) take the **str** parameter being passed and determine if the string is a valid username according to the following rules:<br>1. The username is between 4 and 25 characters.<br>2. It must start with a letter.<br>3. It can only contain letters, numbers, and the underscore character.<br>4. It cannot end with an underscore character.<br>If the username is valid then your program should return the string **true**, otherwise return the string **false**.<br>**Examples**<br>Input: "aa_"<br>Output: falseInput: "u_hello_world123"<br>Output: true | CO2 |

| | | |
|---|---|---|
| 5 | Python Programs using List<br>a) Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number. Suppose the following input is supplied to the program: 34, 67, 55, 33, 12, 98. Then, the output should be: ['34', '67', '55', '33', '12', '98'] ('34',67', '55', '33', '12', '98').<br>b) In this program, create a list of numbers from 1 to 50 named **list_1**. The numbers should be present in the increasing order: Ex **list_1 = [1,2,3,4,5,....,50]** i.e. index zero should be 1, index one should be 2, index two should be 3 and so on. Given an input let's say **a**, you have to print the **number** of elements of **list_1** which are divisible by **a, excluding** the element which is equal to **a.Input:** Number **aOutput:** In a single line, the number of elements (i.e. the count and not the elements) which are divisible by **a. Example: Input: 24 Output: 1**<br>c) In this program, create a list of numbers from 1 to 50 named **list_1**. The numbers should be present in the increasing order: Ex **list_1 = [1,2,3,4,5,....,50]** i.e. index zero should be 1, index one should be 2, index two should be 3 and so on. Given an input let's say **a**, you have to print the **number** of elements of **list_1** which are divisible by **a, excluding** the element which is equal to **a.Input:** Number **aOutput:** In a single line, the number of elements (i.e. the count and not the elements) which are divisible by **a**. Example: Input: 24 Output: 1<br>d) Given a list l of size N and two elements x and y, use counter variables to find which element appears most in the list, x or y. If both elements have the same frequency, then return the smaller element. Write a Python program to implement the above said statement.<br>Note: We need to return the element, not its count.<br>**Example 1:**<br>**Input:**<br>N = 11<br>l = [1,1,2,2,3,3,4,4,4,4,5]<br>x = 4, y = 5<br>**Output: 4**<br>**Explanation:**<br>frequency of 4 is 4.<br>frequency of 5 is 1.<br>**Example 2:**<br>**Input:** N = 8 l = [1,2,3,4,5,6,7,8] x = 1, y = 7**Output: 1**<br>**Explanation:** frequency of 1 is 1.frequency of 7 is 1.Since 1 < 7, return 1. | CO3 |

| | | |
|---|---|---|
| 6 | Python Programs using String, Tuples, Numpy array and Pandas.<br>a) Accepts a string and calculate the number of upper case letters and lower case letters.<br>b) Write a python program to check whether the given string is palindrome or not.<br>c) Create all possible strings by using 'a', 'e', 'i', 'o', 'u'. Use the characters exactly once.<br>d) Python Program to Sort a List of Tuples in Increasing Order by the Last Element in Each Tuple<br>e) Use mtcars.csv dataset do the following:<br>What is the type of each variable of the mtcars data set?<br>o Divide the column that has the car name into columns that contain the make and model of the car.<br>o Do all observations have a make and model value? If there are missing values, can you fix them? (Hint, use Google to help you.)<br>o Some car companies have more than one make. In this data Chrysler, Plymouth, and Dodge were all made by Chrysler. Likewise Cadillac and Pontiac are made by GM and Lincoln and Ford are both made by Ford. Create a company variable based on the data in the make variable<br>o Create a name for use in displaying results that is a character string composed of make, a space character, if the company name is not the same as the make then the company in parentheses (), and model. | CO3 |

<table>
<tr><td></td><td>
f) Write a python program to sort the DataFrame first by 'name' in descending order, then by 'score' in ascending order.<br>
Sample Python dictionary data and list labels:<br>
exam_data = {'name': ['Anastasia', 'Dima', 'Katherine', 'James', 'Emily', 'Michael', 'Matthew', 'Laura', 'Kevin', 'Jonas'],'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']} labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']<br>
Values for each column will be:<br>
name : "Suresh", score: 15.5, attempts: 1, qualify: "yes", label: "k"<br>
Expected Output:Orginal rows:
<table>
<tr><td></td><td>name</td><td>score</td><td>attempts</td><td>qualify</td></tr>
<tr><td>a</td><td>Anastasia</td><td>12.5</td><td>1</td><td>yes</td></tr>
<tr><td>b</td><td>Dima</td><td>9.0</td><td>3</td><td>no</td></tr>
<tr><td>c</td><td>Katherine</td><td>16.5</td><td>2</td><td>yes</td></tr>
<tr><td>d</td><td>James</td><td>NaN</td><td>3</td><td>no</td></tr>
<tr><td>e</td><td>Emily</td><td>9.0</td><td>2</td><td>no</td></tr>
<tr><td>f</td><td>Michael</td><td>20.0</td><td>3</td><td>yes</td></tr>
<tr><td>g</td><td>Matthew</td><td>14.5</td><td>1</td><td>yes</td></tr>
<tr><td>h</td><td>Laura</td><td>NaN</td><td>1</td><td>no</td></tr>
<tr><td>i</td><td>Kevin</td><td>8.0</td><td>2</td><td>no</td></tr>
<tr><td>j</td><td>Jonas</td><td>19.0</td><td>1</td><td>yes</td></tr>
</table>
Sort the data frame first by 'name' in descending order, then by 'score' in ascending order:
<table>
<tr><td></td><td>name</td><td>score</td><td>attempts</td><td>qualify</td></tr>
<tr><td>a</td><td>Anastasia</td><td>12.5</td><td>1</td><td>yes</td></tr>
<tr><td>b</td><td>Dima</td><td>9.0</td><td>3</td><td>no</td></tr>
<tr><td>c</td><td>Katherine</td><td>16.5</td><td>2</td><td>yes</td></tr>
<tr><td>d</td><td>James</td><td>NaN</td><td>3</td><td>no</td></tr>
<tr><td>e</td><td>Emily</td><td>9.0</td><td>2</td><td>no</td></tr>
<tr><td>f</td><td>Michael</td><td>20.0</td><td>3</td><td>yes</td></tr>
<tr><td>g</td><td>Matthew</td><td>14.5</td><td>1</td><td>yes</td></tr>
<tr><td>h</td><td>Laura</td><td>NaN</td><td>1</td><td>no</td></tr>
<tr><td>i</td><td>Kevin</td><td>8.0</td><td>2</td><td>no</td></tr>
<tr><td>j</td><td>Jonas</td><td>19.0</td><td>1</td><td>yes</td></tr>
</table>
</td><td></td></tr>
<tr><td>7</td><td>Python Programs using Dictionary<br>a)Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()<br>b) Write a Python Program to multiply all the items in a dictionary.</td><td>CO3</td></tr>
<tr><td>8</td><td>Python Programs using Files<br>a) Write Python script to display file contents.<br>b) Write Python script to copy file contents from one file to another.<br>c) Write a Python program to count the number of lines, words, letters, blank spaces in a file.</td><td>CO4</td></tr>
</table>

| | | |
|---|---|---|
| 9 | Python Programs using Exceptions<br>Write a Python program to solve the following: (Use Exception Handling)<br>You are given a string . Your task is to find out whether is a valid regex or not.<br>**Input Format**<br>The first line contains integer , the number of test cases.<br>The next lines contains the string .<br>**Constraints:** 0<T<100<br>**Output Format**<br>Print "True" or "False" for each test case without quotes.<br>**Sample Input**<br>2<br>.*\+<br>.*+<br>**Sample Output**<br>True<br>False<br>**Explanation**<br>.*\+ : Valid regex.<br>.*+: Has the error multiple repeat. Hence, it is invalid. | CO4 |
| 10 | Calculation of the Area : Don't measure<br>Monte Hall : 3 doors and a twist<br>Sorting : Arrange the books | CO2 |
| 11 | Searching : Find in seconds<br>Anagram<br>Lottery Simulation - Profit or Loss | CO2 |
| 12 | Simulate a password generator<br>Simulate a grade book for a teacher<br>Rock Paper and Scissor. | CO2 |
| 13 | Python Program for:<br>Converting an Image to Black and White/Grayscale<br>Blurring an Image, Edge Detection and Reducing the Image Size | CO5 |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 1 | 1 | | | | | | | | | 3 |
| 2 | 1 | 2 | 1 | 1 | 1 | | | | | | | | | 3 |
| 3 | 1 | 2 | 1 | 1 | 1 | | | | | | | | | 3 |
| 4 | 1 | 1 | 1 | 2 | 1 | | | | | | | | | 2 |
| 5 | 2 | 2 | 2 | 2 | 1 | | | | | | | | | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | Lab Components | Model Exam | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 10 | 10 | | | 10 |
| UNDERSTAND | 10 | 10 | | | 20 |
| APPLY | 80 | 80 | 100 | 100 | 70 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:**

1. Write a Python Program to read the unit of electricity consumed in a house and calculate the amount to be paid for the electricity consumed. The bill amount should be calculated as per the given specification:
    a. For 0 to 100 units the per unit is ₹ 0/-
    b. For 0 to 200 units, for the first 100 unit the per unit cost is zero and the next 100 units, the consumer shall pay ₹ 1.5 per unit.
    c. For 0 to 500 units, the consumer shall pay ₹ 0 for the first 100 units, for the next 100 units the consumer shall pay ₹ 2 per unit, for the next 300 units the unit cost is ₹3.00/-

    (Apply)
2. Chef and Chefina are at positions X and Y on a number line. They both love badminton. It is known that badminton courts are located at every integer point. They want to find a court such that the maximum distance travelled by either of them is **minimized**. Formally, suppose they choose the badminton court at position Z. You need to find the minimum value of max(|X-Z|, |Y-Z|)max(|X−Z|,|Y−Z|) across all possible choices of Z. Here, |X| denotes absolute value of X. Write a Python Program to Report this minimum value.

**Input Format**

The first line of input will contain a single integer T, denoting the number of test cases.
Each test case consists of two space-separated integers Xand Y.

**Output Format**

For each test case, output the minimum possible value of \max(|X-Z|, |Y-Z|)max(|X−Z|,|Y−Z|).

**Constraints**

1≤T≤1000
1≤X,Y≤1000
X<=Y

**Sample :**

Input
4
3 5
7 6
1 10
Output

1
1
5
16

3. Develop a Python Program to Check if a Date is Valid and Print the Incremented Date if it is. (Apply)

**COURSE OUTCOME 2:**

1. Write a Python Program to Read a Number n and Compute n+nn+nnn. (Apply)
2. Write a program to find Sum of Digit of a Number using Recursion in Python. (Apply)
3. Differentiate break and continue. (Understand)

**COURSE OUTCOME 3:**

1. What is printed by the following statements? (Apply)

```
s = "engineering"
r = ""
for item in s:
        r = item.upper() + r
print(r)
```

2. Is string is mutable. Justify your answer. (Understand)
3. Write a Python Program to count the number of lowercase letters and uppercase letters in a string. (Apply)

**COURSE OUTCOME 4:**

1. What happens if the file is not found in the following Python code? (Apply)

```
a=False
while not a:
try:
        f_n = input("Enter file name")
        i_f = open(f_n, 'r')
except:
        print("Input file not found")
```

2. Write a Python Program that Reads a Text File and Counts the Number of Times a Certain Letter Appears in the Text File. (Apply)
3. Write a Python Program to Extract Numbers from Text File. (Apply)
4. Write a Python Program to merge two files into a third file. (Apply)

**COURSE OUTCOME 5:**

1. Write a python program to convert RGB image to Black and white Image. (Apply)
2. How will you handle exception when it is raised? Explain. (Understand)

| 21ME1513 | COMPUTER AIDED ENGINEERING GRAPHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Prerequisites for the course**

**NIL**

**Preamble**

Engineering drawing is an important tool for all Engineers and for many others professionals. It is the language of Engineers. Engineering Drawing communicates all needed information from the engineer who designed a part to the workers who will manufacture it.

**Objectives**

1. To understand the importance of the drawing in engineering applications
2. To improve their visualization skills so that they can apply these skill in developing new products
3. To expose them to existing standards related to technical drawings
4. To develop graphic skills for communication of concepts, ideas and design of engineering products
5. Train to practice engineering graphics through drafting software.

CONCEPTS AND CONVENTION**(not for examination)**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout of drawing sheets – Lettering and Dimensioning

| UNIT I | PROJECTION OF POINTS AND LINES | 9 |
|---|---|---|

General Principles of orthographic projection – First Angle Projection, projection of points in four quadrants – Projection of straight lines locatedin the first quadrant – inclined to both planes

| UNIT II | PROJECTION OF SOLIDS | 10 |
|---|---|---|

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

| UNIT III | SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES | 10 |
|---|---|---|

Sections of regular solids as per BIS conventions - Constructing sectional views of simple objects and components - Development of lateral surfaces of regular solids-Projection of truncated solids .

| UNIT IV | ISOMETRIC PROJECTIONS | 8 |
|---|---|---|

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

| UNIT V | PERSPECTIVE PROJECTIONS | 8 |
|---|---|---|

Perspective projection of prisms, pyramids and cylinders by visual ray method.

| S.No | List of Experiments | CO |
|---|---|---|

| | | |
|---|---|---|
| 1. | Introduction to drafting commands in AutoCAD. Creation of simple geometry and editing practice. | C112.1, C112.6 |
| 2. | Projection of simple Geometric objects and engineering components using AutoCAD | C112.2, C112.6 |
| 3. | Construction of simple objects and components sectional viewsusing AutoCAD | C112.3, C112.6 |
| 4. | Isometric projection of simple components-flange, cylinder, chimney, lamp shades, valve, Bracketsusing AutoCAD | C112.4, C112.6 |
| 5. | Creating a Perspective Projection of solids using AutoCAD | C112.5, C112.6 |
| | **Total Periods** | **45 Theory + 15 Lab Hours** |

**Laboratory Requirements**

**SYSTEM REQUIREMENTS**

**(For a batch of 30 Students)**

**Hardware:**

1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

**Software:**

Drafting package – AutoCAD – Adequate license (Open source)

**Suggestive Assessment Methods**

| CAT 1 (30Marks) | Model Lab (20 Marks) | End Semester Exams (50 Marks) |
|---|---|---|
| 30 | 20 | 50 |

**Outcomes**

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

**C112.1:** Apply the principles of first angle projection in construction of points and lines.
**C112.2:** Apply the principles of change of position method inprojection of simple solids.
**C112.3:**Develop projections of sectioned solids and their developmental surface.
**C112.4:**Develop isometric views from orthographic projections
**C112.5:** Construct the perspective projections of simple solids
**C112.6:**Developorthographic ,isometric and perspective projection and development of surfaces using drafting software.

**Text Books**

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + Autocad", New Age International (P) Limited (2022)
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai(2015)


**Reference Books**


1. Kumar M.S., "Engineering Graphics", D.D. Publications, (2015)
2. Parthasarathy N.S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, (2015)
3. Shah M.B. and Rana B.C., "Engineering Drawing", Pearson Education (2009)
4. N.D.Bhatt, "Engineering Graphics", Charotor Publishing House, 53RD Edition 2019


**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

**Web Recourses**

1. http://nptel.ac.in/courses/112103019
2. https://archive.nptel.ac.in/courses/112/105/112105294/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 112.1 | 3 | 1 | 1 | 2 | | | | | | | | | 3 | 2 |
| 112.2 | 3 | 1 | 1 | 1 | 1 | | | | | | | | 3 | 2 |
| 112.3 | 3 | 1 | 1 | 1 | 1 | | | | | | | | 3 | 2 |
| 112.4 | 2 | 2 | 1 | 1 | 1 | | | | | | | | 3 | 1 |
| 112.5 | 2 | 2 | 1 | 1 | 1 | | | | | | | | 3 | 2 |
| 112.6 | 2 | 2 | 2 | 2 | 2 | | | | | | | | 3 | 3 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | MODEL | END SEM EXAM |
|---|---|---|---|---|
| REMEMBER | | | | |
| UNDERSTAND | | | | |
| APPLY | 15 | 15 | 20 | 50 |
| ANALYZE | | | | |

| | | | | |
|---|---|---|---|---|
| EVALUATE | | | | |
| CREATE | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:** Apply the principles of first angle projection in construction of points and lines. (Apply)

1. Draw the projections of the following points on a common reference line. (Apply)
A,35 mm above HP and 25 mm in front of VP
B,40 mm below HP and 15mm behind VP
C,50 mm above HP and 25 mm behind VP
D,45 mm below HP and 25 mm behind VP
E, 30 mm behind VP and on HP

2. A line CD measuring 80 mm is inclined at an angle of 30° to HP and 45° to VP. The point C is 20 mm above HP and 30 mm in front of VP. Draw the projections of the straight line.(Apply)

**COURSE OUTCOME 2:** Apply the principles of change of position method in projections of solid problems and draw graphically

1. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30o to VP. Draw the projections of the solid. (A)

2. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30o to HP and 45o to VP. Draw the projections of the solid. (A)

**COURSE OUTCOME 3: Develop projections of sectioned solids and their developmental surface.**

1. A cylinder of base diameter 50mm and height 60mm rest on its base on HP. It is cut by a plane perpendicular to VP and inclined at $45^0$ to HP. The cutting plane meets the axis at a distance 15mm from its top base. Draw the sectional plan and true shape of the section. (A)
2. A regular hexagonal pyramid side of base 30 mm and height 60 mm is vertically on its base on HP, such that two of its sides of the base are perpendicular to VP. It is cut by a plane inclined at 30° to HP and perpendicular to VP. The cutting plane bisects the axis of the pyramid. Obtain the development of the lateral surface of the truncated pyramid. (A)

**COURSE OUTCOME 4: Develop isometric views from orthographic projections**

1. A cone of diameter 50 mm and axis 70 mm rests on its base on HP. A section plane perpendicular to VP and inclined at 30° to HP cuts the solid and passes through a point on axis which is 40 mm above HP. Draw the isometric view of a truncated cone. (A)

2. A pentagonal pyramid of base edge 25 mm and height 65 mm rests vertically on its base on the HP such that one of its base edge parallel to VP. It is cut by a plane, parallel to HP and perpendicular to VP and passes through a point 25 mm from the apex. Draw the isometric view of the frustum of pyramid. (A)

**COURSE OUTCOME 5: Construct the perspective projections of simple solid**

1. Draw the perspective view of a square prism of base side 40mm and height 50mm. one vertical lateral face is parallel to PP and 30mm away from it. The station point is 80mm from PP, 80mm above the base and 60mm to the right of the axis of the prism. (APPLY)

2. A hexagonal pyramid of base side 25mm and axis length 50mm is resting on GP on its base with a side of base is parallel to and 20mm behind PP. The station point is 60mm above GP and 80mm in front of PP and lies in a central plane which is 50mm to the left of the axis of the pyramid. Draw theperspective view of a pyramid. (APPLY)

**COURSE OUTCOME 6: Students will be able to Develop Orthographic ,isometric and perspective projection and Development of surfaces using drafting software**

1. A hexagonal pyramid of base side 30 mm axis length 60 mm is resting on HP on one of its base corners with its axis inclined at 35˚ to HP and parallel to VP. Draw its projections. (APPLY)
2. A cylinder of base diameter 50mm and axis length 50mm is placed horizontally on GP on its base. The axis of the cylinder is 35mm behind PP. The station point is 70mm in front of PP and 70mm above the GP and is 50mm to the left of the axis. Draw the perspective projection of the cylinder. (APPLY)

**Practical Courses**

| 21EE2511 | FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- Engineering Physics
- Engineering Mathematics

**Objectives**

**The course will enable students to:**

1. Verify basic electrical laws - KCL – KVL
2. Gain knowledge on residential house wiring.
3. Understand and practice the measurement of electrical parameters
4. Study the basic electronic components & Design simple digital electronic circuits
5. Understand and design basic logic circuits.

| S.No | List of Experiments | CO |
|---|---|---|
| | **LIST OF EXPERIMENTS (BASIC ELECTRICAL LAB)** | |
| 1 | Verification of ohms law. | CO1 |
| 2 | Verification of Kirchoffs laws for DC circuits. | CO1 |
| 3 | Residential house wiring using switches, fuse, indicator, lamp and energy meter. | CO1 |
| 4 | Fluorescent lamp wiring. | CO1 |
| 5 | Stair case wiring. | CO1 |
| 6 | Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit. | CO2 |
| 7 | Measurement of energy using single phase energy meter. | CO2 |
| 8 | Study of Electronic components and equipments- Resistor Color Coding | CO2 |
| 9 | Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO. | CO2 |
| 10 | Study of logic gates AND, OR, EX-OR and NOT. | CO3 |
| 11 | Soldering practice – Components Devices and Circuits – Using general purpose PCB. | CO4 |
| 12 | P-N Junction Diode Characteristics | CO5 |
| 13 | Measurement of ripple factor of HWR | CO5 |

| | | |
|---|---|---|
| 14 | Input and Output Characteristics of Transistor in CB Configuration. | CO5 |
| | | **Total Periods :60** |

**Suggestive Assessment Methods**

| Lab Components Assessments (50 Marks) | End Semester Exams (50 Marks) |
|---|---|
| 1. EXPERIMENTS<br>2. Observation<br>3. Viva voce | 1. EXPERIMENTS<br>2. Record note<br>3. Viva voce |

**Outcomes**

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

CO1:Demonstrate the basic electrical laws and domestic wiring. (Apply)

CO2: Measure electrical quantities, energy and resistance. (Apply)

CO3:Design basic electronic / logic circuits.(Apply)

CO4:Perform soldering on electronic components in a PCB (Apply)

CO5:Measuring the characteristics of electronic components.(Apply)

**Text Books**

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, 2006.

**Reference Books**

1. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007.
2. Rajendra Prasad A. &Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002. 5. Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.
3. Laboratory Manual, Department of EEE, FXEC.

**Web Resources**

1. https://nptel.ac.in/courses/122106025/

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2** | **2** | **2** | | | | | | | **2** | | **2** | | | | |
| **3** | **2** | **2** | | | | | | | **2** | | **2** | | | | |
| **4** | **2** | **2** | | | | | | | **2** | | **2** | | | | |
| **5** | **2** | **2** | | | | | | | **2** | | **2** | | | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | Model exam+ Rubric based (50 marks) | END SEM PRACTICAL EXAM (50 marks) |
|---|---|---|
| REMEMBER | | |
| UNDERSTAND | | |
| APPLY | 50 | 50 |
| ANALYZE | | |
| EVALUATE | | |
| CREATE | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: :Demonstrate the basic electrical laws and domestic wiring (Apply)**

1. Verify and simulate Kirchhoffs voltage law for the given circuit.
2. Make a staircase wiring using two way controlled switch.

**COURSE OUTCOME 2: Measure electrical quantities, energy and resistance. (Apply)**

1. Measure the electrical quantities – voltage, current, power & power factor for the given RLC circuit.
2. Calculate energy consumed by the given load means of energy meter.

**COURSE OUTCOME 3: Design basic electronic / logic circuits.(Apply)**

1. Verify the combinational circuit and truth table for NOT and AND gate.
2. Verify the combinational circuit for adder which uses 2 bits.

**COURSE OUTCOME 4: Perform soldering on electronic components in a PCB (Apply)**

1. Assemble the following components as per the circuit diagram in the PCB.
2. Modify the given circuit as per the following by desoldering method.

**COURSE OUTCOME 5: Measuring the characteristics of electronic components.(Apply)**

1. Determine the VI characteristics of PN diode.
2. Determine the input characteristics of transistor which uses CB configuration.

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| | **BASIC ELECTRICAL LABORATORY** | |
| 1 | Verification of ohms law. | 2 |
| 2 | Verification of Kirchoffs laws for DC circuits. | 2 |
| 3 | Residential house wiring using switches, fuse, indicator, lamp and energy meter. | 2 |
| 4 | Fluorescent lamp wiring. | 1 |
| 5 | Stair case wiring. | 1 |
| 6 | Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit. | 2 |
| 7 | Measurement of energy using single phase energy meter. | 2 |
| | **BASIC ELECTRONICS LABORATORY** | |
| 8 | Study of Electronic components and equipments- Resistor Color Coding | 1 |
| 9 | Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO | 2 |
| 10 | Study of logic gates AND, OR, EX-OR and NOT. | 2 |
| 11 | Soldering practice – Components Devices and Circuits – Using general purpose PCB. | 2 |
| 12 | P-N Junction Diode Characteristics | 2 |
| 13 | Measurement of ripple factor of HWR | 2 |
| 14 | Input and Output Characteristics of Transistor in CB Configuration. | 2 |

| 21CS2512 | COMPUTER HARDWARE AND SOFTWARE TOOLS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |
| **Prerequisites for the course** | | | | | |

- Basic Knowledge about computer system
- Knowledge about hardware and software.

**Objectives**

1. Understand the basic hardware components
2. Gain knowledge about installation of operating systems
3. Understand hardware assembling and troubleshooting
4. Learn about MS Office tools.
5. Understand computer networking.

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | a) Study of desktop computer, motherboard and its interfacing components.<br>b) Install and configure computer drivers and system components. | **CO1** |
| 2 | Disk formatting, partitioning and Disk operating system commands | **CO1** |
| 3 | a) Install, upgrade and configure Windows/Linux operating systems.<br>b) Installation of Dual OS using Virtual Machine | **CO2** |
| 4 | a) Installation Antivirus and configure the antivirus.<br>b) Installation of printer and scanner software. | **CO2** |
| 5 | a) Assembly and Disassembly of hardware.<br>b) Troubleshooting and Managing Systems | **CO4** |
| 6 | a) Recovering the root file system after corruption.<br>b) Create a FAT32 formatted partition on a disk in Windows 7, and convert the partition to NTFS | **CO4** |
| 7 | Remote desktop connections and file sharing. | **CO3** |
| 8 | Study of basic network commands. Establish network connections, Configure IP address and Domain name system. | **CO3** |
| 9 | a) Create an advertisement page in Word<br>b) Create a Mail Merge Letter and a macro for inserting a picture and formatting the text in Word | **CO5** |
| 10 | Create a report in Excel containing the pay details of the Employee | **CO5** |
| 11 | Create a simple bar chart to high light the sales of a company for 5 different periods | **CO5** |

| | | |
|---|---|---|
| 12 | Create a macro which creates a line chart using the data in the worksheet | **CO5** |
| 13 | a) Make a presentation and apply the following:<br>a. Add audio and video effects<br>b. Apply various Color Schemes<br>c. Apply various animation schemes. | **CO5** |
| 14 | a) Create a simple Database / Tables using MS-Access<br>b) Mail Merge with MS – Access | **CO5** |
| | | **Total Periods : 60** |

**Suggestive Assessment Methods**

| **Lab Components Assessments (50 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|
| | |

**Outcomes:**

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

**CO1** Identify the basic hardware components

**CO2** Install and configure Windows and Linux operating systems.

**CO3** Install and configure software packages and drivers

**CO4** Assemble and troubleshoot hardware devices

**CO5** Install and work with office automation software

**Laboratory Requirements:**

- MS office
- System with windows

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | 3 | | | | | | | | | | 2 | | | |
| 3 | 3 | 3 | | | | | | | | | | 2 | | | |
| 4 | 3 | 3 | | | | | | | | | | 2 | | | |
| 5 | 3 | 3 | | | | | | | | | 2 | 2 | | | |

**Mandatory Course**

| **xxxx** | **TAMIL HERITAGE** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **1** | **0** | **0** | **0** |
| **UNIT I** | **LANGUAGE AND LITERATURE** | | | **3** | |
| Language Families in India-Dravidian Languages –Tamil as Classical Language –Classical Literature in Tamil – Secular Nature of Sangam Literature –Distributive Justice in Sangam Literature Management Principles in Thirukural -Tamil Epic sand Impact of Buddhism & Jainism in Tamil Land Bakthi Literature Azhwars and Nayanmars-Forms of minor Poetry development of Modern literature in Tamil-Contribution of Bharathiyar and Bharathidhasan. | | | | | |
| **UNIT II** | **HERITAGE-ROCK ART PAINTINGS TO MODERN ART–SCULPTURE** | | | **3** | |
| Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making- MassiveTerracotta sculptures, Village Deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils. | | | | | |
| **UNIT III** | **FOLK AND MARTIAL ARTS** | | | **3** | |
| Therukoothu, Karakattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam,Valari, Tigerdance-Sports and Games of Tamils. | | | | | |
| **UNIT IV** | **THINAI CONCEPT OF TAMILS** | | | **3** | |
| Flora and Fauna of Tamils & Agam and Puram Concept from Tholkappiyam and Sangam Literature -Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age-Export and Import during Sangam Age-Overseas Conquest of Cholas. | | | | | |
| **UNIT V** | **CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE** | | | **3** | |
| Contribution of Tamils to Indian Freedom Struggle-The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine–Inscriptions & Manuscripts–Print History of Tamil Books. | | | | | |
| **Total Periods** | | | | **15** | |

**TEXT-CUM-REFERENCE BOOKS**


1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL–(in print)
2. Social Life of the Tamils- The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi-'Sangam City Civilization on the banks of river Vaigai'(Jointly Published by:Department of Archaeology &TamilNadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to TamilNadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization(Jointly Published by:Department of Archaeology &TamilNaduText Book and Educational Services Corporation,Tamil Nadu)
8. Journey of Civilization Industo Vaigai(R.Balakrishnan)(Published by:RMRL)–Reference Book.

**Semester III**

| 21MA3205 | PROBABILITY AND STATISTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Preamble:**

This course provides an elementary introduction to probability and statistics with applications. Topics include: basic probability models; random variables; discrete and continuous probability distributions; statistical estimation and testing; confidence intervals; and an introduction to linear regression. Control charts are a statistical-based controlling tool that assists in monitoring the improvements in the process over time. The goal of these control charts would be to find any causes of variation as well as to analyze the process improvements that have been made.

**Prerequisites for the course**

Basic knowledge about measures of central tendencies and Probability.

**Objectives**

The Course will enable learners:

1. This course aims at providing the required skill to apply the statistical tools in engineering problems.

2. To introduce the basic concepts of random variables.

3. To introduce the basic concepts of two dimensional random variables.

4. To acquire the knowledge of testing hypotheses for small and large samples this plays an important role in real life problems.

5. To introduce the basic concepts of classifications of design of experiments this plays very important roles in the field of agriculture and statistical quality control.

| UNIT I | RANDOM VARIABLES | 9 + 3 |
|---|---|---|

Sample spaces – Events - Axiomatic approach to probability - Conditional Probability - Random variables - Discrete and continuous random variables – Discrete Distributions – Binomial and Poisson distributions – Continuous Distributions –Uniform and Normal distributions.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Discrete and continuous random variables, Distributions.

| UNIT II | TWO-DIMENSIONAL RANDOM VARIABLES | 9 + 3 |
|---|---|---|

Joint distributions – Marginal distributions and conditional distributions – Covariance – Correlation and Linear regression analysis for Statistical data only- Method of Least Squares - Curve Fitting.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on distributions, Correlation, regression.

| UNIT III | TESTING OF HYPOTHESIS | 9 + 3 |
|---|---|---|

Sampling distributions and Standard Error - Small samples and large samples - Test of hypothesis - Type I, Type II Errors - Large sample tests for mean – Small sample tests for mean – t and f test - Chi-Square distribution -Test of independence of attributes.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on Small sample tests for mean – t and f test, Chi-Square distribution.

| UNIT IV | DESIGN OF EXPERIMENTS | 9 + 3 |
|---|---|---|

Basic principles of experimentation - Analysis of variance – One-way classification – Completely Randomized Design –Two-way classification - Randomized Block Design – Comparison of CRD and RBD.

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on ANOVA, Completely Randomized Design

| UNIT V | STATISTICAL QUALITY CONTROL AND TIME SERIES | 9 + 3 |
|---|---|---|

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

**SUGGESTED EVALUATION METHODS:**

- Tutorial Problems on X and R charts, Control charts for attributes (p, c and np charts)

| | |
|---|---|
| **Total Periods** | **45 + 15 = 60 Periods** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. Descriptive Questions | 1.Assignment<br>2. Online Quizzes | 1. Descriptive Questions |

**Outcomes**

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

**CO1**. Apply the concepts of random variables which can describe real life phenomena. (Apply)

**CO2**. Apply the concepts of two-dimensional random variables which can apply in engineering applications. (Apply)

**CO3**. Testing of hypotheses for large samples and small samples in real life problems. (Analyze)

**CO4**. Analyze the design of experiments in the field of agriculture (Analyze)

**CO5**. Apply the charts of sampling distributions in engineering and management problems. (Apply)

**Text Books**

**T1.** Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

**Reference Books**

**R1** Devore. J.L., "Probability and Statistics for Engineering and the Sciences||, Cengage Learning, New Delhi, 8th Edition, 2014.

**R2** Papoulis, A. and Unnikrishna pillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010

**R3** Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.

**R4** Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004

**R5** Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

**R6**. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

**R7**. Hamdy A Taha, "Operations Research An introduction", 10th edition, Prentice Hall

**Web Resources**

1. Random variables - https://youtu.be/zujeSyREcQ4
2. Two dimensional random variables - https://youtu.be/ WM8vzYSQhs
3. Testing of hypothesis - https://youtu.be/8oNGkvuRP60
4. Design of experiments - https://youtu.be/KhjM8YI3agk
5. Statistical quality control - https://youtu.be/qb3mvJ1gb9g

**CO Vs PO Mapping and CO Vs PSO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **2** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **3** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **4** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |
| **5** | 3 | 2 | 1 | 1 | | | | 1 | 1 | | | 1 | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1 (CO 1) : (Apply)**

1) A random variable 'X' has the following probability function

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| p(x) | a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a |

(i) Determine the value of 'a'
(ii) Find $P(X < 3), P(X \geq 3), P(0 < X < 5)$
(iii) Find the distribution function of X.

2) If X is a continuous random variable with probability density function

$$f(x) = \{kx^2, \quad -1 < x < 1\ 0, \quad elsewhere$$

then find (i)The value of $k$

(ii) The mean and variance of X

(iii) $P(\frac{1}{3} \leq x < 4)$

**COURSE OUTCOME 2 (CO 2) : (Apply)**

1) If the joint p.d.f of (x,y) is given by p(x,y)=k(2x+3y), x= 0,1,2 &y =1,2,3.Find k and all the marginal and the conditional probability distribution of (x,y) & p(x+y>3)

2) If the joint PDF of X and Y is given by $f(x,y) = \{\frac{1}{8}(6 - x - y); 0 < x < 2, 2 < y < 4, 0 \quad else$ find

(a) $P[X < 1 \cap Y < 3]$ and $P[X < 1/Y < 3]$.

**COURSE OUTCOME 3 (CO 3) : (Analyze)**

1. A random sample of 200 tins of coconut oil gave an average weight of 4.95 kg. with a standard deviation of 0.21 kg. Do we accept that the net weight is 5 kg per tin at 5% level?
2. A sample of 26 bulbs gives a mean life of 990 hours with a S.D. of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours .Is the sample not up to the standard.

**COURSE OUTCOME 4 (CO 4) : (Analyze)**

1. Perform a two-way ANOVA on the data given below.

| Plots of Land | Treatments | | | |
|---|---|---|---|---|
| | A | B | C | D |

| | | | | |
|---|---|---|---|---|
| I | 38 | 40 | 41 | 39 |
| II | 45 | 42 | 49 | 36 |
| III | 40 | 38 | 42 | 42 |

2. The yield of four strains of a particular variety of wheat was planted in five randomized blocks in Kgs per plot is given below. Test for difference between blocks and strains.

| Blocks | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| strains | A | 32 | 34 | 34 | 35 | 36 |
| | B | 33 | 33 | 36 | 37 | 34 |
| | C | 30 | 35 | 35 | 32 | 35 |
| | D | 29 | 22 | 30 | 28 | 28 |

**COURSE OUTCOME 5 (CO 5) : (Apply)**

1. 35 successive samples of 100 castings each taken from a population line contained 3,3,5,3,5,0,3,2,3,5,6,5,9,1,2,4,5,2,0,10,3,6,3,2,5,6,3,3,2,5,1,0,7,4,3 reject able castings Construct a P chart and state whether the process is under control or not.
2. Ten units were inspected for non-conforming welds with the total number of defects as 360. Construct a C chart for the number of non-conforming welds.

| | | L | T | P | C |
|---|---|---|---|---|---|
| **21CB3601** | **OBJECT ORIENTED PROGRAMMING** | **3** | **0** | **0** | **3** |

**Preamble**

Object-Oriented Software Development is an approach/paradigm of developing software by identifying and implementing a set of objects and their interactions to meet the desired objectives. The first step towards this kind of software development is to learn and master the various concepts, tools and techniques that are to be used design and implementation of such systems.

**Prerequisites for the course**

• C Programming and Python Programming

**Objectives**

1. To understand Object Oriented Programming and Java concepts.
2. To define I/O streams and exception handling.
3. To know about Collection framework.
4. To design and build simple Graphical User Interfaces.
5. To develop a programming application with database connectivity.

| **UNIT I** | **INTRODUCTION TO OOP** | **9** |
|---|---|---|

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java -Java Programming Constructs - Objects and Classes - Methods - Constructors -Access Specifiers - Data Types – Variables – Operators - Control Statements – Arrays - Inheritance – Method Overloading and Overriding - Abstract Class – Interfaces– Packages – Access Modifiers

**SUGGESTED ACTIVITIES:**

Practical-Implementation of simple Java programs Using Java Basic Constructs and Arrays using any standard IDE like NETBEANS / ECLIPSE

EL – Understanding JVM

**SUGGESTED EVALUATION METHODS:**

• Assignment problems

• Quizzes

| **UNIT II** | **I/O AND EXCEPTION HANDLING** | **9** |
|---|---|---|

I/O Stream – Buffered Reader/Writer –File Input Stream – File Output Stream -Strings – String methods – String Comparison – Exception Handling –– Threads: Life Cycle – Creating Thread Using Thread Class and Runnable Interface – Thread Priorities-Multi Threading

**SUGGESTED ACTIVITIES:**

Practical - implementation of Java programs – use Inheritance, polymorphism, abstract classes and interfaces, creating user defined exceptions

EL – dynamic binding, need for inheritance, polymorphism, abstract classes and interfaces

**SUGGESTED EVALUATION METHODS:**

- Assignment problems
- Quizzes

| UNIT III | COLLECTION FRAMEWORK | 9 |
|---|---|---|

Collection framework – Collection Class: ArrayList, HashMap, Set, LinkedList –Iterating Collection –Collection Interface: List, Map- Collections class – iterating a collection – Filter – Optional Class – Map operations – sorting a collection using Comparable and Comparator Interface – Aggregation operations – min, max operations

**SUGGESTED ACTIVITIES :**

Practical - Using Generic classes and Collections framework, Using Comparative interface, list, stack
EL - Code Annotations

**SUGGESTED EVALUATION METHODS:**

- Assignment problems
- Quizzes

| UNIT IV | Applet and SWING | 9 |
|---|---|---|

Applet Basics- Applet Class and Methods -UI Controls (JLabel, JButton, JTextField, JPasswordField, JCheckBox, JRadioButton, JComboBox, JSpinner,JTable, JList, JOptionePane, JScrollBar, JMenuItem&JMenu, JProgressBar, JTabbedPane, JPanel, JScrollPane, JFrame) – Event Handling

**SUGGESTED ACTIVITIES :**

Practical - Implementations of Java programs – Creating applets, servlets, JSP

EL – Java based web servers

**SUGGESTED EVALUATION METHODS:**

- Assignment problems
- Quizzes

| UNIT V | JDBC | 9 |
|---|---|---|

JDBC Architecture – CRUD Operations using console application – CRUD Operations using Java Desktop Application– Struts: Introduction to Struts-Architecture Configuration Actions-Interceptors-Result Type.

**SUGGESTED ACTIVITIES :**

Practical - Implementations of Java programs – Creating UI with JSF, Implementing RMI

| |
|---|
| EL – creating UI with JSF |
| **SUGGESTED EVALUATION METHODS:**<br>• Quizzes |

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2.FORMATIVE MULTIPLE CHOICE QUESTIONS | 1.Assignment<br>2.Online Quizzes<br>3.Online Problem-Solving Platforms | 1.DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

CO 1 Develop Java programs using OOP principles.
CO 2 Explore I/O streams and build Java applications using and exception handling.
CO3 Develop Java applications using collection framework.
CO 4 Create user interfaces using Swing concepts.
CO 5 Develop interactive Java programs using JDBC and Struts.

**Text Books**

1. Anita Seth, B.L.Juneja, "JAVA one step ahead", Oxford University Press Publication, 2 nd Edition, 2018.

**Reference Books**

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, 2018.

**Web Recourses**

1. https://onlinecourses.nptel.ac.in/noc21_cs56

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |

| | | | | | |
|---|---|---|---|---|---|
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | 2 | 3 | | |
| 2 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | | |
| 3 | 3 | 2 | 3 | 3 | 2 | | | | | | | | 3 | | |
| 4 | 3 | 3 | 3 | 3 | | | | | | | | | 3 | | |
| 5 | 3 | 3 | 3 | 2 | 2 | 2 | | | | | | | 3 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Develop Java programs using OOP principles (Understand, Apply)
2. Create a simple Java program to implement basic Calculator Operations. (Apply)
3. Write a Java program to sort set of names stored in an array in alphabetical order. (Analyse)

**Course Outcome 2 (CO2):**

1. Write a Java program to implement user defined exception handling. (Apply)
2. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes. (Apply)

**Course Outcome 3 (CO3):**

1. Justify the statement: The Java Collections Framework provides the following benefit: Reduces programming effort. (Remember)

2. **Why Collection doesn't extend the Cloneable and Serializable interfaces?**

. (Understand)

**3 How the Collection objects are sorted in Java?. (Remember)**

**Course Outcome 4 (CO4):**

1. What happens when an applet is loaded ? (Remember)
2. What is the use of UI ControsJLabel. (Analyse)
3. How do you handle event in Java?. (understand)

**Course Outcome 5 (CO5):**

1. **How can we set null value in JDBC PreparedStatement? (Apply)**
2. Use CRUD Operations in Student Management System. (Apply)
3. Build a Simple CRUD App with Java. (Apply)

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **UNIT I - INTRODUCTION TO OOP** | | |
| 1 | Object Oriented Programming – Abstraction- objects and classes – Encapsulation | 1 |
| 2 | Inheritance – Polymorphism | 1 |
| 3 | OOP in Java – Characteristics of Java -Java Programming Constructs | 1 |
| 4 | Objects and Classes - Methods – Constructors | 1 |
| 5 | Access Specifiers - Data Types – Variables – Operators | 1 |
| 6 | Control Statements – Arrays | 1 |
| 7 | Inheritance | 1 |
| 8 | Method Overloading and Overriding - Abstract Class | 1 |
| 9 | Interfaces– Packages – Access Modifiers | 1 |
| **UNIT II- I/O AND EXCEPTION HANDLING** | | |
| 10 | I/O Stream – Buffered Reader/Writer | 1 |
| 11 | File Input Stream – File Output Stream | 1 |
| 12 | Strings – String methods | 1 |
| 13 | String Comparison | 1 |
| 14 | Exception Handling | |
| 15 | Threads : Life Cycle | 1 |
| 16 | Creating Thread Using Thread Class and Runnable Interface | 1 |
| 17 | Thread Priorities | 1 |
| 18 | Multi Threading | 1 |

| | | |
|---|---|---|
| **UNIT-III - COLLECTION FRAMEWORK** | | |
| 19 | Collection framework – Collection Class: ArrayList, HashMap, Set, LinkedList | 1 |
| 20 | Iterating Collection | 1 |
| 21 | Collection Interface: List, Map | 1 |
| 22 | Collections class – iterating a collection | 1 |
| 23 | Filter – Optional Class | 1 |
| 24 | Map operations | 1 |
| 25 | sorting a collection using Comparable and Comparator Interface | 1 |
| 26 | Aggregation operations | 1 |
| 27 | min, max operations | 1 |
| **UNIT-IV - Applet and SWING** | | |
| 28 | Applet Basics- Applet Class and Methods | 1 |
| 30 | UI Controls (JLabel, JButton, JTextField | 1 |
| 32 | JPasswordField, JCheckBox, JRadioButton, | 1 |
| 33 | JComboBox, JSpinner,JTable, JList | 1 |
| 34 | JOptionePane, JScrollBar | 1 |
| 35 | JMenuItem&JMenu | 1 |
| 36 | JProgressBar, JTabbedPane | 1 |
| 37 | JPanel, JScrollPane, JFrame | 1 |
| 38 | Event Handling | 1 |
| **UNIT-V –JDBC** | | |
| 37 | JDBC Architecture | 1 |
| 38 | CRUD Operations using console application | 1 |
| 39 | CRUD Operations using Java Desktop Application | 2 |
| 40 | Struts: Introduction to Struts | 1 |
| 41 | Architecture Configuration Actions | 2 |
| 42 | Interceptors | 1 |

| | | |
|---|---|---|
| 43 | Result Type | 1 |

| 21CB3602 | SOFTWARE ENGINEERING METHODOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Software engineers shall commit themselves to making the analysis, specification, design, development, testing and maintenance of software a beneficial and respected profession.

**Prerequisites for the course**

- C Programming

**Objectives**

1. To explore the fundamental concepts of software engineering
2. To understand fundamental concepts of requirements engineering and Analysis Modelling.
3. To understand the various software testing methodologies
4. To learn the software project management principles
5. To learn about Agile and Devops model

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Definition of terms - The evolving role of Software – Software characteristics - Software applications- Waterfall life cycle model -Evolutionary Process Model – Incremental Process Model – RAD model- Agile Process Model.

**SUGGESTED ACTIVITIES**:

- In-class activity on Application specific Product and Process view
- External Learning on impact of unified process models on Quality Software Development

**SUGGESTED EVALUATION METHODS:**

- Assignments: Selection of suitable software process models for a given software specification
- Tutorial problems: Identification of Sample Application for each process model and justify the same stating reasons.

| UNIT II | REQUIREMENT ANALYSIS AND DESIGN | 9 |
|---|---|---|

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirement's elicitation and analysis, requirements validation, requirements management-Designing Concepts – Data Flow Diagram.

**SUGGESTED ACTIVITIES:**

- External Learning: Using open-source tools for RE to understand the requirements traceability and interdependency among the functionalities provided by the software project.

**SUGGESTED EVALUATION METHODS:**

- Tutorial on various Requirements elicitation mechanisms and selection of an appropriate strategy.
- Assignment on Requirements categorization (considering contradicting, omission, commission of requirements) in a software project

| UNIT III | TESTING | 9 |
|---|---|---|

Software testing fundamentals - Test case design: White box testing - Basis path testing - Control structure testing. Black box testing - Testing strategies - Unit testing - Integration testing - System testing – Acceptance Testing-Testing Tools – Test Case Management.

**SUGGESTED ACTIVITIES:**

- External Learning: Understanding the requirements (SRS) and designing a suitable test suite.
- External Learning: Determine valid interfaces for integration testing and design necessary stub and driver modules
- External Learning on ideas of testing a simple online application on selected test cases
- Tutorial on using Automation software for testing

**SUGGESTED EVALUATION METHODS:**

- Assignment on obtaining a mind-map on testing strategies • Assignment: Testing of Sample application using any OSS on Software Test Automation

| UNIT IV | SOFTWARE PROJECT MANAGEMENT | 10 |
|---|---|---|

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis, Planning : Project Plan, Planning Process, Risk Management – Identification, Projection – Risk Mitigation, Monitoring and Management Plan.

**SUGGESTED ACTIVITIES:**

- External Learning on using tools for estimating Software Cost

**SUGGESTED EVALUATION METHODS:**

- Tutorial: Identification of potential risks for a software project during development/ maintenance and tabulate.
- Assignment: Using a Software Configuration Management template for a software project

| UNIT V | Introduction to DevOps and Scrum | 8 |
|---|---|---|

DevOps: Need for DevOps – DevOps Life Cycle – DevOps and Agile – Team Structure. Scrum: Scrum Framework – Srcum Role – Team Structures - Scrum Ceremonies and Artifacts

**SUGGESTED ACTIVITIES:**

- External Learning on Software Quality Models
- In-class activity on FP metrics & Variants
- External Learning on Software Test Lifecycle

**SUGGESTED EVALUATION METHODS:**

- Assignment: Calculation of test metrics for sample application

| **Total Periods** | **45** |
|---|---|

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO1:** Demonstrate about software engineering concepts and software development process models.

**CO2:** Able to identify the requirements, Use appropriate design to implement the requirement and document.

**CO3:** Recognize the knowledge about implementation, testing methods and comparison of various testing techniques

**CO4:**Develop a project schedule and handle the risk.

**CO5:**Understand the role of DevOps and Scrum in delivering a quality product.

**Text Books**

1. Roger S.Pressman, “Software Engineering: A Practitioner's Approach”, 8th Edition, Tata McGraw Hill Edition, 2015. (Unit I -IV)
2. Len Bass, Ingo Weber , Liming Zhu “DevOps: A Software Architect's Perspective”, First Edition, Addison-Wesley, 2015. (Unit V)

3. Dave McKenna, "The Art of Scrum: How Scrum Masters Bind Dev Teams and Unleash Agility", Apress, 2016. (Unit V)

**Reference Books**

1. Ian Somerville, "Software Engineering", 10th Edition, Pearson, 2016.

2. Shari Lawrence Pfleeger, "Software Engineering: Theory and Practice", 4th Edition, Pearson Education, New Delhi, 2014.

Web Resources

1. https://www.tutorialspoint.com/software_engineering/index.htm
2. https://nptel.ac.in/courses/106/105/106105182/
3. https://www.javatpoint.com/software-engineering-tutorial
4. www.mhhe.com/pressman

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | 3 | | 3 | | | | | | | | 3 | | |
| 2 | 3 | | 3 | 3 | | | | | | | | | 3 | | |
| 3 | 3 | 3 | | 3 | 3 | | | | | | | | 3 | | |
| 4 | 3 | | 3 | | 2 | | | | 3 | | 2 | | 3 | | |
| 5 | 3 | 3 | 3 | | | | | | | | | | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Draw the software process model for the banking system (Apply)
2. Select software life cycle model suitable for weather monitoring system and justify your answer. (Apply)

**Course Outcome 2 (CO2):**

1. Classify the following as functional /non-functional requirements for a banking system

(a) Verifying bank balance

(b) Withdrawing money from bank

(c) Completion of transactions in less than one second.

(d) Extending the system by providing more tellers for the customers (Apply)

2. Explain how to manage changing requirements during the requirements elicitation process? (Understand)

**Course Outcome 3 (CO3):**

1. Using Boundary value analysis, design the black-box test suite for a software that computes the square root of an input integer which can assume values in the range of 0 to 5000. (Apply)
2. Explain how to broaden testing coverage and improve the quality of white box-testing. (Understand)

**Course Outcome 4 (CO4):**

1. Analyse on how are the software risks assessed. (Analyse)
2. Calculate the risk involved in building a model for power plant system.(Analyze)

**Course Outcome 5 (CO5):**

1. Who are the persons involved in building a team to develop a project for a banking sector. (Analyze)
2. List the activities of a scrum master to develop a team. (Understand)

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **PREREQUISITES TO THE COURSE** | | |
| 1 | Course objective, Course Outcome, Prerequisite, Introduction –Software Engineering – Need for SE | 1 |
| **UNIT I – INTRODUCTION** | | |
| 1 | Definition of terms | 1 |
| 2 | The evolving role of Software | 1 |
| 3 | Software characteristics | 1 |
| 4 | Software applications | 1 |
| 5 | Waterfall life cycle model | 1 |
| 6 | Evolutionary Process Model | 1 |
| 7 | Incremental Process Model | 1 |
| 8 | RAD model | 1 |
| 9 | Agile Process Model | 1 |
| **UNIT-II REQUIREMENT ANALYSIS AND DESIGN** | | |
| 10 | Software Requirements: Functional and Non-Functional | 1 |
| 11 | User requirements | 1 |
| 12 | System requirements | 1 |
| 13 | Software Requirements Document | 1 |
| 14 | Requirement Engineering Process | |

| | | |
|---|---|---|
| 15 | Feasibility Studies | 1 |
| 16 | Requirement's elicitation and analysis | 1 |
| 17 | requirements validation- requirements management | 1 |
| 18 | Designing Concepts – Data Flow Diagram. | 1 |
| **UNIT-III - TESTING** | | |
| 19 | Software testing fundamentals | 1 |
| 20 | Test case design: White box testing | 1 |
| 21 | Basis path testing - Control structure testing | 1 |
| 22 | Black box testing | 1 |
| 23 | Testing strategies | 1 |
| 24 | Unit testing | 1 |
| 25 | Integration testing | 1 |
| 26 | System testing - Acceptance Testing | 1 |
| 27 | Testing Tools – Test Case Management. | 1 |
| **UNIT-IV SOFTWARE PROJECT MANAGEMENT** | | |
| 28 | Software Project Management: Estimation | 2 |
| 29 | LOC, FP Based Estimation, | 2 |
| 30 | Make/Buy Decision COCOMO I & II Model | 1 |
| 31 | Project Scheduling | 1 |
| 32 | Scheduling, Earned Value Analysis, | 1 |

| | | |
|---|---|---|
| 33 | Planning : | 1 |
| 34 | Project Plan, Planning Process, Risk Management | 1 |
| 35 | Identification, Projection | 1 |
| 36 | Risk Mitigation, | 1 |
| 37 | Monitoring and Management Plan. | |
| **UNIT-V** | | |
| 38 | DevOps: Need for DevOps | 1 |
| 39 | DevOps Life Cycle | 1 |
| 40 | DevOps and Agile | 1 |
| 41 | Team Structure. Scrum: Scrum Framework | 1 |
| 42 | Srcum Role | 1 |
| 43 | Team Structures | 1 |
| 44 | Scrum Ceremonies and Artifacts | 1 |
| 45 | Scrum Ceremonies and Artifacts | 1 |

| **21HS4101** | **Principles of Management** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This subject is to familiarize the student with basic management concepts and behaviour processes in the organization. The course will be an introduction to the way in which a firm can develop its managerial thinking, mission and strategy.

**Prerequisites for the course**

- Basic management studies

**Objectives**

1. To enable the students to study the evolution of Management
2. To study the functions of management
3. To know about the principles of management
4. To learn the applications of the principles in an organization
5. To develop ideas on System and process of controlling

| UNIT I | INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS | 9 |
|---|---|---|

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership,– Current trends and issues in Management.

Suggestive Activity:

Assignment: "Management is oldest of the arts and youngest of the sciences".

| UNIT II | PLANNING | 9 |
|---|---|---|

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

Suggestive Activity:

Case Study on Decision Making

Assignment: Why Plan Fails? "Failure to plan is planning to fail".

| UNIT III | ORGANISING | 9 |
|---|---|---|

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization - Human Resource Management – HR Planning, Recruitment, selection.

Suggestive Activity:

Assignment: Identify The Reasons For The Conflicts Between Line And StaffManagers

Case Study Formal And Informal Organization

| UNIT IV | DIRECTING | 9 |
|---|---|---|

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication.

Suggestive Activity:

Assignment: Motivation is the core of management'.

| UNIT V | CONTROLLING | 9 |
|---|---|---|

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control– control and performance – direct and preventive control – reporting.

Suggestive Activity:

Assignment: Why planning and controlling are often described as the 'Siamese' twins of management.

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2.FORMATIVE MULTIPLE CHOICE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES<br>3.PROBLEM-SOLVING ACTIVITIES | 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Course Outcomes**

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

CO 1 Understand the managerial functions

CO 2 Plan the process and take decisions

CO 3 Organize the group with the charts and plans

CO 4 Lead the group with motivation and to know the communication process

CO 5 Use the controlling strategies for budget and all other performance

**Text Books**

1. Stephen P. Robbins & Mary Coulter, —Management||, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert —Management||, Pearson Education, 6th Edition, 2004.

**Reference Books**

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, —Fundamentals of Management Pearson Education, 7th Edition, 2011.
2. Robert Kreitner&MamataMohapatra, — Management, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich —Essentials of management Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, —Principles of Management, Tata McGraw Hill, 1999

**Web Resources**

1. https://nptel.ac.in/courses/110/105/110105146/
2. https://www.mindtools.com/pages/article/henri-fayol.htm

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**Understand the managerial functions

1. Recall the types of managers. (Remember)

2. Summarize the managerial roles and skills. (Understand)

3. Explain the concept ofCurrent trends and issues in Management. (Remember)

**Course Outcome 2 (CO2):**Plan the process and take decisions

1. What is nature and purpose of planning? (Remember)

2. Compare the Planning Tools and Techniques. (Understand)

3. Analyze the Decision making steps and process. (Analyze)

**Course Outcome 3 (CO3):**Organize the group with the charts and plans

1. Narrate the Formal and informal organization. (Understand)

2.Write about Job Design. (Remember)

3. Explain the Career planning and management (Understand)

**Course Outcome 4 (CO4):**Lead the group with motivation and to know the communication process

1. Whatdo you mean by motivation theories? (Remember)

2. Explain the job enrichment concept.(Understand)

3. Howeffective communication can be made? (Remember)

**Course Outcome 5 (CO5):**Usethe controlling strategies for budget and all other performance

1. What is the System and process of controlling? (Remember)

2. Explain Productivity problems and management (Understand)

3. Explaindirect and preventive control. (Remember)

**Case Study 01 on Decision Making**

The day has finally come: Mr. Rajesh is to assume the position of President of Metro Manufacturing. Metro is a widely respected producer of high quality control mechanisms. When the previous president retired, Rajesh was identified as the likely choice for assuming the post. He was respected for his competence in the field and for his ability to work with employees at all levels of operations. Rajesh arrived at work early this morning, not so much to work but to think. As he sits behind his new executive desk, drinking a cup of coffee, his thoughts go back to his early days with Metro.

Twenty years ago Rajesh was just a young man right out of college with no business experience and a degree in industrial management. He was hired as an assistant foreman and was placed immediately on the production line. “Oh, those were the days”, he thought. “Seems like there was a problem that required solving every minute”. Thank goodness for the standard operating procedures manuals (SOP’s) and for a foreman who was patient

enough to answer my questions, didn't have to make too many critical decisions then. But I sure was putting out a lot of daily fires".

As the nostalgia influence continues, Rajesh thinks back to the time when he was taken off the production line and promoted into middle management. "Things sure did change then", he thought. As production manager, he had to think further into the future. As a foreman, Rajesh was primarily concerned with meeting daily production requirements.

Now he had to plan weeks and even months in advance. The human and communication problems remained although it seems like the reports he had to write were longer. But, as he remembers, the major changes occurred because he had to do more creative thinking. Laughing to himself he thought about the time he went to the files to pull out on SOP for an unusual problem he had to confront and there was none. He was frustrated because he had to handle the problem with little assistance. But, as his analytical, decision-making, and conceptual ability increased, he found himself using his technical skills less and less.

Another cup of coffee provided the stimulus to think about the special promotion he made to vice-president of planning five year ago. It was a major hurdle in his life because he had been in heavy competition with five well-qualified managers. He had heard through the grapevine that he had received the position because he was able to think for himself.

But, even his past training did not fully prepare Rajesh for the demands of the job; he had to learn much of it on his own. Rather than thin months into the future, he now was required to envision years. Grinning, he remembered that at first he did not realize that there were so many people outside of production that he had to coordinate activities with. Marketing and finance had to be tied together with production. His conceptual and decision-making skills continued to increase. A long time ago, the benefits of the "good old" SOP's lost their value.

But now, as Rajesh looks at his desk plate which says "President" new thoughts run through his mind. A whole new world opens to him now. He wonders what new requirements will be placed on him. A twinge of fear moves through his body as the thoughts of the new job take hold. What skills will be now needed to be successful?

Questions

1. As the President of Metro Manufacturing, what specific skills will Rajesh need to be effective?
2. How do the demands of different levels of responsibility change as manager progresses up the hierarchy of an organization?
3. What general recommendations would you offer for Rajesh?

**Case Study 02 Formal And Informal Organization**

Mr. SrinivasaRaghavan, the Chairman of the Best Food ProductsCompany, was tired of being the only one in the company actually responsiblefor profits. While he had good vice-presidents in charge of finance, sales,advertising, manufacturing, purchasing, and product research, he realizedhe could not hold any of them responsible for company profits, as much ashe would like to. He often found it difficult even to hold them responsiblefor the contribution of their various areas to company profits. The salesvice-president, for example,

had rather reasonably complained that hecould not be fully responsible for sales when the advertising was ineffective,when the products wanted by customers were not readily available frommanufacturing, or when he did not have the new products he needed tomeet competition. Likewise, the manufacturing vice-president had somejustification when he made the point that he could not hold costs downand still be able to produce short runs so as to fill orders on short notice;moreover, financial controls would not allow the company to carry a largeinventory of everything.

Mr. Raghavan had considered breaking the company down into sixor seven segments by setting product divisions with a manager over eachwith profit responsibility. But he found that this would not be feasibleor economical since many of the company's branded food products wereproduced on the same factory equipment and used the same raw materialsand a sales person calling on a store or supermarket could far moreeconomically handle a number of related products than one or a few.Consequently, Mr. Raghavancame to the conclusion that the bestthing to do was to set up six product managers reporting to a productmarketing manager. Each product manager would be given responsibilityfor one or a few products and would oversee, for each product, all aspectsproduct research, manufacturing, advertising and sale thereby becomingthe person responsible for the performance and profits relating to theproducts.

Mr. Raghavan realized that he could not give these productmanagers actual line authority over the various operating departments ofthe company since that would cause each vice-president and his departmentto report to six product managers and the product marketing manager,as well as the president. He was concerned with this problem but knewthat some of the most successful larger companies in the world had usedthe product manager system. Moreover one o his friends on a universityfaculty told him that he must expect a certain amount of confusion in anyorganisation and that this might not be bad since it forced people to worktogether as teams.

Mr. Raghavan resolves to put in the product manager system in hisorganisation as outlined and hoped for the best. But he wondered how hecould avoid the problem of confusion in reporting relationships.

Questions

1. Do you agree with Mr.Raghavan's programme? State the exact problem in the case.
2. What would you do to avoid any confusion in this organisation?
3. Do you suggest any other organisation model for this business? If so, present the organisation chart of the same.

**COURSE CONTENT AND LECTURE SCHEDULE:**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **UNIT I - INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS** | | |
| 1 | Definition of Management – Science or Art | 1 |

| | | |
|---|---|---|
| 2 | Manager Vs Entrepreneur | 1 |
| 3 | Types of managers | 1 |
| 4 | Managerial roles and skills | 1 |
| 5 | Evolution of Management | 1 |
| 6 | Scientific, human relations , system and contingency approaches | 1 |
| 7 | Types of Business organization | 1 |
| 8 | Sole proprietorship, partnership | 1 |
| 9 | Current trends and issues in Management | 1 |
| **UNIT II-PLANNING** | | |
| 10 | Nature and purpose of planning | 1 |
| 11 | planning process | 1 |
| 12 | types of planning | 1 |
| 13 | objectives – setting objectives | 1 |
| 14 | policies | 1 |
| 15 | Planning premises | 1 |
| 16 | Strategic Management | 1 |
| 17 | Planning Tools and Techniques | 1 |
| 18 | Decision making steps and process | 1 |
| **UNIT-III – ORGANISING** | | |
| 19 | Nature and purpose – Formal and informal organization | 1 |

| | | |
|---|---|---|
| 20 | Organization chart | 1 |
| 21 | Organization structure | 1 |
| 22 | Types – Line and staff authority | 1 |
| 23 | Departmentalization – delegation of authority | 1 |
| 24 | Centralization and decentralization | 1 |
| 25 | Human Resource Management | 1 |
| 26 | HR Planning | 1 |
| 27 | Selection | 1 |
| **UNIT-IV- DIRECTING** | | |
| 28 | Foundations of individual and group behaviour | 1 |
| 29 | Motivation – Motivation theories | 1 |
| 30 | Motivational techniques | 1 |
| 31 | Job satisfaction- job enrichment | 1 |
| 32 | Leadership | 1 |
| 33 | types and theories of leadership – communication | 1 |
| 34 | Process of communication | 1 |
| 35 | Barrier in communication | 1 |
| 36 | Effective communication | 1 |
| **UNIT-V–CONTROLLING** | | |
| 37 | System and process of controlling | 1 |
| 38 | Budgetary control techniques. | 1 |

| | | |
|---|---|---|
| 39 | Non-budgetary control techniques | 1 |
| 40 | use of computers | 1 |
| 41 | use of IT in Management control | 2 |
| 43 | Control and performance | 1 |
| 44 | Direct and preventive control | 1 |
| 45 | Reporting | 1 |

| 21PT3902 | VERBAL ABILITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 1 |

**Preamble:**

This course is developed to enhance the Verbal competency of the students as Verbal Ability is commonly a part of the various competitive exams conducted. This course equips the students in all the aspects of grammar and helps to enhance comprehensive abilities and Analytical skills.

**Prerequisites for the course**

- Foundational English

**Objectives**

1. To help the student understand the importance of having his language skills kept ready for effective use.
2. To provide a host of varied opportunities for the student to hone his acquired language skills basic components, namely, Grammar, Vocabulary, Spelling and Comprehension.

| **Module I** | **Error Identification** | **6** |
|---|---|---|
| Articles, Tenses, Voices, Preposition, Conjunctions, Subject-verb agreement, Adverbials. | | |
| **Module II** | **Sentence Structure** | **6** |
| Parts of speech, Simple, Complex & Compound Sentences, Direct & Indirect Speech, Kinds of Sentences, Degrees of Comparison, Clauses. | | |
| **Module III** | **Verbal Reasoning** | **6** |
| Reading Comprehension, Analogies, Synonyms & Antonyms, Idioms, One word substitutes. | | |
| **Module IV** | **Coherence and Cohesion** | **6** |

| | | |
|---|---|---|
| Para-jumbles, Phrasal verbs, Modifiers, Punctuations, Misspelled words. | | |
| **Module V** | **Rhetorical reasoning** | **6** |
| Verbal syllogism, figures of speech. | | |
| **Suggested Assessment Activities:**<br>● MCQ test through Google forms or other online test platforms.<br>Eg. JavaPoint - Verbal Ability https://www.javatpoint.com/verbal-ability | | |
| | **Total Periods** | **30** |

**Suggestive Assessment Methods**

| Formative Assessment Test (20 Marks) | Continuous Assessment Test 1 (40 Marks) | Continuous Assessment Test 2 (40 Marks) |
|---|---|---|
| MCQ | MCQ | MCQ |

**Outcomes**

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

CO1: Identify the grammatical errors in a sentence.

CO2: Frame sentences using the correct syntax.

CO3: Understand the concepts stated in a sentence or paragraph and analyze using verbal reasoning.

CO4: Construct sentences logically and make the texts semantically meaningful as a whole.

CO5: Interpret and analyze texts on a deeper level.

**Text Books**

1. Wren, P.C., Martin, H, Prasada Rao, N.D.V. (1973–2010). High School English Grammar & Composition. New Delhi: Sultan Chand Publishers
2. Kumar, Sanjay, Pushp Latha. (2018) English Language and Communication Skills for Engineers, India: Oxford University Press.

**Reference Books**

1. Guptha S C, (2012) Practical English Grammar & Composition, 1 st Edition, India: Arihant Publishers
2. Steven Brown, (2011) Dorolyn Smith, Active Listening 3, 3 rd Edition, UK: Cambridge University Press.

**Web Resources:**

1. Indiabix : https://www.indiabix.com/online-test/verbal-ability-test/
2. All India Exams : https://www.allindiaexams.in/online-test/online-verbal-ability-test/all
3. faceprep: https://www.faceprep.in/verbal-ability/

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**Theory cum Practical Courses**

| 21CB3603 | DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Preamble**

The main objective of this course is to make the students understand the basic building blocks of computers, logic gates, combinational and sequential circuits and to conceptualize the basics of computer organizational and architectural issues.

**Prerequisites for the course**

- NIL

**Objectives**

1. To analyze and design combinational circuits.
2. To analyze and design sequential circuits
3. To understand the basic structure and operation of a digital computer
4. To study the design of data path unit, control unit for processor and to familiarize with the hazards.
5. To understand the concept of various memories and I/O interfacing.

| UNIT I | COMBINATIONAL LOGIC | 9 |
|---|---|---|

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers

**SUGGESTED ACTIVITIES**:

- EL - Exclusive OR function 52
- Practical - Simplification and implementation of Boolean functions

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| **UNIT II** | **SYNCHRONOUS SEQUENTIAL LOGIC** | **9** |
|---|---|---|

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

**SUGGESTED ACTIVITIES:**

- Flipped Class room
- Introduction to HDL – in class and EL based on that
- Practical - Implementation of the arithmetic circuits and getting started with HDL

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| **UNIT III** | **COMPUTER FUNDAMENTALS** | **9** |
|---|---|---|

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High-Level Language.

**SUGGESTED ACTIVITIES:**

- Mostly in Class
- Practical - Project demonstration and presentation

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| **UNIT IV** | **PROCESSOR** | **9** |
|---|---|---|

| | | |
|---|---|---|
| Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards. | | |
| **SUGGESTED ACTIVITIES:**<br>• In Class activity for place - value systems<br>• Practical – Abacus – Counting – Activity | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Tutorial problems<br>• Assignment problems<br>• Quizzes | | |
| **UNIT V** | **MEMORY AND I/O** | **9** |
| Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA | | |
| **SUGGESTED ACTIVITIES:**<br>• Combination of in class & Flipped<br>• Practical - Project demonstration and presentation | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Tutorial problems<br>• Assignment problems<br>• Quizzes | | |
| **Total Periods** | | **45+15** |
| **LIST OF EXPERIMENTS** | | **CO** |
| Verification of Boolean theorems using logic gates. | | **CO 1** |
| Design and implementation of combinational circuits using gates for arbitrary functions. | | **CO 1** |
| Implementation of 4-bit binary adder/subtractor circuits. | | **CO 1** |
| Implementation of code converters. | | **CO 1** |
| Implementation of BCD adder, encoder and decoder circuits | | **CO 1** |
| Implementation of functions using Multiplexers. | | **CO 1** |
| Implementation of the synchronous counters | | **CO 2** |
| Implementation of a Universal Shift register. | | **CO 2** |
| Simulator based study of Computer Architecture | | **CO 3** |
| **Suggestive Assessment Methods** | | |

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1** Design various combinational digital circuits using logic gates

**CO 2** Design sequential circuits and analyze the design procedures

**CO 3** State the fundamentals of computer systems and analyze the execution of an instruction

**CO 4** Analyze different types of control design and identify hazards

**CO 5** Identify the characteristics of various memory systems and I/O communication

**Text Books**


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


**Reference Books**


1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.


**Web Resources**

5. https://www.coursera.org/learn/digital-systems

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 2 | 2 | 3 | 2 | | | | | 2 | | | | 3 | | |
| 5 | 3 | 3 | | 3 | | | 3 | | | | | | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Show that NAND gate is a universal gate. (Analyze)
2. What is the basic function of a decoder? Explain basic 3- input decoder with diagram.(Apply)
3. Using the Karnaugh Map Method. Minimize the expression: X = A B C + A B C + A B C + A B C(Apply)

**Course Outcome 2 (CO2):**

1. Describe the mode of working of an edge triggered S-R flip flop.(Apply)

2. Describe the working of Ripple counter with the suitable diagram and counting sequence. How is the Ripple counter used in digital circuit?(Analyse)

3. Describe the working of a Master-Slave J-K flip flop with the help of clear Block diagram and state table. Explain the "Race-around condition" and discuss how the master-slave setup circumvents it?(Analyze)

**Course Outcome 3 (CO3):**

3. Distinguish between Fixed point and Floating-point representation of a given number. (Understand)
4. Perform the arithmetic operation in binary using 2's complement representation (i). (+42) + (-13) (ii) (-42) – (-13). (Apply)
5. Draw the connection between processor and memory and mention the functions of each component in the connection. (Understand)

**Course Outcome 4 (CO4):**

3. Explain the following a) Time shared common bus system b) Cross bar switch c) Multiport memory(Understand)
4. What is instruction hazard? Explain in detail how to handle the instruction hazards in pipelining with relevant examples (Remember)
5. Discuss in detail about the hardwired control unit with block diagram.(Apply)

**Course Outcome 5 (CO5):**

1. Write the formula for the average access time experienced by the processor in a system with two levels of caches(Analyse)
2. How data transfers can be controlled using handshaking technique?(Apply)
3. Draw the neat sketch of memory hierarchy and explain the need of cache memory?(Understand)

| 21AI3603 | **DATA STRUCTURES (Common to AI-DS and CSBS)** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**Preamble**

Data structures course focusing on effective programming than the syntax / semantics of any programming language. In other words, this course views the problem solving not just as solving the problem somehow but about solving the problem in the most efficient way.

**Prerequisites for the course**

- 21CS1501- Problem Solving and Logical Thinking using C

**Objectives**

1. To understand the concepts of ADTs
2. To Learn linear data structures – lists, stacks, and queues
3. To understand sorting, searching and hashing algorithms
4. To apply Tree and Graph structures
5. To learn the Sorting Techniques

| **UNIT I** | **LINEAR DATA STRUCTURES – LIST** | **9** |
|---|---|---|

Introduction to Data structures, Algorithms: Complexity –Time- Space trade off-Mathematicalnotations and functions- Asymptotic notations, Abstract Data Types (ADTs) – List ADT – array-based
implementation – linked list implementation ––singly, doubly and circularly linked lists

**SUGGESTED ACTIVITIES:**

- Practice designing algorithms for some small simple problems, proving their correctness, andestimated their complexity

**SUGGESTED EVALUATION METHODS:**

- Assignment - Based on design, correctness and efficiency
- Quizzes

| UNIT II | LINEAR DATA STRUCTURES – STACKS, QUEUES | 9 |
|---|---|---|

Stack ADT – Operations – Applications: Evaluating arithmetic expressions- Conversion of Infix to postfix expression- Nested function calls, Recursion, Towers of Hanoi - Queue ADT: Operations - Circular Queue –Applications of queues

**SUGGESTED ACTIVITIES:**

- Practical- An application based on linear data structure
- Converting an algorithm from recursive to non-recursive using stack

**SUGGESTED EVALUATION METHODS:**

- Assignment Problem
- Quizzes

| UNIT III | NON LINEAR DATA STRUCTURES – TREES | 9 |
|---|---|---|

Tree ADT – tree traversals - Binary Tree ADT –binary search tree ADT –AVL Trees –B-Tree - B+Tree - Heap – Binary Heap – Applications of heap.

**SUGGESTED ACTIVITIES:**

- Applications of trees.
- Practical - Implementing tree traversals.

**SUGGESTED EVALUATION METHODS:**

- Assignment related to application
- Programming exercises in the laboratory
- Quizzes

| UNIT IV | NON LINEAR DATA STRUCTURES - GRAPHS | 9 |
|---|---|---|

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Minimum Spanning Trees – Kruskal and Prim algorithm – Shortest path algorithm – Dijkstra's algorithm

**SUGGESTED ACTIVITIES:**

- Applications of graph.
- Practical - Implementing graphtraversals.

**SUGGESTED EVALUATION METHODS:**

- Assignment Problem
- Programming exercises in the laboratory
- Quizzes

| UNIT V | SEARCHING, SORTING AND HASHING TECHNIQUES | 9 |
|---|---|---|

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort -Hashing- Hash Functions – Separate Chaining – Open Addressing

**SUGGESTED ACTIVITIES:**

- Comparison of internal sorting algorithms
- Practical – Implementation of Hash table

**SUGGESTED EVALUATION METHODS:**

- Programming exercises in the laboratory
- Quizzes

| | |
|---|---|
| **Total Periods** | **45** |

| S.No | List of Experiments | CO |
|---|---|---|

| | | |
|---|---|---|
| **1** | Linked List implementation of Queue ADT | CO1,CO2 |
| 2 | Linked List implementation of Stack ADT | CO1,CO2 |
| 3 | Applications of Stack | CO2 |
| 4 | Implementation of Binary Trees and operations of Binary Trees | CO3 |
| 5 | Graph – Breath First Search | CO4 |
| 6 | Graph – Depth First Search | CO5 |
| **Total Periods** | | **45 Theory+ 30 lab** |

**Laboratory Requirements**

- Windows with C, Turbo C++ 3.2.

**Suggestive Assessment**

| Continuous Assessment Test (20 Marks) | Lab Components Assessments (30 Marks) | End Semester Exams (50 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. LAB EXPERIMENTS(20)<br>2. MODEL EXAMINATION(10) | **1. DESCRIPTIVE QUESTIONS**<br>**2. CASE BASED QUESTIONS** |

**Outcomes**

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

1. Understand the concept of abstract data types, algorithms, Big O notation (Understand)
2. Understand basic data structures such as arrays, linked lists, stacks and queues.(Apply)3.Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data (Apply) 4.Solve real world problems involving Graph, Tree, Heap (Apply) 5.Evaluate the suitability of different data structures for solving computing problems (Analyze)

**Text Books**

| | | Unit I | Unit II | Unit III | Unit IV | Unit V |
|---|---|---|---|---|---|---|
| **T1** | Mark Allen Weiss, —Data Structures and Algorithm Analysis in C‖, 2nd Edition, Pearson Education,1997 | Chp 1,Chp 2 | Chp 3 | Chp 4,Chp 6,Chp 8 | Chp 9 | C 5, p h 7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **T1** | Reema Thareja, ―Data Structures Using C‖, Second Edition , Oxford University Press, 2011 | Chp 1,Chp 2,Chp 6 | Chp 7,Chp 8 | Chp 9,Chp 10,Chp 11,Chp 12 | Chp 13 | C 1 |
| **R1** | D.S.Malik," data Structures using C++" ,Second edition,Course technology,2010 | Chp 5 | Chp 6,Chp 7,Chp 8 | Chp 11 | Chp 12 | C 9, p |
| **R2** | Paul Deital , Harvey deital , "C How to Program" , 8th Edition , Pearson,2016 | Chp 12 | _ | _ | _ | C |
| **W1** | https://www.programiz.com/dsa | All Topics | All Topics | All Topics | All Topics | T |
| **W2** | https://nptel.ac.in/courses/106102064 | Module 1,Module 3 | Module 2 | Module 5,Module 6 | Module 35,Module 29,Module 30 | M u 2 M ul |

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C‖, 2nd Edition, PearsonEducation,1997
2. Reema Thareja, ―Data Structures Using C‖, Second Edition , Oxford University Press, 2011

**Reference Books**

1.D.S.Malik," data Structures using C++" ,Second edition,Course technology,20102.Paul Deital , Harvey deital , "C How to Program" , 8th Edition , Pearson,2016

**Web Resources**

1. https://www.programiz.com/dsa
2. https://nptel.ac.in/courses/106102064

CO Vs PO Mapping and CO Vs PSO Mapping

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | |
| 2 | 3 | 3 | 3 | | | | | | | | | 3 | |
| 3 | 3 | 3 | 3 | | | | | | | | | 3 | |
| 4 | 2 | 3 | 3 | 3 | | | | | | | | 3 | |
| 5 | 2 | 3 | 3 | 3 | | | | | | | | | |

**COURSE LEVEL ASSESSMENT**

**QUESTIONSCOURSE OUTCOME 1:**

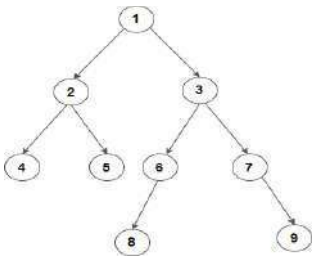
1. Given an array and a singly linked list. Which of these data structures uses more memory space
   to store the same number of elements? Justify your answer.(Understanding)
2. Which asymptotic notations can be used to describe the upper bound and lower bound ofalgorithm's running time and define also? (Remember)
3. Describe the functional code for deleting a desired node in a singly linked list (Understand)
4. Discuss the programming code in C language to create, insert and display the elements in adoubly linked list. (Apply)

**COURSE OUTCOME 2:**

1. Write the postfix form of each of the following infix. (Apply)A-B+(M/N)
   *(O+P)-Q/R^S*T+Z
   K+L-M*N+(O^P)*W/U/V*T+Q
2. Design a stack that returns minimum element in constant time (Analyze)
3. Given a 5 element stack S (from top to bottom: 2, 4, 6, 8, 10), and an empty queue Q, removethe elements one-by-one from S and insert them into Q, then remove them oneby-one from Qand re-insert them into S. List the elements in S (from top to bottom).(Analyze)

**COURSE OUTCOME 3:**

1. Given a binary tree, find all ancestors of a given node in it.(Understand)




2. Explain the following
   a) Complete Binary Tree
   b) Binary Tree
   C) Binary Search Tree. (Understand)
3. Write an algorithm to print complete binary search tree in increasing order. (Apply)
4. Suppose inorder and preorder traversal of a binary tree: (Analyse)Inorder D, B, H, E, A, I, F, J, C, G
   Preorder A, B, D, E, H, C, F, I, J, G

**COURSE OUTCOME 4:**

1. Describe taking an example "linked representation of graph" (Understand)
2. Prove that the maximum number of edges that a graph with n Vertices is n*(n-1)/2. (Apply)
3. Explain Dijkstra's algorithm with an example? (Apply)

**COURSE OUTCOME 5:**

1. How the insertion sort is done with the array? (Apply)
2. Develop a C program to sort the elements using bubble sort and insertion sort (Apply)

Let m = 17, h1(x) = (k+15)%m, h2(x) = (4k+11)%m, and h3(x) = (7k+2)%m. Insert the keys 23,7, 50, and 91 into the bit vector, and show the resulting vectors content. Then, find a key that is afalse positive; that is, find a key that appears to have been inserted, but wasn't.(Analyze)

**Practical Course**

| 21CB3611 | OBJECT ORIENTED PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- Java Programming

**Objectives**

1. To build java programming skills for real-world applications.

2. To understand and develop java packages.
3. To understand and apply the principles of inheritance, interface and abstract class in java applications.
4. To apply the concepts of ArrayList, abstract class, file processing, exception handling, multi-threading and Collection framework.
5. To develop java applications using event handling and JDBC.

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | Program to implement Classes, Constructors, Overloading and Access Control. | **CO 1** |
| 2 | Programs to implement Inheritance. | **CO 1** |
| 3 | Program using Interfaces and Array. | **CO 1** |
| 4 | Program using Class methods | **CO 2** |
| 5 | Program to implement Exception Concepts. | **CO 2** |
| 6 | Program using File Concepts. | **CO 3** |
| 7 | Program using Packages. | **CO 3** |
| 8 | Program using Threads. | **CO 4** |
| 9 | Program to implement Applet/Swing Application. | **CO 4** |
| 10 | Program using JDBC Application. | **CO 5** |
| 11 | Program to implement Structs. | **CO 5** |

| S.No. | List of Projects | Related Experiment | CO |
|---|---|---|---|
| **16.** | Currency Conversion system | Exp. 1,2,3,4 | CO1- CO5 |
| **17.** | ATM System | Exp. 5,6,7,8 | CO1- CO5 |
| **18.** | Airline Reservation System | Exp. 1 – 11 | CO1- CO5 |
| **19.** | Library Management System | Exp. 1,3,4,5,9 | CO1- CO5 |
| **20.** | Chatting Application | Exp. 1 – 11 | CO1- CO5 |
| **21.** | Inventory System | Exp. 2,3,4,10 | CO1- CO5 |
| **22.** | College management system | Exp. 1,2,3,7,8 | CO1- CO5 |
| **23.** | Number Guessing Game | Exp. 3,5,6,7 | CO1- CO5 |
| **24.** | Electricity billing system | Exp. 1 – 11 | CO1- CO5 |

| | | | |
|---|---|---|---|
| **25.** | Healthcare management System | Exp. 1 – 11 | CO1- CO5 |
| **26.** | Digital Clock | Exp. 1,2,3,10,11 | CO1- CO5 |
| **27.** | Quiz Application | Exp. 1,2,4,6 | CO1- CO5 |
| **28.** | Stock management system | Exp. 4,6,7,10 | CO1- CO5 |
| **29.** | Payroll Management System | Exp. 1 – 11 | CO1- CO5 |
| **30.** | Exam Seating Arrangement System | Exp. 1 – 11 | CO1- CO5 |
| **31.** | Hotel booking system | Exp. 1 – 11 | CO1- CO5 |
| **32.** | Movie ticket booking system | Exp. 1 – 11 | CO1- CO5 |
| **33.** | Currency conversion system with digital wallet | Exp. 1 – 11 | CO1- CO5 |
| **34.** | Online shopping system | Exp. 1 – 11 | CO1- CO5 |
| **35.** | Hostel Management system | Exp. 1 – 11 | CO1- CO5 |

**Suggestive Assessment Methods**

| **Lab Components Assessments (50 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|
| **50** | **50** |

**Outcomes**

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

| | |
|---|---|
| **CO1** | Develop and implement Java programs for real-world applications. |
| **CO2** | Understand and apply the principles of inheritance, interface and abstract class in java applications. |
| **CO3** | Implement the concepts of Array List, abstract class, file processing, exception handling |
| **CO4** | Design and develop GUI applications using AWT, Applet, Swing, collection frame work and facilitate appropriate event handling facilities. |
| **CO5** | Develop web applications which communicate with database |

**Laboratory Requirements**

**HARDWARE**: Intel Desktop Systems: 36 nos Printers: 02

**SOFTWARE:** System Software: Microsoft Windows 7 Academic Get Genuine Legalization License Application Software‟s: MS Office, Antivirus (Symantec Endpoint Protection 12.1.5) Net Beans 8.0.2, JDK 7.0.

**Reference Books**


1. Herbert Schildt, "Java: The Complete Reference", 10th edition, McGraw Hill Education, 2017, ISBN-10: 1259589331.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 11th Edition, Prentice Hall, 2019.


**Web Recourses**

1. https://searchapparchitecture.techtarget.com/definition/object-oriented-programming-OOP
2. https://en.wikipedia.org/wiki/Object-oriented_programming
3. https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/
4. https://www.webopedia.com/TERM/O/object_oriented_programming_OOP.html

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | 2 | | | | | 2 | | 3 | | |
| 2 | 3 | 3 | 3 | | | 2 | | | | | 2 | | 3 | | |
| 3 | 3 | 3 | 3 | | 1 | 2 | | | | | | 1 | 3 | | |
| 4 | 3 | 3 | 3 | | 1 | 2 | | | | | | 1 | 3 | | |
| 5 | 3 | 3 | 3 | | 1 | 2 | | | | | | 1 | 3 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:**

1. Write a java program to illustrate the concept of class and object creation. (Apply)
2. Write java program for salary calculation. (Create)

**COURSE OUTCOME 2:**

1. Write a java program to implement inheritance. (Apply)
2. Write a java program to implement abstract class. (Apply)

**COURSE OUTCOME 3:**

1. Write a java program to implement I/O, Throwing and Catching exceptions. (Apply)
2. Create a Java program to read and write a file. (Create)

**COURSE OUTCOME 4:**

1. Write a java program to implement Designing Packages. (Apply)
2. Create arithmetic calculator using packages. (Create)

**COURSE OUTCOME 5:**

1. Write a java program to create multithreads in Java applications. (Create)
2. Write a java program to implement Event driven programming (Apply)

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF WEEKS REQUIRED |
|---|---|---|
| 1 | Program to implement Classes, Constructors, Overloading and Access Control. | 1st week |
| 2 | Programs to implement Inheritance. | 1st week |
| 3 | Program using Interfaces and Array. | 2nd week |
| 4 | Program using Class methods | 2nd week |
| 5 | Program to implement Exception Concepts. | 3rd week |
| 6 | Program using File Concepts. | 3rd week |
| 7 | Program using Packages. | 4th week |
| 8 | Program using Threads. | 4th week |
| 9 | Program to implement Applet/Swing Application. | 5th week |
| 10 | Program using JDBC Application. | 5th week |
| 11 | Program to implement Structs. | 6th week |

| | | L | T | P | C |
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| | | | | | |
|---|---|---|---|---|---|
| **xxxx** | **TECHNOLOGY IN TAMIL CULTURE** | **1** | **0** | **0** | **0** |

| | | |
|---|---|---|
| **UNIT I** | **WEAVING AND CERAMIC TECHNOLOGY** | **3** |

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

| | | |
|---|---|---|
| **UNIT II** | **DESIGN AND CONSTRUCTION TECHNOLOGY** | **3** |

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

| | | |
|---|---|---|
| **UNIT III** | **MANUFACTURING TECHNOLOGY** | **3** |

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads -Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gemstone typesdescribed in Silapathikaram.

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

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

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

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

| | |
|---|---|
| **Total Periods** | **15** |

## TEXT-CUM-REFERENCEBOOKS


1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL–(in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian,Dr.K.D. Thirunavukkarasu) (Published by:International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:

International Institute of Tamil Studies.)
5. Keeladi-'Sangam City Civilization on the bank of river Vaigai'(Jointly Publishedby: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to TamilNadu (Dr.K.K.Pillay )(Published By:TheAuthor)
7. Porunai Civilization (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)Journey of Civilization Industo Vaigai(R.Balakrishnan)(Published by:RMRL)–Reference Book

| 21HS1103 | TAMIL HERITAGE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 1 |

**Preamble**: This course is offered to equip students to create awareness of the contribution of Tamil people to Indian culture by highlighting the characteristics of Tamil language and literature and exhibiting Tamil culture through traditional arts such as performing arts and fine arts.

**Prerequisites for the course:**

The prerequisite knowledge required to study this course is basic knowledge in English and Tamil Heritage.

| UNIT I | LANGUAGE AND LITERATURE | 6 |
|---|---|---|

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

| UNIT II | HERITAGE-ROCK ART PAINTINGS TO MODERN ART–SCULPTURE | 6 |
|---|---|---|

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

| UNIT III | FOLK AND MARTIAL ARTS | 6 |
|---|---|---|

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

| UNIT IV | THINAI CONCEPT OF TAMILS | 6 |
|---|---|---|

| | | |
|---|---|---|
| Flora and Fauna of Tamils & Agam and Puram Concept from Tholkappiyam and Sangam Literature -Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age-Export and Import during Sangam Age-Overseas Conquest of Cholas. | | |
| **UNIT V** | **CONTRIBUTION OF TAMILS TO INDIAN NATIONALMOVEMENT AND INDIAN CULTURE** | **6** |
| Contribution of Tamils to Indian Freedom Struggle-The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine–Inscriptions & Manuscripts–Print History of Tamil Books. | | |
| **Total Periods** | | **30** |

Course Outcomes:

| | |
|---|---|
| **CO1** | To widen the knowledge on the characteristics of Tamil language and literature. |

**CO2** To explore the traditional Tamil fine arts and its techniques of

Tamil Heritage. **CO3** To evaluate the various types of performing arts

and their cultural context.

| | |
|---|---|
| **CO4** | To get an insight on the lifestyle and living techniques of Tamil ancestors. |
| **CO5** | To recognise and perceive the role played by Tamils in the unity and development of India. |

**CO PO Mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | 1 | 2 | 3 | 1 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2** | | | | | | | | **1** | **3** | **2** | **3** | **2** |
| **3** | | | | | | | | **1** | **3** | **2** | **1** | **2** |
| **4** | | | | | | | | **3** | **2** | **2** | **3** | **2** |
| **5** | | | | | | | | **2** | **3** | **3** | **2** | **3** |

**TEXT-CUM-REFERENCE BOOKS**

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL–(in print)
2. Social Life of the Tamils- The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi-'Sangam City Civilization on the banks of river Vaigai'(Jointly Published by:Department of Archaeology &TamilNadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to TamilNadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization(Jointly Published by:Department of Archaeology &TamilNadu Text Book and Educational Services Corporation,Tamil Nadu)
8. Journey of Civilization Industo Vaigai(R.Balakrishnan)(Published by:RMRL)–Reference Book.

| **21HS1103** | தமிழர் மரபு L 2 | **T** | **P** | **C** |
|---|---|---|---|---|
| | | **0** | **0** | **1** |

மு Preamble)

இப்பாடத்திட்டம் ப ொ ாறியியல் பயிலும் முதலாம் ஆண் டு மாணவரக் ளின் முதலாம் பருவத்திற்கு உரியF. தமிழ் ம ொ ாழி மற்றும் இலக்கியத்தின் தன் ரம கரள எடுத்Fரர த்F மரபுக் கரல களான நிகழ்த்F கரல கள் மற்றும் நுண் கரல கள் வழியாகத் தமிழ்ப் பண் பாட்ரட புலப்படுத்தி இந்திய பண் பாட்டிற்கு தமிழரக் ள் ஆற்றிய பங்கிரன மாணவரக் ள் அறியச் ொச ய்தல்.

பாடொந றிக்கானமுன் நிபந்தரன கள் **(Prerequisites for the course)**

தமிழ் ம ொ ாழியில் எழுத படிக்க ொத ரிந்திருத்தல் அவசியம்.

| அலகு I | ம ொ ாழி மற்றும் இலக்கியம் | 6 | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| இந்திய ம ொ ாழிக் குடும்பங் கள் - திராவிட ம ொ ாழிகள் - தமிழ் ஒரு ொச ம் ம ொ ாழி - தமிழ் ொச வ் விலக்கியங் கள் - சங் க இலக்கியத்தின் சமய சார்பற்ற தன் ரம - சங் க இலக்கியத்தில் பகிரதல் அறம் - திருக்குறளில் மம லாண் ரம க் கருத்Fக்கள் - தமிழ் காப்பியங் கள் தமிழகத்தில் சமண ப ொ dத்த சமயங் களின் தாக்கம் - சிற்றிலக்கியங் கள் - தமிழில் நவனீ இலக்கியத்தின் வளரச் ்சி- தமிழ் இலக்கிய வளரச் ்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகிய ம ாரின் பங் களிப்பு. | | | |
| - பாரற ஓவியங் கள் முதல் நவனீ ஓவியங் கள் வரர - சிற்பக்கரல **6**<br>நடுகல் முதல் நவனீ சிற்பங் கள் வரர - ஐம் ப ொ ான் சிரல கள் - பழங் குடியினர் மற்றும் அவரக் ள் தயாரிக்கும் ரக விரன ப் ப ொ ாருட்கள் , ப ொ ாம் ரம கள் - மத ர் ொச ய் யும் கரல - சுடுமண் சிற்பங் கள் - நாட்டுப்புறத் ொத ய் வங் கள் - குமரி முரன யில் திருவள்ளுவர் சிரல - இரச க் கருவிகள் - மிருதங் கம் , பரற , வரணீ ரண, யாழ், நாதஸ் வரம் - தமிழரக் ளின் சமூக<br>ப ொ ாருளாதார வாழ்வில் க ம ாவில் களின் பங் கு..<br>அலகு **III** நாட்டுப்புறக் கரல கள் மற்றும் வரீவிரள யாட்டுகள் **6** | | | |
| ொத ருக்கூத்F, கரகாட்டம் , வில் லுப்பாட்டு, கணியான் கூத்F, ஒயிலாட்டம் , த ம ால் பாரவ க்கூத்F, சிலம் பாட்டம் , வளரி, புலியாட்டம் , தமிழரக் ளின் விரள யாட்டுகள் | | | |
| அலகு **IV** | தமிழரக் ளின் திரண க் க ம ாட்பாடுகள் | **6** | |
| தமிழகத்தின் தாவரங் களும் , விலங் குகளும் - த ொ ால் காப்பியம் மற்றும் சங் க இலக்கியத்தில் அகம் மற்றும் புறக் க ம ாட்பாடுகள் - தமிழரக் ள் ப ம ாற்றிய அறக்க ம ாட்பாடு - சங் க காலத்தில் தமிழகத்தில் எழுத்தறிவும் , கல் வியும் - சங் க கால நகரங் களும் Fரற முகங் களும் - சங் க காலத்தில்<br>ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் ச ம ாழரக் ளின் ொவ ற்றி. | | | |
| அலகு **V** | இந்திய மத சிய இயக்கம் மற்றும் இந்திய பண் பாட்டிற்குத் தமிழரக் ளின் பங் களிப்பு | **6** | |
| இந்திய விடுதரல ப்ப ம ாரில் தமிழரக் ளின் பங் கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண் பாட்டின் தாக்கம் - சுயமரியாரத இயக்கம் - இந்திய மருத்Fவத்தில் சித்த மருத்Fவத்தின் பங் கு - கல் ொவ ட்டுகள் , ரக ொய ழுத்Fப்படிகள் - தமிழ் புத்தகங் களின் அ சு வரலாறு | | | |
| **Total Periods** | | **30** | |

[redacted]ப[redacted]மு[redacted]

| | |
|---|---|
| **CO1** | மாணவரக் ள் தமிழ் ம ொ ாழி மற்றும் இலக்கியத்தின் தன் ரம கள் குறித்F அறிந்F க ொ ாள்வார். |
| **CO2** | தமிழ் மரபு சார்ந்த நுண் கரல கரள யும் அதன் நுட்பங் கரள யும் புரிந்F க ொ ாள்வர். |

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| **CO3** | நிகழ்த்F கரல களின் வரக கரள யும் அதன் பண் பாட்டுச் சூழரல யும் அறிந்F க ொ ாள்வர். |
| **CO4** | பழந்தமிழரின் வாழ்க்ரக ச் சூழல் கரள அறிந்F க ொ ாள்வர். |
| **CO5** | இந்திய ஒருரம ப்பாட்டிற்கும் வளரச் ்சிக்கும் தமிழரக் ள் ஆற்றிய பங் கு குறித்F அறிவர். |

**CO PO Mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | | | | | | | **1** | **2** | **3** | **1** | **3** |
| **2** | | | | | | | | **1** | **3** | **2** | **3** | **2** |
| **3** | | | | | | | | **1** | **3** | **2** | **1** | **2** |
| **4** | | | | | | | | **3** | **2** | **2** | **3** | **2** |
| **5** | | | | | | | | **2** | **3** | **3** | **2** | **3** |

**TEXT-CUM REFERENCE BOOKS**

1. தமிழக வரலாறு - மக்களும் பண் பாடும் - மக . மக பிள்ரள ( ொவ ளியடு ீ : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் -முரன வர் இல. சுந்தரம் ( விகடன் பிரசுரம்).
3. கீழடி - ரவ ரக நதிக்கரர யில் சங்க கால நகர நாகரிகம் ( த ொ ால்லியல் Fரற ொவ ளியடு ீ ). 4. ப ொ ாருரந - ஆற்றங்கரர நாகரிகம் ( த ொ ால்லியல் Fரற ொவ ளியடு ீ )

| Semester IV | | | | | |
|---|---|---|---|---|---|
| **21CB4901** | **INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP** | **L** | **T** | **P** | **C** |
| | | **3** | 0 | 0 | 3 |

**Preamble**

Entrepreneurship refers to the process of developing new business ventures or growing existing ones. Innovation is an important prerequisite for gaining a competitive advantage and building a strong and sustainable business. Modern thriving enterprise demand constant levels of innovation.

**Prerequisites for the course**

- 21CB5501 – Introduction to Innovation, IP Management and Entrepreneurship

**Objectives**

- How to identify and discover market needs
- How to manage an innovation program
- How to create, protect, acetize and commercialize intellectual property
- Opportunities and challenges for entrepreneurs

| **UNIT I** | **INNOVATION** | **9** |
|---|---|---|

A primer on Innovation, IP Rights and Entrepreneurship, Types of Innovation (incremental, disruptive, etc.), Lifecycle of Innovation (idea, literature survey, PoT, PoC, etc.), Challenges in Innovation (time, cost, data, infrastructure, etc.), co-innovation and open innovation (academia, start-ups and corporates)

**SUGGESTED ACTIVITIES:**

- Engage in Forced Connections
- Engage in a Brainstorming Session

**SUGGESTED EVALUATION METHODS:**

- **Quizzes**
- **online Platform working**
- **Programming exercises in Lab**

| **UNIT II** | **INTELLECTUAL PROPERTY RIGHT** | **9** |
|---|---|---|

Types of IPR (patents, copyrights, trademarks, GI, etc.), Lifecycle of IP (creation, protection, assetization, monetization), Balancing IP risks & rewards (Right Access and Right Use of Open Source and 3rd party products, technology transfer & licensing), IP valuation (methods, examples, limitations).

**SUGGESTED ACTIVITIES:**

- Debate
- Group discussion

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| **SUGGESTED EVALUATION METHODS:**<br>• **Quizzes**<br>• **Assignment**<br>• **Tutorial** | | |
| **UNIT III** | **ENTREPRENEURSHIP I** | **9** |
| Opportunity identification in technology entrepreneurship (customer pain points, competitive context), Market research, segmentation & sizing, Product positioning & pricing, go-tomarket strategy, Innovation assessment (examples, patentability analysis). | | |
| **SUGGESTED ACTIVITIES:**<br>• Practical | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Quizzes | | |
| **UNIT IV** | **ENTREPRENEURSHIP II** | **9** |
| Startup business models (fund raising, market segments, channels, etc.), Innovation, Incubation & Entrepreneurship in Corporate Context, Technology-driven Social Innovation & Entrepreneurship, Manage innovation, IP and Entrepreneurship Programs | | |
| **SUGGESTED ACTIVITIES:**<br>• Practical | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Quizzes | | |
| **UNIT V** | **APPLICATIONS** | **9** |
| Case study – A technology innovation that resulted in an IP portfolio which was commercialized by an entrepreneur. | | |
| **SUGGESTED ACTIVITIES:**<br>• Practical | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Quizzes<br>• Online platform | | |
| | **Total Periods** | **45** |

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|---|---|---|
| **Continuous Assessment Test (30 Marks)** | **FORMATIVE ASSESSMENT TEST (10)** | **End Semester Exams (60 Marks)** |

| | | |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br><br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. MCQ<br>2. Assignment<br>3. Tutorials. | 1. DESCRIPTIVE QUESTIONS<br><br>2. FORMATIVE MUL<br><br>3. TIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1** Summarize the life cycle and types of innovation.

**CO 2** Interpret the needs, benefits and procedure of filing an IPR.

**CO 3** Examine a business plan to ensure success of a start-up.

**CO 4** Devise an innovative idea, protect it through IPR and explore the scope of converting it to a start-up.

**Text Books**

1. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail

**Reference Books**

1. Valuation and Deal making of Technology-Based Intellectual Property: Principles, Methods and Tools, http://razgaitis.com/books/dealmaking/

**Web Resource**

Spin-Outs: Creating Businesses from University Intellectual Property,https://www.oreilly.com/library/view/spin-outs-creating-businesses/9781906659424/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 2 | 1 | | | | | | | | | 2 | |
| 2 | 2 | 2 | 2 | 2 | 1 | | | | | | | | | 2 | |
| 3 | 2 | 2 | 2 | 2 | 1 | | | | | | | | | 2 | |
| 4 | 2 | 2 | 1 | 2 | 1 | | | | | | | | | 2 | |
| 5 | 1 | 1 | 2 | 2 | 1 | | | | | | | | | 1 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 20 | 5 | 5 | 10 |
| UNDERSTAND | 20 | 20 | 5 | 5 | 20 |
| APPLY | 60 | 60 | 10 | 10 | 70 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:**

**1. What is meant by Brain storming? .(Understand)**

**2. Comment on Open-minded exploration of the marketplace drivers of innovation(Analyse)**

**3. Point out the types of Innovation? (Apply)**

**COURSE OUTCOME 2:**

**1. Justify Technological Innovation. (Apply)**

**2. Identify the types of creativity?(Understand)**

**3. Give an elaborate note on the different techniques in brain storming and how problems are solved by this.(Apply)**

**COURSE OUTCOME 3:**

**1. What do you meant by Achievement motivation?(Understand)**
**2. Identify the Economic Factors? (apply)**
**3. "Entrepreneurship as a Career"- comment this statement(Analyse)**

**COURSE OUTCOME 4:**

**1. List out the characteristics of a successful Training programme? (Apply)**

**2. What are the uses of Job Rotation?(Remember)**

**3. Narrate the Role of Government in Supporting Entrepreneurship? (Understand)**

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **PREREQUISITES TO THE COURSE** | | |
| 1 | Principles of Management | 1 |
| **UNIT – I INNOVATION** | | |
| 1 | A primer on Innovation, | 1 |
| 2 | IP Rights and Entrepreneurship, | 1 |
| 3 | IP Rights and Entrepreneurship, | 1 |
| 4 | Types of Innovation (incremental, disruptive, etc.), | 1 |
| 5 | Types of Innovation (incremental, disruptive, etc.), | 1 |
| 6 | Lifecycle of Innovation (idea, literature survey, PoT, PoC, etc.), | 1 |
| 7 | Lifecycle of Innovation (idea, literature survey, PoT, PoC, etc.), | 1 |
| 8 | Challenges in Innovation (time, cost, data, infrastructure, etc.), | 1 |
| 9 | co-innovation and open innovation (academia, start-ups and corporates) | 1 |
| **UNIT – II INTELLECTUAL PROPERTY RIGHT** | | |
| 10 | Types of IPR (patents, copyrights, trademarks, GI, etc.), | 1 |
| 11 | Types of IPR (patents, copyrights, trademarks, GI, etc.), | 1 |
| 12 | Lifecycle of IP (creation, protection, assetization, monetization), | 1 |
| 13 | Lifecycle of IP (creation, protection, assetization, monetization), | 1 |
| 14 | Balancing IP risks & rewards (Right Access and Right Use of Open Source and 3rd party products, technology transfer & licensing), | 1 |

| | | |
|---|---|---|
| 15 | Balancing IP risks & rewards (Right Access and Right Use of Open Source and 3rd party products, technology transfer & licensing), | 1 |
| 16 | Balancing IP risks & rewards (Right Access and Right Use of Open Source and 3rd party products, technology transfer & licensing), | 1 |
| 17 | IP valuation (methods, examples, limitations). | 1 |
| 18 | IP valuation (methods, examples, limitations). | 1 |
| **UNIT – IIIENTREPRENEURSHIP I** | | |
| 19 | Opportunity identification in technology entrepreneurship (customer pain points, competitive context), | 1 |
| 20 | Opportunity identification in technology entrepreneurship (customer pain points, competitive context), | 1 |
| 21 | Opportunity identification in technology entrepreneurship (customer pain points, competitive context), | 1 |
| 22 | Market research, segmentation & sizing, | 1 |
| 23 | Market research, segmentation & sizing, | 1 |
| 24 | Product positioning & pricing, go-tomarket strategy, | 1 |
| 25 | Product positioning & pricing, go-tomarket strategy, | 1 |
| 26 | Innovation assessment (examples, patentability analysis) | 1 |
| 27 | Innovation assessment (examples, patentability analysis) | 1 |
| **UNIT – IV ENTREPRENEURSHIP II** | | |
| 28 | Startup business models (fund raising, market segments, channels, etc.), | 1 |
| 29 | Startup business models (fund raising, market segments, channels, etc.), | 1 |

| | | |
|---|---|---|
| 30 | Innovation, Incubation & Entrepreneurship in Corporate Context, | 1 |
| 31 | Innovation, Incubation & Entrepreneurship in Corporate Context, | 1 |
| 32 | Innovation, Incubation & Entrepreneurship in Corporate Context, | 1 |
| 33 | Technology-driven Social Innovation & Entrepreneurship, | 1 |
| 34 | Technology-driven Social Innovation & Entrepreneurship, | 1 |
| 35 | Manage innovation | 1 |
| 36 | IP and Entrepreneurship Programs | 1 |
| **UNIT – V APPLICATIONS** | | |
| 37 | Case study – A technology innovation that resulted in an IP portfolio which was commercialized by an entrepreneur. | 1 |
| 38 | Case study – A technology innovation that resulted in an IP portfolio which was commercialized by an entrepreneur. | 1 |
| 39 | Case study – A technology innovation that resulted in an IP portfolio which was commercialized by an entrepreneur. | 1 |
| 40 | Case Study report submission | 1 |
| 41 | Case Study report submission | 1 |
| 42 | Case Study report submission | 1 |
| 43 | Case study presentation | 1 |
| 44 | Case study presentation | 1 |
| 45 | Case study presentation | 1 |

| 21CS4601 | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course provides the fundamental knowledge about database concepts and its realisation using relational data model. It focuses not only on data storage and retrieval but provides deeper understanding on eliminating redundant data and efficient data management as a whole for seamless transactions, security and recovery.

**Prerequisites for the course**

- Data structures

**Objectives**

1. To teach the basic database concepts, Entity Relationship model and Relational model
2. To describe the basics of SQL and construct queries using SQL
3. To demonstrate the use of constraints, relational algebra operations and Normal forms
4. To emphasize the importance of transaction processing and concurrency control
5. To describe data storage mechanisms and query processing techniques

| UNIT I | INTRODUCTION TO DATABASE DESIGN | 9 |
|---|---|---|

Introduction and applications of DBMS- Purpose of data base- Data Independence- Data models, Database System architecture- Database user Levels, Mappings–DBA- ER Diagrams - Entities, Attributes, Relationships, Constraints, keys - Extended ER features, Generalization, Specialization, Aggregation- Conceptual design with the E-R Model.

**SUGGESTED ACTIVITIES**

- Discussion about the overview of databases

**SUGGESTED EVALUATION METHODS**

- Assignment on creating E-R diagrams
- Quiz on database and data models

| UNIT II | STRUCTURED QUERY LANGUAGE | 10 |
|---|---|---|

SQL: Basics of SQL, DDL, DML,DCL, TCL-Enforcing integrity constraints- IN/NOT IN operators- aggregate functions-Built-in functions – numeric, date, string functions, set operations, views, sub queries, nested subqueries. Use of group by, order by, having, join and its types- triggers - cursors – functions - stored procedures

**SUGGESTED ACTIVITIES**

- Demonstrate the use of SQL queries

**SUGGESTED EVALUATION METHODS**

- Assignment on SQL
- Quiz on SQL

| UNIT III | RELATIONAL ALGEBRA AND SCHEMA REFINEMENT | 9 |
|---|---|---|

Introduction to the relational model- Querying relational data- Mapping E-R model to relational model - Relational algebra operations- functional dependencies and types- Armstrong axioms- normalization- Normalforms: 1NF, 2NF, 3NF,4NF,5NF,BCNF- properties and types of decompositions

**SUGGESTED ACTIVITIES**

- Solve problems regarding normalization

**SUGGESTED EVALUATION METHODS**

- Quiz on relational algebra operations

| | | |
|---|---|---|
| • Quiz on normal forms | | |
| **UNIT IV** | **TRANSACTIONS MANAGEMENT** | **10** |
| Transaction concepts- transaction states- ACID properties- implementation of atomicity and durability- schedules- Serializability- implementation of isolation- transaction definition in SQL- concurrent executions- need for concurrency- concurrency control- two phase commit and two phase locking protocol – Time stamping –Backup and Recovery techniques | | |
| **SUGGESTED ACTIVITIES** | | |
| • Discussion on types of concurrency control techniques | | |
| **SUGGESTED EVALUATION METHODS** | | |
| • Quiz on transaction concepts | | |
| **UNIT V** | **DATA STORAGE, QUERYING AND RECENT TRENDS** | **7** |
| Physical Storage structures- RAID-File Organization-Indexing and types- Ordered indexing- B trees- B+ trees- Hashing and types- Query processing- Query optimization and cost estimation- Advanced Topics: case study on parallel database and distributed database | | |
| **SUGGESTED ACTIVITIES** | | |
| • Perform insertion and deletion operations on B trees and B+ trees | | |
| **SUGGESTED EVALUATION METHODS** | | |
| • Assignment on storage techniques<br>• Comparison report on parallel and distributed database | | |
| | **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE MCQ | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1Understand the basic concepts of Database Systems in Database design using ER Modelling
CO2 Apply SQL queries to interact with the database
CO3 Apply normalization on database design to eliminate anomalies
CO4Analyze database transactions and can control them by applying ACID properties
CO5Understand the concepts of indexing, hashing and query processing

**Text Books**

1. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition,Tata McGraw Hill, New Delhi,India, 2016.

**Reference Books**

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2019), Database System Concepts, 7th edition, McGraw-Hill, New Delhi,India.
2. ElmasriNavate, Fundamentals of Database Systems, Pearson Education,India, 2016.

**Web Resources**

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.geeksforgeeks.org/dbms/
3. https://www.guru99.com/what-is-dbms.html

4. https://searchsqlserver.techtarget.com/definition/database-management-system
5. https://onlinecourses.nptel.ac.in/noc21_cs04/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 2 | 3 | 3 | 3 | | 3 | 3 | | | | | | | 3 | | |
| 3 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 4 | 3 | 3 | 3 | | 3 | 3 | | | | | | | 3 | | |
| 5 | 2 | 3 | 3 | | 2 | 2 | | | | | | | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Discuss about applications of Database Systems?(Remember)
2. Draw the ER diagram for a company needs to store information about employees identified by ssn, with salary and phone as attributes), departments (identified by dno, with dname and budget as attributes), and children of employees (with name and age as attributes). Employees work in departments, each department is managed by an employee; a child must be identified uniquely by name when the parent (who is an employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company. (Understand)

**Course Outcome 2 (CO2):**

1. Consider a university database and design an E-R diagram. Write SQL statements to create the corresponding relations and capture as many of the constraints as possible. If you cannot capture some constraints, explain why. (Apply)

2. Consider the following query: Find the names of sailors with a higher rating than all sailors with age<21. The following two SQL queries attempt to obtain the answer to this question. Do they both compute the result? If not, explain why? Under what conditions would they compute the same result? (Apply)
   (a) selectS.sname from sailors S where not exists (select * from sailors S2 where S2.age<21 and S.rating<=S2.rating)
   (b) select * from Sailors S where S.rating> ANY( select S2.rating from sailors S2 where S2.age<21)

**Course Outcome 3 (CO3):**

1. Consider a relation R with five attributes ABCDE. You are given the following dependencies. A->B, BC->E and ED->A (Apply)
   (a) List all keys for R.
   (b) Is R in 3NF?
   (c) Is R in BCNF?
2. Assume that you are given a relation with attributes ABCD. (Apply)
   (a) Assume that no record has null values. Write an SQL query that checks whether the functional dependency A->B holds.
   (b) Assume again that no record has null values. write an SQL assertion that enforces the functional dependency A-> B.
   (c) Let us assume that records could have null values. Repeat the previous two questions under this assumption.

**Course Outcome 4 (CO4):**

1. Consider the following actions taken by transaction T1 on database object X and Y: R(X), W(X), R(Y), W(Y) (Analyze)
   (a) Analyse if another transaction T2 is run concurrently to transaction T without some form of concurrency control, could it interfere with T1?
   (b) State your opinion whether the use of Strict 2PL would prevent interference between two transactions.
   (c) Strict 2PL is used in many database systems. Give two reasons for its popularity.
2. We call a transaction that only reads database object a read-only transaction; otherwise it is called read-write transaction. Give brief answers to the following questions. (Analyze)
   (a) What happens to the database throughput if the number of read-only transactions is increased?
   (b) What happens to the database throughput if the number of read-only transactions is increased?

**Course Outcome 5 (CO5):**

1. Why should we create clustered indexes? What is co-clustering and when should we use it? ( Understand)
2. What are the choices for managing locks in a distributed DBMS? What issues must be considered in optimizing queries over distributed data? ( Understand)

## COURSE CONTENT AND LECTURE SCHEDULE

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **UNIT I - INTRODUCTION TO DATABASE DESIGN** | | |
| 1 | Introduction and applications of DBMS, Purpose of data base | 1 |
| 2 | Data Independence, Data models | 1 |
| 3 | Database System architecture | 1 |
| 4 | Database user Levels, Mappings, DBA | 1 |
| 5 | ER Diagrams - Entities, Attributes, Relationships | 1 |
| 6 | Constraints, keys | 1 |
| 7 | Extended ER features, Generalization | 1 |
| 8 | Specialization, Aggregation | 1 |
| 9 | Conceptual design with the E-R Model | 1 |
| **UNIT II-STRUCTURED QUERY LANGUAGE** | | |
| 10 | SQL: Basics of SQL, DDL | 1 |
| 11 | DML,DCL, TCL | 1 |
| 12 | Enforcing integrity constraints, IN/NOT IN operators | 1 |
| 13 | aggregate functions, Built-in functions, numeric, date, string functions | 1 |
| 14 | set operations, views | 1 |
| 15 | sub queries, nested sub queries | 1 |
| 16 | Use of group by, order by, having, join and its types | 1 |
| 17 | Triggers and Cursors | 1 |
| 18 | PL/SQL functions, procedures | 1 |
| **UNIT-III RELATIONAL ALGEBRA AND SCHEMA REFINEMENT** | | |
| 19 | Introduction to the relational model | 1 |
| 20 | Querying relational data, Mapping E-R model to relational model | 1 |
| 21 | Relational algebra operations | 1 |

| | | |
|---|---|---|
| 22 | Functional dependencies and types | 1 |
| 23 | Armstrong axioms | 1 |
| 24 | Normalization | 1 |
| 25 | Normalforms: 1NF, 2NF | 1 |
| 26 | 3NF,4NF,5NF | 1 |
| 27 | BCNF- properties and types of decompositions | 1 |
| **UNIT-IVTRANSACTIONS MANAGEMENT** | | |
| 28 | Transaction concepts, transaction states, ACID properties, implementation of atomicity and durability | 1 |
| 30 | Schedules, Serializability | 2 |
| 32 | Implementation of isolation, transaction definition in SQL | 1 |
| 33 | Concurrent executions- need for concurrency- concurrency control | 2 |
| 34 | Two phase commit and two phase locking protocol | 2 |
| 35 | Time stamping | 1 |
| 36 | Backup and Recovery techniques | 1 |
| **UNIT-V DATA STORAGE, QUERYING AND RECENT TRENDS** | | |
| 37 | Physical Storage structures, RAID,File Organization | 1 |
| 38 | Indexing and types, Ordered indexing | 1 |
| 39 | B trees, B+ trees | 1 |
| 40 | Hashing and types | 1 |
| 41 | Query processing- Query optimization and cost estimation | 1 |
| 42 | Advanced Topics: case study on parallel database | 1 |
| 43 | Advanced Topics: case study on distributed database | 1 |

| 21IT4601 | INTRODUCTION TO ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | **3** | 0 | 0 | 3 |

**Preamble**

- Introduction to algorithms implies the use of efficient algorithms for developing a programming solution of a given problem. Selection of a particular data structure greatly influences the characteristics of the obtained solution that include efficiency (performance, or speed), space (memory) requirements, scalability, reuse, and robustness (or reliability). The other equally important skill is to choose a suitable problem solving technique to apply to a particular problem. Acquiring these skills, greatly enhances the problem solving skills of the learner.

**Prerequisites for the course**

- 21IT3601– Data Structures using C.

**Objectives**

- To learn the algorithm analysis techniques.
- To become familiar with the different algorithm design techniques.
- To understand the limitations of Algorithm power.

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.

| UNIT II | Divide-and-Conquer | 9 |
|---|---|---|

Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen‟s Matrix Multiplication.

| UNIT III | Dynamic Programming | 9 |
|---|---|---|

| | | |
|---|---|---|
| Dynamic Programming – Warshall‟s and Floyd‟s algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. - Bellman Ford algorithm | | |
| **UNIT IV** | **Greedy Technique and Approximation Algorithm** | **9** |
| Greedy Technique– Change-Making problem – Prim’s algorithm- Kruskal's Algorithm-Dijkstra's Algorithm-Huffman Trees - Approximation Algorithms for NP: Travelling Salesman problem – Knapsack problem. | | |
| **UNIT V** | **Backtracking and Branch and Bound** | **9** |
| Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem | | |
| | **Total Periods** | **45** |

| **Continuous Assessment Test (20 Marks)** | **FORMATIVE ASSESSMENT TEST (20)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. MCQ<br>2. Assignment<br>3. Tutorials. | 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO1:** Design algorithms for computing problems and analyze the time and space complexity of algorithms.

**CO2:** Design algorithms to solve problems using divide and conquer approach.

**CO3:** Design algorithms to solve problems using dynamic programming approach.

**CO4:** Design algorithms to solve problems using Greedy Strategy and approximation algorithms.

**CO5:** Design algorithms to solve problems using backtracking and branch bound approach.

**Text Books**

1. Bhasin, H., " Algorithms: Design and Analysis", India: Oxford University Press, 2015.
2. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

**Reference Books**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Fourth Edition, PHI Learning Private Limited, 2022.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Roughgarden, Tim. Algorithms Illuminated: Greedy algorithms and dynamic programming. Part 3. United States, Sound like yourself Publishing, LLC, 2019.

**Web Resources**

1. Introduction to Algorithm Analysis: https://nptel.ac.in/courses/106/105/106105164/

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 20 | | | 10 |
| UNDERSTAND | 20 | 20 | | | 20 |
| APPLY | 60 | 60 | | | 70 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:**

1. Write an algorithm to find the number of binary digits in the binary representation of positive decimal integer. (Apply)
2. Write down the general for the mathematical analysis of recursive algorithm and apply the same for analyzing the algorithm for solving Tower Hanoi Problem. (Apply)

**COURSE OUTCOME 2:**

1. Find all the solution to the traveling salesman problem (cities and distance shown below) by exhaustive search. Give the optimal solutions. (Apply)
2. Analyze the algorithm given below: (Analyze)

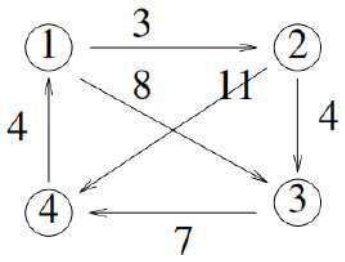
   Algorithm Search(A[0..n-1], k)

   //Input: An array A[0..n-1] sorted in ascending order and a search key k

```
l←0; r←n-1
while l ≤ r do
        m←[(l+r)/2]
        if k = A[m] return m
        else if k < A[m]  r←m-1
        else l←m+1
return -1
```

**COURSE OUTCOME 3:**

**1.** Design an algorithm to solve all pairs shortest path problem and illustrate the same for the graph given below. (Apply)




**COURSE OUTCOME 4:**

1. Design an approximation algorithm to solve the Knapsack problem and apply the same for the given set of items with a Knapsack of capacity $W = 5$. (Apply)

| item | Weight | value |
|---|---|---|
| 1 | 2 | $12 |
| 2 | 1 | $10 |
| 3 | 3 | $20 |
| 4 | 2 | $15 |

**COURSE OUTCOME 5:**

1. Assume that a backtracking algorithm which uses a stack has been designed to find a solution to the 4-Queen‟s problem on a 4x4 chess board. The algorithm has already completed an

unknown number of iterations say "k". After these "k" iterations, the chess board state and the state of the stack are as shown in Fig. 1 and Fig. 2 respectively. Infer the sequence of chess board configurations and the sequence of stack states for each of the iterations from 1 to k.

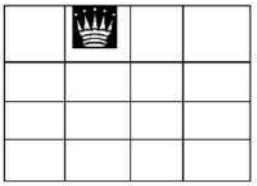


Figure 1

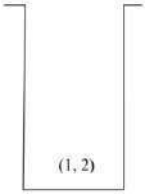



Figure 2

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **UNIT I - INTRODUCTION** | | |
| 1 | Notion of an Algorithm | 1 |
| 2 | Fundamentals of Algorithmic Problem Solving | 2 |
| 4 | Fundamentals of the Analysis of Algorithm Efficiency | 2 |
| 6 | Analysis Framework | 1 |
| 7 | Asymptotic Notations and its properties | 1 |
| 8 | Mathematical analysis for Recursive and Non-recursive algorithms. | 1 |
| 9 | Mathematical analysis for Recursive and Non-recursive algorithms. | 1 |
| **UNIT II-Divide-and-Conquer** | | |
| 10 | Divide and conquer methodology | 1 |
| 11 | Merge sort | 1 |
| 12 | Quick sort | 1 |
| 13 | Quick sort | 1 |
| 14 | Binary search | 1 |
| 15 | Binary search | 1 |

| | | |
|---|---|---|
| 16 | Multiplication of Large Integers | 1 |
| 18 | Strassen‟s Matrix Multiplication. | 2 |
| **UNIT-III DYNAMIC PROGRAMMING** | | |
| 19 | Dynamic Programming | 1 |
| 20 | Warshall‟s and Floyd‟s algorithm | 1 |
| 21 | Warshall‟s and Floyd‟s algorithm | 1 |
| 22 | Optimal Binary Search Trees | 1 |
| 23 | Optimal Binary Search Trees | 1 |
| 24 | Knapsack Problem and Memory functions. | 1 |
| 25 | Knapsack Problem and Memory functions. | 1 |
| 26 | Bellman Ford algorithm | 1 |
| 27 | Bellman Ford algorithm | 2 |
| **UNIT IV- Greedy Technique and Approximation Algorithm** | | |
| 29 | Greedy Technique | 1 |
| 30 | Change-Making problem | 1 |
| 31 | Prim’s algorithm | 1 |
| 32 | Kruskal's Algorithm- | 1 |
| 33 | Dijkstra's Algorithm-Huffman Trees | 1 |
| 34 | Approximation Algorithms for NP: | 1 |
| 35 | Travelling Salesman problem | 1 |
| 36 | Knapsack problem. | 1 |
| **UNIT V Backtracking and Branch and Bound** | | |
| 37 | Backtracking | 1 |
| 38 | n-Queens problem | 1 |
| 39 | Hamiltonian Circuit Problem | 1 |
| 41 | Subset Sum Problem | 1 |
| 42 | Branch and Bound | 1 |

| | | |
|---|---|---|
| 43 | Assignment problem | 1 |
| 44 | Knapsack Problem | 1 |
| 45 | Travelling Salesman Problem | 1 |

| 21CB4601 | FORMAL LANGUAGES AND AUTOMATA THEORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Preamble**

Formal Languages and Automata theory presents the theoretical aspects of computer science, and helps define infinite languages in finite ways; construct algorithms for related problems and decide whether a string is in language or not.

**Prerequisites for the course**

- Fundamentals of Programming

**Objectives**

1. Understand different formal language classes and their relationships
2. Construct the mathematical models
3. Develop grammars to recognize formal languages
4. Analyse the undesirability of complex problems
5. Analysethe complexity of computational problems

| UNIT I | REGULAR LANGUAGES AND FINITE AUTOMATA | 12 |
|---|---|---|

Alphabet-languages and grammars- Productions and derivation-Chomsky hierarchy of languages. Regular expressions and languages- Deterministic finite automata (DFA) and equivalence with regular expressions- Nondeterministic finite automata (NFA) and equivalence with DFA- Regular grammars and equivalence with finite automata - Properties of regular languages - Kleene's theorem - Pumping lemma for regular languages- Myhill- Nerode theorem and its uses

**SUGGESTED ACTIVITIES:**

- Defining automata for different types of patterns
- EL – Epsilon NFA to DFA direct conversion

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems

- Assignment problems
- Quizzes

| UNIT II | CONTEXT-FREE LANGUAGES AND PUSHDOWN AUTOMATA | 12 |
|---|---|---|

Context-free grammars (CFG) and languages (CFL)- Chomsky and Greibach normal forms - Nondeterministic pushdown automata (PDA) and equivalence with CFG - Parse trees- Ambiguity in CFG - Pumping lemma for context-free languages – Deterministic pushdown automata- Closure properties of CFLs.

**SUGGESTED ACTIVITIES:**

- Proofs in class
- EL – Regular expression for practical patterns

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| UNIT III | LINEAR BOUNDED AUTOMATA AND TURING MACHINES | 12 |
|---|---|---|

Context-sensitive grammars (CSG) and languages - Linear bounded automata and equivalence with CSG. The basic model for Turing machines (TM) - Turing recognizable (recursively enumerable) and Turing- decidable (recursive) languages and their closure properties Nondeterministic TMs and equivalence with deterministic TMs.

**SUGGESTED ACTIVITIES:**

- Flipped Class room – Moore and Mealy machines
- Problems based on properties – in-class and CSG

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| UNIT IV | UNDECIDABILITY | 12 |
|---|---|---|

Church-Turing thesis -Universal Turing machine – The universal and diagonalization languages Reduction between languages – Rice's theorem -Undecidable problems aboutlanguages.

**SUGGESTED ACTIVITIES:**

- UTM - CFG for practical programming constructs
- EL – Alternate theorems and proofs

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| UNIT V | COMPLEXITY THEORY | 12 |
|---|---|---|

Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines - P and NP, NP- completeness - Cook's Theorem, other NP - Complete problems

- NP – Problems based on context-free grammar
- Proofs of all the grammar equivalence – in-class

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| | |
|---|---|
| **Total Periods** | **45+15 Periods** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Assignment<br>2. Online Quizzes<br>3. Problem-Solving Activities | 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1**Design finite automata to recognize regular languages

**CO 2** Prove the equivalence of finite automata

**CO 3** Construct push down automata to accept context free languages and prove their equivalence

| |
|---|
| **CO 4** Generate Linear bounded automata and Turing Machines for a given computation and languages.<br><br>**CO 5** Analyze the undecidability of languages |
| **Text Books** |
| 1. Harry R.Lewis and Christos.H.Papadimitriou, Elements of The theory of Computation Pearson Education/PHI,2007 |
| **Reference Books** |
| 1. MichealSipser, Introduction of the Theory and Computation, Thomson Brokecole,2014 |
| **Web Resources**<br><br>https://nptel.ac.in/courses/111/103/111103016/ |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | | | | | | | | | | | 3 | | |
| 2 | 3 | | 3 | 3 | 3 | | | | | | | | 3 | | |
| 3 | 3 | 2 | 3 | 2 | 2 | | | | | | | | 3 | | |
| 4 | 3 | 2 | 2 | 3 | 2 | | | | | | | | 3 | | |
| 5 | 3 | 2 | 3 | 2 | | 2 | | | | | | | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 20 |
| UNDERSTAND | 40 | 20 | 5 | 5 | 20 |
| APPLY | 40 | 40 | 5 | 5 | 35 |

| | | | | | |
|---|---|---|---|---|---|
| ANALYZE | | 30 | 10 | 10 | 25 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:**

**Course Outcome 1 (CO1):**

1. DifferentiateDFA and NFA..(Understand)
2. Identify NFA-ɛtorepresenta*b |c. (Analyze)
3. Describe a Finite automata and give its types. (Analyze)

**Course Outcome 2 (CO2):**

1. Construct a finite automaton for theregularexpression0*1*. (Remember)
2. Express the ways of languages accepted by PDA and define them? (Understand)
3. Design equivalence of PDA and CFG. (Apply)

**Course Outcome 3 (CO3):**

1. Write a note on Turing machine as Transducers. (Remember)
2. Construct a Turing machine which multiplies two unary numbers. (Understand)
3. Point out the role of checking off symbols in a Turing Machine. (Analyze)

**Course Outcome 4 (CO4):**

1. When a problem is said to be decidable? Give an example of undecidable problem. Analyzeit.(Analyze)
2. Construct a Turing machine that recognizes the language $a^n b^n c^n$ (Remember)
3. Discuss the significance of universal turing machine and also construct a turing machine to add two numbers and encode it.(Understand)

**Course Outcome 5 (CO5):**

1. Assume that a problem (language) is decidable. Does that mean we can realistically solve it?.(Analyse)
2. What impact would P=BQP have on NP?Analyse)
3. Can NP-complete problems be solved in polynomial time?. (Apply)

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|

| | | |
|---|---|---|
| | | |
| 1 | Course objective, Course Outcome, Prerequisite, Introduction –Formal languages and Automata Theory – Need for the course | 1 |
| **UNIT I - REGULAR LANGUAGES AND FINITE AUTOMATA** | | |
| **1** | Alphabet-languages and grammars | 1 |
| **2** | Productions and derivation | 1 |
| **3** | Chomsky hierarchy of languages | 1 |
| **4** | Regular expressions and languages | 1 |
| **5** | Deterministic finite automata (DFA) and equivalence with regular expressions | 2 |
| **6** | Nondeterministic finite automata (NFA) and equivalence with DFA | 2 |
| **7** | Regular grammars and equivalence with finite automata | 1 |
| **8** | Properties of regular languages | 1 |
| **9** | Kleene's theorem | 1 |
| **10** | Pumping lemma for regular languages | 1 |
| **UNIT II- CONTEXT-FREE LANGUAGES AND PUSHDOWN AUTOMATA** | | |
| **11** | Context-free grammars (CFG) | 1 |
| **12** | Context-free languages (CFL) | 1 |
| **13** | Chomsky and Greibach normal forms | 2 |
| **14** | Nondeterministic pushdown automata (PDA) and equivalence with CFG | 2 |
| **15** | Parse trees | 1 |

| | | |
|---|---|---|
| **16** | Ambiguity in CFG | 1 |
| **17** | Pumping lemma for context-free languages | 1 |
| **18** | Deterministic pushdown automata | 2 |
| **19** | Closure properties of CFLs. | 1 |
| **UNIT-III LINEAR BOUNDED AUTOMATA AND TURING MACHINES** | | |
| **20** | Context-sensitive grammars (CSG) and languages | 1 |
| **21** | Linear bounded automata and equivalence with CSG | 1 |
| **22** | The basic model for Turing machines (TM) | 2 |
| **23** | Turing recognizable (recursively enumerable) | 2 |
| **24** | Turing- decidable (recursive) languages and their closure properties | 2 |
| **25** | Nondeterministic TMs | 2 |
| **26** | Nondeterministic TMs and equivalence with deterministic TMs | 2 |
| **UNIT IV– UNDECIDABILITY** | | |
| **27** | Church | 1 |
| **28** | Turing thesis | 2 |
| **29** | Universal Turing machine | 2 |
| **30** | The universal and diagonalization languages | 2 |
| **31** | Reduction between languages | 2 |
| **32** | Rice's theorem | 1 |

| | | |
|---|---|---|
| **33** | Undecidable problems aboutlanguages | 2 |
| **UNIT V- COMPLEXITY THEORY** | | |
| **34** | Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines | 3 |
| **35** | P and NP, NP- completeness | 3 |
| **36** | Cook's Theorem | 2 |
| **37** | other NP | 2 |
| **38** | Complete problems | 2 |

| **21HS3101** | **ETHICS AND VALUES** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**Preamble:**

The course is designed with the purpose of helping students in developing a holistic perspective about life. It opens the space for the student to explore his/her role (value) in all aspects of living – as an individual, as a member of a family, as a part of the society and as a unit in nature.

**Prerequisites for the course**

- Nil

**Objectives**

1. To help students distinguish between values and skills.
2. To help students identify what they 'really want to be' in their life and profession.
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

| **MODULE 1** | **Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** | **9** |
|---|---|---|

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

**Suggested Activities:**

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

| **MODULE 2** | **Understanding Harmony in the Human Being - Harmony in Myself** | **9** |
|---|---|---|

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha (happiness and physical facility)
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'

5. Understanding the harmony of I with the Body: Sanyam(control) and Swasthya (Health); correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Swasthya

**Suggested Activities:**

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with disease.

| **MODULE 3** | **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** | **9** |
|---|---|---|

1. Understanding harmony in the Family- the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of *Nyaya* (justice) and program for its fulfillment to ensure *Ubhay-tripti* (mutual happiness)
3. Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
4. Understanding the meaning of *Vishwas*; Difference between intention and competence
5. Understanding the meaning of *Samman* (respect), Difference between respect and differentiation; the other salient values in relationship
6. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* (Resolution, Prosperity, fearlessness, co-existence) as comprehensive Human Goals

**Suggested Activities:**

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives. Pay a visit to the old age home / orphanage / physically & mentally challenged asylum and support them in catering their needs to ensure mutual happiness.

| MODULE 4 | Understanding Harmony in the Nature and Existence - Whole existence as Coexistence | 9 |
|---|---|---|

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Coexistence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

**Suggested Activities:**

Include practice sessions to discuss human beings as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. Submit a video documentary highlighting the ways of humans creating an imbalance in nature and ways to prevent it.

| MODULE 5 | Implications of the above Holistic Understanding of Harmony on Professional Ethics | 9 |
|---|---|---|

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in Professional Ethics:
   a) Ability to utilize the professional competence for augmenting universal human order,

   b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order

**Suggested Activities:**

Include a presentation session on identifying human inventions that are non eco friendly and brainstorming to come up with eco friendly production systems or eco friendly alternatives.

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (30 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| Written Assessment<br>MCQ / written exam | Activity / Presentation in the classroom / on or off campus activities | Written Examination |

**Outcomes**

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

CO1 - Understand the significance of value inputs in a classroom and start applying them in their life and profession

CO2 Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.

CO3 Understand the value of harmonious relationship based on trust and respect in their life and profession

CO4 Understand the role of a human being in ensuring harmony in society and nature.

CO5 Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

**Text Books**

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

**Reference Books**

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, JeevanVidyaEkParichay, Divya Path Sansthan, Amarkantak.

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**Assessment Pattern**

**SUGGESTED COURSE LEVEL ASSESSMENT QUESTIONS:**

COURSE OUTCOME 1 (CO 1) : Need, Basic Guidelines, Content and Process for Value Education

1) Explain the process of value education.
2) Illustrate the content of value education.
3) What should be the content of value education to make it complete? How do values relate to our day to day living?
4) Explain the content of self – exploration?
5) "Mutual fulfilment in human relationships is something we want, we aspire for." Explain
6) What is value education? Why is there a need for value education?
7) How does value education help in fulfilling one's aspirations?
8) What are the basic guidelines for value education?
9) Write a short note on the need for value education in today's scenario.
10) Values and skill complement each other. Elaborate.

COURSE OUTCOME 2 (CO 2) : Understanding Harmony in the Human Being - Harmony in Myself

1) Distinguish between Sukh and Suvidha in detail taking needs of yourself as an example
2) How can we ensure harmony in self ('I')?
3) The needs of the self are qualitative. Illustrate.
4) 'The need for physical facilities is temporary' – explain the meaning of this statement with any two examples.
5) Do you think that human beings are a sum-total of sentiments and physical aspects, the 'self' and the 'body'? Explain your answer using examples.
6) 'Human being is the co-existence of the Self and the Body' – elaborate on this statement.
7) Explain how activities in 'I' are continuous.
8) "I am the seer, doer and enjoyer. The body is my instrument" – Explain.
9) Explain the relation between the self and the body. What is the responsibility of the self towards the body?

10) Define Sanyam and Swasthya. How are they helpful in keeping harmony between self and body?

COURSE OUTCOME 3 (CO 3) :Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1) Define trust. or How is 'trust' the foundation value of relationships?
2) Define 'affection'. or How does affection lead to harmony in the family?
3) How can you say that love is the complete value?
4) What is the meaning of justice in human relationships? How does it follow from family to world family?
5) 'Discrimination leads to acrimony in relationships'. Explain. What problems are created when we discriminate?
6) What values are necessary in human relationships? Explain each briefly.
7) What is the basis of 'respect' for a human being? Do you see that other human beings are also similar to you? Explain.
8) Explain the comprehensive human goal. How does fearlessness follow from right understanding and prosperity?
9) Critically examine the state of society today in terms of fulfillment of comprehensive human goals.
10) What is the comprehensive human goal? Explain how this is conducive to sustainable happiness and prosperity for all.

COURSE OUTCOME 4 (CO 4) : Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1) What is sanskaar? Explain its effects or the conformance of the human order.
2) Explain the harmony in nature.
3) Define harmony in nature and how you will create it. Explain with examples.
4) What are the four orders of nature? Briefly explain them.
5) Present the difference and similarity between a human being and an animal. Give examples to support your answer.
6) "Other than human order, the three orders are mutually fulfilling to each other". Explain with examples.
7) 'Existence is coexistence'. Give your opinion.
8) How is the activity in human order different from that of animal and plant order?
9) Explain the concept of holistic perception of harmony in existence.
10) Explain how there is recyclability and self regulation in nature.

COURSE OUTCOME 5 (CO 5) : Implications of the above Holistic Understanding of Harmony on Professional Ethics.

1) How does right understanding provide the basis for ethical human conduct? Give two examples.
2) What is ethical human conduct? Explain in terms of values, policies and character with appropriate examples.
3) What do you understand about the definitiveness of ethical human conduct? Why is this definiteness desirable?

4) Describe briefly the criteria for evaluation of holistic technology. Support your answer with an example.
5) Give a critical review of the current management models in the profession.
6) Elaborate on the meaning of swatwa (innateness), swatantrata (self organization) and swarajya (self expression). How are they related?
7) What do you mean by professional ethics?
8) What do you understand by competence in professional ethics? Give two examples of its implications in industry.
9) What are the implications of value based living at all four levels of living? Explain.
10) What is utility value and artistic value? How are both important in human life? Explain with example

| 21GE2M02 | ENVIRONMENTAL AND SUSTAINABLE ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

**Preamble**

To inculcate knowledge on the environment and all sorts of biotic and abiotic components related to its ecosystem, climate changes and challenges faced due to global warming and the importance of renewable sources of energy. Inspire students to find ways in contributing personally and professionally thereby rectifying environmental and social problems.

**Prerequisites for the course**

- Basic theoretical concepts of biological science in higher secondary level.
- Basic theoretical concepts of Engineering Chemistry.

**Objectives**

- To make the students conversant with the interdisciplinary and holistic nature of the environment.
- To make the students understand the impacts of environmental degradation and to minimise vulnerability to future disasters.
- To enrich the students with the significance of natural resources and environment on the quality of life.
- To have an increased awareness among students to create a quest on issues in areas of sustainability.
- To have a thorough understanding of the concepts of sustainable habitat.

| UNIT I | ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY | 7 |
|---|---|---|

Environment: Definition, Scope and Importance of environment studies. Ecosystem: Structure and function of an ecosystem - Producers - Consumers – Decomposers- Types – Characteristic features: Forest ecosystem - Desert ecosystem - Pond ecosystem-Ocean ecosystem.

Biodiversity - Value of biodiversity - Hot-spots of biodiversity- Threats to biodiversity - Endangered and Endemic species - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Field study of commonplants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

| UNIT II | ENVIRONMENTAL POLLUTION & DISASTER MANAGEMENT | 6 |
|---|---|---|

Pollution: Definition - Causes - Effects - Control measures of air pollution - Water pollution: (Sewage water treatment by activated sludge and trickling filter process) - Marine pollution - Noise pollution - Soil pollution - Solid waste management - E-waste management.

Disaster management: Causes - Effects - Control measures of Floods - Earthquake - Cyclone.

Field study of local polluted sites – Urban / Rural / Industrial / Agricultural.

| UNIT III | NATURAL RESOURCES | 6 |
|---|---|---|

Forest resources: Use - Overexploitation - Deforestation - case studies. Water resources: Use - Overutilization of surface and groundwater - Water conservation: Rainwater harvesting- Conflicts over water. Mineral resources: Use - Exploitation -Environmental effects of extracting and using mineral resources - Case studies. Food resources: Effects of Modern Agriculture - Fertilizer-Pesticide problems (Eutrophication, Blue baby syndrome, Biomagnification) - Water logging - Salinity - case studies. Energy resources: Renewable (Solar, Wind) - Non renewable energy sources.

| UNIT IV | SUSTAINABILITY | 6 |
|---|---|---|

Introduction, Need and concept of sustainability, Social- Environmental and Economic Sustainability Concepts, Sustainable Development, Challenges for Sustainable Development. Environmental legislations in India - Water Act, Air Act.

| UNIT V | SUSTAINABLE HABITAT | 5 |
|---|---|---|

Basic concepts of sustainable habitat, Environment Impact Assessment (EIA) - Procedures of EIA in India, Green Engineering, Social and technological change, Industrial Processes: Pollution Prevention, Industrial Ecology.

| | Total Periods | 30 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (100 Marks) | Formative Assessment Test | End Semester Exams |
|---|---|---|
| WRITTEN TEST | NA | NA |

**Outcomes**

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

| | |
|---|---|
| 1 | Extract the knowledge on the interdisciplinary and holistic nature of the environment. |

| | |
|---|---|
| | (Understand) |
| **2** | Discover the problems related to environmental degradation. (Apply) |
| **3** | Sketch the significance of natural resources on the quality of life. (Apply) |
| **4** | Solve the issues in areas of sustainability. (Apply) |
| **5** | Articulate knowledge on the concepts of sustainable habitat (Apply) |

**Text Books**

1. 1.Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.(UNIT-1,2.3)
2. 2.Nibin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-HillProfessional.(UNIT-4,5)

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**Reference Books**

1. 1.G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
2. 2.Rajagobalan.R.'Environmental studies-From Crisis to cure' Oxford University Press,2005.

**Web Resources**

1. NPTEL Lecture: https://www.youtube.com/watch?v=hihFHam_wNE
2. NPTEL Lecture: https://www.youtube.com/watch?v=DNUYxyaYh3g

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 1 | | | | 2 | 3 | | | | | 2 | | |
| **2** | 3 | 2 | | | | 2 | 3 | | | | | 2 | | |
| **3** | 3 | | 1 | 1 | | 2 | 3 | | | | | 2 | | |
| **4** | 3 | 2 | 1 | 1 | | 2 | 3 | | | | | 2 | | |
| **5** | 3 | 2 | 1 | 1 | | 2 | 3 | | | | | 2 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1 Students will be able to** extract the knowledge on the interdisciplinary and holistic nature of the environment. (Understand)

1. Describe the Multidisciplinary nature of Tirunelveli District.
2. Demonstrate the regulation of Ecosystem

**COURSE OUTCOME 2: Students will be able to** discover the problems related to environmental degradation. (Apply)

1. Demonstrate the control measures of Air and water Pollution

2. Account the problem and suitable remedial measures for floods in the rainy season.

**COURSE OUTCOME 3: Students will be able to** Sketch the significance of natural resources on the quality of life. (Apply)

1. Highlight the control and effects of deforestation.
2. Label the role of individual in conservation of natural resources

**COURSE OUTCOME 4: Students will be able to** Solve the issues in areas of sustainability. (Apply)

1. Outline the term "sustainable development"
2. Compare the major limitations of the Air act, 1972 and Water act, 1980.

**COURSE OUTCOME 5: Students will be able to** articulate knowledge on the concepts of sustainable habitat (Apply)**.**

1. Narrate the concept and procedure for Environment Impact Assessment.
2. Elucidate the prevention of pollution from various industries.

| **21PT3901** | **SOFT SKILLSAPTITUDE - I** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **1** | **0** | **0** | **1** |

**Prerequisites for the course**

- Basic Maths

**Objectives**

1. Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
2. Students will be able to reason, model, and draw conclusions or make decisions with mathematical, statistical, and quantitative information.

| **UNIT I** | **MODULE I** | **3** |
|---|---|---|
| Number system, Number series, HCF and LCM of Numbers, Factors and Decimals. | | |
| **UNIT II** | **MODULE II** | **3** |
| Square roots and cube roots, Indices and surds, Simplification and approximation, Problems on ages and numbers. | | |
| **UNIT III** | **MODULE III** | **3** |
| Percentage, Profit, loss and discount, Average, Ratio and Proportion. | | |
| **UNIT IV** | **MODULE IV** | **3** |
| Partnership and share, Alligation and mixtures, Time, work and wages. | | |
| **UNIT V** | **MODULE V** | **3** |
| Pipes and cisterns, simple interest, Compound interest, Growth and depreciation. | | |
| | **Total Periods** | **15** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test** | **Formative Assessment Test** |
|---|---|

| 1. DESCRIPTIVE QUESTIONS | 1. ASSIGNMENT<br>2. ONLINE QUIZZES<br>3. PROBLEM-SOLVING ACTIVITIES |
|---|---|

**Outcomes**

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

**CO1:** Solve real-life problems requiring interpretation and comparison of complex numeric summaries which extend beyond simple measures of center.

**CO2:**Solve real-life problems requiring interpretation and comparison of various representations of ratios

**CO3:**Distinguish between proportional and nonproportional situations and, when appropriate, apply proportional reasoning.

**CO4:**Develop an answer to an open-ended question requiring analysis and synthesis of multiple calculations, data summaries, and/or models.

**CO5:** justify and communicate their conclusions in ways appropriate to the audience.

**Text Books**

1. Quantitative Aptitude for Competitive Examinations | 7th Edition (Paperback, AbhijitGuha)

**Reference Books**

1. https://myupsc.com/wp-content/uploads/2020/11/Quantitative-Aptitude-for-Competitive-Examinations-by-Dinesh-Khattar-z-lib.org_.pdf
2. Quantitative Aptitude for Competitive Examinations - Quantitative Aptitude by rsagrawal with 0 Disc. (English, Paperback, Aggarwal R. S.) Revised, 2021

**Web Recourses**

1. https://pdf.bankexamstoday.com/raman_files/Quant%20Formula.pdf
2. https://ugcportal.com/raman-files/QT-TRICKS.pdf
3. https://www.javatpoint.com/aptitude/quantitative#speed-and-distance
4. https://www.indiabix.com/aptitude/questions-and-answers/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | | 2 | | 1 | 1 | 3 | | | 2 | 2 | | 3 | 1 | |
| 2 | | | | 2 | | 3 | | 1 | 2 | | 1 | 1 | | 2 | |
| 3 | 2 | 2 | 2 | 2 | | | 2 | | 3 | 3 | | | 2 | 1 | |
| 4 | | | | 2 | | 1 | 2 | 2 | | | | 1 | 2 | 1 | |
| 5 | 2 | | 3 | | 2 | | 2 | | 2 | | 2 | | | 2 | 1 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS | CAT 1 | CAT 2 | FAT 1 | FAT 2 |
|---|---|---|---|---|

| CATEGORY | | | | |
|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 |
| UNDERSTAND | 40 | 20 | 10 | 10 |
| APPLY | 40 | 50 | 5 | 5 |
| ANALYZE | | 20 | 5 | 5 |
| EVALUATE | | | | |
| CREATE | | | | |

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED |
|---|---|---|
| **UNIT I – MODULE I** | | |
| **1** | Number system, Number series | **1** |
| **2** | HCF and LCM of Numbers | **1** |
| **3** | Factors and Decimals. | **1** |
| **UNIT II – MODULE II** | | |
| **4** | Square roots and cube roots | **1** |
| **5** | Indices and surds, Simplification and approximation | **1** |
| **6** | Simplification and approximation, Problems on ages and numbers. | **1** |
| **UNIT-III MODULE III** | | |
| **7** | Percentage | **1** |
| **8** | Profit, loss and discount | **1** |
| **9** | Average, Ratio and Proportion. | **1** |
| **UNIT-IV MODULE IV** | | |
| **10** | Partnership and share | **1** |
| **11** | Alligation and mixtures | **1** |

| | | |
|---|---|---|
| **12** | Time, work and wages. | **1** |
| **UNIT-V MODULE V** | | |
| **13** | Pipes and cisterns | **1** |
| **14** | Simple interest, Compound interest | **1** |
| **15** | Compound interest, Growth and depreciation. | **1** |

**Theory cum Practical Courses**

| **21CS4604** | **OPERATING SYSTEM CONCEPTS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**Preamble:**
In this course will be discussing about Address spaces, system call interface, process/threads, inter process communication, deadlock, scheduling, memory, virtual memory, file systems.

**Prerequisites for the course**

- Problem Solving and Logical Thinking using C

**Objectives**

1. Understand the principles and modules of operating systems.
2. Be familiar with the factors in process scheduling strategies, concurrent processes and threads.
3. Learn the algorithmic solutions to handle deadlock problems.
4. Understand the physical and logical memory management and feel the role of virtual memory.
5. To manage the issues related to file system interface, implementation and disk management.

| **UNIT I** | **PROCESSES** | **6** |
|---|---|---|

Introduction to operating systems – operating system structures – system calls – system programs – system structure - Processes: Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter process communication. **Case study:** IPC in Linux

**Suggested Activities:**
**PRACTICAL:**
Shell programming assignments
1. Shell programming
2. Read the history of Unix/Linux/Windows
3. Know the operating system in your phone/laptop

SUGGESTED EVALUATION METHODS:
Quiz on understanding of Linux and shell programming

| **UNIT II** | **THREADS, PROCESS SCHEDULING AND SYNCHRONIZATION** | **6** |
|---|---|---|

Threads: Multi-threading models– Threading issues - CPU Scheduling: Scheduling criteria – Scheduling algorithms – Algorithm Evaluation. Process Synchronization: The critical - section problem – Semaphores – Classic problems of synchronization – critical regions. **Case study:** Process Scheduling in Linux

**SUGGESTED ACTIVITIES :**

**Practical:**

Implement multi-threading using the Pthread library

Java threads

**SUGGESTED EVALUATION METHODS:**

Evaluation of the implementation of multi-threading

| **UNIT III** | **DEADLOCK** | **6** |
|---|---|---|

Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

Suggested Activities:

Discussion about realtime deadlock problems

**SUGGESTED EVALUATION METHODS:**

Quiz on the understanding of the different concepts in this module

| **UNIT IV** | **MEMORY MANAGEMENT** | **6** |
|---|---|---|

Memory Management: Background – Swapping – Contiguous memory allocation – Paging-Segmentation - Virtual Memory: Background – Demand paging –Process creation – Page replacement. **Case study:** Memory Management in Linux

**SUGGESTED ACTIVITIES :**

**Practical:**

1. Read and understand appropriate files in xv6 related to process scheduling and memory management

Assignment problems on memory management

**SUGGESTED EVALUATION METHODS:**

- Quiz

| **UNIT V** | **FILE SYSTEMS** | **6** |
|---|---|---|

File System Interface: File concept – Access methods – Directory structure – File system mounting – Protection - File-System Implementation: Directory implementation – Allocation methods – Free space management – efficiency and performance - Mass Storage Structure: Disk scheduling – Disk management – Swap space management. **Case study:** File Systems in Linux, File Systems in Windows 7 and Input and Output in Linux

**SUGGESTED ACTIVITIES:**

**Practical:**

1. Use of system calls like creat, open, read, write, close, dup, readdir and scandir

**SUGGESTED EVALUATION METHODS:**

- Quizzes

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | Installation of UNIX Operating System | 5 |
| 2 | Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir | 5 |
| 3 | Implement the following CPU scheduling algorithms<br>a) Round Robin b) SJF c) FCFS d) Priority | 5 |

| | | |
|---|---|---|
| 4 | Implement Bankers Algorithm for Dead Lock Avoidance | 5 |
| 5 | Implement all page replacement algorithms<br>a) FIFO b) LRU c) LFU | 5 |
| 6 | Implement the File Allocation Strategies<br>a) Sequential b) Indexed c) Linked | 5 |
| | **Total Periods** | **30 Theory +30 Lab** |

**Laboratory Requirements**

Unix with C

**Suggestive Assessment Methods**

| Continuous Assessment Test & FAT (20 Marks) | Lab Components Assessments (30 Marks) | End Semester Exams (50 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.CONDUCT OF EXPERIMENTS<br>2. MODEL EXAM | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1 Choose the OS based on the knowledge on principles and modules of operating systems(Remember)
CO2 Explain the factors in process scheduling strategies, concurrent processes and threads (Understand)
CO3 Develop algorithmic solutions to handle deadlock problems(Create)
CO4 Analyze the physical and logical memory management and the virtual memory(Analyze)
CO5 Identify and solve the issues related to file system interface, implementation and disk Management(Apply)

**Text Books**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018

**Reference Books**

1. William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Prentice Hall, 2018.

**Web Resources**

1. https://www.geeksforgeeks.org/operating-systems/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 2 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 3 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 4 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 5 | 3 | 3 | 3 | | | | | | | | | | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | Average marks of Experiments | Model Practical | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | | | 10 |
| UNDERSTAND | 40 | 20 | | | 20 |
| APPLY | 40 | 50 | 10 | 10 | 50 |
| ANALYZE | | 20 | | | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**
**COURSE OUTCOMES**

**Course Outcome 1 (CO1): CO1 Choose the OS based on the knowledge on principles and modules of operating systems.(Remember)**

1. What is an operating system?
2. Recall the operating system structures.
3. List the methods in Inter process Communication

**Course Outcome 2 (CO2): Explain the factors in process scheduling strategies, concurrent processes and threads (Understand)**

1. Outline the role of the scheduler and how its behaviour influences the performance of the system
2. Summarize the process synchronization techniques managed using various techniques.
3. Explain the concept of threads.

**Course Outcome 3 (CO3): Develop algorithmic solutions to handle deadlock problems (Create)**

1. Discuss the methods of deadlock.
2. Elaborate the several approaches to mitigate the issue of deadlock in operating systems.

**Course Outcome 4 (CO4): Analyze the physical and logical memory management and the virtual memory(Analyze)**

1. Examine that how program memory addresses relate to physical memory addresses, memory management in base-limit machines and swapping
2. Infer the virtual memory management, including paging and segmentation.

**Course Outcome 5 (CO5): Identify and solve the issues related to file system interface, implementation and disk Management (Apply)**

1. Build the various Disk-Scheduling Algorithms.
2. Make use of the different Accessing Methods of a File and manipulate it.

| 21CS4611 | DATABASE MANAGEMENT SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |
| **Preamble** | | | | | |

This lab enables efficientuse of data to store and retrieve from the databases. By incorporating SQL, practical experience is provided to students with real time examples. Provides knowledge to interface Programming with databases to cater the needs of data driven businesses and application development

**Prerequisites for the course**

- Data Structures

**Objectives**

1. To explain basic database concepts, applications and types of data models
2. To demonstrate the use of constraints and relational algebra operations
3. To implement the basics of SQL and construct queries using SQL
4. To emphasize the correlation of SQL and programming languages
5. To facilitate students in Database design and development

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | Student should decide on a case study and formulate the problem statement. | CO1 |
| 2 | Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)Note: Student is required to submit a document by drawing ER Diagram | CO1 |
| 3 | Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys)Note: Student is required to submit a document showing the tables created from ER Model. | CO2 |
| 4 | Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables, Constraints | CO2 |
| 5 | Practicing DDL commands, Integrity constraints, DML commands | CO3 |
| 6 | Practicing DCL, TCL commands, Views and operations on views | CO3 |
| 7 | Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, etc | CO3 |
| 8 | Practicing Sub queries (Nested, Correlated) and Joins | CO3 |
| 9 | Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping. | CO3 |
| 10 | Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger | CO4 |
| 11 | Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure. | CO4 |
| 12 | Cursors- Declaring and Opening Cursor, Fetching the data, closing the cursor. | CO4 |
| | | **Total Periods :60** |

| S. No | List of Test Projects | CO |
|---|---|---|
| 1 | College Admission Management System | CO5 |
| 2 | Restaurant Management System | CO5 |

| | | |
|---|---|---|
| 3 | Movie booking Management System | CO5 |
| 4 | Vehicle ParkingManagement System | CO5 |
| 5 | Travel Planner Management System | CO5 |
| 6 | Toll Booth Management System | CO5 |
| 7 | Mini mart Management System | CO5 |
| 8 | Hospital Data Management System | CO5 |
| 9 | Bike/ Car rental Management System | CO5 |
| 10 | Banking Management System | CO5 |
| 11 | Library Management System | CO5 |
| 12 | Product review Management System | CO5 |
| 13 | Employee payslip Management System | CO5 |
| 14 | School Management System | CO5 |
| 15 | Online Shopping Management System | CO5 |

**Suggestive Assessment Methods**

| **Lab Components Assessments (50 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|
| 4. Exercises<br>5. Project File (Progress Score)<br>6. Viva voce | 1. Exercises<br>2. Record note<br>3. Viva voce |

**Outcomes**

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

CO1 Apply the basic concepts of Database Systems and Applications

CO2 Understand and apply the relational model and relational algebra operations

CO3 Construct queries using SQL in database creation, manipulation andinteraction

CO4 Apply the programming aspects using SQL to create procedure and perform functions

CO5 Implement a project based on the Database concepts using SQL

**Laboratory Requirements**

Oracle/SQL

**Reference Books**

1. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition,Tata McGraw Hill, New Delhi,India, 2016.

**Web Resources**

1. https://www.hackerrank.com/domains/sql
2. https:// www.geeksforgeeks.org/sql-tutorial/
3. https://www.tutorialspoint.com/sql/index.htm
4. https://www.sololearn.com/learning/1060

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 3 | 3 | | | | | | | | | | 2 | | |
| 2 | | 3 | 3 | | | | | | | | | | 2 | | |
| 3 | 3 | 3 | 3 | | 3 | | | | | | | | 2 | | |
| 4 | 3 | 3 | 3 | | | | | | | | | | 2 | | |
| 5 | 2 | 2 | 2 | | 2 | 2 | | | 2 | 2 | 2 | 2 | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | Model Exam | END SEM EXAM |
|---|---|---|
| REMEMBER | | |
| UNDERSTAND | | |
| APPLY | 50 | 100 |
| ANALYZE | | |
| EVALUATE | | |
| CREATE | 50 | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):(Blooms Category: Apply)**

1. Identifying entities, attributes and its types, keys, relationships between entities, cardinalities, generalization, and specialization for library management system.
2. A university database contains information about professors (identified by social security number, or SSN) and courses (identified by courseid). Professors teach courses; each of the following situations concerns the Teaches relationship set. For each situation, draw an ER diagram that describes it (assuming that no further constraints hold).

1. Professors can teach the same course in several semesters, and each offering must be recorded.
2. Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded. (Assume this condition applies in all subsequent questions.)
3. Every professor must teach some course.
4. Every professor teaches exactly one course (no more, no less).
5. Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor.
6. Now suppose that certain courses can be taught by a team of professors jointly, but it is possible that no one professor in a team can teach the course. Model this situation,

introducing additional entity sets and relationship sets if necessary.

**Course Outcome 2 (CO2):(Blooms Category: Apply)**

1. Consider the following relations containing airline flight information:

Flights(flno: integer, from: string, to: string, distance: integer, departs, arrives: time)

Aircraft(aid: integer, aname: string, cruisingrange: integer)

Certified(eid: integer, aid: integer)

Employees(eid: integer, ename: string, salary: integer)

Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft (otherwise, he or she would not qualify as a pilot), and only pilots are certified to fly. Write the following queries in relational algebra, tuple relational calculus, and domain relational calculus. Note that some of these queries may not be expressible in relational algebra

1. Find the eids of pilots certified for some Boeing aircraft.
2. Find the names of pilots certified for some Boeing aircraft.
3. Find the aids of all aircraft that can be used on non-stop flights to Chennai.
4. Identify the flights that can be piloted by every pilot whose salary is more than $100,000. (Hint: The pilot must be certified for at least one plane, large cruising range.)
5. Find the names of pilots who can operate some plane with a range greater than 3,000 miles but are not certified on any Boeing aircraft.
6. Find the eids of employees who make the highest salary.
7. Find the eids of employees who make the second highest salary.
8. Find the eids of pilots who are certified for the largest number of aircraft.
9. Find the eids of employees who are certified for exactly three aircraft.
10. Find the total amount paid to employees as salaries

2. Answer each of the following questions briefly. The questions are based on the following relational schema:

Emp(eid: integer, ename: string, age: integer, salary: real)

Works(eid: integer, did: integer, pct time: integer)

Dept(did: integer, dname: string, budget: real, managerid: integer)

a. Give an example of foreign key constraint that involves the Dept relation. What are the options for enforcing this constraint when a user attempts to delete a Dept tuple?

b. Write the SQL statements required to create the above relations, including appropriate versions of all primary and foreign key integrity constraints.

c. Define the Dept relation in SQL so that every department has a manager.

d. Add 'John' as an employee with eid = 101, age = 32 and salary = 15, 000.

e. Write an SQL statement to give every employee a 10% raise. 6. Write an SQL statement to delete the 'Toy' department. Given the referential integrity constraints you chose for this schema, explain what happens when this statement is executed.

**Course Outcome 3 (CO3):(Blooms Category: Apply)**

1. (a) For the above given Employee tables, create and insert values.

(b) **Write a query to fetch the number of employees working in the department 'HR'**

**(c) Write a query to find the names of employees that begin with 'S'**

(d) **Write a query to fetch details of all employees excluding the employees with first names, "Sanjay" and "Sonia" from the EmployeeInfo table.**

(e) **Write a query to fetch all employees who also hold the managerial position.**

(f) Write a query to fetch the department-wise count of employees sorted by department's count in ascending order.

2. Consider the following schema:

Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

Catalog(sid: integer, pid: integer, cost: real)

The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in SQL:

1. Find the pnames of parts for which there is some supplier
2. Find the snames of suppliers who supply every part
3. Find the snames of suppliers who supply every red part
4. Find the pnames of parts supplied by Acme Widget Suppliers and by no one else
5. Find the sids of suppliers who charge more for some part than the average cost of that part (averaged over all the suppliers who supply that part).
6. For each part, find the sname of the supplier who charges the most for that part
7. Find the sids of suppliers who supply only red parts
8. Find the sids of suppliers who supply a red part and a green part
9. Find the sids of suppliers who supply a red part or a green part

**Course Outcome 4 (CO4):(Blooms Category: Apply)**

1. Write Trigger logic to check whether the age is valid or not Using Message Alert in Election voting system for Raising appropriate error code and error message for ineligible candidates.
2. Create a function that takes the name as input and returns the welcome message as output. Use anonymous block and select statement to call the function.

**Course Outcome 5 (CO5):(Blooms Category: Create)**

1. Write the case study for Cafeteria Management System,formulate the problem statement, model using E-R diagram and design the database using SQL.
2. Write the case study for Online Auction Management System, formulate the problem statement, model using E-R diagram and design the database using SQL.

**COURSE CONTENT AND LECTURE SCHEDULE**

| S.NO | TOPIC | NO OF HOURS REQUIRED FOR LAB EXERCISES | NO OF HOURS REQUIRED FOR TEST PROJECTS |
|---|---|---|---|
| 1 | Student should decide on a case study and formulate the problem statement. | 2 | 2 |
| 2 | Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)<br>Note: Student is required to submit a document by drawing ER Diagram | 2 | 2 |

| | | | |
|---|---|---|---|
| 3 | Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys)<br>Note: Student is required to submit a document showing the database tables created from ER Model. | 2 | 2 |
| 4 | Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables, Constraints | 3 | 1 |
| 5 | Practicing DDL commands, Integrity constraints, DML commands | 3 | 1 |
| 6 | Practicing DCL, TCL commands, Views and operations on views | 3 | 1 |
| 7 | Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, etc | 3 | 1 |
| 8 | Practicing Sub queries (Nested, Correlated) and Joins. | 3 | 1 |
| 9 | Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping. | 3 | 1 |
| 10 | Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger | 3 | 1 |
| 11 | Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure. | 3 | 1 |
| 12 | Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor. | 3 | 1 |
| 13 | Project- Integrated implementation of the database management system | 0 | 12 |
| Total Hours | | 33 | 27 |
| Total Hours Required | | 60 | |

| **21HS2103** | **TECHNOLOGY IN TAMIL CULTURE** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **0** | **1** |

**Preamble:**

This course is offered to develop technical thinking based on Tamil tradition and to acquaint students with the fundamentals of various technologies through Tamil culture and history.

**Prerequisite:** The prerequisite knowledge required to study this course is basic knowledge in English and Tamil Heritage.

| UNIT I | WEAVING AND CERAMIC TECHNOLOGY | 6 |
|---|---|---|

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

| UNIT II | DESIGN AND CONSTRUCTION TECHNOLOGY | 6 |
|---|---|---|

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

**UNIT III MANUFACTURING TECHNOLOGY 6**

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

| UNIT IV | AGRICULTURE AND IRRIGATION TECHNOLOGY | 6 |
|---|---|---|

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

| UNIT V | SCIENTIFIC TAMIL & TAMIL COMPUTING | 6 |
|---|---|---|

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

| Total Periods | 30 |
|---|---|

**Course Outcomes:**

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

| | |
|---|---|
| **CO1** | To learn the techniques adopted in Industries of ancient Tamil culture. |
| **CO2** | To assess the technical competence of ancient Tamil. |
| **CO3** | To achieve the ability to think about various production technologies in Tamil Culture. |
| **CO4** | To explore the recovery and development of agricultural and water management technical skills of Tamil culture. |
| **CO5** | To enumerate the technical development that Tamil has achieved in the field of science and computer. |

**CO PO Mapping:**

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

**TEXT-CUM-REFERENCEBOOKS**

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL–(in print) 2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

5. Keeladi-'Sangam City Civilization on the bank of river Vaigai'(Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published By: TheAuthor)

7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) Journey of Civilization Industo Vaigai (R.Balakrishnan) (Published by:RMRL)–Reference Book

| 21HS2103 | தமிழரும் த ொ ாழில் நுட்பமும் L 2 | T | P | C |
|---|---|---|---|---|
| | | 0 | 0 | 1 |

மு Preamble)

இந்தப் பாடத்திட்டம் ப ொ ாறியியல் பயிலும் முதலாம் ஆண் டு மாணவரக் ளின் இரண் டாம் பருவத்திற்குரியF. தமிழ் மரபு சார்ந்த த ொ ாழில் நுட்ப சிந்தரன ரய வளரத்F பல் மவ று த ொ ாழில் நுட்பங் களின் அடிப்பரட கூறுகரள த் தமிழரின் பண் பாடு மற்றும் வரலாற்றின் மூலம் மாணவரக் ரள அறியச் ொச ய்தல்.

பாடொந றிக்கானமுன் நிபந்தரன கள் **(Prerequisites for the course)**

தமிழ் ம ொ ாழியில் எழுத படிக்க ொத ரிந்திருத்தல் அவசியம்.

| அலகு I | ொந சவு மற்றும் பாரன த் த ொ ாழில் நுட்பம் | 6 |
|---|---|---|

சங் க காலத்தில் ொந சவுத்த ொ ாழில் - பாரன த் த ொ ாழில் நுட்பம் - கருப்பு சிவப்பு பாண் டங் கள் - பாண் டங் களில் கீறல் குறியடு ீ கள்

| அலகு II | வடிவரம ப்பு மற்றும் கட்டிடத் த ொ ாழில் நுட்பம் | 6 |
|---|---|---|

சங் க காலத்தில் வடிவரம ப்பு மற்றும் கட்டுமானங் கள் & சங் க காலத்தில் வட டுப் ப ொ ாருட்களில் வடிவரம ப்பு - சங் க காலத்தில் கட்டுமான ப ொ ாருட்களும் நடுகல் லும் - சிலப்பதிகாரத்தில் மம ரட அரம ப்பு பற்றிய விவரங் கள் - மாமல் லபுரச் சிற்பங் களும் , க ம ாவில் களும் - ச ம ாழர் காலத்F ொப ருங் க ம ாயில் கள் மற்றும் பிற வழிபாட்டுத்தலங் கள் - நாயக்கர் காலக் க ம ாயில் கள் - மாதிரி கட்டரம ப்புகள் பற்றி அறிதல் , மFரர மீனாட்சி அம் மன் ஆலயம் மற்றும் திருமரல நாயக்கர் மஹால் - ொச ட்டிநாட்டு வடு கள் - பிரிட்டிஷ் காலத்தில் ொச ன்ரன யில் இந்த ம ா - சார ம ாொச னிக் கட்டிடக்கரல

அலகு III உற்பத்தித் த ொ ாழில் நுட்பம் 6 கப்பல் கட்டும் கரல - உல ம ாகவியல் - நரக த் த ொ ாழில்நுட்பம் - இரும்பு த ொ ாழிற்சாரல - இரும் ரப உருக்குதல், எஃகு

- வரலாற்று சான் றுகளாக ொச ம் பு மற்றும் தங் க நாணயங் கள் - நாணயங் கள் அசசடித்தல் - மணி உருவாக்கும் த ொ ாழிற்சாரல கள் - கல் மணிகள் கண் ணாடி மணிகள் - சுடுமண் மணிகள் - சங் கு மணிகள் - எலும் பு Fண் டுகள் - த ொ ால்லியல் சான் றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வரக கள்

| அலகு IV | மவ ளாண் ரம மற்றும் நீ ர் பாசன த ொ ாழில் நுட்பம் | 6 |
|---|---|---|

அரண , ஏரி, குளங்கள், மதகு - ச ம ாழரக் ாலக் குமிழித் தூம் பின் முக்கியத்Fவம் - கால் நரட பராமரிப்பு - கால் நரட களுக்காக வடிவரம க்கப்பட்ட கிணறுகள் - மவ ளாண் ரம மற்றும் மவ ளாண் ரம ச் சார்ந்த ொச யல் பாடுகள் - கடல் சார் அறிவு - மீன் வளம் - முத்F மற்றும் முத்F குளித்தல் - ொப ருங் கடல் குறித்த பண் ரட ய அறிவு - அறிவுசார் சமூகம்

| அலகு V | அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் | 6 |
|---|---|---|
| அறிவியல் தமிழின் வளரச் ்சி - கணினித் தமிழ் வளரச் ்சி - தமிழ் நூல் கரள மின் பதிப்பு ொச ய் தல் - தமிழ் ொம ன் ப ொ ாருட்கள் உருவாக்கம் - தமிழ் இரண ய கல் விக்கழகம் - தமிழ் மின் நூலகம் - இரண யத்தில் தமிழ் அகராதிகள் - ச ொ ாற்குரவ த் திட்டம். | | |
| **Total Periods** | | **30** |

[redacted]ப[redacted]மு[redacted]

| CO1 | மாணவரக் ள் பண் ரட த் தமிழரின் த ொ ாழில்நுட்பங் கரள அறிந்F க ொ ாள்வர். |
|---|---|
| CO2 | பண் ரட த் தமிழரின் த ொ ாழில்நுட்பத் திறரன மதிப்பிடுதல். |
| CO3 | தாய் ம ொ ாழியில் பல்மவ று உற்பத்தி த ொ ாழில்நுட்பங் கரள க் குறித்F சிந்திக்கும் திறரன அரட வார். |
| CO4 | தமிழரின் மவ ளாண் ரம மற்றும் நீ ர் மம லாண் ரம த ொ ாழில்நுட்ப திறன் கரள மீட்டு உருவாக்கம் ொச ய்தல் குறித்F அறிதல். |

| CO5 | அறிவியல் மற்றும் கணினி Fரற யில் தமிழ்ப் ொப ற்றுள்ள த ொ ாழில் நுட்ப வளரச் ்சிரய அறிதல். |
|---|---|

**Course Outcomes:**

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

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5** | | | **2** | | | | **1** | **2** | **1** | **3** | | **1** |

**TEXT – CUM – REFERENCE BOOKS**

1. தமிழக வரலாறு - மக்களும் பண் பாடும் - மக . மக பிள்ரள ( ொவ ளியடு ீ : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முரன வர் இல. சுந்தரம் ( விகடன் பிரசுரம்).
3. கீழடி - ரவ ரக நதிக்கரர யில் சங் க கால நகர நாகரிகம் ( த ொ ால் லியல் Fரற ொவ ளியடு ீ ). 4. ப ொ ாருரந - ஆற்றங் கரர நாகரிகம் ( த ொ ால் லியல் Fரற ொவ ளியடு ீ )

**SEMESTER V**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21CB5601 | Computational Statistics | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 21CB5602 | Introduction to Business Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CS5602 | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | 21CB5XXX | Professional Elective I | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 21CB5XXX | Professional Elective II | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | 21OE5XXX | Open Elective I | OE | 3 | 3 | 0 | 0 | 3 |
| 7 | 21PT3904 | Soft skills –Reasoning | EEC | 1 | 0 | 0 | 2 | 1 |
| **Theory cum Practical Courses** | | | | | | | | |
| **Practical Course** | | | | | | | | |
| 1 | 21CB5611 | Computational Statistics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 2 | 21CS5611 | Computer Networks Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | Total | 27 | 19 | 0 | 8 | 23 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Professional Elective I** | | | | | | | | |
| 1 | 21CB5701 | Big Data Technologies and Analytics | 5 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB5702 | Business Analytics | 5 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB5703 | Marketing Research | 5 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB5704 | Cloud application Development | 5 | 3 | 0 | 0 | 3 | Full Stack Development |
| **Professional Elective II** | | | | | | | | |
| 1 | 21CB5705 | Data Mining for Business Intelligence | 5 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21AI5703 | Healthcare Analytics | 5 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB5706 | Micro and Macroeconomics | 5 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB5707 | Web Technologies | 5 | 3 | 0 | 0 | 3 | Full Stack Development |

| 21CB5601 | COMPUTATIONAL STATISTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The goal of the course is to present essential **statistical** concepts. Simulation is used to illustrate the concepts and to provide understanding. Mathematical development provides an alternative presentation of the same ideas, when that is possible, and is used to develop a tool or get insight into a concept

**Prerequisites for the course**

- 21MA3205-Probability and Statistics
- 21IT4601-Introduction to algorithms

**Objectives**

1. Understand the mean, variance, linear regression models and error term for use in Multivariate data analysis.
2. Understand the relationship of the data collected for decision making.
3. Know the concept of principal components, factor analysis and cluster analysis for profiling and interpreting the data collected.
4. Analyse the problems using principal component methods
5. Formulate the best clustering areas

| UNIT I | MULTIVARIATE NORMAL DISTRIBUTION | 9 |
|---|---|---|

Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and sampling without replacement), Sampling distribution of sample mean, stratified random sampling.

**Suggested Activities**: Implementation of Sampling distribution

**Suggested Evaluation methods:** quiz, Assignment.

| UNIT II | MULTIPLE LINEAR REGRESSION MODEL, MULTIVARIATE REGRESSION | 9 |
|---|---|---|

Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, validation of model assumptions. Assumptions of Multivariate Regression Models, Parameter estimation.

**Suggested Activities**: Implementation of Parameter estimation

**Suggested Evaluation methods:** quiz, Assignment.

| UNIT III | DISCRIMINANT ANALYSIS | 9 |
|---|---|---|

Multivariate Analysis of variance and covariance. Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties

| | | |
|---|---|---|
| **Suggested Activities**: Implementation of Estimating linear discriminant functions | | |
| **Suggested Evaluation methods:** quiz, Assignment. | | |
| **UNIT IV** | **PRINCIPAL COMPONENT ANALYSIS, FACTOR ANALYSIS** | **9** |
| Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot. SFactor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores. | | |
| **Suggested Activities**: Implementation of Transformation of factor analysis solutions | | |
| **Suggested Evaluation methods:** Assignment. | | |
| **UNIT V** | **CLUSTER ANALYSIS** | **9** |
| Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters. | | |
| **Suggested Activities**: Implementation of K-Means Clustering | | |
| **Suggested Evaluation methods:** Assignment. | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20Marks)** | **Lab Components Assessments (20 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|---|
| **1. DESCRIPTIVE QUESTIONS**<br>**2. FORMATIVE MULTIPLE-CHOICE QUESTIONS** | 1. MODEL EXAMINATION | **1. DESCRIPTIVE QUESTIONS**<br>**2. FORMATIVE MULTIPLE-CHOICE QUESTIONS** |

**Outcomes**

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

**CO.1** Understand the concept of means and variances of the individual variables in a multivariate set and also the correlations between those variables (Understand)
**CO.2** Compare the relationship between two or more features and to fit a linear equation to the observed data and to interpret the results of Multivariate Regression models. (Apply)
**CO.3** Develop two dimensional as well as multidimensional curves. (Apply)
**CO.4** Apply the principal component techniques to solve eigen value and eigenvector problems, and to reduce the number of variables in regression models using Factor analysis. (Apply)
**CO. 5** Apply the techniques of clustering methods for massive amounts of data. (Apply)

**Text Books**

1. T.W. Anderson," An Introduction to Multivariate Statistical Analysis", 6th edition, Wiley, 2013. (Unit 1, 2 & 3)

**Reference Books**

1. Kshirsagar,Anant.M, Marcel Dekker," Multivariate Analysis (Marcel Dekker)", First Edition,1972.
2. Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining," Introduction to Linear Regression Analysis", Fifth Edition, Wiley, 2012.
3. Johnson R.A. &Wichern, D.W, "Applied Multivariate Statistical Analysis ", Sixth Edition, Pearson, 2018.

**Web Resources**

1. https://nptel.ac.in/courses/110106064/
2. https://www.datacamp.com/community/tutorials/python-statistics-data-science
3. https://github.com/cliburn/Computational-statistics-with-Python/tree/master/

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | | 2 | | 3 | | | | | | | 2 | 2 | 3 |
| 2 | 2 | 1 | 2 | | 2 | 2 | | | | | | | 2 | | 3 |
| 3 | 3 | 3 | 3 | 2 | | 1 | | | | | | | | 2 | 3 |
| 4 | 2 | 2 | 2 | | 1 | | | | | | | | 2 | | 3 |
| 5 | 2 | 2 | | 3 | | 3 | | | | | | | 3 | 2 | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 20 |
| UNDERSTAND | 40 | 30 | 10 | 10 | 20 |
| APPLY | 40 | 30 | 5 | 5 | 30 |
| ANALYZE | | 30 | 5 | 5 | 30 |

| | | | | | |
|---|---|---|---|---|---|
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Solve the example problem using sampling with replacement method. (apply)
2. How to find a sample mean? (analyse)

**Course Outcome 2 (CO2):**

**1.** Let Y ~ B (200, p). To test H0: p = 0.75 against H1: p > 0.75. we observe Y and reject H0 if Y150. Use the normal approximation to compute the level and power function of the test for values of p starting from 0.75 at intervals of 0.02 up to 0.85. (Apply)

**2.** Implement the Assumptions of Multivariate Regression Models (Apply)

**Course Outcome 3 (CO3):**

1. How do you interpret a linear discriminant analysis? (Understand)
2. How can you estimate linear discriminant functions and give their properties (Analyse)

**Course Outcome 4 (CO4):**

1. Apply and solve the problem using transformation of factor analysis. (Create)
2. Give a step-by-step description of how the method of bootstrapping cases would be applied to a sample (x1, y1),...,(xn, yn) in order to estimate the standard error of the least squares estimators $\alpha\hat{}$ and $\hat{}\beta$ of the intercept α and the slope β. (Evaluate)

**Course Outcome 5 (CO5):**

1. What is a real-life example of clustering? (Understand)
2. Generate a cluster and solve it using K-means clustering algorithm. (Evaluate)

| 21CB5602 | INTRODUCTION TO BUSINESS SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The main purpose of this course is to make the students in the field of business studies to understand the concept and comprehensive views on business and allied activities. The understanding of basic role of business in our society requires exploration into various areas.

**Prerequisites for the course:**

- 21HS4101 - Principles of Management

**Objectives**

1. Understand the basic business skills
2. Understand to run a business efficiently and effectively.
3. Study to measure business performance
4. Understand Business Intelligence in e-business and e-governance
5. Develop and strengthen business quality and motivate the students.

| UNIT I | OVERVIEW OF BUSINESS SYSTEM | 9 |
|---|---|---|

Business environmental factors - Internal and External. System approach of management Process - Input for the business, Transformational process and output. Objectives of the business system. System model of business management. Management functions – Planning, Organising, Staffing, Directing and Controlling.

| UNIT II | OUTLINE OF BUSINESS ORGANISATION | 9 |
|---|---|---|

Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises, Multinational and Global companies. Managing Global environment. Management levels and types.

| UNIT III | FUNCTIONS OF BUSINESS | 9 |
|---|---|---|

Functions and Objectives – Production, Marketing, Finance, Human Resource, quality control and Research & development.

| UNIT IV | MEASURING BUSINESS PERFORMANCE AND CONTROLPROCESS | 9 |
|---|---|---|

Key performance indicators. Financial statement analysis- Cash flow analysis, ROI, working capital, cost volume profit analysis. Customer - satisfaction Retention and acquisition. Employee Performance - Benchmarking, employee retention. Controlling Techniques - Budgetary and Non-Budgetary control measures.

| UNIT V | COMPUTER APPLICATIONS IN BUSINESS | 9 |
|---|---|---|

Introduction to business Software- Enterprise application and Business application. Overview on types of Business software. ERP. Business Intelligence, e-business and e-governance.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE MCQ | 1.DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

CO1: Demonstrate and strengthen business quality and motivation in students (Understand)

CO2: Examine basic business skills and measuring business performance. (Understand)

CO3: Demonstrate business Applications using business software. (Apply)

CO4: Apply Enterprise application and Business application. (Apply)

CO5: Use Business Intelligence in e-business for marketing and sales. (Apply)

**Text Books**

1. Harold Koontz, Heinz Weihrich, Mark V. Cannice, "Essentials of Management", Tata McGrawHill, 11th Edition, 2020 (Unit 1 & 2)

2. Stephen P. Robbins and David A. Decenzo, "Fundamentals of Management", Pearson Education,8th Edition, 2012. (Unit 3,4 & 5)

**Reference Books**

1. James A. O'Brien, "Management Information Systems: Managing Information Technology in the Business Enterprise", Tata McGraw Hill, 2004.

2. Corey Schou and Dan Shoemaker, "Information Assurance for the Enterprise: A Roadmap to Information Security", Tata McGraw Hill, 2007.

3. Bateman Snell, "Management: Competing in the new era", McGraw-Hill Irwin, 5th Edition,2002.

**Web Resources**

1. https://www.business.msstate.edu/academics/department-management-information-systems/business-information-systems
2. https://study.com/academy/topic/introduction-to-business-information-systems.html
3. https://onlinecourses.nptel.ac.in › noc19_mg54

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 10 | 5 | 5 | 5 | 10 |
| UNDERSTAND | 10 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |

| | | | | | |
|---|---|---|---|---|---|
| ANALYZE | 40 | 25 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Identify the kinds of skills companies look for in managers. (Understand)
2. Give the current trends in management.(Understand)

**Course Outcome 2 (CO2):**

1. Distinguish private limited company and private limited company. (Understand)
2. With illustrations from Indian and International context, explain in detail the different types of business organization with suitability. (Understand)

**Course Outcome 3 (CO3):**

1. Sketch goalpost view of quality. (Apply)
2. Why talent acquisition is always on top priority in the role of HR? (Apply)

**Course Outcome 4 (CO4):**

1. If sales is 10,000 units and selling price is Rs 20 per unit, variable cost Rs 10 per unit and fixed cost is Rs 80,000. Find out BEP in units and in sales revenue. (Apply)
2. Modern company has been using a Budgetary control system for the last three years. When asked to explain the system, Mr.John the managing director of the company observed: We are flexible in our budgetary system. Every manager is given a total amount that he or she can spend for the next year. We don't care how it is used as long as the total isn't exceeded and organizational objectives are achieved.
   Do you agree or disagree with this approach. (Apply)

**Course Outcome 5 (CO5):**

**1.** Compare B2B and B2C. (Apply)

2. State the impact of E-commerce on Business. (Apply)

| **21CS5602** | **COMPUTER NETWORKS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Thiscourse offers a first formal introduction to performance analysis of different components of computer networks. Computer Network courses enables the learners to understand networking concepts, technologies and terminologies which in turn helps the students to analyze the flow control and perform error correction and detection. This course presents the concepts of transmission control protocol, which makes the individual to understand Application layer and also gives the glimpses of recent trends in computer networks.

**Prerequisites**

- 21CS4605/Operating System Concepts

**Objectives**

1. Understand layered architecture of computer networks and protocols.
2. Learn the various mediums used in the physical layer.
3. Understand the functionalities of data link layer.

| | | |
|---|---|---|
| 4. Learn the routing algorithms and the use of IP addressing in the network layer.<br>5. Understand the working of transport layer | | |
| **UNIT I** | **INTRODUCTION, PHYSICAL LAYER** | **9** |
| Overview: Data Communication - Network Types - Internet History - TCP/IP Protocol Suite - The OSI Model - Digital Signals - Data rate limits - Performance - Line Coding - Block Coding - Transmission Media: Guided Media - Unguided Media - Switching | | |
| Suggested Activities:<br>• Practical – Local Area Network set up<br>• Practical – RJ45 Cable Crimping | | |
| SUGGESTED EVALUATION METHODS:<br>• Assignment problems<br>• Quizzes | | |
| **UNIT II** | **DATA LINK LAYER** | **9** |
| Link Layer Addressing - ARP - Error Detection and Correction - Data Link Control Services - Data Link Layer Protocols - HDLC - PPP - Media Access Control - Ethernet - Wireless LANs: IEEE 802.11, Bluetooth - Connecting Devices. | | |
| Suggested Activities:<br>• Practical – CRC Checking<br>• Practical – Bluetooth Connection between PC and Mobile. | | |
| SUGGESTED EVALUATION METHODS:<br>• Assignment problems<br>• Quizzes | | |
| **UNIT III** | **NETWORK LAYER** | **9** |
| Network layer Services - Packet switching - Performance - IPV4 addresses –classful addressing and classless addressing- Forwarding of packets - Internet Protocol - ICMPV4 - Mobile IP - Routing algorithms - Routing Protocols - IPV6 addressing - IPV6 protocol -Transition from IPV4 to IPV6 | | |
| Suggested Activities:<br>• Practical –Routing Concept Using CISCO Packet Tracer<br>• Practical – IP Address Setting in PC/LAPTOP | | |
| SUGGESTED EVALUATION METHODS:<br>• Assignment problems<br>• Quizzes | | |
| **UNIT IV** | **TRANSPORT LAYER** | **9** |
| Transport Layer Services - Protocols - UDP - TCP: Transition Diagram, Flow Control, Error Control, Congestion Control - SCTP - QoS: Flow Control to improve QoS - Integrated Services - Differentiated Services - Client Server Programming. | | |
| Suggested Activities:<br>• Practical – Capturing of UDP, TCP Packets Using Ethereal<br>• Practical – Establishing Client Server Concept Using Crossover connection between two systems | | |

SUGGESTED EVALUATION METHODS:

- Assignment problems
- Quizzes

| UNIT V | APPLICATION LAYER AND SECURITY | 9 |
|---|---|---|

World Wide Web and HTTP –MIME- FTP - Electronic Mail - SMTP- Telnet - Secure Shell - Domain Name System - Network Layer Security - Transport Layer Security - Application Layer Security - Firewalls.

Suggested Activities:

Practical – File Transfer Systems Using Cross over connection between two systems.

Practical – Installation of Software Firewall.

SUGGESTED EVALUATION METHODS:

- Assignment Problems
- Quizzes

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE MCQ | 1.DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

CO1 Identify the role of each layer in computer networks and its protocols. (REMEMBER)

CO2 Develop scheme for error detection and correction (CREATE)

CO3 Evaluate the performance of various routing algorithms. (EVALUATE)

CO4 Analyze the flow control and congestion control algorithms for QoS at end to end level. (ANALYSE)

CO5 Analyze the role of Application Layer Protocols and Security features (ANALYSE)

**Text Books**

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, Fifth Edition, 2013 (Unit 1 – 5)

**Reference Books**

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan KauffmannPublishers Inc., Third Edition, 2003.

2. James F. Kuross, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Addison Wesley, ThirdEdition,2004.

3. Pete Loshin, “IPv6: Theory, Protocol and Practice”, ELSEVIER, Morgan Kauffmann Publishers Inc.,Second edition, 2004

4. William Stallings, “ Data and Com puter Communication ”, Pearson Education, Sixth Edition, 2000.

5. Andrew S. Tannenbaum, “Computer Networks”, Pearson Education, Fourth Edition, 2003

6. D.E. Comer, “Internetworking with TCP/IP Vol- III”, (BSD Sockets Version), Pearson Education,Second Edition, 2003.

7. W. Richard Stevens, "UNIX Network Programming Vol-I", Pearson Education, Second Edition, 1998.

**Web Resources**

1. https://nptel.ac.in/courses/106/105/106105081/www.nptel.ac.in
2. http://www.protocols.com/pbook/tcpip1.html
3. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-cs38/

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: Students will be able to Predict the suitable method for...(Apply)**

**Course Outcome 1 (CO1):**

1. Examine the two types of line configuration. (Analyze)
2. Can you list the five components of data communication? (Understand)
3. List the common approaches for switching. (Understand)

**Course Outcome 2 (CO2):**

1. Infer why the data link layer is subdivided into two sublayers. (Analyze)
2. Compose your view on why fragmentation is recommended in a wireless LAN? (Apply)
3. Show the Ethernet frame format. (Understand)

**Course Outcome 3 (CO3):**

1. Can you relate the two different classes of routing protocol? (Apply)
2. Demonstrate the need for sub netting?. (Understand)
3. Identify all the metrics used by routing protocols?. (Apply)

**Course Outcome 4 (CO4):**

1. Discover the services provided by Transport layer protocol? (Apply)
2. Suppose a TCP connection is transferring a file of 5000 bytes. The first byte is numbered 10001.What are the sequence numbers for each segment if data are sent in three segments, each carrying 1000 bytes.. (Apply)
3. Compare unicast, multicast and broadcast routing. (Analyze)

**Course Outcome 5 (CO5):**

1. Examine the function of SSH components? (Analyze)
2. Propose a comparison between GET and SET in SNMP. (Apply)
3. Interpret the design of a MIB for a simple SNMP? (Apply)

| 21PT3904 | SOFT SKILLS –REASONING | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**Prerequisites for the course**

- Verbal Ability

**Objectives**

1. To strengthen the social network by the effective use of social media and social interactions.
2. To identify own true potential and build a very good personal branding
3. To develop critical thinking to solve real world problems and competitive exam problems for students

| UNIT I | Social Media | 3 |
|---|---|---|

Effective use of social media - Types of social media, Moderating personal information, Social media for job/profession, Communicating diplomatically.

Networking on social media - Maximizing network with social media, How to advertise on social media.

| UNIT II | Social Interaction | 3 |
|---|---|---|

Event management - Event management methods, Effective techniques for better event management. Influencing - How to win friends and influence people, Building relationships, Persistence and resilience, Tools for talking when stakes are high Conflict resolution - Definition and strategies ,Styles of conflict resolution

| UNIT III | Non Verbal Communication | 3 |
|---|---|---|

Proximecs - Types of proximecs, Rapport building. Reports and Data Transcoding - Types of reports. Negotiation Skill - Effective negotiation strategies. Conflict Resolution - Types of conflicts.

| UNIT IV | Interpersonal Skill | 3 |
|---|---|---|

Social Interaction - Interpersonal Communication, Peer Communication, Bonding, Types of social interaction. Responsibility - Types of responsibilities, Moral and personal responsibilities. Networking - Competition, Collaboration, Content sharing. Personal Branding - Image Building,

| | | |
|---|---|---|
| Grooming, Using social media for branding. Delegation and compliance - Assignment and responsibility, Grant of authority, Creation of accountability | | |
| **UNIT V** | **Reasoning Ability** | **3** |
| Analytical Reasoning Data Arrangement(Linear and circular & Cross Variable Relationship), Blood Relations, Ordering/ranking/grouping, Puzzle test, Selection Decision table | | |
| | **Total Periods** | **15** |
| **Suggestive Assessment Methods** | | |
| **Continuous Assessment Test**<br>**Formative Assessment Test** | | |
| **1. DESCRIPTIVE QUESTIONS** | 1.ASSIGNMENT<br>2. ONLINE MCQ<br>3.PROBLEM-SOLVING ACTIVITIES | |
| **Outcomes** | | |
| **Upon completion of the course, the students will be able to:** | | |
| **CO1:**Understanding the various strategies of conflict resolution among peers and supervisors and respond appropriately<br>**CO2:** Acquire wide knowledge on social interaction<br>**CO3:**Improve speaking skills in academic and social contexts<br>**CO4:** Improve interpersonal communication through proper pronunciation.<br>**CO5:** Interpret the analytic reasoning ability which would help them in their professional career. | | |
| **Text Books** | | |
| 1. ETHNUS, Aptimithra, 2013, First Edition, McGraw-Hill Education Pvt.Ltd.<br>2. Mark G. Frank, David Matsumoto, Hyi Sung Hwang, Nonverbal Communication: Science and Applications, 2012, 1 st Edition, Sage Publications, New York. | | |
| **Reference Books** | | |
| 1. Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler, Crucial Conversations: Tools for Talking When Stakes are High, 2001,1st edition McGraw Hill Contemporary, Bangalore.<br>2. Dale Carnegie, How to Win Friends and Influence People, Latest Edition,2016. Gallery Books, New York | | |
| **Web Recourses**<br>1. https://www.fresherslive.com/online-test/logical-reasoning-test/questions-and-answers<br>2. https://www.indiabix.com/non-verbal-reasoning/questions-and-answers/<br>3. https://www.indiabix.com/logical-reasoning/questions-and-answers/ | | |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 2 | | | | | | | | | | 2 | 2 | |
| 2 | | 2 | | 2 | | 2 | | | 1 | | 3 | | 1 | 2 | 1 |
| 3 | 1 | | | 1 | 1 | | 2 | | | 1 | 2 | 2 | | | 2 |
| 4 | 1 | 2 | 2 | | 3 | | | 3 | 2 | | | | 2 | 1 | |
| 5 | 2 | | 2 | 2 | | 2 | | | 2 | | 1 | | 2 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 |
|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 |
| UNDERSTAND | 40 | 20 | 10 | 10 |
| APPLY | 40 | 50 | 5 | 5 |
| ANALYZE | | 20 | 5 | 5 |
| EVALUATE | | | | |
| CREATE | | | | |

**PRACTICAL COURSES**

| 21CS5611 | COMPUTER NETWORKS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- 21CB3601/Object Oriented Programming
- 21CS4605/Operating System Concepts

**Objectives**

1. To learn the communication between two desktop computers.
2. To implement the different protocols
3. To be familiar with socket programming.
4. To be familiar with the various routing algorithms
5. To be familiar with simulation tools.

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and | CO1 |

| | | |
|---|---|---|
| | traceroute PDUs using a network protocol analyzer and examine. | |
| 2 | Write a HTTP web client program to download a web page using TCP sockets. | **CO1** |
| 3 | Applications using TCP sockets like:<br>• Echo client and echo server<br>• Chat<br>• File Transfer | **CO1** |
| 4 | Write a code simulating ARP /RARP protocols. | **CO2** |
| 5 | Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS. | **CO2** |
| 6 | Study of TCP/UDP performance using Simulation tool. | **CO2** |
| 7 | Simulation of Distance Vector/ Link State Routing algorithm. | **CO3** |
| 8 | Performance evaluation of Routing protocols using Simulation tool. | **CO4** |
| 9 | Implementation of Stop and Wait Protocol and sliding window. | **CO5** |
| | | **Total Periods: 60** |

**Suggestive Assessment Methods**

| Lab Components Assessments (50 Marks) | End Semester Exams (50 Marks) |
|---|---|
| Lab Experiment<br>• Viva<br>• Model Exam | • Practical Exam<br>• Viva |

**Outcomes:**

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

CO1: Learn to communicate between two desktop computers. (Understand)

CO2: Learn to implement different protocols (Apply)

CO3: Be familiar with socket programming (Apply)

CO4: Be familiar with the various routing algorithms (Apply)

CO5: Be familiar with simulation tools. (Analyse)

**Laboratory Requirements:**

**SOFTWARE:**

- C / C++ / Java / Equivalent Compiler
- Network simulator like NS2/ NS3 / Glomosim/OPNET/ 30 Equivalent

**HARDWARE:**

- Standalone desktops

**Reference Books**

1. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill, Fifth Edition, 2013

| Web Resources |
|---|
| 1. www.nptel.ac.in<br>2. http://www.protocols.com/pbook/tcpip1.html |

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | 2 | | | | 1 | | | 1 | 3 | 2 | |
| 2 | 3 | 3 | 3 | | 2 | | | | 1 | | | 1 | 3 | 2 | |
| 3 | 3 | 3 | 3 | | 2 | | | | 1 | | | 1 | 3 | 2 | |
| 4 | 3 | 3 | 3 | | 2 | | | | 1 | | | 1 | 3 | 2 | |
| 5 | 3 | 3 | 3 | | 2 | | | | 1 | | | 1 | 3 | 2 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | Model Exam | END SEM EXAM |
|---|---|---|
| REMEMBER | | |
| UNDERSTAND | | |
| APPLY | 100 | 100 |
| ANALYZE | | |
| EVALUATE | | |
| CREATE | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Learn to use commands like tcpdump, netstat, ipconfig, nslookup and traceroute .(Understand)
2. Capture ping and traceroute PDUs using a network protocol analyzer and examine. (Analyze)

**Course Outcome 2 (CO2):**

1. Write a java program for code simulating ARP protocols(Apply)
2. Write a java program for code simulating RARP protocols. (Apply)

**Course Outcome 3 (CO3):**

1. Write a HTTP web client program to download a web page using TCP sockets.(Apply)
2. Write a java program for Echo client and echo server using TCP sockets. (Apply)

**Course Outcome 4 (CO4):**

1. To simulate and observe traffic route of a network using distance vector routing protocol.
2. To simulate and observe traffic route of a network using distance vector routing protocol. (Analyze)

**Course Outcome 5 (CO5):**

1. implement User Datagram Protocol (UDP) using NS-2 (Apply)
1. Compare various Routing Protocols performance using NS-2. (Apply)

| 21CB5611 | COMPUTATIONAL STATISTICS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Preamble**

The goal of the course is to present essential **statistical** concepts. Simulation is used to illustrate the concepts and to provide understanding and develop the mathematical operations.

**Prerequisites for the course**

- 21MA3205- Probability and Statistics
- 21IT4601-Introduction to algorithms

**Objectives**

- To expose the variables, expressions, control stations of R.
- To use R programming for analysis of data and visualize outcomes in the form of graphs, charts.
- To develop and understand the modern computational statistical approaches and their applications to different data sets.
- To apply principles of data science to analyse various business problems.
- To use R software to carry out statistical computations and to analysis data using R.

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | Python Concepts, Data Structures | CO1 |
| 2 | Classes: Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, | CO1 |
| 3 | Sequences and Class Definition, Constructors, Text & Binary Files - Reading and Writing | CO1 |
| 4 | Visualization in Python: Matplotlib package | CO2 |
| 5 | Plotting Graphs, Controlling Graph, Adding Text, | CO2 |
| 6 | More Graph Types, Getting and setting values, Patches. | CO2 |
| 7 | Multivariate data analysis: Multiple regression, | CO3 |
| 8 | multivariate regression, cluster analysis with various algorithms, | CO4 |
| 9 | factor analysis, | CO4 |
| 10 | PCA and linear discriminant analysis. | CO5 |
| | | **Total Periods :60** |

| S. No | List of Test Projects | CO |
|---|---|---|
| 1 | Market Basket Analysis | CO5 |
| 2 | Reducing Manufacturing Failures | CO5 |
| 3 | Insurance Pricing Forecast | CO5 |

| | | |
|---|---|---|
| 4 | City Employee Salary Data Analysis | CO5 |
| 5 | Churn Prediction in Telecom | CO5 |
| 6 | Predicting Wine Preferences of Customers using Wine Dataset | CO5 |
| 7 | Identifying Product Bundles from Sales Data | CO5 |
| 8 | Movie Review Sentiment Analysis | CO5 |
| 9 | Store Sales Forecasting | CO5 |
| 10 | Building a Music Recommendation Engine | CO5 |
| 11 | Airline Dataset Analysis | CO5 |
| 12 | Predicting Flight Delays | CO5 |
| 13 | Event Data Analysis | CO5 |
| 14 | Building a Job Portal using Twitter Data | CO5 |
| 15 | Implementing Slowly Changing Dimensions in a Data | CO5 |

**Suggestive Assessment Methods**

| **Lab Components Assessments (50 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|
| 7. Exercises<br>8. Project File (Progress Score)<br>9. Viva voce | 1. Exercises<br>2. Record note<br>3. Viva voce |

**Outcomes**

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

CO1 Apply the basic concepts of Computational Statistics using python & R
CO2 Apply the Graph techniques
CO3 Apply the multivariate graphing techniques
CO4 Apply the concept of regression and clustering
CO5 Implement a project based on the Data Analytics

**Laboratory Requirements**

Python & R Studio

**Reference Books**

2. T.W. Anderson," An Introduction to Multivariate Statistical Analysis", Third edition, Wiley, 2003.
3. J.D. Jobson, "Applied Multivariate Data Analysis ", Volume I & II, Springer texts in statistics, Fourth Edition, New York, 1999.
4. Mark Lutz, "Programming Python", Fourth Edition, O'Reilly Media, Mark Lutz Germany, 2011

**Web Resources**

1. https://nptel.ac.in/courses/111105091
2. https://nptel.ac.in/courses/111105077

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | 2 | | 3 |
| 2 | 3 | 3 | 3 | | | | | | | | | | 2 | | 3 |
| 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | | 3 |
| 4 | 3 | 3 | 3 | 3 | | | | | | | | | 2 | | 3 |
| 5 | 2 | 2 | 2 | 3 | 2 | | | | 2 | 2 | 2 | 2 | 3 | | 3 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | Model Exam | END SEM EXAM |
|---|---|---|
| REMEMBER | | |
| UNDERSTAND | | |
| APPLY | 50 | 100 |
| ANALYZE | | |
| EVALUATE | 50 | |
| CREATE | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):(Blooms Category: Apply)**

1. Implement a NumPy program to test element-wise for positive or negative infinity
2. Implement a R program to create a data frame using two given vectors and display the duplicated elements and unique rows of the said data frame

**Course Outcome 2 (CO2):(Blooms Category: Apply)**

1. Implement a Python program to plot quantities which have an x and y position.
2. Create a Python program to display the grid and draw line charts of the closing value of Alphabet Inc. between October 3, 2016 to October 7, 2016. Customized the grid lines with linestyle -, width .5. and color blue

**Course Outcome 3 (CO3):(Blooms Category: Apply)**

1. Implement linear regression with one variable to predict profits for a food truck.
2. Implement regularized logistic regression to predict whether microchips from a fabrication plant passes quality assurance (QA).

**Course Outcome 4 (CO4):(Blooms Category: Apply)**

1. Implement regularized linear regression and use it to study models with different bias-variance properties.

2. In this exercise, we will be experimenting support vector machines (SVMs) on various example 2D datasets.

**Course Outcome 5 (CO5):(Blooms Category: Create)**

1. Use principal component analysis (PCA) to perform dimensionality reduction.
2. Implement the K-means clustering algorithm and apply it to compress an image.

| Professional Elective I | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | **21CB5701** | **Big Data Technologies and Analytics** | **5** | **3** | **0** | **0** | **3** | **Data Analytics** |
| **2** | **21CB5702** | **Data Science and Business Analytics** | **5** | **3** | **0** | **0** | **3** | **Business Analytics** |
| **3** | **21CB5703** | **Marketing Research** | **5** | **3** | **0** | **0** | **3** | **Business Management** |
| **4** | **21CB5704** | **Cloud application Development** | **5** | **3** | **0** | **0** | **3** | **Full Stack Development** |

| **21CB5701** | **BIG DATA TECHNOLOGIES AND ANALYTICS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**Preamble**

The use of various data technologies and tools such as Hadoop, Spark, NoSQL, and machine learning algorithms, to manage, store, process, and analyse vast amounts of structured and unstructured data has been described.

**Prerequisites for the course**

- 21CS5201/Introduction to Computing Using Python
- 21CS4601/Data Base Management Systems

**Objectives**

6. Understand the concept of big data.
7. Learn and use NoSQL big data management.
8. Learn MapReduce analytics using Hadoop and related tools.
9. Work with map, reduce applications.
10. Understand the usage of Hadoop related tools for Big Data Analytics

| **UNIT I** | **UNDERSTANDING BIG DATA** | **9** |
|---|---|---|

What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – other big data applications– big

data technologies – introduction to Hadoop – open-source technologies – cloud and big data – mobile business intelligence.

**SUGGESTED ACTIVITIES**:

- Downloading and installing Hadoop; Understanding different Hadoop modes.
- Startup scripts, Configuration files.

**SUGGESTED EVALUATION METHODS:**

• Assignments: List out the other bigdata applications like bigdata in medicinal field, bigdata in healthcare etc.

| **UNIT II** | **NOSQL DATA MANAGEMENT** | **9** |
|---|---|---|

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – mapreduce.`

**SUGGESTED ACTIVITIES:**

• External Learning: Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files

**SUGGESTED EVALUATION METHODS:**

• Tutorial on master-slave replication method and peer-peer replication

| **UNIT III** | **BASICS OF HADOOP** | **9** |
|---|---|---|

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.

**SUGGESTED ACTIVITIES:**

• Implement of Matrix Multiplication with Hadoop Map Reduce

**SUGGESTED EVALUATION METHODS:**

• Assignment on obtaining a java interface between the data and network in Hadoop platform.

| **UNIT IV** | **MAPREDUCE APPLICATIONS** | **9** |
|---|---|---|

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

**SUGGESTED ACTIVITIES:**

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

**SUGGESTED EVALUATION METHODS:**

- Tutorial: Different operations done using Map Reduce function.

| **UNIT V** | **HADOOP RELATED TOOLS** | **9** |
|---|---|---|

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

**SUGGESTED ACTIVITIES:**

- Installation of Hive along with practice examples.
- Installation of HBase, Installing thrift along with Practice examples
- Practice importing and exporting data from various databases.
- In-class activity on FP metrics & Variants

**SUGGESTED EVALUATION METHODS:**

- Assignment: Real time task on developing and testing Pig Latin scripts

| **Total Periods** | **45** |
|---|---|

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1** Describe big data and use cases from selected business domains. (Understand)

**CO 2** Apply NoSQL concepts in big data management. (Apply)

**CO 3** Install, configure, and run Hadoop and HDFS. (Apply)

**CO 4** Perform map-reduce analytics using Hadoop. (Apply)

**CO 5** Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics. (Apply)

**Text Books**

6. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013. (Unit 1 – 3)
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012. (Unit 4 & 5)

**Reference Books**

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.

**Web Resources**

1. https://nptel.ac.in/courses/10610418
2. https://www.edureka.co/big-data-technologies/

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | 3 | 2 | | | | | | | 2 | 3 | | |
| 2 | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | | |
| 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | | |
| 4 | 3 | 2 | 3 | 2 | 3 | | | | | | | 2 | 2 | | 2 |
| 5 | 3 | 2 | 3 | 3 | 3 | | | | | | | 2 | 2 | | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |

| | | | | | |
|---|---|---|---|---|---|
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. How do you analyze process involve in various business sectors? (Apply)
2. Compare Traditional Vs Big data business approach with its drawbacks? (Apply)

**Course Outcome 2 (CO2):**

1. In which materialized view process the market managing has been take over? (Apply)
2. Draw a graph database for patient data. (Apply)

**Course Outcome 3 (CO3):**

1. Justify how hadoop technology satisfies the business insights now -a –days? (Apply)
2. Implement the processing data with Hadoop? (Apply)

**Course Outcome 4 (CO4):**

1. Identify block replication in HDFS? (Apply)
2. How to overcome the Faults and handling of Errors? (Apply)

**Course Outcome 5 (CO5):**

1. Interpret joins with an example? (Apply)
2. A start-up company want to use Hive for storing its data. List the collection types provided by Hive for this purpose? Write a shell command in Hive to list all the files in the current directory? (Apply)

| 21CB5602 | BUSINESS ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Business analytics focuses on data, statistical analysis and reporting to help investigate and analyse business performance, provide insights, and drive recommendations to improve performance.

**Prerequisites for the course**

- 21CS5201/Introduction to Computing Using Python
- 21CS460/Data Base Management Systems

**Objectives**

1. Understand the Analytics Life Cycle.
2. Comprehend the process of acquiring Business Intelligence
3. Understand various types of analytics for Business Forecasting.
4. Learn the supply chain management for Analytics.
5. Apply analytics for different functions of a business

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition–Data Collection – Data Preparation – Hypothesis Generation – Modelling –Validation and Evaluation– Interpretation–Deployment and Iteration

**SUGGESTED ACTIVITIES**:

- In-class activity on Analysing a real time data such as Forecasting the Sales of a Supermarket During Festival Season
- External Learning on Customer Segmentation.

**SUGGESTED EVALUATION METHODS:**

- Assignments: Selection of suitable analytics models for a given software specification

| UNIT II | BUSINESSINTELLIGENCE | 9 |
|---|---|---|

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions – Decision Making Process- Decision Support Systems – Business Intelligence –OLAP – Analytic functions

**SUGGESTED ACTIVITIES:**

- External Learning: Using open-source tools implement a project by following the best practices to implement data mart.
- External Learning: Using open-source OLAP tools such as IBM Cognos, Apache Kylin, and Jedox.

**SUGGESTED EVALUATION METHODS:**

- Tutorial on understanding the basic difference between the data warehouse and data mart and selection of an appropriate strategy.
- Assignment on Decision making for business intelligence process for a software project

| UNIT III | BUSINESSFORECASTING | 9 |
|---|---|---|

Introduction to Business Forecasting and Predictive analytics-Logic and Data Driven Models –Data Mining and Predictive Analysis Modelling – Machine Learning for Predictive analytics.

**SUGGESTED ACTIVITIES:**

• External Learning on ideas of straight-line, moving average, simple linear regression and multiple linear regression.

• Tutorial on using Automation software for forecasting

**SUGGESTED EVALUATION METHODS:**

• Assignment on implementing health care analysis using predictive learning.

| UNIT IV | HR& SUPPLYCHAINANALYTICS | 9 |
|---|---|---|

Human Resources – Planning and Recruitment – Training and Development - Supply chain network-Planning Demand, Inventory and Supply–Logistics–Analytics applications in HR& Supply Chain. Apply HR Analytics to make a prediction of the demand for hourly employees for a year.

**SUGGESTED ACTIVITIES:**

• External Learning on using tools for estimating Supply chain analytics

• External Learning on Apply HR Analytics to make a prediction of the demand for hourly employees for a year.

**SUGGESTED EVALUATION METHODS:**

• Tutorial: predictive analytics on point-of-sale terminal data stored in a demand signal repository

• Assignment on integration between the many SCM and supply chain execution platforms

| UNIT V | MARKETING&SALESANALYTICS | 9 |
|---|---|---|

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – AnalyticsapplicationsinMarketingandSales.Dopredictiveanalyticsforcustomers'behaviourinmarketingandsales.

**SUGGESTED ACTIVITIES:**

• External Learning on sales and marketing analytics solutions that integrate data from CRM systems, automated marketing platforms, website analytics tools, SEO tools, social media platforms.

**SUGGESTED EVALUATION METHODS:**

• Assignment on software projects by using tools like Google Trends to help identify what customers are searching for.

| **Total Periods** | **45** |
|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1. DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO1:** Understand the real-world business problems and model with analytical solutions. (Understand)
**CO2:** Extract Business Intelligence to identify the business processes. (Apply)
**CO3:** Apply predictive analytics for business fore-casting. (Apply)
**CO4:** Apply analytics for supply chain and logistics management. (Apply)
**CO5:** Analyse marketing and sales using Supply chain analytics. (Analyse)

**Text Books**

1. Prasad, Seema Acharya, FundamentalsofBusinessAnalytics,2ndEdition, Wiley, 2016. (unit 1 – 3)
2. Philip Kotler and Kevin Keller, MarketingManagement,15thedition, PHI,2016. (Unit 4 & 5)

**Reference Books**

1. VSPRAO, HumanResourceManagement,3rdEdition, ExcelBooks,2010.
2. Mahadevan B, "OperationsManagement-TheoryandPractice",3rdEdition, Pearson Education,2018

**Web Resources**

1. https://nptel.ac.in/courses/110107092
2. https://analytics.hbs.edu/business-analytics/

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | | | 3 | | | | | | | | 3 | | |
| 2 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | | |
| 3 | 3 | 2 | | 3 | 3 | | | | | | | | 3 | | |
| 4 | 3 | | 2 | | 2 | | | 2 | 3 | | 2 | 3 | 3 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 3 | 2 | 2 | | | | | 2 | 2 | | 2 | 3 | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

3. Mention the role of decision support system with its main components for the Social Media system perform the concept of Modelling (Understand)

2. Mention the different factors responsible for successful BI projects, briefly explain. (Understand)

**Course Outcome 2 (CO2):**

1, Exhibit the task of data visualization. Explain the job responsibilities of BI analysts for creating data visualizations. (Understand)

2. For a real time example differentiate Data Warehouses and Data Mart. (Understand)

3. For the Marketing Media System exhibit the four stages of Simon's decision-making process. (Apply)

**Course Outcome 3 (CO3):**

1. Use the Machine learning algorithms to implement predictive analysis for dashboards. (Apply)

2. Mention different types of charts? Apply DDM techniques. (Understand)

**Course Outcome 4 (CO4):**

1.Describe the approaches of decision makers for a real time management decision making environment (understand)

2. Justify the importance of data visualization techniques in decision making. (understand)

**Course Outcome 5 (CO5):**

1. Who are the persons involved in building a team to develop a project for a banking sector. (Analyse)

2. List the activities of a scrum master to develop a team. (Understand)

| 21CB5703 | MARKETING RESEARCH | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The importance of understanding customer needs and wants, creating value for customers, and building strong relationships with customers have been included.

**Prerequisites for the course**

- 21HS2102/Business Communication and Value Science -II

**Objectives**

- Understand the changing business environment and the fundamental premise underlying market driven strategies.
- Identify the indicators of management thoughts and practices.
- Learn the nature of consumer buying behaviour
- Understand the marketing research
- Apply the new trends in the arena of marketing

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Defining Marketing – Core concepts in Marketing – Evolution of Marketing – Marketing Planning Process – Scanning Business environment: Internal and External – Value chain – Core Competencies – PESTEL – SWOT Analysis – Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System – Marketing in global environment – International Marketing – Rural Marketing – Prospects and Challenges

| UNIT II | MARKETING STRATEGY | 9 |
|---|---|---|

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing – Services marketing – Competition Analysis – Analysis of consumer and industrial markets – Influence of Economic and Behavioral Factors – Strategic Marketing Mix components.

| UNIT III | MARKETING MIX DECISIONS | 9 |
|---|---|---|

Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning – Brand Positioning and Differentiation – Channel Management – Managing Integrated Marketing Channels – Managing Retailing, Wholesaling and Logistics – Advertising and Sales Promotions – Pricing Objectives, Policies and Methods.

| **UNIT IV** | **BUYER BEHAVIOUR** | **9** |
|---|---|---|

Understanding Industrial and Consumer Buyer Behaviour – Influencing factors – Buyer Behaviour Models – Online buyer behaviour – Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection – Creating Long Term Loyalty Relationships.

| **UNIT V** | **MARKETING RESEARCH & TRENDS IN MARKET** | **9** |
|---|---|---|

Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing – Ethics in marketing – Online marketing trends - social media and digital marketing.

| **Total Periods** | **45** |
|---|---|

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2.FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1.DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1** Understand the contemporary marketing theories to the demands of business and management practice. (Understand)

**CO 2**Enhance the knowledge of marketing strategies for consumer and industrial marketing. (Apply)

**CO 3**Analyze the nature of consumer buying behaviour and managing integrated marketing channels. (Apply)

**CO A**nalyze the nature of consumer buying behaviour. (Analyse)

**CO 5** Understanding of the marketing research and new trends in the arena of marketing. (Understand)

**Text Books**

1. Philip. T. Kotler and Kevin Lane Keller, Marketing Management, Prentice Hall India, 15th Edition, 2017 ( Unit 1-5)

**Reference Books**

1. Lamb, Hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching- A south Asian perspective, Cengage Learning, 2012.
2. Paul Baines, Chris Fill, Kelly Page, Marketing, Asian edition, Oxford University Press,5 th edition, 2019.

**Web Resources**

1. https://archive.nptel.ac.in/courses/110/107/110107080/
2. https://www.hubspot.com/resources

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 2 | | 3 | 2 | 3 | | 3 | 3 | 3 | |
| 2 | | | | | | 2 | | 3 | 2 | 3 | | 3 | 3 | 3 | |
| 3 | | | | | | 3 | | 3 | | 3 | 3 | 3 | 3 | 3 | |
| 4 | | | | | | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| 5 | | | | | | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |

| | | | | | |
|---|---|---|---|---|---|
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Identify the ethical issues in marketing research process in marketing management. (Understand)
2. Give a research proposal for a study required by a company which intends to launch a new brand of health drink. (Apply)

**Course Outcome 2 (CO2):**

1. Design a questionnaire to study online buying behaviour of consumers for electronic goods using appropriate attitudinal scale (Apply)
2. Discuss the concept of cluster analysis and its importance in marketing research. Explain the procedure of 'cluster Analysis' and 'clustering methods. (Apply)

**Course Outcome 3 (CO3):**

1. Differentiate between univariate and multivariate techniques. Which category of techniques is best suited for consumer research and why? (Apply)
2. "Is everyday low pricing leading to low profit in current scenario" Discuss. (Apply)

**Course Outcome 4 (CO4):**

1. When can you use Observation Research Method, Listout its advantages and limitation (Apply)
2. How are Field Surveys conducted? Explain with examples. (Apply)

**Course Outcome 5 (CO5):**

1. Are there any other potential existing markets and/or possible emerging markets? (Apply)
2. Is the industry sensitive to economics fluctuations? (Apply)

| **21CB5704** | **CLOUD APPLICATION DEVELOPMENT** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**Preamble**

Cloud computing refers to the delivery of computing services, including servers, storage, databases, networking, software, analytics, and more, over the internet ("the cloud").

**Prerequisites for the course**

- 21CB3603/Digital principles and Computer Organization

- 21CB4601/Database Management Systems

**Objectives**

- Understand the fundamentals of cloud computing
- Understand the various cloud services
- Understand the concepts of web service and framework
- Learn to create and manage open-source cloud services
- Understand the various security issues in cloud services

| | | |
|---|---|---|
| **UNIT I** | **INTRODUCTION** | **9** |

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges. Requirements for Cloud application development, Cloud computing Eco systems SaaS/PaaS/IaaS.

| | | |
|---|---|---|
| **UNIT II** | **WEB SERVICES, FRAMEWORK AND CLOUD SERVICES** | **9** |

Frameworks: Model View Controller (MVC), Struts, Spring, JQuery, API: Web, RESTFUL, JSON. Hybrid cloud services, Mobile cloud services, Database as a service, Load balancer as a service, Multi cloud.

| | | |
|---|---|---|
| **UNIT III** | **ANALYTICS SERVICES** | **9** |

AWS Introduction - EC2 – Amazon EMR - Amazon Kinesis - Amazon Kinesis Data Analytics - Amazon Quick Sight - Amazon Elastic search Service - Amazon Kinesis Data Firehose - AWS Glue

| | | |
|---|---|---|
| **UNIT IV** | **APPLICATION DEVELOPMENT** | **9** |

Google Cloud Platform (GCP) Introduction – Dataproc - Cloud Dataprep – Data Studio – Data Catalog – Google Marketing platform. AppAgile – cloudfoundry

| | | |
|---|---|---|
| **UNIT V** | **OPEN-SOURCE CLOUD PLATFORM AND APPLICATION SECURITY** | **9** |

OpenStack Introduction, Architecture, Components – Nova, Swift, Cinder, Neutron, Keystone, Glance – Heat.

Cloud security issues – threats – Prevention. OWASP Top 10 Security Risks & Vulnerabilities. Case Studies.

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| | | |
|---|---|---|
| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |

| | | |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2.FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1.DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1**: Understand the fundamentals of cloud computing. (Understand)

**CO 2**: Understand the concepts of web services and framework and various cloud services. (Understand)

**CO 3:** Implement cloud application for business analytics and visualize the data. (Apply)

**CO 4:** Implement various applications, deploy and generate analysis with reports. (Apply)

**CO 5:** Create an open-source cloud services and understand the various security issues in cloud services. (Analyse)

**Text Books**

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, 2nd Edition, MK Publishers,2017. (Unit 1 – 3)

2. Barrie Sos in sky, Cloud Computing Bible, 1st Edition, 2011. (Unit 4 & 5)

**Reference Books**

1. Mark Wilkins, Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud, 1st Edition, 2019.
2. Legorie Rajan PS, Google Cloud Platform Cookbook: Implement, deploy, maintain, and migrate applications on Google Cloud Platform, 2018.

**Web Resources**

1. https://archive.nptel.ac.in/courses/106/106/106106156/
2. https://nptel.ac.in/courses/106105167

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | | |
| 2 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | | |
| 4 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 | 3 | | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Which is the most common scenario for a private cloud. (Apply)
2. Provide some examples of IaaS implementation. (Apply)

**Course Outcome 2 (CO2):**

1. Describe some examples of CRM and ERP implementation based on cloud computing technologies. (Apply)
2. Describe how cloud computing technologies can be applied to support remote ECG monitoring? (Apply)

**Course Outcome 3 (CO3):**

1. "Although Virtualization is widely Accepted today, it does have its limits". Comment on the statement. (Apply)
2. How does the virtualization Support the Linux platform? (Apply)

**Course Outcome 4 (CO4):**

1. Show the interaction between the Actors in the cloud computing. (Apply)

2. I am starting a new company to analyze videos. I'll need a lot of storage as videos consume quite a bit of disk. Additionally, I'll need ample computational power, possibly running applications concurrently. I have discovered some very good tools to facilitate development in Windows but the deployment will be more effiicently handled in the Linux environment. All the pointers say that I need to move to cloud. I have found that SaaS is the most attractive service, followed by PaaS and IaaS, in that order. Given the above information, which service do you recommend? Why? (Apply)

**Course Outcome 5 (CO5):**

1. "Virtual machine is secured". Is it true? Justify your answer. (Apply)
2. For a SaaS application, who will be responsible to provide security for the infrastructure? Will it be cloud service provider or the cloud service consumer? Who will be responsible to ensure compliance with a privacy standard? Formulate your views about it. (Apply)

| Professional Elective II | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 21CB5705 | Data Mining for Business Intelligence | 5 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21AI5703 | Healthcare Analytics | 5 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB5706 | Micro and Macroeconomics | 5 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB5707 | Web Technologies | 5 | 3 | 0 | 0 | 3 | Full Stack Development |

| 21CB5705 | DATA MINING FOR BUSINESS INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Data mining for business intelligence refers to the introductory statement or explanation that provides context and background information for the use of data mining techniques and methods to extract valuable insights and knowledge from data in order to improve business decision-making.

**Prerequisites for the course**

- 21MA3205/Probability and Statistics
- 21CS4601/Database Management Systems

**Objectives**

- Know how to derive meaning from huge volume of data and information.
- Understand how knowledge discovering process is used in business decision making.
- Extract, transform, and load transaction data onto the data warehouse
- Provide data access to business analysts and IT professionals
- Analyze the data by application software

| | | |
|---|---|---|
| **UNIT I** | **INTRODUCTION** | **9** |
| Data mining - Database Data, Data Warehouse, Transactional Data, Text mining, Web mining, Data ware house. | | |
| **UNIT II** | **DATA MINING PROCESS** | **9** |
| Datamining process – KDD, CRISP-DM, SEMMA Prediction performance measures. | | |
| **UNIT III** | **PREDICTION TECHNIQUES** | **9** |
| Data visualization - Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations, Time series – ARIMA, Winter Holts | | |
| **UNIT IV** | **CLASSIFICATION AND CLUSTERING TECHNIQUES** | **9** |
| Classification- Bayesian Belief Networks, Classification by Backpropagation, Support Vector Machines, Association - Classification Using Frequent Patterns, Clustering - Lazy Learners (or Learning from Your Neighbors). | | |
| **UNIT V** | **MACHINE LEARNING AND AI** | **9** |
| Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization. | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2.FORMATIVE MULTIPLE-CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1.DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE-CHOICE QUESTIONS |

**Outcomes**

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

**CO 1**Understand various data mining techniques into various areas of different domains. (Understand)

**CO 2**Apply data mining for business intelligence. (Apply)

**CO 3**Apply various prediction techniques. (Apply)

**CO 4**Learn about supervised and unsupervised learning technique. (Understand)

**CO 5** Develop and implement machine learning algorithms. (Apply)

**Text Books**

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006. (Unit 1 & 2)

2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008. (Unit 3 – 5) tn72bt4150

**Reference Books**

1. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 3rd edition,2013
2. Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011

**Web Resources**

1. https://nptel.ac.in/courses/110107095
2. https://nptel.ac.in/courses/110107129

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | | 2 |
| 2 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 | 3 | 2 | 3 |
| 4 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 2 | 2 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 2 | 3 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. A data warehouse is a subject-oriented, integrated, time-variant, and non-volatile collection of data – Justify. (Apply)
2. Can BI be used for DM? Or vice versa? (Apply)

**Course Outcome 2 (CO2):**

1. With the help of a suitable example, illustrate the OLAP operations: 'drill-down', 'roll-up', 'slice' and 'dice'. (Apply)
2. Compare OLAP and OLTP in detail. (Apply)

**Course Outcome 3 (CO3):**

1. Why outlier mining is important? Briefly describe the different approaches: statistical-based outlier detection, distance-based outlier detection and deviation-based outlier detection. (Apply)
2. What is apex cuboid? Discuss drill down and roll up operation with diagram. (Apply)

**Course Outcome 4 (CO4):**

1. Minimum salary is 20,000Rs and Maximum salary is 1,70,000Rs. Map the salary 1,00,000Rs in new Range of (60,000 , 2,60,000) Rs using min-max normalization method. (Apply)
2. Use min-max normalization method to normalize the following group of data by setting min = 0 and max = 1 ,200, 300, 400, 600, 1000(Apply)

**Course Outcome 5 (CO5):**

1. In real-world data, tuples with missing values for some attributes are a common occurrence. Describe various methods for handling this problem. (Apply)
2. With the help of a neat diagram explain the topology of a multilayer, feed-forward Neural Network. Also explain the terms: "activation function" and"epoch". (Apply)

| 21AI5703 | HEALTH CARE ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Students able to learn the fundamental ideas and methods of Game Programming are covered in this course as intelligent if it is similar to those carried out by people

**Pre requisites for the course:**

- 21MA3205-Probability and statistics
- 21AI4601- Data Analytics

**Objectives**

- To know the introduction about the benefits, challenges and opportunities in healthcare for data science
- To explore specific technologies used to improve healthcare data
- To implement innovative tool to gather health relevant data
- To analyze various data linkage method for supporting the adoption of healthy lifestyles
- To implement various data visualization techniques for healthcare domain

| UNITI | INTRODUCTION | 9 |
|---|---|---|

Data science in health care- Benefits -challenges and opportunities- Introduction to classification algorithm and their performance analysis using medical examples

| UNITII | CLINICAL NATURAL PROCESSING | 9 |
|---|---|---|

The role of deep learning in improving healthcare- making effective use of healthcare data using data-to text technology- Clinical natural processing with deep learning

| UNIT III | HEALTHCARE ROBOTS | 9 |
|---|---|---|

Ontology based knowledge management for comprehensive geriatric assessment and reminiscence therapy on social robots- assistive robots for elderly: innovative tools to gather health relevant data

| UNITIV | DATA LINKAGE | 9 |
|---|---|---|

Overview of data linkage methods for integrating separate health data resources-
A flexible knowledge based architecture for supporting the adoption of health

lifestyles with persuasive dialogs

| UNITV | CLINICAL DATA VISUALIZATION | 9 |
|---|---|---|

Visual analytics for classifier construction and evaluation for medical data-Data visualization in clinical practice- using process analytics to improve healthcare process- a multi scale computational approach to understanding cancer metabolism

| | |
|---|---|
| **Total Periods** | **45** |

**SuggestiveAssessmentMethods**

| ContinuousAssessmentTest (30Marks) | FormativeAssessmentTest (10 Marks) | EndSemester Exams(60Marks) |
|---|---|---|
| • **DESCRIPTIVE QUESTIONS**<br>• CASE BASED QUESTION | • ASSIGNMENT<br>• ONLINEQUIZZES<br>• PROBLEM-SOLVINGACTIVITIES | 1. **DESCRIPTIVEQUESTIONS**<br>2. CASE BASED QUESTION |

**Course Outcomes**

Upon completion of the course,the studentswillbeableto:

1. Able to know the fundamentals of data science used for healthcare applications (Understand)
2. Apply the use some unique technologies which is applicable for healthcare domain. (Apply)
3. Able to develop simple robotic application in healthcare sectors(Apply)
4. Able to integrate various data resources using data linkage approaches(Apply)
5. Apply visualization techniques for better understanding of healthcare applications (Apply)

**TextBooks**

1.Sergio Consoli, Diego and Melian petakovic, “Data science for healthcare methodologies and applications”, springer,2019

2. Mike Mc Shaffrfy and David Graham, “healthcare analytics Complete”, Fourth Edition, Cengage Learning, PTR, 2012.

**ReferenceBooks**

1. Ernest Adams and Andrew Rollings, “Fundamentals of healthcare analysis”, 2 nd Edition Prentice Hall / New Riders, 2009.

2. Eric Lengyel, “Mathematics for healthcare analysis”, 3 rd Edition, Course

Technology PTR, 2011.

**WebResources**

- https://onlinecourses.nptel.ac.in/noc19_ge32/preview
- http://healthcareanlaytics/datasource.ac.in
- http://healthcaresectoranalyzis/towardsdatascience.in

**COVsPO Mapping and COVsPSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 2 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 3 | 3 | 3 | | | | | | | | | | | 3 | 3 | |
| 4 | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | |
| 5 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 3 | 3 | 3 |

**COURSEOUTCOME1:**

1. How do you Collect Patient-Reported Outcomes and Total Pathway Costs for Value-Based Healthcare? **(Understand)**
2. Analyze about the technical challenges and opportunities regarding the application of data science in healthcare **(Analyze)**

**COURSEOUTCOME2:**

1. Explain the following Lemma with its proof:
   Any classifier C can be transformed into a classifier ¬ C by simplyreversing its outcome for each patient. As a consequence,
   $$FPR(\neg C) = 1 - FPR(C) \text{ and } TPR(\neg C) = 1 - TPR(C)$$ **(Analyze)**
2. Perform sentence aggregation for the following sentence: "The patient was intubated" and "The patient was given morphine**".(Apply)**

**COURSEOUTCOME3:**

**1.** Implement with an example of prompting question formulation for user specific knowledge graph **(Apply)**

**2.** Analyze various innovative tools to gather health relevant data: for creating assistive robots for elderly **(Analyze)**

**COURSEOUTCOME4:**

1. Elaborate the Architectural model of the CGA and reminiscence applications(understand)
2. Demonstrate a use case of the data linkage process using two dataset from home care services. One homecare service is personal emergency response service and other home care services is telehealth service which remotely manage patient **(Apply)**

**COURSEOUTCOME5:**

1. From the following input data, how do you perform visual analytics for classifier construction and evaluation for medical data (apply)

| Feature name | Feature type | Feature range |
|---|---|---|
| Age at surgery | Quantitative | [37,6,78] |
| Prostate volume | Quantitative | [9,365] |
| Preoperative PSA level | Quantitative | [0.11,107.11] |
| Number of biopsy cores | Integral | [1 . . . 28] |
| Number of positive biopsy cores | Integral | [1 . . . 10] |
| Positive biopsy cores (%) | Quantitative | [10,90] |
| Primary biopsy Gleason score | Integral | [2 . . . 5] |
| Secondary biopsy Gleason score | Integral | [2 . . . 5] |
| Clinical stage | Ordinal | {T1, T1a, T1b, T1c, T2, T2, T2b, T2c T3, T3a, T3b, T3c} |

2. Demonstrate various Data Visualization Techniques in Clinical Practice with an example **(Apply)**

| 21CB5706 | MICRO and MACRO ECONOMICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

It may include statements about the importance of understanding the behaviour of individuals, firms, and governments in making economic decisions.

**Prerequisites for the course**

- 21MA3205/Probability and Statistics

**Objectives**

1. Understanding how individuals, businesses, and governments make decisions about resource allocation.
2. Understanding the principles of supply and demand and how they affect prices in markets.
3. Exemplify the demand curves of households and supply curves of firms with the principles.
4. Differentiate Price ceilings, price floors and compare income effects, substitute effects
5. Analyze the Keynesian's process of multiplier theory in macro economics

| | | |
|---|---|---|
| **UNIT I** | **MICRO ECONOMICS** | **9** |
| Principles of Demand and Supply Ã¢?? Supply Curves of Firms Ã¢?? Elasticity of Supply; Demand Curves of Households Ã¢?? Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve); | | |
| **UNIT II** | **WELFARE ANALYSIS** | **9** |
| Consumers and Producers Surplus- Price Ceilings and Price Floors; Consumer Behaviour - Axioms of Choice-Budget Constraints and Indifference Curves; Consumers Equilibrium Effects of a Price Change, Income and Substitution Effects Derivation of a Demand Curv | | |
| **UNIT III** | **APPLICATIONS** | **9** |
| Tax and Subsidies - Inter temporal Consumption -Suppliers- Income Effect; Theory of Production - Production Function and Isoquants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition | | |
| **UNIT IV** | **MACRO ECONOMICS** | **9** |
| National Income and its Components - GNP, NNP, GDP, NDP Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector - Exports and Imports; Money -Definitions; Demand for Money Transaction and Speculative Demand; Supply of Money - Banks Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model | | |
| **UNIT V** | **BUSINESS CYCLES AND STABILIZATION** | **9** |
| Monetary and Fiscal Policy - Central Bank and the Government; the Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment. | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| | | |
|---|---|---|
| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |

| | | |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2.FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1.DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1**Understand the functioning of elasticity of demand in micro economics. (Understant)

**CO 2** Analyze the supporting of price, income and substitution effects in the consumers and producer surplus. (Apply)

**CO 3**Analyse the equilibrium of a firm under perfect competition, monopoly and monopolistic competition. (Apply)

**CO 4**Analyze the concepts of demand for money and supply of money with appropriate model in macro-economic analysis. (Analyse)

**CO 5 E**xamine and evaluate the problems of voluntary and involuntary unemployment(Analyse)

**Text Books**

1. Pindyck, Robert S and Daniel L. Rubinfeld , Microeconomics, Eighth Edition, 2013. (Unit 1-3)
2. Dornbusch, Fischer and Startz, Macroeconomics, Tenth Edition, Tata Mcgraw Hill, 2012. (Unit 4 & 5)

**Reference Books**

1. Paul Anthony Samuelson, William D. Nordhaus, Economics, Nineteenth Edition, McGraw-Hill Education, 2010.

**Web Resources**

1. https://archive.nptel.ac.in/courses/110/105/110105075/
2. https://nptel.ac.in/courses/110101005
3. https://nptel.ac.in/courses/109104125

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | | | | | | | 3 | 3 | | 3 | | 3 | | |
| 2 | 2 | | | | | | | 3 | 3 | 2 | 3 | | 3 | 2 | |
| 3 | 1 | | | | | | | 3 | 2 | 3 | 3 | | 3 | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 2 | | | | | | | 3 | 3 | 2 | 3 | | 2 | 3 | |
| 5 | | | | | | | | 2 | 2 | 3 | 3 | | 2 | 3 | 1 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. In the case of rare coins, supply curve will be (A) Horizontal (B) Vertical (C) backward bending (D) positively sloped (Apply)
2. If a firm produces 200 units of commodity X by employing 10 workers and 240 units of the same commodity by employing 12 workers, then what is the Average Product of the worker? (Apply)

**Course Outcome 2 (CO2):**

**1.** Distinguish between: a) Short run production function and Long run production function b) Increasing returns to scale and Decreasing returns to scale c) Economies of scale and Diseconomies of scale (Apply)
**2.** Derive the various short run cost curves. (understand)

**Course Outcome 3 (CO3):**

1. Distinguish between: a) Average revenue and Marginal revenue b) Profit maximization and Growth maximization (Apply)
2. Enumerate the conditions for equilibrium of a firm under monopoly. (Understand)

**Course Outcome 4 (CO4):**

1. Distinguish between: a) Distinguish between perfect competition and Monopoly b) Monopoly and Monopolistic competition c) Excess profit and Normal profit d) Firm and Industry (Apply)
2. Explain price rigidity with the help of kinky demand curve. (Understand)

**Course Outcome 5 (CO5):**

1. What is discriminating monopoly? Describe the essential conditions for price discrimination. (Understand)
2. Distinguish between: a) Pay Back Period and Net Present Value method b) Net Present Value method and Internal Rate of Return method (Apply)

| 21CB5707 | WEB TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The world wide web has become an essential part of our daily lives, connecting people, businesses, and information from all corners of the globe. Web technologies have evolved tremendously.

**Prerequisites for the course**

- 21CB3601/Object Oriented Programming
- 21CS4601/Database Management Systems

**Objectives**

1. Understand different Internet Technologies
2. Learn java-specific web services architecture
3. Develop web applications using frameworks
4. Enable innovation and experimentation
5. Deliver personalized and contextual experiences

| UNIT I | WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 | 9 |
|---|---|---|

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework

| UNIT II | CLIENT-SIDE PROGRAMMING | 9 |
|---|---|---|

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files.

| UNIT III | SERVER-SIDE PROGRAMMING | 9 |
|---|---|---|

| | | |
|---|---|---|
| Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC. | | |
| **UNIT IV** | **PHP and XML** | **9** |
| An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL | | |
| **UNIT V** | **INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS** | **9** |
| Introduction to AngularJS, MVC Architecture, understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- DjangoUI& UX | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2.FORMATIVE MULTIPLE CHOICE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1.DESCRIPTIVE QUESTIONS<br>2. FORMATIVE MULTIPLE CHOICE QUESTIONS |

**Outcomes**

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

**CO 1** Create a basic website using HTML and Cascading Style Sheets. (Apply)

**CO 2** Understand the concept of dynamic web page with validation using Java Script objects (Understand)

**CO 3**Develop server-side programs using Servlets and JSP(Apply)

**CO 4** Create simple web pages in PHP and to represent data in XML format(Apply)

**CO 5** Develop interactive web applications(Apply)

**Text Books**

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011. (Unit 1-4)

2. Angular for Enterprise-Ready Web Applications, DoguhanUluca, 1st edition, Packt Publishing. ( Unit 5)

**Reference Books**

1. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.

**Web Resources**

1. https://archive.nptel.ac.in/courses/106/105/106105084/
2. https://onlinecourses.swayam2.ac.in/nou20_cs05/

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | 3 | 2 | | | | | | | 3 | 3 | | |
| 2 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 2 | |
| 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | | |
| 4 | 3 | 2 | 3 | 2 | 3 | | | | | | | 2 | 2 | 3 | |
| 5 | 3 | 2 | 3 | 3 | 3 | | | | | | | | 2 | 3 | 1 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Design a html registration page in which the name, password, confirm password, gender are to be validated. (Apply)
2. Mention the different internet address class and it's range. (Understand)

**Course Outcome 2 (CO2):**

1. How will you read the servlet parameters? Explain with examples. (Apply)
2. Write a servlet program to read the input from the forms and display the same. (Understand)
3. Build a JavaScript program to convert temperature from Celsius to Fahrenheit and vice versa (Apply)

**Course Outcome 3 (CO3):**

1. How to read data from web form control like Check boxes explain with an example. (Apply)
2. How can both Internal and External DTDs be used in an XML File? Show with an Example (Apply)
3. How will you pass the control and data between pages. (Apply)

**Course Outcome 4 (CO4):**

1. How will you handle errors and exceptions in PHP? (Apply)
2. How do you use a picture as the background in HTML? (Apply)

**Course Outcome 5 (CO5):**

1. How would you insert an image file named elephant.jpg at the very top of a Web page? (Apply)
2. Write an AJAX program that access details from XML and display the same (Understand)

**SEMESTER VI**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 21CB6601 | Business Strategy | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 21CB6XXX | Professional Elective III | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | 21CB6XXX | Professional Elective IV | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | 21OE6XXX | Open Elective II | OE | 3 | 3 | 0 | 0 | 3 |
| 5 | 21PT3903 | Soft skills –Aptitude II | EEC | 1 | 0 | 0 | 2 | 1 |
| **Theory cum Practical Courses** | | | | | | | | |
| 1 | 21CB6602 | Statistical Modelling | PC | 5 | 3 | 0 | 2 | 4 |
| 2 | 21CB6603 | Legal Aspects of Information Security | PC | 5 | 3 | 0 | 2 | 4 |
| **Practical Courses** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | **21CB6911** | **Project Phase – I** | **EEC** | **4** | **0** | **0** | **4** | **2** |
| | | | **Total** | **27** | **19** | **0** | **12** | **23** |

**Professional Electives**

| **Professional Elective III** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 21AI3602 | Data Science Essentials | 6 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB6701 | Enterprises Systems | 6 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB6702 | Industrial Psychology | 6 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CS5703 | IoT and its applications | 6 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21AI7707 | Cognitive Science and Analysis | 6 | 3 | 0 | 0 | 3 | Advanced Technology |
| **Professional Elective IV** | | | | | | | | |
| 1 | 21CS7711 | Data Analytics Using R | 6 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB6703 | Marketing Analytics | 6 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB6704 | Human Resource Management for Business | 6 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB6705 | Mobile Application Development | 6 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21CS7709 | Deep Learning Essentials | 6 | 3 | 0 | 0 | 3 | Advanced Technology |

| **21CB6601** | **BUSINESS STRATEGY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**Preamble**

A business strategy is a course of action designed to aid executives in achieving organisational objectives. Teams are given a clear path to support the goals as it describes business requirements and resource allocation. This aids organisations in mobilising operations, boosting customer satisfaction, and securing a dominant position in the market.

**Prerequisites for the course**

- 21CB5602 - Introduction to Business Systems

**Objectives**

**11.** Understand the concepts of strategic management, its nature in competitive.

**12.** Develop a holistic approach to see business issues comprehensively and functional subject knowledge for decision-making.

**13.** Identify and interpret the critical challenges and opportunities before an organization.

**14.** Apply the business concepts in case studies and latest business events.

15. Analyse the corporate strategy and growth strategy

| **UNIT I** | **INTRODUCTION TO STRATEGIC MANAGEMENT** | **9** |
|---|---|---|
| Importance of Strategic Management-Vision and Objectives - Schools of thought in Strategic Management- Strategy Content, Process, and Practice - Fit Concept and Configuration Perspective in Strategic Management. | | |
| **UNIT II** | **INTERNAL ENVIRONMENT OF FIRM** | **9** |
| Recognizing a Firm's Intellectual Assets - Core Competence as the Root of Competitive Advantage - Sources of Sustained Competitive Advantage -Business Processes and Capabilities-based approach to Strategy | | |
| **UNIT III** | **EXTERNAL ENVIRONMENTS OF FIRM** | **9** |
| Competitive Strategy - Five Forces of Industry Attractiveness that Shape Strategy- The concept of Strategic Groups, and Industry Life Cycle - Generic Strategies, Generic Strategies and the Value Chain. | | |
| **UNIT IV** | **CORPORATE STRATEGY AND GROWTH STRATEGIES** | **9** |
| The Motive for Diversification - Related and Unrelated Diversification- Business Portfolio Analysis - Expansion, Integration and Diversification - Strategic Alliances, Joint Ventures and Mergers & Acquisitions – case studies. | | |
| **UNIT V** | **STRATEGY IMPLEMENTATION** | **9** |
| Structure and Systems - The 7S Framework -Mckinsey 7s framework example- How to Use the McKinsey 7S Model, Strategic Control and Corporate Governance. | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

**CO 1**Understand the fundamental concepts of strategic management. (Understand)

**CO 2**Understand the interrelationships among business functions. (Understand)

**CO 3**Apply the business functions in the industrial environment. (Apply)

**CO 4** Apply the inter-relationships of business to individuals, other organizations, government and society. (Apply)

**CO5** Analyze complex, unstructured qualitative and quantitative problems, using appropriate tools. (Analyse)

**Text Books**

8. Robert M. Grant , Contemporary Strategic Management, Blackwell, Seventh Edition,2012. (Unit I – II)
9. Kazmi, Azhar, Business Policy and Strategic Management, Third Edition, Tata McGrawhill, New Delhi, 2008. (Unit III - V)

**Reference Books**

3. Michael E.Porter, Competitive Advantage, The Free Press, New York, 1985. 3 Richard Rumelt , Good Strategy Bad Strategy: The Difference and Why It Matters. Profile Books, Fourth edition, 2011.
4. Dislodging multinationals: India's strategy in comparative perspective (2019), Encarnation, D.Cornell, University Press.

**Web Resources**

1. https://archive.nptel.ac.in/courses/110/108/110108047/
2. https://onlinecourses.nptel.ac.in/noc22_mg01/

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | | | 2 | | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | | |
| 2 | 3 | | | 2 | | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | | |
| 3 | 3 | | | | | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | | |
| 4 | 3 | | | | | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | | |
| 5 | 3 | | | | | 3 | 2 | 2 | | 3 | 3 | 3 | 2 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 40 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Explore the concept of Fit in strategic Management. (Understand)
2. Distinguish between Strategy Formulation and Strategy implementation. (Understand)
3. Explain How do you practice content strategy? (Understand)

**Course Outcome 2 (CO2):**

1. Explain how do these core competencies contribute to the competitive advantage of an organization? (Understand)
2. Explain how do competencies apply to organizational success? (Understand)
3. How to create a capability Map for Capability-based learning? (create)

**Course Outcome 3 (CO3):**

1. Classify Competitive Strategy VS Business Strategy and explain what the difference is? (analysis)
2. How does the industry life cycle affect business strategy? (Understand)
3. Explain what are the four stages of the Industry Lifecycle Model? (Understand)

**Course Outcome 4 (CO4):**

1. Classify the difference between joint venture and merger and acquisition? (Understand)
2. How much will it cost to enter the industry? (Apply)
3. How attractive is the industry that a firm is considering entering? (Apply)

**Course Outcome 5 (CO5):**

1. Apply the McKinsey 7-s model for business strategic planning with real time example? (Apply)
2. Explain the role of corporate governance in strategic management. (Understand)
3. How does the organizational structure influence strategy implementation? (Apply)

| 21PT3903 | SOFT SKILLS - APTITUDE – II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**Prerequisites for the course**

- Basic Maths

**Objectives**

- Students will be able to critique and evaluate quantitative arguments that utilize mathematical, statistical, and quantitative information.
- Students will be able to use appropriate technology in a given context.

| | | |
|---|---|---|
| **I** | **MODULE I** | **3** |
| Timeanddistance, Trains, Boatsand Streams, Races. | | |
| **II** | **MODULE II** | **3** |
| Clocks, Calendar,Areaofplanefigures,Volume and surface area of solid figures. | | |
| **III** | **MODULE III** | **3** |
| Elementary algebra, Linearequations, Quadratic equations and in–equations, Progression. | | |
| **IV** | **MODULE IV** | **3** |
| Permutation and combination,Probability,Geometry,Trigonometry. | | |
| **V** | **MODULE V** | **3** |
| Data interpretation, Data sufficiency. | | |
| | **Total Periods** | **15** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30Marks) | Formative Assessment Test (10Marks) | End Semester Exams(60Marks) |
|---|---|---|
| **1. DESCRIPTIVEQUESTIONS** | **1.ASSIGNMENT**<br>**2. ONLINE QUIZZES**<br>**3. PROBLEM-SOLVINGACTIVITIES** | **1. DESCRIPTIVE QUESTIONS** |

| **Outcomes** |
|---|
| **Upon completion of the course, the students will be able to:** |
| • **CO1:** Distinguish between proportional and non proportional situations and, when appropriate, apply proportional reasoning.<br>• **CO2:** Analyze and critique mathematical models and be able to describe their limitations.<br>• **CO3:** Analyze and critique mathematical equations and be able to describe their limitations.<br>• **CO4:** Evaluate claims based on empirical, theoretical, and subjective probabilities.<br>• **CO5:** Create and use visual displays of data. |
| **Books** |
| QuantitativeAptitudeforCompetitiveExaminations\|7thEdition(Paperback,AbhijitGuha) |
| **ReferenceBooks** |
| 1. https://myupsc.com/wp-content/uploads/2020/11/Quantitative-Aptitude-for-Competitive-Examinations-by-Dinesh-Khattar-z-lib.org_.pdf<br>2. QuantitativeAptitudeforCompetitiveExaminations-QuantitativeAptitudebyrsagarwalwith0Disc.(English, Paperback, AggarwalR. S.) Revised, 2021 |
| **Resources**<br>https://pdf.bankexamstoday.com/raman_files/Quant%20Formula.pdfhttps://ugcportal.com/raman-files/QT-TRICKS.pdf<br>https://www.javatpoint.com/aptitude/quantitative#speed-and-distancehttps://www.indiabix.com/aptitude/questions-and-answers/ |

**Theory cum Practical Courses**

| **21CB6602** | **STATISTICAL MODELLNG** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **2** | **4** |
| **Preamble** | | | | | |

The science of statistics is the study of how to learn from data. It helps you collect the right data, perform the correct analysis, and effectively present the results with statistical knowledge. Statistical modelling is key to making scientific discoveries, data-driven decisions, and predictions.

**Prerequisites for the course**

- 21MA3205- Probability and Statistics
- 21CB5601 – Computational Statistics

**Objectives**

1. Learn the linear statistical models
2. Understand the basic concepts of Design of experiments and Methods of Estimation
3. Learn the concept of testing hypothesis using statistical analysis
4. Understand the fundamental concepts of estimation methods
5. Apply the Statistical concepts using R Programming.

| **UNIT I** | **INTRODUCTION TO STATISTICAL MODELING** | **9** |
|---|---|---|

Overview of statistical modelling in machine learning - Types of data and model selection - Bias-variance trade-off. Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Tolerance region (simple problems)

**SUGGESTED ACTIVITIES**:

- Group discussion

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| **UNIT II** | **CLASSIFICATION MODELS** | **9** |
|---|---|---|

Logistic regression - Naive Bayes - Decision trees - Random forests

**SUGGESTED ACTIVITIES:**

- Flipped Class room

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| **UNIT III** | **SUPPORT VECTOR MACHINES (SVM) & BAYESIAN MODELS** | **9** |
|---|---|---|

Linear SVM - Non-linear SVM - Kernel methods. Bayesian statistics and inference - Bayesian linear regression - Bayesian networks - Markov Chain Monte Carlo (MCMC) methods.

| | | |
|---|---|---|
| **SUGGESTED ACTIVITIES:**<br>• Mostly in Class<br>• Practical - Project demonstration and presentation | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Tutorial problems<br>• Assignment problems<br>• Quizzes | | |
| **UNIT IV** | **NEURAL NETWORKS AND DEEP LEARNING** | **9** |
| Introduction to neural networks - Deep learning architectures (e.g., CNNs, RNNs) - Model training and optimization - Transfer learning. | | |
| **SUGGESTED ACTIVITIES:**<br>• Practical- Activity | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Tutorial problems<br>• Assignment problems<br>• Quizzes | | |
| **UNIT V** | **BASICS OF TIME SERIES ANALYSIS & FORECASTING** | **9** |
| Stationary, ARIMA Models: Identification, Estimation and Forecasting (simple problems). Programming Method: R statistical programming language. | | |
| **SUGGESTED ACTIVITIES:**<br>• Practical - Project demonstration and presentation<br>• Case studies | | |
| **SUGGESTED EVALUATION METHODS:**<br>• Assignment problems<br>• Quizzes | | |
| **Total Periods** | | **45+15** |
| **LIST OF EXPERIMENTS** | | **CO** |
| Introduction to R, Functions, Control flow and Loops | | **CO 1** |
| Working with Vectors and Matrices | | **CO 1** |
| Reading in Data, Writing Data, Working with Data, Manipulating Data | | **CO 2** |
| Simulation | | **CO 2** |
| Linear model | | **CO 3** |

| | |
|---|---|
| Data Frame | **CO 4** |
| Graphics in R | **CO 4** |
| Building ARIMA Models | **CO 5** |
| Fitting the multiple regression | **CO 5** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (30 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. PRACTICAL COMPONENTS<br>2. MODEL PRACTICAL | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

1. Understand the basic concepts of linear statistical models and Estimation methods (Understand)
2. Learn the concept of testing of hypothesis using statistical analysis (Understand)
3. Apply the concepts of Bivariate and Multivariate Regression and Correlation Analysis, for forecasting and also perform ANOVA and F-test (Apply)
4. Apply the knowledge of time series analysis in economics and engineering. (Apply)
5. Apply non-parametric methods in estimation (Apply)

**Text Books**

1. I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers (4th Edition)", 8 th edition, Pearson Education. (Unit I – II)
2. A. Goon, M. Gupta and B. Das Gupta, "Fundamentals of Statistics (vol. I and vol. II)". (Unit III – IV)
3. Chris Chat field, "The Analysis of Time Series: An Introduction", 6 th Edition, CRC Press. (Unit V)

**Reference Books**

1. D.C. Montgomery &E.Peck , "Introduction to Linear Regression Analysis", 5th Edition .
2. A.M. Mood, F.A. Graybill & D.C. Boes, "Introduction to the Theory of Statistics", Wiley, New York.

**Web Resources**

1. https://onlinecourses.nptel.ac.in/noc17_ch03
2. https://www.edx.org/course/statistical-modeling-and-regression-analysis

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 3 | 1 | | 3 | 1 | 1 | | | | | 1 | | | 3 |
| 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | | | | | 1 | | | 2 |
| 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | | | | | 1 | | | 2 |
| 4 | 1 | 3 | 2 | 2 | 1 | 1 | 1 | | | | | 1 | | | 3 |
| 5 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | | | | | 1 | | | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Which models are linear models? (Understand)
2. How to perform simple linear regression in Machine Learning?(Understand)
3. How to Calculate a Correlation between Multiple Variables? (Understand)

**Course Outcome 2 (CO2):**

1. How do you find point estimate in statistics? Understand)
2. How to find the point estimate for the population proportion?(Apply)
3. Examine the factorization theorem for sufficient statistics(Analyse)

**Course Outcome 3 (CO3):**

1. What is hypothesis testing in statistics with example? (Understand)

2. Classify Type I error and Type II error. (Understand)
3. Which test is provided by Neyman-Pearson lemma? (Understand)

**Course Outcome 4 (CO4):**

1. Give an example for non-parametric inferential statistic?(Understand)
1. How to Conduct the Wilcoxon Sign Test? (Analyse)
2. What does tolerance mean in statistics? (Understand)

**Course Outcome 5 (CO5):**

1. What is stationary and why is it important for time series analysis? (Understand)
2. Which model is best for ARIMA? (Understand)
3. Examine Is Python or R better for statistics? (Analyse)

| | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| **21CB6603** | **LEGAL ASPECTS OF INFORMATION SECURITY** | **3** | **0** | **2** | **4** |

**Preamble**

Security is the absence of unacceptable risk, which includes information confidentiality, data integrity, assets, efficient and proper use, and system availability. Confidentiality is the privacy of personal or corporate information, data integrity is the correctness and completeness of data.

**Prerequisites for the course**

- 21CS5602 – Computer Networks
- 21CS4601 – Data Base Management Systems
- 21CS4604 – Operating System Concepts.

**Objectives**

1. Understand the overview of computer security.
2. Understand the information security policy and system design.
3. Understand techniques of system security.
4. Learn about operating system and database security
5. Learn about various applications of system security.

| | | |
|---|---|---|
| **UNIT I** | **INFORMATION SECURITY FUNDAMENTALS** | **9** |

The Basic Components- Confidentiality, integrity and availability; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and operational issues; Security Life Cycle -Access Control Models: Role based Model.

| | | |
|---|---|---|
| **UNIT II** | **SECURITY POLICIES AND SYSTEM DESIGN** | **9** |

| | | |
|---|---|---|
| Types of Security Policies-Confidentiality policies: Goals of Confidentiality Policies, The Bell-LaPadula Model - Integrity policies: Biba Integrity Model, Clark-Wilson Integrity Model -Hybrid policies: Chinese Wall Model, Clinical Information Systems Security Policy. Access Control Mechanisms: Access Control Lists- Information Flow: Compiler-Based Mechanisms, Execution-Based Mechanisms. | | |
| **UNIT III** | **SYSTEM SECURITY** | **9** |
| Malicious Logic: Trojan Horses, Computer Viruses, Computer Worms- Vulnerability Analysis: Penetration Studies, Vulnerability Classification-Auditing: Anatomy of an Auditing System, Auditing Mechanisms, Audit Browsing - Intrusion Detection. | | |
| **UNIT IV** | **OPERATING SYSTEM AND DATABASE SECURITY** | **9** |
| Operating System Security: Security Architecture, Analysis of Security in Linux/Windows-Database Security: Security Architecture, Database Auditing-Case Study: Discretionary Access Control. | | |
| **UNIT V** | **NETWORK AND PROGRAM SECURITY** | **9** |
| Network Security: Policy Development, Network Organization- System Security: Policy- User Security: Policy, Access, Files and Devices- Program Security: Requirements and Policy, Design, Case Study: Common Security Related Programming Problems. | | |
| **Total Periods** | | **45+15** |
| **LIST OF EXPERIMENTS** | | **CO** |
| **Suggested tools:** Wireshark, Nessus, OWASP ZAP, IDA Pro | | |
| Analysis of security in Unix/Linux. | | CO1 |
| Administration of users, password policies, privileges and roles. | | CO2 |
| Implementation of discretionary access control and mandatory access control. | | CO2 |
| Demonstrate intrusion detection system (ids) using any tool Eg. Snort or any other software. | | CO3 |
| Implementation of IT audit, malware analysis and vulnerability assessment and generate the report. | | CO3 |
| Implementation of mobile audit and generate the report of the existing artifacts. | | CO3 |
| Implementation of OS hardening and RAM dump analysis to collect the artifacts and other information. | | CO4 |
| Implementation of digital forensics tools for disk imaging, data acquisition, data extraction and data analysis and recovery | | CO4 |
| Perform mobile analysis in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT. | | CO5 |
| Implementation to identify web vulnerabilities, using OWASP project. | | CO5 |

| **Suggestive Assessment Methods** | | |
|---|---|---|
| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (30 Marks)** | **End Semester Exams (60 Marks)** |
| 1. DESCRIPTIVE QUESTIONS | 1. PRACTICAL COMPONENTS<br>2. MODEL PRACTICAL | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1 Discuss the basics of information security and international standards (Understand)

CO 2 Analyse information security policy and system design. (Analyse)

CO3 Comprehend system level security (Apply)

CO 4 Analyse the operating system and database security methods. (Analyse)

CO 5 Apply the Network and Program security concepts. (Apply)

**Text Books**

1. Ross Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", Third Edition, Wiley, 2021. (Unit I – II)
2. M. Bishop, "Computer Security: Art and Science", 2nd Edition, Pearson Education, 2019. (Unit III – IV)
3. M. Stamp, "Information Security: Principles and Practice", 2nd Edition, Wiley, 2011. (Unit – V)

**Reference Books**

1. C.P. Pfleeger, S.L. Pfleeger, J. Margulies, "Security in Computing", 5th Edition, Prentice Hall, 2015.
2. David Wheeler, "Secure Programming HOW TO", v3.010 Edition, 2003.

**Web Resources**

1. https://nptel.ac.in/courses/106106129
2. https://nptel.ac.in/courses/106106141

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 3 | 2 | 2 | 2 | 2 | 2 | 2 | | | | 2 | 2 | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | | | | | 2 | 2 | | |
| 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | | | | | 2 | 2 | | |
| 4 | 2 | 3 | 2 | 2 | 3 | 2 | | | | | | 2 | 2 | | |
| 5 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | | | | | 2 | 2 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Analyze different security *services* and mechanisms. (Analyse)
2. What are 5 ways to maintain confidentiality? (Understand)
3. How do hackers hack firewalls? (Understand)

**Course Outcome 2 (CO2):**

1. Examine How many rules are in Bell-LaPadula model and explain how it works? (Apply)
2. What does the Clark-Wilson Integrity Model use to refer to objects? (Understand)
3. How do you implement a Chinese wall? (Apply)

**Course Outcome 3 (CO3):**

1. What are the different types of Vulnerability Classification?(Understand)
2. How do you complete a system audit? (Apply)
3. Where can you implement intrusion prevention system? (Apply)

**Course Outcome 4 (CO4):**

1. Identify the five steps to build a First Security Architecture? (Analyse)
2. Which of the operating system is discretionary access control implemented? (Apply)
3. Which of the following methods are used for the implementation of access matrix? (Apply)

**Course Outcome 5 (CO5):**

1. How do you implement root cause analysis? (Apply)
2. How to perform Root cause Analysis in Database Security? (Apply)
3. Why do we implement risk management? (Apply)

**Professional Electives**

| **Professional Elective III** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 21AI3602 | Data Science Essentials | 5 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB6701 | Enterprises Systems | 5 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB6702 | Industrial Psychology | 5 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CS5703 | IoT and its applications | 5 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21AI7707 | Cognitive Science and Analysis | 6 | 3 | 0 | 0 | 3 | Advanced Technology |

| **21AI3602** | **DATA SCIENCE ESSENTIALS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**Preamble**

This course encompasses the analysis and evaluation of data using mathematics, statistics, andcomputer science. The main goal of this course is to gather useful data for forecasting, trend analysis, product development, and strategic decision-making.

**Prerequisites for the course**

- 21MA3205-Probability and Statistics
- 21CS2501 - Introduction to Computing using Python

**Objectives**

1. To introduce the essential elements of data science.
2. To explore the data, process the data and infer knowledge.
3. To summarize, analyze and visualize the data.
4. Be exposed with different applications in Data Science.
5. To identify and apply suitable techniques for solving real-world problems

| UNIT I | INTRODUCTION TO DATA SCIENCE | 9 |
|---|---|---|

Life cycle of Data Science Project –Setting goals – Listening to customers – Data Sources – Flat files, HTML, XML, JSON – Data Acquisition Pipeline - Role of data scientist – Predictivemodeling - Understanding data – types of data.

**SUGGESTED ACTIVITIES:**

- In class activity identifying the data and data resources
- Analyze the role of data scientist

**SUGGESTED EVALUATION METHODS:**

- Assignment problems
- Quizzes

| UNIT II | DATA EXPLORATION AND MANIPULATON | 9 |
|---|---|---|

Vectors – Matrices – Data Frames -Indexing, Slicing, Aggregation – Broadcasting – Binning – Partitioning – k-neighbours example – Data selection – Handling missing data – Data loading,storage and file formats - Combining data sets – Concat, Append, merge and join operations.

**SUGGESTED ACTIVITIES:**

- Presentation and discussion on data exploration.
- Implementation of data handling

**SUGGESTED EVALUATION METHODS:**

- Practical on data selection and concat, merge operations.

| UNIT III | DATA ANALYSIS | 7 |
|---|---|---|

Central Tendencies – Dispersion – Correlation – Causation – Dependence and Independence – Conditional Probability – Bayes Theorem – Hypothesis and Inference – Defining statisticalmodeling – Data Cleaning and preparation.

**SUGGESTED ACTIVITIES:**

- Implementation of classification problem using Bayes Theorem

**SUGGESTED EVALUATION METHODS:**

- Assignment Problem
- Quizzes

| UNIT IV | VISUALIZATION | 7 |
|---|---|---|

Visualization Techniques - Bar chart – Line chart – Scatter plot – Histograms – Binning – Densityand Contour plots – Visualizing Errors – Error bars – Text and Annotation – Customizing colours – Geo maps.

**SUGGESTED ACTIVITIES:**

- Perform the data visualization for behaviour of human in online social networks

**SUGGESTED EVALUATION METHODS:**

- Practical- Plot the charts for visualizing errors.

| UNIT V | RECENT ADVANCEMENTS | 13 |
|---|---|---|

Recommendation systems – Natural language processing – Image Data Analysis – Machine learning – Deep learning – Artificial Neural Networks – Case studies.

**SUGGESTED ACTIVITIES:**

- Implementation of Recommendation System
- Implementation of deep learning algorithm

**SUGGESTED EVALUATION METHODS:**

- Project submission

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test(10 \|Marks) | End Semester Exams(60 Marks) |
|---|---|---|

| | | |
|---|---|---|
| • **DESCRIPTIVE QUESTIONS**<br>**2.CASE BASED QUESTIONS** | 1. ASSIGNMENT<br>2. ONLINE QUIZZES<br>3. PROBLEM-SOLVING ACTIVITIES | **1. DESCRIPTIVE QUESTIONS**<br>**2. CASE BASED QUESTIONS** |

Course Outcomes

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

1. Understand the basic concepts of Data Science to practice Python functionality andlibraries.
2. Use linear algebra, descriptive statistics to represent data and to understand distributionsof data.
3. Prepare the data to improve its quality and to build the effective models
4. Interpret the significance of data using inferential statistics and visualization techniques.
5. Implement data science in Speech Recognition and Recommendation system etc,.

**Text Books**

1. Joel Grus ,"Data Science from Scratch",O 'Reilly Publishers, First Edition,2015 2.Wes McKinney,"Python for data analysis",O'Reilly Media.Second edition, 2017, (Unit I – V)

**Reference Books**

1. Brain Godsey," Data scientist-Tackle the data science process step-by-step", ManningPublications Co,First edition, 2017.
2. Jake VanderPlas,"Python Data science Handbook", O'Reilly Media, Inc.,First Edition,2017

**Web Resources**

1. https://onlinecourses.nptel.ac.in/noc22_cs74/preview
2. https://towardsdatascience.com/

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO1 | PO1 | PO1 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | **0** | **1** | **2** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 2 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| 3 | 3 | 3 | | | | | | | | | | | 3 | 3 | |
| 4 | 3 | 3 | 2 | | | | | | | | | | 3 | 3 | |
| 5 | 3 | 2 | 2 | 2 | 3 | | | | | | | | 3 | 3 | 3 |

**COURSE LEVEL ASSESSMENT**

**QUESTIONS**

**COURSE OUTCOME 1:**

**1.** Given the names and grades for each student in a Physics class of students, store them in a nestedlist and print the name(s) of any student(s) having the second lowest grade. (Apply)

**2.** Find the value of h (231,8) for the function below? def h(m,n): ans = 0 while (m >= n): (ans,m) =(ans+1,m-n) return(ans)(Apply)

**COURSE OUTCOME 2:**

**1.** In a class of 50,000 students what is the probability that more than 5050 students get grades D orworse (D or F) (approximately)(Analyze)

**COURSE OUTCOME 3:**

**1.** Find the statistical test/ technique would you use: We are an online shopping portal. We can tell if someone who is on our website is a mac user or a PC user. We want to test the hypothesis that amongpeople who purchase something from our website mac users tend to spend more money than PC users.(Apply)

**2.** Your task is to conduct ANOVA over this data to check whether you get evidence that prices over the land were not same for the three years considered. Find the F-statistic for the given data.(Analyze) **COURSE OUTCOME 4:**

1. Draw bar chart and box plot for a numerical data set and infer the results of visualization using various visualization Techniques.(Analyze)
2. How does text annotators helpful for Engineers? Give example (Analyze)

**COURSE OUTCOME 5:**

2. Find the number of vectors present in the null space of the given matrix 1 −3 −5 −2 1 3 Reflect your recommendations in data science process(Analyze)
3. Design a data science project for the following scenario. Student Evaluation Dataset is based on an evaluation form filled out by students for different courses. It has different attributes including attendance, difficulty, score for each evaluation question, among others. This is an unsupervised learning problem. The dataset has 5820 rows and 33 columns. [https://archive.ics.uci.edu/ml/datasets/Wine+Qualityhttps://archive.ics.uci.edu/ml/ datasets/Turkiye+Student+Evaluation](Apply)

| 21CB6701 | ENTERPRISE SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

Preamble

Enterprise Resource Planning is the latest high-end solution, information technology has lent to business application.

**Prerequisites for the course**

- 21CB4901/Introduction to Innovation, IP Management and Entrepreneurship
- 21CB3601/ Object Oriented Programming

**Objectives**

- Understand the essential concepts of ERP involved in business processes
- Imparts kills in the design and implementation of ERP architecture
- Familiarize with various tools and technologies for developing ERP for large project
- Apply the advanced ERP technologies
- Analyses the marketing and sales process

| UNIT I | MODEL-VIEW-CONTROL (MVC)ARCHITECTURE | 6 |
|---|---|---|

OverviewofMVC-MVCmethodofsoftwaredevelopmentina3-tierenvironment-Control (MVC) developmentina3-tierenvironment.

| UNIT II | TOOLS AND TECHNOLOGIES | 11 |
|---|---|---|

Tools and Technologies: -Microsoft.NET frame work, PHP, Rubyon Rails, JavaScript, Ajaxand Overview of SAP and Oracle Applications

| UNIT III | ERP ARCHITECTURE AND GENERIC MODULES | 10 |
|---|---|---|

Service Oriented Architecture (SOA)-Principles of loose coupling–encapsulation-Inter-operability- Enterprise Resource Planning (ERP) systems and their architecture-generic ERP Modules: Finance, HR, Materials Management, Investment-Examples of Domain Specific Modules

| UNIT IV | ERP TECHNOLOGIES | 9 |
|---|---|---|
| Business Process Reengineering- Decision Support System- On-Line Analytical Processing – Electronic Data Exchange-Customer Relationship Management (CRM)-Supplier Relationship Management (SRM) | | |
| **UNIT V** | **MARKETING & SALES ANALYTICS** | **9** |
| Overview of MPLS-Virtual Private Networks (VPN)–Firewalls- Network monitoring and enforcement of policies-ERP Security Issues–Authentication–Authorization-Access control–Roles-single-sign-on-Directory servers-Audit trails-Digital signatures–Encryption-review of IP Sec–SSL | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

**CO1:** Develop simple web applications using MVC architecture(Apply)
**CO2:** Implement simple web applications using SAP and Oracle Applications. (Apply)
**CO3**: Understand the concepts of CRM models (Understand)
**CO4:** Implement interactive network and application(Apply)
**CO5:** Analyseorganizational opportunities and challenges in the design system (Apply)

**Text Books**

1. Alexis Leon, EnterpriseResourcePlanning,2020,4thEdition, Tata Mc Graw Hill. ( Unit 1 – 5)

**Reference Books**

1. Kurbel,K.E.,EnterpriseResourcePlanningandSupplyChainManagement,2016,Springer.
2. Ganesh K,Sanjay M, Anbuudayasankar S.P, Sivakumar P., Enterprise Resource Planning-FundamentalsofDesignandImplementation,2014,Springer.

**Web Resources**

1. https://archive.nptel.ac.in/courses/110/102/110102058/
2. https://www.classcentral.com/course/enterprise-systems-12165

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | 3 | | 3 | | | | | | | | 2 | | |
| 2 | 3 | | 3 | 3 | | | | | | | | | 3 | | |
| 3 | 3 | 3 | | 3 | 3 | | | | | | | 2 | 3 | | |
| 4 | 3 | | 3 | | 2 | | | | 3 | | 2 | 2 | 3 | | |
| 5 | 3 | 3 | 3 | | | | | | | | | 2 | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Develop an application project for the banking system using MVC architecture. (Apply)
2. For anrealtime project develop a test case and implement TDD approach. (Apply)

**Course Outcome 2 (CO2):**

2. Develop the following as functional /non-functional requirements for a banking system using php.

(a) Verifying bank balance

(b) Withdrawing money from bank

(c) Completion of transactions in less than one second.

(d) Extending the system by providing more tellers for the customers (Apply)

2. Implement an web application using php, pearl or SAP as a tool? (Apply)

**Course Outcome 3 (CO3):**

1. With a neat sketch mention the SOA architecture with an example. (Understand)
2. Mention the benefits of ERP with a real time example. (Understand)

**Course Outcome 4 (CO4):**

1. Draw and implement customer relationship model for the stock market. (Apply)
2. Mention the guidelines for implementing BPR success . How the process is carried out in the Analytical Exchange.(Understand)

**Course Outcome 5 (CO5):**

1Building a team to develop a project for a banking sector and mention the firewall network implementation policies. (Analyse)

2.Mention the Encryption review of IPL Sec and detail the view in terms of SSL. (Understand)

| 21CB6702 | INDUSTRIAL PSYCHOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The field of Industrial Psychology is concerned with the application of psychological principles and theories to the workplace. As such, the field plays a critical role in helping organizations achieve their goals and objectives by maximizing the productivity and well-being of their employees.

**Prerequisites for the course**

- **21HS4101 - Principles of Management**

**Objectives**

1. Learn the content areas of industrial psychology and the applications
2. Understand the measurements of qualitative parameters.
3. Apply the applied approach to improve their roles as employees and managers.
4. Impart the leadership qualities.
5. Analyse the healthy work-life balance which can help to reduce employee stress.

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

| | | |
|---|---|---|
| Industrial-Organizational Psychology-definition. Research Methods, Statistics, and Evidence-based Practice, Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modelling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment. | | |
| **UNIT II** | **EVALUATING THE QUALITY OF PERFORMANCE MEASURES** | **10** |
| Evaluating the Effectiveness of Recruitment Strategies, Realistic Job Previews, Effective Employee Selection Techniques. Employment Interviews - Types of Interviews, Advantages of Structured Interviews, Problems with Unstructured Interviews, creating a Structured Interview, Conducting the Structured Interview, Job Search Skills. | | |
| **UNIT III** | **EMPLOYEES PERFORMANCE AND EVALUATION** | **9** |
| Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance. Employee Motivation, Satisfaction and Commitment, Fairness and Diversity | | |
| **UNIT IV** | **LEADERSHIP AND ORGANISATIONAL DEVELOPMENT** | **10** |
| Leadership, Personal Characteristics Associated with Leadership, Interaction between the Leader and the Situation, Specific Leader Skills. Organizational Development - Managing Change, Career Workshop: Coping with Change, Empowerment, Downsizing, Work Schedules. | | |
| **UNIT V** | **STRESS MANAGEMENT.** | **7** |
| Stress Management: Stress Defined, Predisposition to Stress, Sources of Stress, Consequences of Stress, Managing Stress, Stress Reduction Interventions Related to Life/Work Issues, Measuring Stress, Workplace Violence. | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Open Book Test<br>2. Online Quizzes<br>3. Assignments | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

**CO 1**Understand about the major content areas of Industrial Psychology. (Understand)

**CO 2**Apply the statistical concepts in the context of making personnel decisions to reinforce content. (Apply)

**CO** Apply the series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being.(Apply)

**CO 4**Analyse the information based on collected data and make sound data-based decisions. (Analyse)

**CO 5** Apply the techniques behind stress management. (Apply)

**Text Books**

1. Landy, F. J. and Conte, J. M. Work in the 21st Century,2013, 4th Edition. Oxford: Blackwell Publishing. (Unit I – II)
2. Aamodt, M. Industrial/Organizational Psychology: An Applied Approach,2015, 8th Edition, Wadsworth Publishing Co. (Unit III – V)

**Reference Books**

1. Miner.B, J. Industrial-Organizational Psychology. 1992, McGraw Hill Inc., US.
2. Ashwathappa, K. Human Resource Management: Text & Cases,2017,8th Edition, McGraw Hill Education.

**Web Resources**

1. https://www.citehr.com/133261-industrial-psychology-study-material.html
2. https://www.siop.org/Events-Education/Educators/I-O-Resources-for-Teachers/I-O-Psychology-Content

**CO – PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 2 | 2 | 3 | | 2 | | | | 2 | 3 | | |
| 2 | | 2 | 2 | 2 | | 2 | 3 | 3 | | | | 2 | 3 | | |
| 3 | 2 | 2 | 2 | 2 | | 3 | 2 | 2 | | | | 2 | 3 | | |
| 4 | | 2 | 2 | 2 | | 2 | 2 | 3 | 2 | | | 2 | 3 | | |
| 5 | | 2 | | 2 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |

| | | | | | |
|---|---|---|---|---|---|
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Is I-O psychology a good degree? (understand)
2. Apply Hawthorne Experiment in the development of Industry. (Apply)
3. In the field, workers can seldom be randomly assigned to conditions or treatments. True or false. (Apply)

**Course Outcome 2 (CO2):**

1. How would you evaluate an organization's recruitment activity? (Understand)
2. Identify the job prospects for industrial-organizational psychology?. (Understand)
3. Discuss the difference between Industrial Psychology and Organizational Psychology. Provide one example of a topic that an Industrial-Organizational Psychologist might study, Explain whether it is an example of Industrial Psychology, or whether it is an example of Organizational Psychology, and why. (Apply)

**Course Outcome 3 (CO3):**

1. How does work environment influence productivity? (Apply)
2. Joseph possesses a combination of skills, knowledge, abilities, and personality characteristics that allow him to complete his project management tasks. What are the sets of behaviors called that allow him to do his job well? (Analyse)
3. Sarah, in an interview for a Disc Jockey position, was asked to describe how she would respond to a dissatisfied client. She most likely experienced what type of interview? (Analyse)

**Course Outcome 4 (CO4):**

1. Discuss at least two things that may limit the ability of an I/O psychologist from using the best available solution to solve a problem in the workplace. **(Analyze)**
2. **There is a conflict between two of your team members. How do you handle it? (Analyze)**

**Course Outcome 5 (CO5):**

1. Give consequences of Stress on Personal and Organizational Level. (Apply)
2. What is a good measure to prevent workplace violence?. (Analyze)
3. Why is stress related to violence at the workplace? (Analyze)

| 21CS5703 | IOT AND ITS APPLICATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

It defines a network of physical items – 'things'– that are built into sensors, apps and other technology to communicate and share data across the Internet with other devices and systems

**Prerequisites for the course**

- Embedded systems, mobile application development, Computer Networking,

  Microprocessors and Microcontrollers

**Objectives**

- Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- 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
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

| UNIT I | INTRODUCTION TO INTERNET OF THINGS | 9 |
|---|---|---|

IOT Fundamentals - Characteristics of IoT - Physical Design of IoT - IoT Protocols - IoT communication models - IOT Communication APIs -IOT enabled Technologies – Sensors in IoT- Wireless Sensor Networks, Cloud Computing, Big data analytics, and Communication protocols, Embedded Systems, IOT Levels and Templates

**Suggested Activities**:

- Survey the open hardware platforms available for IoT and compare their characteristics.
- IOT Levels and Templates
- Explore big data analytics.

**SUGGESTED EVALUATION METHODS**:

- Assignment problems
- Quizzes

| UNIT II | IOT REFERENCE ARCHITECTURE | 9 |
|---|---|---|

Introduction- State of the art - Architecture Reference Model- IOT reference Model-IOT Protocols: Zigbee, RFID, BLE, NFC, BACnet, 6LowPAN, RPL, XMPP, CoAP, and MQTT.

**Suggested Activities**:

- Describing IOT Reference Model.
- Explaining various IOT Protocols such as Zigbee, RFID, BLE, NFC, BACnet, 6LowPAN, RPL, XMPP, CoAP, and MQTT.

**SUGGESTED EVALUATION METHODS**:

- Assignment problems
- Quizzes

| UNIT III | IOT DEVICES AND INTERFACING | 9 |
|---|---|---|

IOT components - Sensors - Actuators - Hardware Platforms - Interfacing with devices: Setting up the board -Programming for IOT - Reading from Sensors, Communication: Connecting microcontroller with mobile devices - communication through Bluetooth, wifi, Ethernet.

**Suggested Activities**:

- Assignment on operational principles of sensors and actuators
- Identify the sensors required for the system, connect sensors
- Assignment on access technologies

**SUGGESTED EVALUATION METHODS**:

- Assignment problems
- Quizzes

| UNIT IV | IOT CLOUD, WEB SERVICES AND DATA ANALYTICS | 9 |
|---|---|---|

Introduction to Cloud Storage models - Cloud services and IOT - communication APIs -Cloud for IOT - Web server: Web server for IOT - Amazon Web services for IOT- Data analytics for IOT.

**Suggested Activities**:

- Lecture on Cloud Storage models/
- Explaining Web server for IOT
- Explaining data analytics for IoT.

**SUGGESTED EVALUATION METHODS**:

- Assignment problems
- Quizzes

| UNIT V | IOT SECURITY | 9 |
|---|---|---|

Security Requirements in IOT - Security Concerns in IOT Applications - Security Architecture in the Internet of Things - Insufficient Authentication and Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IOT. Vulnerabilities - Secrecy and Secret- Key Capacity – Authentication and Authorization for Smart Devices - Transport Encryption.

**Suggested Activities**:

- Review of security in various IoT platform

**SUGGESTED EVALUATION METHODS**:

- Assignment problems
- Quizzes

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES | 1.DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

CO1 Identify physical design, components and communication models used in IOT (Remember)
CO2 Understand the protocol architecture of IOT.(Understand)
CO3 Implement sensor interfacing and collaborate them with network devices.(Apply)
CO4 Analyze protocols used for connecting devices to cloud and web servers.(Apply)
CO5 Analyze the security requirements and threats in IOT (Apply)

**Text Books**

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014. (Unit I – III)
2. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1stEdition, VPT, 2014. (Unit IV – V)

**Reference Books**

1. Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things Key applications and Protocols, Wiley, 2012
2. Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) [Kindle Edition] by CunoPfister,2011
3. Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren
4. Security and Privacy in Internet of Things (IOTs): Models, Algorithms, and Implementations

**Web Resources**

1. https://nptel.ac.in/courses/106/105/106105166/
2. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
4. https://www.arenasolutions.com/blog/10-valuable-iot-web-resources/
5. https://www.gsma.com/iot/iot-resources/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| 2 | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | 2 | 2 | 3 | 3 | |
| 4 | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| 5 | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 | 3 | 3 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: Students will be able to Predict the suitable method for.(Apply)**

**Course Outcome 1 (CO1):**

1. Define IoT. (Remember)
2. Give the evolutionary phases of IoT. (Understand)
3. Poin tout the challenges faced by Internet of Things.(Analyse)

**Course Outcome 2 (CO2):**

1. Analyze the use of ZigBee.(Analyze)
2. Examine the use of IEEE 1901.2a. (Remember)
3. Illustrate the high level ZigBee Protocol stack. (Apply)

**Course Outcome 3 (CO3):**

1. Analyze the purpose of Sensors, Actuators and Smart Objects .(Analyze)
2. Classify the different types of Sensors(Apply)
3. Formulate the communication criteria used for connecting smart objects. (Apply)

**Course Outcome 4 (CO4):**

1. Analyze the use of AWS in IoT. (Apply)
2. Examine the role of Python Web application framework – Django. (Apply)
3. Define Amazon S3 and Amazon RDS. (Remember)

**Course Outcome 5 (CO5):**

1. Examine the use of security Architecture (Remember)
2. Classify the different types of threads(Apply)
3. Analyze the use of secret keys(Apply)

| 21AI7707 | COGNITIVE SCIENCE AND ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **Preamble** | | | | | |

This course explores the area of cognitive computing and its implications for today's world of big data analytics and evidence-based decision making. Topics covered include: cognitive computing design principles, natural language processing, knowledge representation, Students will have an opportunity to build cognitive applications, as well as explore how knowledge-based artificial intelligence and deep learning are impacting the field of data science.

**Prerequisites for the course**

- Machine learning
- Artificial intelligence

**Objectives**

- To develop algorithms that use AI and machine learning along with human interaction and feedback.
- To help humans make choices/decisions and to understand how Cognitive computing supports human reasoning.
- To evaluating data in context and presenting relevant findings along with the evidence that justifies the answers with the help of machine learning.
- To understand the advance analytics on a path to cognitive computing.
- To apply cognitive analytics on various applications

| UNIT I | FOUNDATION OF COGNITIVE COMPUTING | 9 |
|---|---|---|

Cognitive science and cognitive Computing with AI, Cognitive Computing - Cognitive Psychology - The Architecture of the Mind - The Nature of Cognitive Psychology – Cognitive architecture – Cognitive processes – The Cognitive Modeling Paradigms - Declarative / Logic based Computational cognitive modeling – connectionist models – Bayesian models. Introduction to Knowledge-Based AI – Human Cognition on AI – Cognitive Architectures

**SUGGESTED ACTIVITIES**

- Distinguishing features of cognitive system
- Discuss about the frame works of cognitive architectures

**SUGGESTED EVALUATION METHODS**

- Quizzes on cognitive modelling
- Case study on Human cognition on AI

| UNIT II | COGNITIVE COMPUTING WITH INFERENCE AND DECISION SUPPORT SYSTEMS | 9 |
|---|---|---|

Intelligent Decision making, Fuzzy Cognitive Maps, Learning algorithms: Non linear Hebbian Learning – Data driven NHL - Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps.

**SUGGESTED ACTIVITIES**

- Case study on Intelligent Decision making
- Quizzes on Fuzzy cognitive maps

**SUGGESTED EVALUATION METHODS**

- Implement various learning algorithm for decision making in an enterprise

| UNIT III | COGNITIVE COMPUTING WITH MACHINE LEARNING | 9 |
|---|---|---|

Machine learning Techniques for cognitive decision making – Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies - Deep Learning.

**SUGGESTED ACTIVITIES**

- Demonstration of text parsing, topic modelling, text clustering and text classification.
- Demonstration of Part-of-Speech tagging using spaCy.

**SUGGESTED EVALUATION METHODS**

- Evaluate the accuracy of text classification
- Quizzes on ML techniques for cognitive decision making

| UNIT IV | ADVANCED ANALYTICS AND COGNITIVE COMPUTING | 9 |
|---|---|---|

Advanced analytics is on path to cognitive computing- Key capabilities in advanced analytics- The relationship between statistics, data mining and machine learning- using machine learning in the analytic process-predictive analytics- text analytics-image analytics –speech analytics

**SUGGESTED ACTIVITIES**

- Discuss about various type of analytics on a path to cognitive computing
- Case study on machine learning techniques and tools for advanced analytics

**SUGGESTED EVALUATION METHODS**

- Estimate the relationship between the statistics, data mining and machine learning
- Automate specific tasks with advanced analytics

| UNIT V | APPLICATIONs OF COGNITIVE COMPUTING | 9 |
|---|---|---|

Cognitive Systems in health care – Cognitive Assistant for visually impaired – AI for cancer detection, Predictive Analytics - Text Analytics - Image Analytics -Speech Analytics – IBM Watson

**SUGGESTED ACTIVITIES**

- Implement a cognitive assistant for visually impaired
- Implement AI for cancer detection

**SUGGESTED EVALUATION METHODS**

- Evaluating the accuracy of cognitive assistant for visually impared
- Evaluating the accuracy of cancer detection

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROGRAMING AND PROBLEM SOLVING QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES<br>3.PROBLEM-SOLVING ACTIVITIES | 1.DESCRIPTIVE QUESTIONS<br>2. PROGRAMING AND PROBLEM SOLVING QUESTIONS |

**Course Outcomes**

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

**CO1:** Understand basics of Cognitive Computing and its differences from traditional Approaches of Computing.

**CO2:** Plan and use the primary tools associated with cognitive computing
**CO3:** able to understand the basics of machine learning in cognitive analytics
**CO4:** able to understand the advanced analytics in a path of cognitive computing
**CO5:** Plan and execute a project that leverages Cognitive Computing

**Text Books**


3. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4. (Unit I – III)
4. Masood, Adnan, Hashmi, Adnan ,Cognitive Computing Recipes-Artificial Intelligence Solutions Using Microsoft Cognitive Services andTensorFlow, 2015. (Unit IV – V)


**Reference Books**


1. Peter Fingar, Cognitive Computing: A Brief Guide for Game Changers, PHI Publication, 2015
2. Gerardus Blokdyk ,Cognitive Computing Complete Self-Assessment Guide, 2018
3. Rob High, Tanmay Bakshi, Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service, IBM Book Series, 2019


**Web Resources**

- https:// cloud.google.com/architecture/mlops-continous-delivery-and-automation-pipelines-in-machine learning
- http://ml-ops.org
- https://towardsdatascience.com/what-is-mlops-everything-you-must-know-to-get-started-523f2d0b8bd8

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 2 | | | 2 | | | | | | | 1 | 1 | |
| **2** | 3 | 2 | 2 | | | 2 | | | | | | | 1 | 2 | |
| **3** | 3 | 2 | 2 | | | 2 | | | | | | | 2 | 2 | |
| **4** | 3 | 2 | 2 | | | 2 | | | | | | | 2 | 2 | |
| **5** | 3 | 2 | 2 | | | 2 | | | | | | | 3 | 2 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |

| | | | | | |
|---|---|---|---|---|---|
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:**

1. Why cognitive is important in the computer science? Compare it with philosophy and explain it with example **(Understand)**
2. ---------- Data, --------- analytics & ---------- computing acts as the core component in achieving cognitive intelligence-based analytics in larger business applications **(Understand)**

**COURSE OUTCOME 2:**

1. Investigate the business outcome from cognitive analytics **(Understand)**

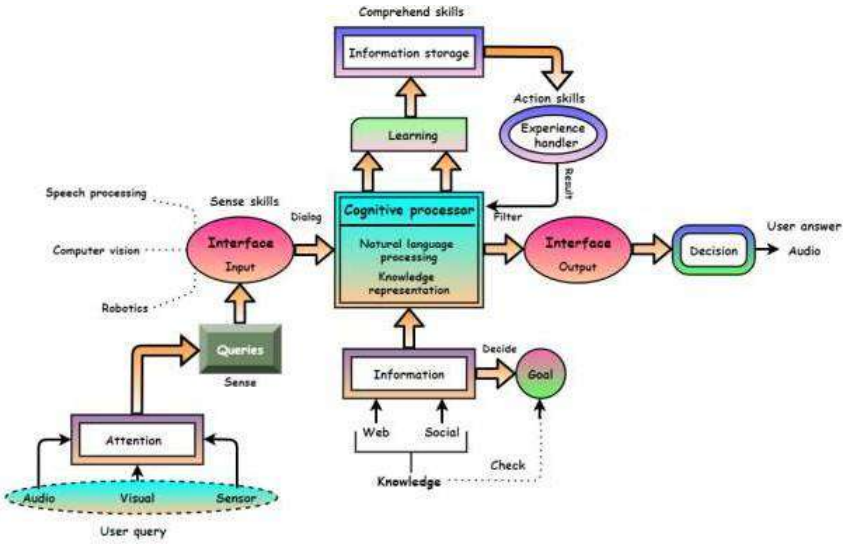
2. Discuss about Proposed cognitive computing-based human speech recognition framework for smart decision-making **(Understand)**

**COURSE OUTCOME 3:**

1. Evaluating ML algorithm with balanced and unbalanced datasets Comparison of Machine Learning algorithms **(Apply)**
2. Perform stemming & lemmatization in python using NLTK **(Apply)**

**COURSE OUTCOME 4:**

1.Based on the below diagram, infer your smart-decision making on human speech recognition frameworks of the following




2.Build a hybrid intelligence framework for collaborative decision-making in enterprises **(Apply)**

**COURSE OUTCOME 5:**

1. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data, set for clustering using k- Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program **(Apply)**

**2.** Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using cancer data sets**(Apply)**

| **Professional Elective IV** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 21CS7711 | Data Analytics Using R | 6 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB6703 | Marketing Analytics | 6 | 3 | 0 | 0 | 3 | Business Analytics |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3 | 21CB6704 | Human Resource Management for Business | 6 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CB6705 | Mobile Application Development | 6 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21CS7709 | Deep Learning Essentials | 6 | 3 | 0 | 0 | 3 | Advanced Technology |

| 21CS7711 | Data Analytics using R | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Fundamental data analytics algorithms and methods will be covered in this course. The various machine learning and data mining algorithms will be covered after the statistical underpinnings. The use of technology will also be discussed, including data management, scalable computation, and visualisation using R. In conclusion, this course will expose students to both the theory and the real systems and software utilised in data analytics.

**Prerequisites for the course**

- 21MA3202 - Probability and Queuing Theory
- 21CS4601 - Database Management Systems

**Objectives**

1. To learn data preparation and transformations, R Language.
2. Implement various statistic techniques for data analysis.
3. Learn different data visualization techniques.
4. To perform predictive analysis and Implement Clustering for various kinds of data.
5. To perform analysis on data for real time applications

| UNIT I | OVERVIEW OF R LANGUAGE , DATA PREPARATION | 9 |
|---|---|---|

Introduction of R- Installation and Configuring R on PCs- Basic concepts of Object Orientation and R- Generating R code- Graphics- Data manipulation; Arrays and Matrices, Functions, Grouping, Loop and conditional Execution in R.

Introduction - Data sources – Data understanding: Data tables- continuous and discrete variables- Data preparation: Overview-Cleaning the data – Removing variables – Data transformations – Segmentation.

| UNIT II | STATISTICS | 9 |
|---|---|---|

Overview of Statistics – Descriptive statistics: central tendency-variation-shape –Inferential statistics- Confidence intervals – Hypothesis tests- chi-square- One-way analysis of variance – Comparative statistics: Visualizing relationships – Correlation coefficient – Correlation analysis for more than two variables.

| UNIT III | DATA VISUALIZATION | 9 |
|---|---|---|

Visualization Design Principles : General principles-Graphics design-Anatomy of a graph- Tables : Simple Tables- Summary Tables- Two-way Contingency Tables- Super tables– Univariate Data

Visualization – Bivariate Data Visualization – Multivariate Data Visualization – Visualizing Groups : Dendrograms-Decision Trees, Cluster Image Maps - Dynamic Techniques.

| UNIT IV | CLUSTERING AND PREDICTIVE ANALYSIS | 9 |
|---|---|---|

Overview – Distance Measures – Agglomerative Hierarchical Clustering – Partitioned Based Clustering – Fuzzy Clustering – Overview of Predictive Analysis – Principal Component Analysis – Multiple Linear Regression – Discriminant Analysis – Logistic Regression – Naive Bayes Classifiers - k-nearest neighbours – classification and regression trees- Neural networks.

| UNIT V | APPLICATIONS | 9 |
|---|---|---|

Application: Sales and Marketing – Industry Specific Data Mining – microRNA Data Analysis Case Study – Credit Scoring Case Study – Data Mining Nontabular Data.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| DESCRIPTIVE QUESTIONS | ASSIGNMENT<br>ONLINE MCQ | DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

- Understand data preparation and transformations in R Language. (Understand)
- Implement various statistic techniques for data analysis. (Apply)
- Analyze different data visualization techniques. (Analyze)
- Implement Clustering and predictive analysis for various kinds of data. (Apply)
- Analyze data for real time applications. (Analyze)

**Text Books**

1. Glenn J.Myatt, —Making sense of data : A practical guide to exploratory data analysis and data mining||, 2 nd Edition, 2014. A

2. Edward R. Tufte, — The Visual display of Quantitative Information||, 2 nd Edition, 2001.

**Reference Books**

1. Ben Fry, —Visualizing data : Exploring and Explaining Data with the processing Environment||, 2008.

2. Tamraparni Dasu, —Exploratory Data mining and Data cleaning||, 2013.

**Web Resources:**

1. Business analytics and data mining Modeling using R - Course (nptel.ac.in)
2. Data Analysis with R Programming Course (Google) | Coursera
3. Getting Started analyzing Data in R - Introduction to Data Analysis with R | Coursera

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 20 | 50 | 5 | 5 | 50 |
| ANALYZE | 20 | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **21CB6703** | **MARKETING ANALYTICS** | **3** | **0** | **0** | **3** |

**Preamble**

Marketing analytics course focuses on measuring, managing, and analysing marketing performance to optimize marketing campaigns and strategies. It is also to improve the effectiveness of marketing campaigns and strategies and ultimately to drive more sales and revenue for businesses.

**Prerequisites for the course**

- 21CB5601 – Computational Statistics
- 21HS4101 - Principles of Management

**Objectives**

1. Learn about the metrics in Marketing analytics
2. Understand the Pilot product and market segmentation strategies
3. Analyse the customer value and customer analytics
4. Apply the root causes and not just the symptoms of why markets underperform for poor people.
5. Analyse to get better results across your marketing channels.

| | | |
|---|---|---|
| **UNIT I** | **MARKETING ANALYTICS AND METRICS** | **9** |

Basics of Marketing and Marketing Management – Analytics and Analysis – Why marketing analytics –Marketing decision models and marketing response models– Introduction to marketing metrics - Functional Marketing Measurement : Channel Management , Advertising Effectiveness ,Promotion Effectiveness - Result oriented metrics.

| | | |
|---|---|---|
| **UNIT II** | **MARKETING RESEARCH TOOLS EXPOSURE** | **9** |

Understanding appropriateness of Marketing Research tools –Principal Component Analysis , Multi-dimensional Scaling, Discriminant Analysis , One way and Two way Analysis of Variance – Practical Case studies for Forecasting Tools : Simple Linear regression-– Multiple Regression.

| | | |
|---|---|---|
| **UNIT III** | **TOOLS FOR SEGMENTATION AND POSITIONING** | **9** |

The segmentation process – Tools used for segmentation (Theory Only): Factor analysis , Clustering methods , Regression Analysis – Differentiation and Positioning : Analytical tools for differentiation and positioning – role of Perceptual Maps in segmentation – Models for Strategic marketing decision making.

| | | |
|---|---|---|
| **UNIT IV** | **NEW PRODUCT DECISIONS** | **9** |

Conjoint Analysis for Forecasting Sales of New products – Advertising : Measuring the effectiveness of Advertising – Product Design Media Selection models – Channel Decision: Marketing Channel Decision models and tools – Pricing: Price Bundling – Price Skimming and Sales.

| | | |
|---|---|---|
| **UNIT V** | **ERP SECURITY ISSUES** | **9** |

Introduction to ERP Systems and Security Concepts, Common ERP Security Threats - Unauthorized access and authentication vulnerabilities, Data breaches and confidentiality risks, Insider threats and privilege abuse, social engineering attacks and phishing, System vulnerabilities and exploits.

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| | | |
|---|---|---|
| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |

| | | |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Assignments<br>2. Online Quizzes<br>3. Open Book Test<br>4. Seminars | 1. DESCRIPTIVE QUESTIONS |

| **Outcomes** |
|---|
| **Upon completion of the course, the students will be able to:** |
| CO1 Understand the basic business analytics. (Understand)<br>CO2 Apply the Marketing research tools in various environment. (Apply)<br>CO3 Apply tools for market segmentation and positioning. (Apply)<br>CO4 Analyse new product introduction decisions. (Analyse)<br>CO5 Analyse the ERP security issues in the modern era. (Analyse) |
| **Text Books** |
| 1. Wayne L. Winston (2014). Marketing Analytics: Data-Driven Techniques with Microsoft Excel, Wiley. (Unit I – V) |
| **Reference Books** |
| 1. Stephan Sorger (2013). Marketing Analytics, Pearson Prentice Hall.<br>2. Paul W. Farris (2010). Marketing Metrics, Pearson Education.<br>3. Gary L. Lilien (2004). Marketing Engineering: Computer-Assisted Marketing Analysis and Planning, Pearson Education, USA. |
| **Web Resourses**<br>2. https://www.udemy.com/topic/marketing-analytics/<br>3. https://www.coursera.org/learn/uva-darden-market-analytics<br>4. https://www.upgrad.com/digital-marketing-courses/marketing-analytics/ |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 10 | 5 | 5 | 5 | 5 |
| UNDERSTAND | 50 | 25 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 10 | 5 | 55 |
| ANALYZE | | 20 | | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | | | | | 2 | 3 | | |
| 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | | | | | 2 | 3 | | |
| 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | | | | | 2 | 3 | | |
| 4 | 2 | 3 | 2 | 2 | 3 | | 2 | | | | | 2 | 3 | | |
| 5 | | 3 | 2 | 2 | 2 | | 2 | 3 | | | | 2 | 3 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Why marketing analytics is gaining importance? (Analyse)
2. *How would you measure the effectiveness of a marketing channel?* (Apply)
3. Discuss the Marketing decision models and Marketing Response models. (Apply)

**Course Outcome 2 (CO2):**

1. Outline some of the research tools used in Marketing. Explain each tool. (Analyse)
2. Show Principal Component Analysis tool provide the better understanding of marketing.(Apply)
3. Categorize multiple Forecasting Tools used for Marketing Analytics. (Analyse)

**Course Outcome 3 (CO3):**

1. Determine the tools used for segmentation in Marketing Analytics. (Analyse)
2. How market data is helpful in decision making ?(Apply)
3. Examine the need of Analytical tools for differentiation and positioning in Marketing. (Analyse)

**Course Outcome 4 (CO4):**

1. Why you need analytics for your pricing. (Analyse)
2. Financial performance of a firm measured by marketing analytics. Justify your answer. (Apply)
3. Conjoint analysis method is one of the most popular market analysis methods. Illustrate your answer in detail. (Apply)

**Course Outcome 5 (CO5):**

1. Customer Analytics is the most important phase in Marketing. Justify your answer. (Apply)
2. How Customer Lifetime Analyticscan help your business? (Apply)
3. How to collect and store customer analytics data? Classify the various methods in detail. (Analyse)

| 21CB6704 | HUMAN RESOURCE MANAGEMENT FOR BUSINESS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Entrepreneurship is an undertaking in which particular human being proceeds along favourable opportunities by exploiting the available resources successfully. An Entrepreneur needs to recruit, allocate persons to different work, influence the employees and conserve them for the growth and expansion of the enterprise.

**Prerequisites for the course**

• 21HS2102 - Business Communication and Value Science

**Objectives**

1. Learn the basic concepts, structure and functions of human resource management for entrepreneurs.
2. Create an awareness of the roles, functions and functioning of human resource department.
3. Understand the methods and techniques followed by Human Resource Management practitioners.

| UNIT I | INTRODUCTION TO HRM | 9 |
|---|---|---|

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles-Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.

| UNIT II | HUMAN RESOURCE PLANNING | 9 |
|---|---|---|

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

| UNIT III | RECRUITMENT AND SELECTION | 9 |
|---|---|---|

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

| UNIT IV | TRAINING AND EMPLOYEE DEVELOPMENT | 9 |
|---|---|---|

Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices

| UNIT V | CONTROLLING HUMAN RESOURCES | 9 |
|---|---|---|

| |
|---|
| Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends |

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Assignment<br>2. Online Quizzes<br>3. Open Book test | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO 1 Understand the Evolution of HRM and Challenges faced by HR Managers. (Understand)
CO 2 Understand about the HR Planning Methods and practices. (Understand)
CO 3 Acquaint about the Recruitment and Selection Techniques followed in Industries. (Understand)
CO 4 Known about the methods of Training and Employee Development. (Understand)
CO 5 Comprehend the techniques of controlling human resources in organizations. (Apply)

**Text Books**

1. Gary Dessler and Biju Varkkey, Human Resource Management, 14e , Pearson, 2015. (Unit I – III)
2. Mathis and Jackson, Human Resource Management, Cengage Learning 15e, 2017. (Unit IV – V)

**Reference Books**

1. David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014
2. R. Wayne Mondy, Human Resource Management, Pearson , 2015.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012

**Web Resourses**

https://archive.nptel.ac.in/courses/122/105/122105020/
https://onlinecourses.nptel.ac.in/noc20_mg15/preview

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM |
|---|---|---|---|---|---|

| CATEGORY | | | | | EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 2 | 3 | 3 | 3 | | 2 | 2 | 3 | | |
| 2 | | | | | | 2 | 3 | 3 | 3 | | 2 | 2 | 3 | | |
| 3 | | | | | | 2 | 3 | 3 | 3 | | 2 | 2 | 3 | | |
| 4 | | | | | | 2 | 3 | 3 | 3 | | 2 | 2 | 3 | | |
| 5 | | | | | 2 | 2 | 2 | 3 | 3 | | 2 | 2 | 3 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1 Management of men is a challenging job. Explain. (Analyse)

2. The role of audit in Human Resource Management is important. Justify. (Apply)

3. What are measures required for making workers participation in management successful? (Analyse)

**Course Outcome 2 (CO2):**

1. Analyse human resource information system in global business. (Analyse)

2 What are various methods used in forecasting human resource planning? (Understand)

3. How the manpower inventory is prepared? (Apply)

**Course Outcome 3 (CO3):**

1. Compare various on-the-job and of-the-job training methods. (Understand)
2. How do you calculate man power utilization? (Apply)
3. Why job enrichment is needed in an organization? (Analyse)

**Course Outcome 4 (CO4):**

1. How does Human resource Audit help an organization in preparing Human resource planning? (Analyse)

2. Why quality circle is necessary to have a quality circle in the organisation? (Analyse)

3. Elucidate the steps to successfully implement the human resource information system in an organization. (Understand)

**Course Outcome 5 (CO5):**

1. Why management by wandering around considered as effective communication? ( Analyse)
2. Apply porter and Lawler theory of motivation in real time example. (Apply)

| | | L | T | P | C |
|---|---|---|---|---|---|
| **21CB6705** | **MOBILE APPLICATION DEVELOPMENT** | **3** | **0** | **0** | **3** |

**Preamble**

This course introduces students to programming technologies, design and development related to mobile applications. Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using an OS Software Development Kit (SDK). Upon completion, students should be able to create basic applications for mobile devices.

**Prerequisites for the course**

- 21CB3601 – Object Oriented Programming (Java).

**Objectives**

1. Understand fundamentals and identify need and scope for mobile applications.
2. Learn the technologies and frameworks for designing and deploying mobile applications in Android and iPhone marketplace for distribution.
3. Study and take into account technical constraints, communication interfaces and user interfaces.
4. Explore emerging technologies and tools used to design and implement feature-rich mobile applications.
5. Develop mobile applications for Android.

| UNIT I | INTRODUCTION | 6 |
|---|---|---|

Mobile Applications – Characteristics and Benefits –Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Web vs Mobile App.

| UNIT II | USER INTERFACE | 12 |
|---|---|---|

User Interface Design part 1: Views & View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative, List View, Grid View, Table View, Web View, Adapters. User Interface Design Part 2: Menus, Action Bars, and Notifications: Status, Toasts and Dialogs.

| UNIT III | INTENTS AND BROADCAST RECEIVERS | 9 |
|---|---|---|

Introducing intents- Using intent to launch activities- Introducing Linkify- Using intents to Broadcast Events- Creating Intent filters and broadcast receivers –Using intent filters to services to implicit intent- Using Intent Filters for Plug-Ins and Extensibility- Monitoring Device State Changes using Broadcast Intents.

| UNIT IV | CONTENT PROVIDERS AND DATA STORAGE | 9 |
|---|---|---|

Content Providers: Contents provider, Uri, CRUD access, Browser, CallLog, Contacts, Media Store, and Setting. Data Access and Storage: Shared Preferences, Storage External, Network Connection. SQLite - SQLite Databases.

| UNIT V | ANDROID APPLICATION DEVELOPMENT | 9 |
|---|---|---|

Designing Real world android application –Mapping out the application flow- Application source code- Managing jobs- Sever code- Building android application without SDK. Case Study: EmojiCompat Sample using Kotlin Platform.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Assignment<br>2. Online Quizzes<br>3. Online Problem-Solving Platforms | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1: Understand the Concepts of Mobile Application. (Understand)

CO2: Analyze and Design UI in the context of mobile application. (Analyse)

CO3: Analyze how the Android platform uses Intents. (Analyse)

CO4: Understand the concept of Data storage and Content providers. (Understand)

CO5: Develop mobile applications for Android. (Apply)

**Text Books**

1. Joseph Annuzzi, Jr.,Lauren Darcey, Shane Conder "Introduction to Android Application Development", Addision-Wesley, 4th Edition, 2015. (Unit – I)

2. Reto Meier, "Professional Android 4 Development", John Wiley and Sons, 2012. (Unit II – III)

3. W. Frank Ableson, RobiSen, Chris King, C. Enrique Ortiz, "Android in Action", 3 rd Edition, 2012. (Unit IV – V)

**Reference Books**

1. ZigurdMednieks, Laird Dornin, G.BlakeMeike and Masumi Nakamura, "Programming Android", O"Reilly, 2012.

**Web Resourses**

1. http://developer.android.com/guide/index.html.
2. https://swayam.gov.in/explorer?searchText=mobile+application+development

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | | 3 | |
| 2 | 2 | 2 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | | 3 | |
| 3 | 2 | 2 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | | 3 | |
| 4 | 2 | 2 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | | 3 | |
| 5 | 2 | 2 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | | 3 | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. How do you store and retrieve data in Android environment? (Apply)
2. Examine the Market Drivers in Mobile Application (Analyse)
3. Identify what are the features considered for a successful mobile application? (Apply)

**Course Outcome 2 (CO2):**

1. How to interact with UI with suitable example (Apply)
2. List the various touch events and gestures in mobiledevice. (Understand)
3. Write an android program to explain its life cycle. (Understand)

**Course Outcome 3 (CO3):**

1. How to Create Intent filters? (Apply)
2. What is the purpose of toggle buttons? (Apply)

**Course Outcome 4 (CO4):**

1. How to connect a database to an android app using SQLite ? (Apply)
2. How to create our own content provider in android app? (Apply)
3. Write an android app to send a SMS. (understand)

**Course Outcome 5 (CO5):**

1. Analyse what are design issues in Apple iPhone? (Analyse)
2. Develop an alarm application that rings every Monday at 8AM.(Apply)

| **21CS7709** | **DEEP LEARNING ESSENTIALS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**Preamble**

This course is about learning the foundational concept of machine learning algorithms, neural networks and deep learning, Convolutional networks, RNNs, LSTM, optimization. This course will culminate in case studies from Imagenet, object detection, natural language processing, face recognition.

**Prerequisites for the course**

- 21CS6602 - Artificial Intelligence Practices

**Objectives**

1. To Learn the basis of Machine Learning
2. To Explore various Deep Learning Networks
3. To Implement Convolutional and Recurrent Neural Algorithms
4. To learn optimization and generalization in deep learning and its applications
5. To Explore the deep learning algorithms in various real time applications

| **UNIT I** | **MACHINE LEARNING BASICS** | **9** |
|---|---|---|

| | | |
|---|---|---|
| Introduction to machine learning - Linear models (SVMs and Perceptrons, logistic regression). Learning Algorithms – Capacity, Overfitting and underfitting – Hyperparameters and Validation Sets – Estimators, Bias and Variance – Maximum Likelihood Estimation – Bayesian Statistics – Supervised Learning Algorithms – Unsupervised Learning Algorithms – Stochastic Gradient Descent – Building a Machine Learning Algorithm – Challenges Motivating deep learning. | | |
| **UNIT II** | **DEEP NETWORKS** | **9** |
| History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and other Differentiation Algorithms – Regularization: Dataset Augumentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning –Long Short Term Memory | | |
| **UNIT III** | **CONVOLUTION & RECURRENT NETWORKS** | **9** |
| Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms- Transfer Learning- Recurrent Neural Networks: Bidirectional RNNs – Deep Recurrent Networks – Concepts in Natural Language Processing | | |
| **UNIT IV** | **OPTIMIZATION AND GENERALIZATION** | **9** |
| Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience | | |
| **UNIT V** | **CASE STUDY AND APPLICATIONS** | **9** |
| Imagenet- Object Detection – Object Tracking - Audio WaveNet - Natural Language Processing Word2Vec - Joint Detection - Face Recognition - Scene Understanding - Gathering Image Captions. | | |
| **Total Periods** | | **45** |

| **Suggestive Assessment Methods** | | |
|---|---|---|
| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
| DESCRIPTIVE QUESTIONS | ASSIGNMENT<br>ONLINE MCQ | DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

CO1 Understand and effectively use the procedures for Machine Learning Algorithms(Understand)

CO2 Analyze the data generated using Deep Learning model (Apply)

CO3 Develop models using Convolutional and Recurrent Neural Algorithms (Apply)

CO4 Analyze optimization and generalization in deep learning (Analyze)

CO5 Apply appropriate datasets to the deep learning algorithms and analyze the output (Apply)

**Reference Books**

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation,2016.
2. Dr.Adrian Rosebrock, —Deep Learning for Computer Vision with Python: Starter Bundle||, PyImage Search, 1st edition, 2017.
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013. 4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

**Web Resources**

1. https://nptel.ac.in/courses/108103192
2. https://nptel.ac.in/courses/106105215
3. https://nptel.ac.in/courses/106106184

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**SEMESTER VII**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| **1** | **21IT5707** | **Design Thinking** | **PC** | **3** | **3** | **0** | **0** | **3** |
| **2** | **21CB7602** | **Artificial Intelligence and Logical Thinking** | **PC** | **3** | **3** | **0** | **0** | **3** |
| **3** | **21CB7XXX** | **Professional Elective V** | **PE** | **3** | **3** | **0** | **0** | **3** |
| **4** | **21CB7XXX** | **Professional Elective VI** | **PE** | **3** | **3** | **0** | **0** | **3** |
| **5** | **21OE7XXX** | **Open Elective III** | **OE** | **3** | **3** | **0** | **0** | **3** |
| **Theory cum Practical Courses** | | | | | | | | |
| **1** | **21CB7601** | **Machine Learning for Finance** | **PC** | **5** | **3** | **0** | **2** | **4** |
| **Practical Courses** | | | | | | | | |
| **1** | **21CB7611** | **Artificial Intelligence Lab** | **PC** | **4** | **0** | **0** | **2** | **2** |
| | | | **Total** | **24** | **18** | **0** | **8** | **21** |

**Professional Electives**

| **Professional Elective V** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 21CB7701 | Natural Language Processing | 7 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB7702 | Financial Analytics | 7 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB7703 | Entrepreneurship Development | 7 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21IT7706 | Agile Methodologies and DEvops | 7 | 3 | 0 | 0 | 3 | Full Stack Development |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 | 21IT6711 | Quantum Computing | 7 | 3 | 0 | 0 | 3 | Advanced Technology |
| **Professional Elective VI** | | | | | | | | |
| 1 | 21CB7704 | Text and media analytics | 7 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB7705 | Computational Finance & Modeling | 7 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21IT6707 | Software project management | 7 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CS7705 | Blockchain Technologies | 7 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21CS5704 | Virtual and Augmented Reality | 7 | 3 | 0 | 0 | 3 | Advanced Technology |

| 21IT5707 | DESIGN THINKING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The course Design thinking help the learners to transform the way developing products, services, processes, and organizations. It brings innovative solutions to life based on how real users think, feel and behave.

**Prerequisites for the course**

21IT4603 – Integrated Software Engineering

**Objectives**

- Learn design thinking concepts and principles
- Use design thinking methods in every stage of the problem
- Learn the different phases of design thinking
- Apply various methods in design thinking to different problems

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Need for design - Tools - Principles of Design Thinking - The process of Design Thinking - Planning a Design Thinking project.

| UNIT II | PROBLEM ANALYSIS AND DEFINITION | 9 |
|---|---|---|

Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

| UNIT III | IDEATION AND PROTOTYPING | 9 |
|---|---|---|

Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Start-up Method for Prototype Development - Visualization and presentation techniques.

| UNIT IV | TESTING AND IMPLEMENTATION | 9 |
|---|---|---|

Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.

| UNIT V | DESIGN THINKING IN INDUSTRY | 9 |
|---|---|---|

Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow – Case Study.

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| **1. DESCRIPTIVE QUESTIONS** | 1. ASSIGNMENT<br>2. MCQ | **1. DESCRIPTIVE QUESTIONS** |

**Outcomes**

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

**CO1**– Understand the key concepts of design thinking.

**CO2**– Apply design thinking in the problem analysis phase.

**CO3**– Apply design thinking in the ideate and innovate phase of problem solving.

**CO4**– Apply design thinking in the testing and implementation phase.

**CO5**– Apply innovative solutions to real world problems using industry standards.

**Text Books**

1. Mueller-Roterberg, Christian. "Handbook of Design Thinking: Tips & Tools for How to Design Thinking. N.P"., Amazon Digital Services LLC - KDP Print US, 2018.
2. Brown, Tim. "Change by Design, Revised and Updated: How Design Thinking Transforms Organizations and Inspires Innovation", United States, HarperCollins, 2019.

**Reference Books**

1. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Reilly Media, 2017.

**Web Resources**

http://ajjuliani.com/design-thinking-activities/ (Unit I – Process of design thinking)

**CO Vs. PO Mapping and CO vs. PSO Mapping**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 1 | 1 | 2 | | | | | | | | 1 | 1 |
| 2 | 1 | 3 | 1 | 1 | 1 | 1 | | 1 | | | | | 1 | 2 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 |
| 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | 1 | | 1 | 2 |
| 5 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | | 1 | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | | | | | |
| UNDERSTAND | 70 | 70 | 70 | 70 | 70 |
| APPLY | 30 | 30 | 30 | 30 | 30 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 21CB7602 | ARTIFICIAL INTELLIGENCE AND LOGICAL THINKING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The fundamental ideas and methods of artificial intelligence are covered in this course. The subarea of computer science known as artificial intelligence is focused on developing the software and hardware necessary to enable computers to perform actions that would be regarded as intelligent if it is similar to those carried out by people. The students in this course will learn general problem-solving techniques that they can use to solve a variety of issues in the real world. Students can discover how computers can reason, interact, solve problems, and learn.

**Prerequisites for the course**

- 21CS1501 – Problem solving and logical thinking using C
- 21CS2501 - Introduction to Computing using Python

**Objectives**

1. To understand basics about Intelligent agents and problem solving
2. To learn about the different search strategies in AI
3. To learn knowledge representation techniques and reasoning.
4. To Develop problem solving agents
5. To Perform logical and probabilistic reasoning

| UNIT I | INTRODUCTION TO AI | 9 |
|---|---|---|

Definition - Future of Artificial Intelligence - Characteristics of Intelligent Agents – Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

**SUGGESTED ACTIVITIES:**

- Basics of Intelligent Agents

**SUGGESTED EVALUATION METHODS:**

- **Quizzes**

| UNIT II | PROBLEM SOLVING METHODS | 9 |
|---|---|---|

Problem solving Methods - Search Strategies- Uninformed – Informed– Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems– Constraint Propagation - Backtracking Search- Game Playing – Optimal Decisions in Games– Alpha - Beta Pruning - Stochastic Games

**SUGGESTED ACTIVITIES:**

- Alpha Beta pruning
- Backtracking problem

**SUGGESTED EVALUATION METHODS:**

- Practical on Alpha Beta Pruning and Backtracking Problem using Python

| UNIT III | KNOWLEDGE REPRESENTATION | 9 |
|---|---|---|

First Order Predicate Logic– Prolog Programming– Unification – Forward Chaining – Backward Chaining – Resolution– Knowledge Representation - Ontological Engineering - Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

**SUGGESTED ACTIVITIES:**

- Prolog Programming for object classification
- Forward chaining and backward chaining.

**SUGGESTED EVALUATION METHODS:**

- Assignment Problems
- Quizzes

| UNIT IV | LOGICAL REASONING | 9 |
|---|---|---|

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.

**SUGGESTED ACTIVITIES:**

- Seminars on Agent communication

**SUGGESTED EVALUATION METHODS:**

- Assignment problems
- Quizzes

| UNIT V | PROBABILISTIC REASONING | 9 |
|---|---|---|

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

**SUGGESTED ACTIVITIES:**

- Solving Real world problems with Speech Recognition Robot
- Seminars

**SUGGESTED EVALUATION METHODS:**

- Project Demonstration and Presentation

| Total Periods | 45 |
|---|---|

| Suggestive Assessment Methods | | |
|---|---|---|
| **Continuous Assessment Test (30 Marks)** | **Formative Assessment Test (10 Marks)** | **End Semester Exams (60 Marks)** |
| 1. DESCRIPTIVE QUESTIONS | 1. ASSIGNMENT | **1. DESCRIPTIVE QUESTIONS** |
| **2.CASE BASED QUESTIONS** | 2. ONLINE QUIZZES | **2. CASE BASED QUESTIONS** |
| | 3.PROBLEM-SOLVING ACTIVITIES | |

**Course Outcomes**

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

1. Understand AI agents, Select and apply appropriate algorithms and AI techniques to solve complex problems
2. Formulate real-world problems as state space problems, optimization problems or constraint satisfaction problems
3. Represent knowledge using first order and predicate logics
4. Perform logical reasoning
5. Perform probabilistic reasoning under uncertainty

**Text Books**

1.S.Russell and P.Norvig, Artificial Intelligence: A Modern Approach ,Prentice Hall, Third Edition,2009
2.M.Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science),Jones and Bartlett Publishers,Inc.; FirstEdition, 2008.

**Reference books**

1. Nils J. Nilsson, —The Quest for Artificial Intelligence, Cambridge University Press,2009.
2. William F. Clocksin and Christopher S.Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.

**Web Resources**

1. https://www.udacity.com/course/intro-to-artificial-intelligence--cs271
2. https://onlinecourses.nptel.ac.in/noc22_ge29/preview

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **4** | 3 | 3 | 3 | 2 | | | | | | | | | 3 | 3 | |
| **5** | 3 | 3 | 3 | | | | | | | | | | 3 | 3 | 3 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

**COURSE LEVEL**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**ASSESSMENT QUESTIONS**
**COURSE OUTCOME 1:**

1. How to measure the problem-solving performance of an algorithm? (Understand)
2. Describe the differences and similarities between problem solving and planning(Understand)

**COURSE OUTCOME 2:**

**1.** Given a constraint satisfaction problem with two variables x and y whose domains areDx={1,2,3}, Dy={1,2,3} and constraint x.Consider the following constraint network R = where D1 = D2 = D3 = {a, b, c} and C = , , , }. How many solutions exist? **(Analyze)**

**2.** Given the following constraint networks X,Y and Z with four variables x1,x2,x3 andx4 all defined on the same domain values {red,blue}. The constraints in the network are as follows:

X: R13=R14=R23=R24={(red,blue) (blue,red)} Y: R13=R14=R23=R24={(red,blue) (blue,red)} , R12={(red,red) (blue,blue)} Z: R13=R14=R23=R24={(red,blue) (blue,red)} , R34={(red,blue) (blue,red)}

Identify the equivalent pairs **(Apply)**

**3.** Formulate the minimax and alpha–beta algorithms and how it works for the game oftic-tac-toe.

**COURSE OUTCOME 3:**

1. How LISP and PROLOG can help you in regard of developing artificial intelligence? Explain in detail with features (Analyze)
2. Translate the following statement into FOL. "For every a, if a is a philosopher, then ais a scholar" (Apply)

**COURSE OUTCOME 4:**

1. Write PEAS description of an agent that reports threat of tsunami activity: Determinewhat type of agent architecture is most appropriate (table lookup, simple reflex, goal-based,or utility-based). Give a detailed explanation and justification of your choice.(Analyze)

2. Describe the properties of the environment of the Tsunami Activity Reporter in terms of the principal distinctions we can make (accessible vs. inaccessible, deterministic vs. nondeterministic, episodic vs. nonepisodic, static vs. dynamic vs. semidynamic, discrete vs.continuous). That is, identify in detail which properties are characteristic of the environment described, and give a justification for your description (Apply)

**COURSE OUTCOME 5:**

1. A search engine is designed to work over a collection of 1000 documents. In response to a query Q, the system retrieves 200 documents, of which 15 are found to be relevant. It is known from human judgements that the collection has 25 documents which are relevant to Q. Estimate the precision and recall of retrieval. (Apply)
2. Compare the early development of robotics to those being developed today. How have advancements in the field of electronics affected robotics research today? (Analyze)

**Theory cum Practical Courses**

| | | | | | |
|---|---|---|---|---|---|
| **21CB7601** | **MACHINE LEARNING IN FINANCE** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **2** | **4** |
| **Preamble** | | | | | |

Machine learning in finance is now considered a key aspect of several financial services and applications, including managing assets, evaluating levels of risk, calculating credit scores, and even approving loans. Machine learning is a subset of data science that provides the ability to learn and improve from experience without being programmed.

**Prerequisites for the course**

- 21CB5601 - Computational Statistics
- 21CB6602 – Statistical Modelling

**Objectives**

1. Understand the basic concepts of python in finance.
2. Understand the importance of data and data processing.
3. Understand and build supervised and unsupervised learning financial models.
4. Design and implement machine learning solutions to financial classification, regression, and clustering problems.
5. Apply the practical knowledge for handling and analyzing data sets covering a variety of real-world business applications.

| **UNIT I** | **PYTHON AND FINANCE** | **7** |
|---|---|---|

Why python for Finance? – Technology in Finance – finance and python syntax – data driven and AI – first finance – python infrastructure – using docker containers – using cloud instances.

**SUGGESTED ACTIVITIES**:

- Problems on Bayesian models.

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| **UNIT II** | **FINANCIAL DATA SCIENCE** | **9** |
|---|---|---|

Data visualization – static and interactive 2D plotting - Financial Time Series – Financial data – rolling statistics – correlation analysis - input/output operations – performance python – Monte Carlo Simulation – Recursive pandas algorithm.

**SUGGESTED ACTIVITIES:**

- Problems on Linear Regression.

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems

- Quizzes

| UNIT III | FINANCIAL MODELING | 9 |
|---|---|---|

Mathematical tools – approximation – convex optimization – integration – symbolic computation – stochastics – random numbers – simulation – valuation – statistics – normality tests – portfolio optimization – Bayesian statistics – Machine learning.

**SUGGESTED ACTIVITIES:**

- Analysis of Credit Risk Assessment using ML Models

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| UNIT IV | ALGORITHMIC TRADING | 10 |
|---|---|---|

The FXCM trading platform – retrieving data – working with the API - Trading strategy – simple moving averages – random walk hypothesis – classification – deep neural network – automated trading – capital management – ML – based trading strategy.

**SUGGESTED ACTIVITIES:**

- Use case of applying PCA in Financial applications

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| UNIT V | DERIVATIVE ANALYTICS | 10 |
|---|---|---|

Valuation framework – fundamental theorem of asset pricing – risk – neutral discounting – market environments – Simulation of financial models – derivative valuation – portfolio valuation – market based – valuation.

**SUGGESTED ACTIVITIES:**

- Analyze and discuss published research papers or industry use cases applying machine learning in finance.

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

| **Total Periods** | **45+15** |
|---|---|
| **LIST OF EXPERIMENTS** | **CO** |

| | | |
|---|---|---|
| **1.** | Data Exploration and Preprocessing:<br>- Obtain financial datasets (e.g., stock prices, financial statements, economic indicators).<br>- Perform data cleaning, handling missing values, and outlier detection.<br>- Explore and visualize data distributions, correlations, and trends using Python libraries (e.g., Pandas, Matplotlib). | **CO 1** |
| **2.** | Predictive Modeling:<br>- Develop a stock price prediction model using regression algorithms (e.g., linear regression, random forest) and evaluate its performance.<br>- Build a credit risk assessment model using classification algorithms (e.g., logistic regression, support vector machines) and evaluate its accuracy, precision, and recall. | **CO 2** |
| **3.** | Clustering and Segmentation:<br>- Apply clustering techniques (e.g., K-means, hierarchical clustering) to segment customers based on financial behavior or investment preferences.<br>- Analyze the characteristics of each cluster and identify potential target groups for personalized financial services. | **CO 3** |
| **4.** | Portfolio Optimization:<br>- Implement dimensionality reduction techniques (e.g., Principal Component Analysis) to identify key factors impacting portfolio performance.<br>- Construct an optimized portfolio using mean-variance optimization or other advanced techniques, considering risk and return trade-offs. | **CO 4** |
| **5.** | Implementation of RL in Financial application. | **CO 5** |
| **LIST OF PROJECTS** | | |
| **1.** | Stock Portfolio Optimization | **CO 1 - CO 5** |
| **2.** | Credit Risk Assessment | **CO 1 - CO 5** |
| **3.** | Fraud Detection | **CO 1 - CO 5** |
| **4.** | Stock Price Prediction | **CO 1 - CO 5** |
| **5.** | News Sentiment Analysis for Stock Trading | **CO 1 - CO 5** |
| **6.** | Algorithmic Trading Strategy | **CO 1 - CO 5** |
| **7.** | Reinforcement Learning for Portfolio Management | **CO 1 - CO 5** |

| **Suggestive Assessment Methods** | | |
|---|---|---|
| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (30 Marks)** | **End Semester Exams (50 Marks)** |

| | | |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Conduct Experiments<br>2. Model Exam | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

**CO 1**Explain the basic concepts of machine learning. (Understand)

**CO 2**Construct supervised learning models. (Apply)

**CO 3**Construct unsupervised learning algorithms. (Apply)

**CO 4**Examine and compare different models. (Analyze)

**CO 5** Apply algorithms in Machine Learning using real-world data to address social and business problems (Apply)

**Text Books**

1. Yves Hilpisch, "Python for Finance – Mastering data – driven finance", 2nd edition, Orielly publication, 2019. (Unit I – V).

**Reference Books**

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Macros Lopez de Prado, "Advances in Financial Machine Learning ", John Wiley Publication, 2018.
3. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

**Web Resources**

1. https://nptel.ac.in/courses/106106139
2. https://www.udemy.com/course/machine-learning-for-finance/

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | 2 | 2 | 1 | | | | | | | | | 3 |
| 2 | 3 | 3 | 3 | 2 | 2 | 1 | | | | | | | | | 3 |
| 3 | 3 | 3 | 3 | 2 | 2 | 1 | | | | | | | | | 3 |
| 4 | 3 | 3 | 3 | 2 | 2 | 1 | | | | | | | | | 3 |
| 5 | 3 | 3 | 3 | 2 | 2 | 1 | | | | | | | | | 3 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. How is Candidate Elimination algorithm different from Find-S Algorithm. (Understand)
2. How do you design a checkers learning problem. (Apply)
3. Trace the Candidate Elimination Algorithm for the hypothesis space H' given the sequence of training examples from Table 1. H'= < ?, Cold, High, ?,?,?>v (Apply)

**Course Outcome 2 (CO2):**

1. Give decision trees to represent the following boolean functions:
   (a) A ∧˜B (b) A V [B ∧ C] (c) A XOR B (d) [A ∧ B] v [C ∧ D (Apply)
2. (i) Write the learned concept for Martian as a set of conjunctive rules (e.g., if (green=Y and legs=2 and height=T and smelly=N), then Martian; else if ... then Martian;...; else Human). (ii) The solution of part b)i) above uses up to 4 attributes in each conjunction. Find a set of conjunctive rules using only 2 attributes per conjunction that still results in zero error in the training set. Can this simpler hypothesis be represented by a decision tree of depth 2? Justify. (Apply)

**Course Outcome 3 (CO3):**

1. Under what conditions the perceptron rule fails and it becomes necessary to apply the delta rule. (Understand)
2. Derive the Backpropagation rule considering the training rule for Output Unit weights and Training Rule for Hidden Unit weights (Understand)
3. Differentiate between Gradient Descent and Stochastic Gradient Descent (Apply)

**Course Outcome 4 (CO4):**

1. How do you classify text using Bayes Theorem (Apply)

2. Who are Consistent Learners. (Understand)

**Course Outcome 5 (CO5):**

1. Discuss the major drawbacks of K-nearest Neighbour learning Algorithm and how it can be corrected (Understand)
2. Apply Precision and Recall to any model? (Apply)
3. Examine the parametric estimation method (Analyse)

**Practical Courses**

| 21CB7611 | ARTIFICIAL INTELLIGENCE LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Preamble**

The laboratory course will enable the students to use machine learning libraries, Python, LISP, and PROLOG to apply the concept of artificial intelligence to various challenges, such as the eight queens and travelling salesperson difficulties. These exercises are designed to give students hands-on experience that will help them develop general problem-solving abilities that can be applied to a variety of real-world issues. Students can study how machines can think, interact, solve problems,

**Prerequisites for the course**

- 21CS250 - Introduction to Computing using Python
- 21CS1501- Problem Solving and Logical Thinking using C

**Objectives**

1. To study and discuss various techniques and algorithms of AI used in general problem solving.
2. To solve optimization problems, constraint satisfaction problems, and game programming.
3. To apply the AI concepts to solve real world problem.

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | Basics of PROLOG | **CO 1** |
| 2 | Write simple fact for the statements using PROLOG. | **CO 1** |
| 3 | Write a program to solve the Money Banana problem. | **CO 2** |
| 4 | Write a program to solve 8-Queen problem. | **CO 3** |
| 5 | Write a program to Solve problems using Best First Search | **CO 4** |
| 6 | Write a program Solve problems using Depth First Search | **CO 4** |

| | | |
|---|---|---|
| 7 | Write a program Solve problems using union and intersection of a list | **CO 4** |
| 8 | Write a program to flatten a list | **CO 4** |
| 9 | Write a program to solve water jug problem using LISP/PROLOG | **CO 5** |
| 10 | Write a constraint logic program for weather monitoring Using Fuzzy Prolog | **CO 5** |

| **S.No.** | **List of Projects** | **Related Experiment** | **CO** |
|---|---|---|---|
| **1.** | Family Tree | **1,2 ,3** | CO1 |
| **2.** | Ordering a Pizza | **1,2 ,5** | CO1 |
| **3.** | Sudoko Game | **1,2 ,4** | CO1 |
| **4.** | Retrieve a disease in base of different input with a prologbase of knowledge | **1,2 ,4** | CO2 |
| **5.** | Truth table maker | **1,2 ,4** | CO2 |
| **6.** | Tic Tac Toe Game | **1,2,6,7** | CO3 |
| **7.** | Offers for customers based on a database | **1,2,6,7** | CO3 |
| **8.** | pet shop | **1,2 ,8** | CO3 |
| **9.** | Words and their English meanings | **1,2 ,9** | CO4 |

**Suggestive Assessment Methods**

| **Lab Components Assessments (60 Marks)** | **End Semester Exams (40 Marks)** |
|---|---|
| • Lab Experiment(40)<br>• Model Exam& Test project(20) | Practical Exam |

**Outcomes**

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

| | |
|---|---|
| **CO1** | Understand the basics of PROLOG and its working environment |
| **CO2** | Design and develop expert system by using appropriate tools and techniques. |

| | |
|---|---|
| **CO3** | Solve the problems with different optimization Techniques like travelling salesman problem, 8-Queenproblem |
| **CO4** | Implement the Depth first Search algorithm for solving the various problem Using PROLOG/Lisp. |
| **CO5** | Construct solutions for Image Classification and Object Detection in any large dataset. |

**Laboratory Requirements**

**Laboratory Requirements:**

- PROLOG and Lisp
- Python

**Reference Books**

1. S.Russell and P.Norvig, Artificial Intelligence:A Modern Approach ,Prentice Hall, Third Edition, 2009.
2. Bratko, —Prolog: Programming for Artificial Intelligence||, Fourth edition, Addison-WesleyEducational Publishers Inc., 2011

**Web Recourses**

5. https://hackernoon.com/16-best-resources-to-learn-ai-machine-learning-in-2019-f95c4f59018b
6. https://learndigital.withgoogle.com/digitalgarage/course/elements-artificial-intelligence.
7. https://walker.cs.grinnell.edu/courses/261.sp98/lab-beginning-LISP-2.html

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | | | | | | | | | | | 3 |
| 2 | 3 | 3 | | | 3 | | | | | | | | | | 3 |
| 3 | 2 | 2 | 3 | 3 | 3 | | | | | | | | | | 3 |
| 4 | | | 3 | 3 | 3 | | | | | | | | | | 3 |
| 5 | | 3 | 3 | 3 | | | | | | | | | | | 3 |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1:**

**1.** Consider the expression (all x (if (human x) (mortal x))). Write lisp expressions to extract each of thefollowing. .(Understanding)

Allifhuman

**2.** Evaluate the following slightly tricky forms:(Evaluate)
(append '(a b c) '( ))
(list '(a b c) '( ))

(cons '(a b c) '( ))

**COURSE OUTCOME 2:**

1. How can AI are used in fraud detection by the rule-based algorithms. Analyze the patterns toidentify the fraudulent bank transaction.(Analyze)
2. Implement a k-means clustering algorithm for any given data set

**COURSE OUTCOME 3:**

1. Implement the optimization technique to solve Robot problem using MeansEnd Analysis.(Apply)
2. Apply any one randomized search technique (Simulated annealing, Genetic Algorithms, Particle swarm optimization) for solving problems like, TSP, Graph coloring, Vertex cover problem, shortest path problems, etc

**COURSE OUTCOME 4:**

3. Select and apply appropriate algorithms and AI techniques to solve complex problems.(Apply)

**COURSE OUTCOME 5:**

**1.** Formulate real-world problems as state space problems, optimization problems or constraintsatisfaction problems.(Analyze)
**2.** Implement Image Classification ( MNIST Handwritten Digit Recognition) using Backpropagation.(Apply)

| **Professional Elective V** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 21CB7701 | Natural Language Processing | 7 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB7702 | Financial Analytics | 7 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21CB7703 | Entrepreneurship Development | 7 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21IT7706 | Agile Methodologies and DEvops | 7 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21IT6711 | Quantum Computing | 7 | 3 | 0 | 0 | 3 | Advanced Technology |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **21CB7701** | **NATURAL LANGUAGE PROCESSING** | **3** | **0** | **0** | **3** |

**Preamble**

Text and Speech Analysis course covers the foundation techniques in Natural Language and Speech Processing to retrieve, organize, categorize, analyse and interpret unstructured text for getting insights in decision making. They also design custom solutions using Natural Language Processing and Speech Processing techniques for Text and Speech Analytics problems in organizations.

**Prerequisites for the course**

• 21CB3601 – Object Oriented Programming

**Objectives**

1. Understand Neural Language Models
2. Understand conference and coherence by applying Encoder-Decoder and Transformer models
3. Build question answering systems, Chabot's and dialogue systems
4. Develop a speech recognition system
5. Develop a speech synthesizer

| **UNIT I** | **DEEP LEARNING ARCHITECTURES FOR LANGUAGE PROCESSING** | **9** |
|---|---|---|

Foundations of Natural Language Processing – Recurrent Neural Networks, RNN for language modelling , Semantic Embeddings – GRU, LSTM, BLSTM – Attention Models and Transformers – Machine Translation – The Encoder-Decoder Model, Bidirectional Transformer Encoders - Transfer Learning.

| **UNIT II** | **COREFERENCE AND COHERENCE** | **9** |
|---|---|---|

Coreference phenomena – Coreference Tasks and Datasets – Mention Detection – Coreference Algorithms – Neural Mention - Ranking Algorithm – Evaluation of Coreference – Gender bias in Coreference – Coherence Relations – Discourse Structure Parsing – Centering and Entity-based Coherence – Local Coherence – Global Coherence.

| **UNIT III** | **QUESTION ANSWERING AND DIALOGUE SYSTEMS** | **9** |
|---|---|---|

Information Retrieval – Relation Extraction – Extraction of Time – Extracting Events – Template Filling – Review of SRL – Lexicons – IR-based Factoid Question Answering – Entity Linking – Knowledge-based question answering – Language Models for QA – Classic QA Models – Evaluation of Factoid Answers Properties of Human Conversation – Chabot's – GUS a Frame-based Dialogue System – Dialogue-State Architecture – Evaluating Dialogue Systems – Design of Dialogue Systems.

| **UNIT IV** | **AUTOMATIC SPEECH RECOGNITION** | **9** |
|---|---|---|

Speech Recognition: Acoustic Modelling – Deep Neural Network (DNN) Acoustic Modelling – HMM, HMM-DNN systems – Feature extraction; Connectionist Temporal Classification (CTC) – Listen, Attend & Spell (LAS) – Multi-task objectives for end-to-end ASR – ASR Evaluation: Word Error Rate.

| UNIT V | TEXT TO SPEECH SYNTHESIS | 9 |
|---|---|---|

Text to Speech (TTS): Overview Text normalization – Letter-to-sound – Prosody, Getting TTS working well: Data collection, Evaluation – Signal processing – Concatenative and parametric approaches – WaveNet and other Deep Learning based TTS systems.

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 arks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Assignments<br>2. Online Quizzes<br>3. Open Book Test<br>4. Seminars | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1 Understand Emerging Deep Learning architectures for text and speech processing (Understand)

CO2 Analyse deep learning techniques for NLP tasks, language modelling and machine translation (Analyse)

CO3 Explore coreference and coherence for text processing. (Analyse)

CO4 Implement question answering systems, Chabot's and dialogue systems (Apply)

CO5 Apply deep learning models for building speech recognition and text-to-speech systems. (Apply)

**Text Books**

1. Chris Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press. Cambridge, MA: May 1999. (Unit 1,2,3)

2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022. (Unit 4,Unit 5)

**Reference Books**

1. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.

3. Shrikanth Narayanan, Abeer Alwan, "Text To Speech Synthesis – New Paradigms and Advances", Prentice Hall, 2005.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.
5. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress.

**Web Recourses**

1. https://monkeylearn.com/text-analysis/
2. https://www.ontotext.com/knowledgehub/fundamentals/text-analysis/
3. https://study.com/learn/lesson/speech-analysis-elements-steps-examples.html
4. https://cloud.google.com/architecture/visualize-speech-data-with-framework

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 10 | 5 | 5 | 5 | 5 |
| UNDERSTAND | 50 | 25 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 10 | 5 | 55 |
| ANALYZE | | 20 | | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 2 | 2 | 2 | | | | | | 2 | 2 | 2 | | |
| 2 | 3 | 3 | 2 | 2 | 2 | | | | | | 2 | 2 | 2 | | |
| 3 | 3 | 3 | 2 | 2 | 2 | | | | | | 2 | 2 | 2 | | |
| 4 | 3 | 3 | 2 | | 2 | | | | | | 2 | 2 | 2 | | |
| 5 | 3 | 3 | 2 | | 2 | | | | | | 2 | 2 | 2 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Discuss various stages involved in NLP process with suitable example. (Understand)
2. Define Parsing in NLP. **Explain how we can do parsing.** (Understand)
3. List various ways to resolve ambiguity in NLP. (Understand)

**Course Outcome 2 (CO2):**

1. Why do we care *about* the Coreference and coherence? (Analyse)
2. Apply the coreference algorithms with real time example. (Apply)
3. Mention the various types of coherence in Text and Speech Analytics. (Understand)

**Course Outcome 3 (CO3):**

1. Illustrate the generic architecture of question answering and dialogue systems. (Understand)
2. Justify the need of Reinforcement learning for dialogue generation. (Apply)
3. How Information retrieval is done with the help of question answering and dialogue systems? (Apply)

**Course Outcome 4 (CO4):**

1. Can you justify how an Automatic Speech Recognition system works? (Analyse)
2. What do you understand about acoustic modeling and language modeling? (Understand)
3. Can you give some real time examples of where people use automatic speech recognition technology today? (Apply)

**Course Outcome 5 (CO5):**

1. Who needs text to speech? Explain the need of Text normalization. (Apply)
2. Depending on the device using, how many types of TTS tools are there? (Apply)
3. Explain in detail about the working of TTS. (Understand)

| | | L | T | P | C |
|---|---|---|---|---|---|
| **21CB7702** | **FINANCIAL ANALYTICS** | **3** | **0** | **0** | **3** |

**Preamble**

Financial analytics is the field to analyze whether an entity is stable, solvent, liquid, or profitable enough to warrant a monetary investment. It is used to evaluate economic trends, set financial policy, build long-term plans for business activity, and identify projects or companies for investment

**Prerequisites for the course**

- 21CB5601 – Computational Statistics
- 21CB5706 - Enterprise Systems

**Objectives**

1. Understand the fundamental concepts of spreadsheet modelling and spreadsheet analysis
2. Apply the business analytic concepts using spreadsheet
3. Apply the concepts of regression, classification, clustering and other optimization algorithms in key analytical problems
4. Developing proficiency in solving business analytics problems

| | | |
|---|---|---|
| **UNIT I** | **INTRODUCTION TO SPREADSHEET MODELS AND SPREADSHEET MODELLING** | **9** |

Introduction to Models – Modeling – Build Spread Sheet models – Simulate model – Test Models – Analysis using Spread Sheets – What-if analysis, Break even analysis – other analysis tools in Excel

| | | |
|---|---|---|
| **UNIT II** | **DESCRIPTIVE ANALYTICS – SPREADSHEET** | **9** |

Data Visualization and Analytics- Charts(Bars-Pie-Line-Scatter-Map-Bubble-Box & Whisker-Tree map - Heat map-Circle and Area) -Worksheet, Dashboard and Story Board creation

| | | |
|---|---|---|
| **UNIT III** | **PREDICTIVE ANALYTICS AND CLUSTERING** | **9** |

Linear Regression, Multi-linear Regression and Time Series Forecasting, Linear optimization, Integer optimization, Non-linear programming, Optimization of Network models and Monte Carlo Simulation

| | | |
|---|---|---|
| **UNIT IV** | **DECISION ANALYSIS** | **9** |

Introduction - Payoff Tables and Decision Criteria, Using Trees to Model Decisions - Decision Trees for a Series of Decisions, Principles for Building and Analyzing Decision Trees, The Cost of Uncertainty, Using Decision Tree Software, Maximizing Expected Utility with Decision Tree.

| | | |
|---|---|---|
| **UNIT V** | **OPTIMIZATION IN SIMULATION** | **9** |

Optimization with One or Two Decision Variables - Base-case Mode, Grid Search, Optimizing Using Simulation Sensitivity, Optimizing Using Solver, Stochastic Optimization, Chance Constraints, Two-Stage Problems with Recourse

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Assignment<br>2. Online Quizzes<br>3. Online Problem-Solving Platforms | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1: Understand the skills in spreadsheet for exploring data. (Understand)
CO2: Develop models in spreadsheet to solve all type of business analytics problems ranging

from regression to clustering and classification. (Apply)
CO3: Develop and apply prescriptive analytics models using spreadsheet and to solve various optimization problem. (Apply)
CO4: Analyse the decision taken based on decision tree methods. (Analyze)
CO5: Apply the concept of optimization in simulation. (Apply)

**Text Books**

1. Stephen G. Powell, Kenneth R. Baker, (2014), Business Analytics : The art of Modeling with Spreadsheets, John Wiley & Sons. (Unit I – V)

**Reference Books**

1. Hair, J. F, Black W. C, Babin B. J, Anderson R. E, Tatham R. L, (2009), Multivariate data analysis, 7th edition, Pearson education.
2. Gerald Knight (2006), Analysing Business data with excel, O'REILLY Media Incorporated.
3. Michael L. Middleton, Michael R. Middleton, Data Analysis using Excel 5.0, Wadsworth

**Web Resourses**

1. https://www.udemy.com/topic/financial-analysis/

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 3 | 2 | 3 | | 2 | | | | | 2 | 3 | | |
| 2 | 2 | 2 | 3 | 2 | 3 | | 2 | | | | | 2 | 3 | | |
| 3 | 2 | 3 | 3 | 2 | 2 | | 2 | | | | | 2 | 3 | | |
| 4 | 2 | 2 | 3 | 2 | 3 | | 2 | | | | | 2 | 3 | | |
| 5 | 2 | 2 | 3 | 2 | 3 | | 2 | | | | | 2 | 3 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Develop your own models to resolve the real world problems. (Apply)
2. How you can use the spreadsheets to address the uncertainty and probability. (Apply)
3. How to use spreadsheets to implement Monte Carlo simulations as well as linear programs for optimization. (Apply)

**Course Outcome 2 (CO2):**

1. Describe the various types of Data Visualization techniques and also explain how to visualize the data using pie chart, Bar chart, Histogram and Network diagram?(Understand)
2. How to explore a single variable using Univariate analysis in Data Visualization? (Apply)
3. How to visualize the values that are distributed in various ranges using Histograms? (Apply)

**Course Outcome 3 (CO3):**

1. Define Cluster and how to estimate the cluster wise linear regression modelling with soft scale constraints? (Understand)
2. What type of business analytics in regression analysis? (Understand)
3. How is Non-linear regression is used? (Apply)

**Course Outcome 4 (CO4):**

1. What is cluster analysis? How to make different analysis tools using cluster analysis? (Understand)
2. Explain Cluster Analysis Applications.(Understand)
3. How do businesses use cluster analysis strategies? (Apply)

**Course Outcome 5 (CO5):**

1. Why business analytics is challenging? (Apply)
2. What are the contemporary issues in business?(Understand)
3. Examine what are the major contemporary global issues and problems? (Analyse)

| | | L | T | P | C |
|---|---|---|---|---|---|
| **21CB7703** | **ENTREPRENEURSHIP DEVELOPMENT** | **3** | **0** | **0** | **3** |

**Preamble**

Entrepreneurship refers to the process of developing new business ventures or growing existing ones. Entrepreneurship development is the means of enhancing the knowledge and skill of entrepreneurs through several classroom coaching and programs, and training.

**Prerequisites for the course**

- 21CB4901 - Introduction to Innovation, IP Management and Entrepreneurship
- 21HS1102 - Business Communication and Value Science-I
- 21HS2102 - Business Communication and Value Science-II

**Objectives**

1. Understand entrepreneurial skills and qualities essential to undertake business.
2. Understand entrepreneurial competencies needed for managing business efficiently and effectively.
3. Understand to run a business efficiently and effectively
4. Identify and discover market needs
5. Understand the opportunities and challenges for entrepreneurs

| UNIT I | ENTREPRENEURAL COMPETENCE | 9 |
|---|---|---|

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Entrepreneur – Types of Entrepreneurs – Characteristics of Successful Entrepreneurs – Knowledge and Skills of an Entrepreneur.

| UNIT II | ENTREPRENEURAL ENVIRONMENT | 7 |
|---|---|---|

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations.

| UNIT III | BUSINESS PLAN PREPARATION | 9 |
|---|---|---|

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital Budgeting- Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria

| UNIT IV | LAUNCHING OF SMALL BUSINESS | 11 |
|---|---|---|

Small Enterprises – Characteristics, Ownership Structures – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Finance and Human Resource Mobilisation - Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching, Start-ups. Government Policies: Atal Incubation Centre (AIC), Refinancing by NABARD, Coir Udyami Yojana, MUDRA Loans, MSME Market Development Program.

| UNIT V | MANAGEMENT OF SMALL BUSINESS | 9 |
|---|---|---|

Monitoring and Evaluation of Business - Business Sickness - Prevention and Rehabilitation of Business Units - Effective Management of small Business - Case Studies.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 arks) |
|---|---|---|
| 1.DESCRIPTIVE QUESTIONS | 1. Assignments<br>2. Online Quizzes<br>3. Open Book Test<br>4. Seminars | 1.DESCRIPTIVE QUESTIONS |

| **Outcomes** |
|---|
| **Upon completion of the course, the students will be able to:** |
| CO1 Gain entrepreneurial competence to run the business efficiently. (Understand)<br>CO2 Undertake businesses in the entrepreneurial environment. (Apply)<br>CO3 Capable of preparing business plans and undertake feasible projects. (Apply)<br>CO4 Launch and develop their business ventures successfully. (Apply)<br>CO5 Monitor the business effectively towards growth and development. (Apply) |
| **Text Books** |
| 1. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013. (Unit I – II)<br>2. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9 th Edition, Cengage Learning, 2014. (Unit III – V) |
| **Reference Books** |
| 1. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016.<br>2. R.D.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.<br>3. Rajeev Roy, Entrepreneurship, Oxford University Press, 2nd Edition, 2011. |
| **Web Recourses**<br>1.https://leverageedu.com/blog/entrepreneurship-development/<br>2.https://www.udemy.com/courses/business/entrepreneurship/ |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 10 | 5 | 5 | 5 | 5 |
| UNDERSTAND | 50 | 25 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 10 | 5 | 55 |
| ANALYZE | | 20 | | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 3 | | | 3 | 3 | 2 | 2 | | | 2 | 2 | | |
| 2 | | | 3 | | | 2 | 2 | 2 | 2 | | | 2 | 2 | | |
| 3 | | 2 | 3 | | 2 | 2 | 2 | 2 | 2 | | | 2 | 2 | | |
| 4 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | | 1 | | 1 | 1 | 2 | | |
| 5 | | | 3 | 2 | 2 | 2 | 3 | 2 | | | | 2 | 2 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. Who is an entrepreneur? State the difference between the Innovative and Initiative Entrepreneur. (Understand)
2. List out the barriers to Entrepreneurship. (Apply)
3. What are the factors favouring Entrepreneurship as a career option? (Analyse)

**Course Outcome 2 (CO2):**

1. Show that Central and State Government Industrial Policies plays an vital role in Entrepreneurship Development. (Apply)
2. Suggest a suitable place for setting up the specified enterprise on the basis of given data with justification. (Apply)
3. Discuss the service activities carried out by the organisation in Entrepreneurship Environment. (Understand)

**Course Outcome 3 (CO3):**

1. Elaborate the components for writing a business plan. Give the essential requirements of developing business plan. (Understand)
2. "Capital Budgeting is an essential step for Business Plan Preparation"- State your responses Can you provide the need of Capital Budgeting. (Analyse)
3. Provide the need of pre-feasibility study. And also describe the steps and types of pre-feasibility study. (Apply)

**Course Outcome 4 (CO4):**

1. Explain the methods and strategies in launching of small business. (Understand)
2. Apply the Elucidate Market and Channel Selection in real time example. (Apply)
3. How to select a good business opportunity when planning for start-ups? (Apply)

**Course Outcome 5 (CO5):**

1. Enumerate the signals of business sickness. (Understand)
2. Justify the dynamic role of small business in economic development. (Apply)

3. Identify the risks that you may encounter for business management with justification. (Apply)

| 21IT7706 | AGILE METHODOLOGIES AND DEVOPS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course aims to deliver the right product, with incremental and frequent delivery of small chunks of functionality, through small cross-functional self-organizing teams, enabling frequent customer feedback and course correction as needed by the user.

**Prerequisites for the course**

- 21IT3603 - Integrated Software Engineering

**Objectives**

- To understand the differences between conventional and agile approaches
- To understand the incremental and iterative fashion using practical techniques
- To understand the agile process and requirement engineering
- To apply agile principles to a range of decision possibilities
- To apply Devops for CI/CD using containers, container orchestration and pipeline

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Overview - Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods- Scrum, XP, Lean, and Kanban, – Agile Manifesto and Principles.

| UNIT II | AGILE PROCESSES AND PROJECT MANAGEMENT | 9 |
|---|---|---|

Lifecycle – Work Products, Roles and Practices- Impact of Agile Processes in RE–Current Agile Practices – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agile Drivers, Capabilities and Values.

| UNIT III | REQUIREMENTS ENGINEERING | 9 |
|---|---|---|

Overview of RE Using Agile Requirements - story mapping - user stories - acceptance criteria – sprints - product backlog and backlog grooming - Agile Product Development – Agile Metrics – Feature Driven Development (FDD)

| UNIT IV | TESTING | 9 |
|---|---|---|

**Testing:** Functionality Testing - UI Testing - Performance Testing - Security Testing

**Selenium Agile Testing:** Principles of agile testers - The agile testing quadrants - Agile automation - Test automation pyramid

| UNIT V | DEVOPS | 9 |
|---|---|---|

**Continuous Integration and Continuous Delivery CI/CD:** Jenkins Creating pipelines - Setting up runners Containers and container orchestration (Dockers and Kubernetes) - Checking build status - Fully Automated Deployment - Continuous monitoring with Nagios - DevOps on Cloud

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| **1. DESCRIPTIVE QUESTIONS** | 1. ASSIGNMENT<br>2. MCQ | **1. DESCRIPTIVE QUESTIONS** |

**Outcomes**

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

**CO1** – Understand the differences between Agile and other project management methodologies

**CO2** – Understand the various principles, phases and activities of the Scrum methodology

**CO3** – Understand the various tools for Agile development and CI/CD

**CO4** – Apply the Agile Testing principles for real life situations

**CO5** – Apply and implement DEVOPS principles for CI/CD

**Text Books**

1. Sricharan, "DEVOPS: Continuous Delivery, Integration, and Deployment with DevOps", Vadapalli, Packt, 2018 **(Unit V)**
2. David J. Anderson and Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2013. **(Unit I – IV)**

**Reference Books**

1. Andrew Stellman, Jennifer Greene, "Learning Agile: Understanding Scrum, XP, Lean, and Kanban", O Reilly, 2015.
2. James A. Crowder, Shelli Friess, "Agile Project Management: Managing for Success", Springer 2014.
3. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide For Testers And Agile Teams", Pearson Education, 2010.

**Web Resources**

1. https://intellipaat.com/blog/tutorial/devops-tutorial/
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/agile-testing-methodology-and-project-management-test-automation/

**CO Vs. PO Mapping and CO vs. PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| **BLOOMS CATEGORY** | **CAT 1** | **CAT 2** | **FAT 1** | **FAT 2** | **END SEM EXAM** |
|---|---|---|---|---|---|
| REMEMBER | | | | | |
| UNDERSTAND | 70 | 60 | 15 | 15 | 70 |
| APPLY | 30 | 40 | 10 | 10 | 30 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 21IT6711 | QUANTUM COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course provides an introduction to the theory and practice of quantum computation. The contents covered include: quantum information processing, quantum algorithms, quantum error correction, quantum communication, and cryptography.

**Prerequisites for the course**

- 21MA1201 – Matrices and Advanced Calculus
- 21PH1301 – Physics for Engineers
- 21CS1501 – Problem Solving and Logical Thinking using C.

**Objectives**

- To understand the background of classical computing and quantum computing.
- To understand the fundamental concepts behind quantum computation.
- To understand the details of quantum mechanics and the relation to Computer Science.
- To analyze the knowledge of hardware and software mathematical models of quantum computation.
- To analyze the quantum information and the theory behind it.

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information.

| UNIT II | MECHANICS AND COMPUTATIONAL MODELS | 9 |
|---|---|---|

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application: Super dense Coding – Density Operator – The Schmidt Decomposition and Purifications – EPR and the Bell Inequality – Computational Models: Turing Machines – Circuits – Analysis of Computational Problems.

| UNIT III | QUANTUM COMPUTATION | 9 |
|---|---|---|

**Quantum Circuits:** Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers

| UNIT IV | QUANTUM INFORMATION | 9 |
|---|---|---|
| **Quantum Noise and Quantum Operations:** Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy | | |
| **UNIT V** | **QUANTUM INFORMATION THEORY** | **9** |
| Quantum States and Accessible Information – Data Compression – Classical Information Over Noisy Quantum Channels – Quantum Information Over Noisy Quantum Channels – Entanglement as a Physical Resource – Quantum Cryptography. | | |
| | **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| **1. DESCRIPTIVE QUESTIONS** | 1. ASSIGNMENT<br>2. MCQ | **1. DESCRIPTIVE QUESTIONS** |

**Outcomes**

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

**CO1**– Understand the basics of quantum computing.

**CO2**– Understand the background of Quantum Mechanics and the computation models.

**CO3**– Understand the quantum computation in circuit design.

**CO4**– Analyze the quantum noise and quantum operations.

**CO5**– Analyze the quantum mechanics and computation models to solve complex problems for classical computers.

**Text Books**

1. Michael A. Nielsen, Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 2016.

**Reference Books**

1. Zygelman, Bernard, "A First Introduction to Quantum Computing and Information. Germany", Springer International Publishing, 2018.

**Web Resources**

1. https://nptel.ac.in/courses/106106232 **(Unit IV – Quantum Error Correction (Week 4))**

**CO Vs. PO Mapping and CO vs. PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | | | | | |
| UNDERSTAND | 70 | 70 | 10 | 10 | 70 |
| APPLY | | | | | |
| ANALYZE | 30 | 30 | 15 | 15 | 30 |
| EVALUATE | | | | | |
| CREATE | | | | | |

| Professional Elective VI | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 21CB7704 | Text and media analytics | 7 | 3 | 0 | 0 | 3 | Data Analytics |
| 2 | 21CB7705 | Computational Finance & Modeling | 7 | 3 | 0 | 0 | 3 | Business Analytics |
| 3 | 21IT6707 | Software project management | 7 | 3 | 0 | 0 | 3 | Business Management |
| 4 | 21CS7705 | Blockchain Technologies | 7 | 3 | 0 | 0 | 3 | Full Stack Development |
| 5 | 21CS5704 | Virtual and Augmented Reality | 7 | 3 | 0 | 0 | 3 | Advanced Technology |

| 21CB7704 | TEXT AND MEDIA ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Social media analytics is the ability to gather and find meaning in data gathered from social channels to support business decisions and measure the performance of actions based on those decisions through social media. Social media analytics tools typically incorporate listening into more comprehensive reporting that involves listening and performance analysis.

**Prerequisites for the course**

- 21AI3603 – Data Structures
- 21AI3602 – Data Science Essentials

**Objectives**

1. Understand the basic issues and types of social, text and media mining.
2. Familiarize the learners with the concept of social, text and media analytics and understand its significance.
3. Familiarize the learners with the tools of social, text and media analytics.
4. Enable the learners to develop skills required for analysing the effectiveness of social, text and media for business purpose.
5. Enumerate the applications in real time systems.

| UNIT I | INTRODUCTION TO SOCIAL MEDIA ANALYSIS | 8 |
|---|---|---|

Social media landscape-Need for SMA-SMA in Small organizations-SMA in large organizations; Application of SMA in different areas-Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks.

| UNIT II | SOCIAL MEDIA TEXT MINING | 11 |
|---|---|---|

Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Pre-processing–Types of Problems- basics of document classification- information retrieval clustering and organizing documents- information extraction- prediction and evaluation.

| UNIT III | TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION | 10 |
|---|---|---|
| Information retrieval and text mining- keyword search- nearest-neighbour methods-. Information extraction Architecture - Named Entity and Relation Extraction- Template filling and database construction –Applications. Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations – Pattern Extraction - Apriori Algorithm – FP Tree algorithm. | | |
| **UNIT IV** | **WEB ANALYTICS TOOLS** | **7** |
| Click stream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis. Web Analytic Tools: Types, Tools - Google Analytics, Hotjar, Woopra, Chartbeat, SEMrush. | | |
| **UNIT V** | **MARKETING RESEARCH & TRENDS IN MARKET** | **9** |
| Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. Case study: Identify Consumer Preferences and Market Positioning of a New Product. | | |
| | **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (20 Marks) | Formative Assessment Test (20 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Assignment<br>2. Online Quizzes<br>3. Online Problem-Solving Platforms | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO 1Understand the basics of Social Media Analysis. (Understand)
CO2 Understand the significance of Text Mining and Data Mining.(Understand)
CO3 Analyse various Algorithms on Text Mining for Information Retrial and Information Extraction. (Analyse)
CO4 Apply Various Web Analytics Tools on real Time Examples (Apply)
CO5 Analyse the trends in Market with the help of Research Tools. (Analyse)

**Text Books**

1. Marshall Sponder, Social Media Analytics, McGraw Hill, 2011. (Unit I – IV)
2. Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley, 2010. (Unit - V)

**Reference Books**

1. Matthew Ganis, Avinash Kohirkar , Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2016.
2. Charu C. Aggarwal ,ChengXiang Zhai, Mining Text Data, Springer; 2012

**Web Recourses**

https://www.udemy.com/course/web-and-social-media-analytics-with-r-2

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 3 | 2 | | 2 | 2 | 2 | | 2 | | | 2 | | |
| 2 | 2 | 2 | 2 | 2 | | 2 | 2 | 2 | | 2 | | 2 | 2 | | |
| 3 | 2 | 3 | 3 | 2 | | 2 | 2 | 2 | | | | | 2 | | |
| 4 | 2 | 3 | 2 | 2 | 3 | | 2 | | | | | 2 | 2 | | |
| 5 | | 3 | 2 | 2 | 2 | 3 | | | 2 | | | 2 | 2 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1 How can you get social media data in order to analyse it? What tools do you recommend? (Apply)

2. How can social media engagement influence student retention in online learning? (Apply)

3. Which social platforms do you have the strongest presence on and how did you grow them (for your work or personal use)? (Apply)

**Course Outcome 2 (CO2):**

1. How can you make an extractive text summarization dataset using just crawling web pages? (Apply)
2. How to import text (from scientific publications) into R Studio to perform text mining? (Apply)
3. **Why Fuzzy logic is an important area for Data Mining?** (Understand)

**Course Outcome 3 (CO3):**

1. Discuss the influence of AI in Information Retrieval. (Understand)
2. How can we represent the queries in Boolean model? (Apply)
3. How can you find similarity between doc and query in probabilistic principle Using Bayes' rule? (Analyse)

**Course Outcome 4 (CO4):**

1. Write a detail note on how to measure size of web? (Understand)
2. How can we assign a page Rank score to each node of the graph? (Apply)
3. Discuss the difficulties in Evaluating IR Systems? (Understand)

**Course Outcome 5 (CO5):**

1. How do we get feedback about our product, so we know what to improve, and what to highlight in sales and marketing messages? (Apply)
2. How do we create more value to justify our prices? (Analyse)
3. What social media channels does our target market use? Should we boost our presence on those channels? (Analyse)

| | | L | T | P | C |
|---|---|---|---|---|---|
| **21CB7705** | **COMPUTATIONAL FINANCE & MODELING** | **3** | **0** | **0** | **3** |

**Preamble**

**Prerequisites for the course**

- 21CB6701 - Enterprises Systems
- 21CB6703 - Marketing Analytics

**Objectives**

1. Understand existing financial models in a quantitative and mathematical way.
2. Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering.
3. Explain the approaches required to calculate the price of options.
4. Identify the methods required to analyze information from financial data and trading systems.

| **UNIT I** | **NUMERICAL METHODS RELEVANT TO INTEGRATION** | **9** |
|---|---|---|

Differentiation and solving the partial differential equations of mathematical finance- examples of exact solutions including Black Scholes and its relatives-finite difference methods including algorithms and question of stability and convergence- treatment of near and far boundary conditions- the connection with binomial models- interest rate models- early exercises.

| **UNIT II** | **BLACK-SCHOLES FRAMEWORK-DISCONTINUOUS PAYOFFS** | **9** |
|---|---|---|

Black-Scholes PDE: simple European calls and puts- put-call parity-The PDE for pricing commodity and currency options- Discontinuous payoffs - Binary and Digital options-The Greeks: theta, delta, gamma, vega & rho and their role in hedging-The mathematics of early exercise - American options

| UNIT III | SOCIAL MEDIA ANALYTICS FOR HEALTHCARE | 9 |
|---|---|---|

Variance reduction methods and statistical analysis of simulation output- Pseudo random Numbers- Linear congruential generator- Mersenne twister RNG- The use of Monte Carlo simulation in solving applied problems on derivative pricing discussed in the current finance literature.

| UNIT IV | FINANCIAL PRODUCTS AND MARKETS | 9 |
|---|---|---|

Introduction to the financial markets and the products which are traded in them-Equities, indices, foreign exchange, and commodities- Options contracts and strategies for speculation and hedging-Application areas include the pricing of American options- pricing interest rate dependent claims-and credit risk.

| UNIT V | STATISTICAL ANALYSIS OF FINANCIAL RETURNS | 9 |
|---|---|---|

Fat tailed and skewed distributions, outliers, stylized facts of volatility, implied volatility surface, and volatility estimation using high frequency data. Copulas, Hedging in incomplete markets, 228 American Options, Exotic options, Electronic trading, Jump Diffusion Processes, High dimensional covariance matrices.

| | **Total Periods** | **45** |
|---|---|---|

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. Assignment<br>2. Online Quizzes<br>3. Online Problem-Solving Platforms | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

1. Learn about numerical methods to be used in financial markets. **(Understand)**
2. Know about the various frameworks adopted in derivatives segment like option trading. **(Understand)**
3. Understand and apply the concept of mathematics to trade online like equity, crypto currency and in IPOs. **(Apply)**
4. Analyze the suitable methods to trade in ADRs, GDRs etc. **(Analyze)**
5. CO5 Perform Statistical Analysis of financial returns. **(Analyze)**

**Text Books**

1. R. Seydel: Tools for Computational Finance, 2nd edition, Springer-Verlag, New York, 2004.
2. P. Glasserman: Monte Carlo Methods in Financial Engineering, Springer-Verlag, New York, 2004.

**Reference Books**

1. A. Lewis: Option Valuation under Stochastic Volatility, Finance Press, Newport Beach, California, 2000.
2. A. Pelsser: Efficient Methods for Valuing Interest Rate Derivatives, Springer-Verlag, New York, 2000.

**Web Resources**

1. https://nptel.ac.in/courses/111/103/111103126/
2. https://www.youtube.com/watch?v=IRMn6JQvU8A
3. https://www.youtube.com/watch?v=Fwl0yPeOzOM

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | | 3 | 2 | 3 | 2 | | | | | 2 | 2 | | |
| 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | | | | | 2 | 2 | | |
| 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | | | | | 2 | 2 | | |
| 4 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | | | | | 2 | 2 | | |
| 5 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | | | | | 2 | 2 | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. **Which is the best regression to use for panel data, and how should i format it for STATA?** (Apply)
2. Identify how to collect the health care data during the COVID period using predictive analysis? (Apply)
3. How to create EHR (Electronic Health Record)? (Understand)

**Course Outcome 2 (CO2):**

1. How to calculate position profits and trading profits as presented in Fishe and Smith (Analyse)
2. Computing the optimal exercise boundary simultaneously with options in high dimensional pricing problem?

**Course Outcome 3 (CO3):**

1. What is the technique which I use to convert the annual ESG score data to (Monthly, weekly, or daily data) with good accuracy? How can I apply Python? (Apply)
2. What are the strategies to be taken during distillation, package, and disseminate in social media public health(Understand)
3. How to use social media in healthcare? (Apply)

**Course Outcome 4 (CO4):**

1. Intrusion Detection method is based on graph oriented bigdata analytics. How? (Apply)
2. What are the three steps of malware analysis? (Understand)
3. How do you protect the data against malware? (Apply)

**Course Outcome 5 (CO5):**

1. How to evaluate performance of prediction methods? Measure and their interpretation in various effect analysis? (Apply)
2. What are the problems and theses proposed in the field of: Security of the financial system? (Apply)
3. How do you choose the correct predictive modelling techniques? (Apply)

| 21IT6707 | SOFTWARE PROJECT MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course aims to equip participants with essential project management skills, tools, and techniques specific to software projects. It emphasizes the importance of effective planning, communication, risk management, and quality assurance in software project delivery. This course encourages active participation, collaboration, and the application of theoretical concepts through case studies. By the end of this course, the students can expect an enriching learning experience that prepares them for successful software project management.

**Prerequisites for the course**

21IT3604 – Integrated Software Engineering

**Objectives**

1. To understand the maturity models and the process of software project management.
2. To understand the management renaissance of the software project.
3. To apply the workflows and estimations in the project plan.
4. To analyze the process automations and evolution of organizations.
5. To develop software product using conventional and modern principles of software project management.

| UNIT I | SOFTWARE PROCESS MATURITY | 9 |
|---|---|---|

Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

| UNIT II | SOFTWARE PROJECT MANAGEMENT RENAISSANCE | 9 |
|---|---|---|

| | | |
|---|---|---|
| Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures. | | |
| **UNIT III** | **PROJECT PLANNING** | **9** |
| Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments. Process Planning Work breakdown structures, Planning guidelines, Timelines-GANTT Charts cost and schedule estimating process, iteration planning process, Pragmatic planning. | | |
| **UNIT IV** | **PROJECT ORGANIZATIONS** | **9** |
| Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation. | | |
| **UNIT V** | **SOFTWARE MANAGEMENT PRACTICES** | **9** |
| SCRUM- CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions. | | |
| | **Total Periods** | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| **1. DESCRIPTIVE QUESTIONS** | 1. ASSIGNMENT<br>2. MCQ | **1. DESCRIPTIVE QUESTIONS** |

**Outcomes**

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

**CO1** – Understand the maturity models and the process of software project management.

**CO2** – Understand the management renaissance of the software project.

**CO3** –. Apply the workflows and estimations in project plan.

**CO4** – Analyze the process automations and evolution of organizations of various project organizations.

**CO5** – Design software product using conventional and modern principles of software project management

**Text Books**

1. Bob Hughes, Mike Cotterel, Rajib Mall, "Software Project Management", 6th Edition, McGraw-Hill, 2018

**Reference Books**

1. Robert K. Wysocki, "Effective Software Project Management" Wiley Publication,2011.
2. Walker Royce,"Software Project Management",Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" McGraw HillEducation (India), Fourteenth Reprint 2013

**Web Resources**

1. https://www.geeksforgeeks.org/software-engineering-software-project-management-spm/

**CO Vs. PO Mapping and CO vs. PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | | | | | |
| UNDERSTAND | 60 | 40 | 10 | 5 | 50 |
| APPLY | 20 | 20 | 10 | 10 | 30 |
| ANALYZE | 20 | 40 | 5 | 10 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 21CS7705 | BLOCK CHAIN TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

A blockchain is a permanent, sequential list of transaction records distributed over a network. Each block in the chain contains a hash of the previous block, along with a timestamp and transaction data.Bitcoin and other cryptocurrencies use blockchain technology to record transactions. Blockchain for business applications can include recording of contracts, medical records, monetary transactions and much more.

**Prerequisites for the course**

- 21CS5602 - Computer Networks

**Objectives**

1. To learn the concept of blockchain
2. To learn the applications and design methodology of blockchain
3. To learn the working of ethereum account.
4. To learn the concept of decentralized applications,mining and whisper.
5. To learn swarm and the advanced trends in blockchain

| UNIT I | BLOCKCHAIN TECHNOLOGY | 9 |
|---|---|---|

Blockchain Evolution –Structure –Characteristics - Blockchain stack- Decentralized computation platform-Decentralized Storage Platform-Decentralized Messaging Platform-Smart Contracts-Decentralized Applications-Domain Specific BlockChain Applications-Benefits-Challenges.

| UNIT II | BLOCKCHAIN COMPONENTS AND APPLICATION | 9 |
|---|---|---|

Blockchain Application Templates-application components-Design Methodology for BlockchainApplications- Application Templates- Setting up Ethereum Development Tools-Ethereum Clients – Ethereum Languages-TestRPC-MistEthereum Wallet-MetaMask-Web3 JavaScriptAPI-Truffle.

| UNIT III | ETHEREUM ACCOUNTS | 9 |
|---|---|---|

Ethereum Accounts-keypairs-working with EOA Accounts-Working with Contract Accounts-SmartContract- structure- setting up and interacting with a contract using GethClient-Setting up and interacting with a Contract using Mist Wallet-Smart Contract Examples-smart contract patterns.

| UNIT IV | DECENTRALIZED APPLICATIONS, MINING, WHISPER | 9 |
|---|---|---|

Decentralized applications-implementing Dapps - Case studies- Mining-Consensus on Blockchain Network- Mining stages-Block validation-Stetting up Mining Node-State Storage in Ethereum-Whisper-Protocol-Whisper Routing approaches-API.

| UNIT V | SWARM, ADVANCED TOPICS | 9 |
|---|---|---|

Swarm architecture and concepts-incentive mechanism in swarm—Swarm setup-working-case study. Advanced topics on block chain

| | Total Periods | 45 |
|---|---|---|

| Suggestive Assessment Methods | | |
|---|---|---|
| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
| DESCRIPTIVE QUESTIONS | ASSIGNMENT<br>ONLINE MCQ | DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

CO1 Understand the concept of blockchain
CO2 Understand the applications and design methodology of blockchain
CO3 Apply the methods needed to create account in ethereum
CO4 Analyze the applications in decentralized mining and Whisper Routing approaches
CO5 Analyze the swarm architecture and Advanced topics on block chain

**Text Books**

1. Arshdeep Bahga, Vijay Madisetti, "Block Chain Applications- A Hands-On Approach"UniversityPress,2017.

**Reference Books**

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press,2019.
2. Josh Thompson,'Blockchain:TheBlockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform,2017.

**Web Resources**

1. https://onlinecourses.nptel.ac.in/noc22_cs44

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 5 | 20 |
| APPLY | 40 | 40 | 5 | 10 | 50 |
| ANALYZE | | 30 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 21CS5704 | VIRTUAL AND AUGMENTED REALITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course provide the fundamental knowledge about virtual reality and augmented reality using the modelling and rendering aspects of a VR system. It provides knowledge and understanding in 3D analogy and modelling geometry.

**Prerequisites for the course**

- Engineering drawing, Computer graphics

**Objectives**

1. To impart knowledge on To introduce virtual reality and input and output devices
2. To acquire knowledge on computing architectures and modeling
3. To explore VR programming and human factors
4. To learn various applications of VR
5. To get exposure on augmented reality

| UNIT I | INTRODUCTION TO VIRTUAL REALITY AND INPUT AND OUTPUT DEVICES | 9 |
|---|---|---|

Introduction: The three I's of Virtual Reality - A short history of early virtual reality - Early commercial VR technology - VR becomes an industry - The five classic components of a VR system. Input devices: Three-Dimensional position trackers - tracker performance parameters - ultrasonic trackers - optical trackers - navigation and manipulation interfaces - gesture interfaces. Output devices: graphics displays - large-volume displays - sound displays.

**Suggested Activities:**

- Assignment on trackers and its types
- Flipped Class room – How audio video analogies are retrieved using output devices

**SUGGESTED EVALUATION METHODS:**

- Quizzes
- Assignment Problems

| UNIT II | COMPUTING ARCHITECTURES AND MODELING OF A VR SYSTEM | 9 |
|---|---|---|

Computing architectures for VR: The rendering pipeline - The graphics rendering pipeline - The haptics rendering pipeline - PC graphics architecture - PC graphics accelerators - Graphics benchmarks - Distributed VR architectures - Multipipeline synchronization - Colocated rendering pipelines. Modeling: geometric modeling - kinematics modeling - physical and behavior modeling

**Suggested Activities:**

- Assignment on rendering process and pipeline
- Group discussion – Modeling 3d environments with different depth factor.

**SUGGESTED EVALUATION METHODS:**

- Quizzes
- Assignment Problems

| UNIT III | VR PROGRAMMING AND HUMAN FACTORS | 9 |
|---|---|---|

Toolkits and scene graphs **-** WorldToolKit - Model geometry and appearance - The WTK scene graph - Sensors and action functions - WTK networking - Java 3D - Model geometry and appearance - Java 3D scene graph - Sensors and behaviors - Java 3D networking - WTK and Java 3D performance comparison –Human factors in VR: Methodology and terminology - user performance studies - VR health and safety issues - VR and society

**Suggested Activities:**

- Practicing WTK installation and understand – WorldToolKit's user interface functions.
- Flipped Class room- Which is best WTK or Java 3D.

**SUGGESTED EVALUATION METHODS:**

- Quizzes
- Assignment Problems

| UNIT IV | APPLICATIONS OF VR | 9 |
|---|---|---|

Medical applications of VR - Virtual anatomy - Triage and diagnostic - Surgery - VR in education - VR and the Arts - Entertainment applications of VR - military VR applications - Army use of VR - VR applications in the Navy - Air force use of VR - Applications of VR in Robotics - Robot programming - Robot teleoperation

**Suggested Activities:**

- Assignment on applications of VR in real world.
- Discussion Topic- Future applications of VR in its extreme.

**SUGGESTED EVALUATION METHODS:**

- Quizzes
- Assignment Problems

| UNIT V | AUGMENTED REALITY | 9 |
|---|---|---|

Augmented reality: An overview: Introduction - History - Augmented reality technologies - Computer vision methods in AR - AR devices - AR interfaces - AR systems. Visualization techniques for augmented reality: data integration - Depth perception - Augmenting pictorial depth cues - Occlusion handling - Image based X-ray visualization - Scene manipulation: Rearranging real world objects - Space-distorting visualization – Context driven visualization.

**Suggested Activities:**

- Discussion Topic- Augmented reality in 3d gaming.
- Practicing Augmented reality using android apps.

**SUGGESTED EVALUATION METHODS:**

- Quizzes
- Assignment Problems

| | |
|---|---|
| **Total Periods** | **45** |
| | |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE MCQ<br>3.PROBLEM-SOLVING ACTIVITIES | 1.DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

CO1 Identify different input and output devices used in virtual reality system (Remember)
CO2 Model the VR system(Apply)
CO3 Create scene graph using different toolkits(Apply)
CO4 Apply VR in various fields(Apply)
CO5 Apply visualization techniques for AR(Apply)

**Text Books**

1. Grigore C. Burdea, Philippe Coiffet, "Virtual reality technology", Wiley, Second Edition, 2006
2. "Handbook of Augmented Reality", Borko Furht, Springer, 2011.

**Reference Books**

1. Sherman, William R & Craig, Alan B, "Understanding Virtual reality", Elsevier India Private Limited, Noida, 2008 .

**Web Resources**

1. https://nptel.ac.in/courses/121106013
2. https://archive.nptel.ac.in/courses/106/106/106106138/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | | 3 | | | | | | | | | | 3 |
| 2 | 3 | 3 | 3 | | 3 | | | | | | | | | | 3 |
| 3 | 3 | 2 | 3 | 3 | 3 | | | | | | | | | | 3 |
| 4 | 3 | 3 | | 3 | 3 | | | | | | | | | | 3 |
| 5 | 3 | 3 | | 3 | | | | | | | | | | | 3 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: Students will be able to Predict the suitable method for.(Apply)**

**Course Outcome 1 (CO1):**

1. Define Virtual reality (Remember)
2. Examine the classic components of a VR system.(Apply)
3. Differentiate graphics and large volume displays. (Analyse)

**Course Outcome 2 (CO2):**

1. How can you access the rendering pipeline? (Remember)
2. Whether a haptics rendering pipeline? (Apply)
3. Write about kinematics modelling. (Create)

**Course Outcome 3 (CO3):**

1. List the different categories of toolkit. (Remembering)
2. State the general form of java 3D scene graph (Remember)
3. How can you access the Java 3D networking class? (Apply)

**Course Outcome 4 (CO4):**

1. Illustrate the use of virtual anatomy. (Understand)
2. How to use VR in military application? (Apply)
3. Which application of VR is used in Robotics? (Analyse)

**Course Outcome 5 (CO5):**

1. Which devices were used in AR? (Apply)
2. How would you used image based x-ray visualization in VR?(Evaluate)
3. How will you create a scene manipulation for real world objects? (Create)

**MINOR COURSE SYLLABUS**

| 21CB4S01 | BIG DATA FRAMEWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Prerequisites for the course**

- Nil

**Objectives**

1. To understand the need of Big Data, challenges and different analytical architectures

2.Installation and understanding of Hadoop Architecture and its ecosystems

3. Processing of Big Data with Advanced architectures like spark.

4. Describe graphs and streaming data in Spark.

5.Explore data analysis to process BigData

| UNIT I | INTRODUCTION TO BIG DATA | 9 |
|---|---|---|

Data Storage and Analysis - Characteristics of Big Data – Big Data Analytics - Typical Analytical Architecture – Requirement for new analytical architecture – Challenges in Big Data Analytics – Need of big data frameworks

| UNIT II | HADOOP FRAMEWORK | 9 |
|---|---|---|

Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with other system - Hadoop Components – Hadoop 1 vs Hadoop 2 – Hadoop Daemon's – HDFS Commands –Map Reduce Programming: I/O formats, Map side join, Reduce Side Join, Secondary sorting

| UNIT III | HADOOP ECOSYSTEM | 9 |
|---|---|---|

Introduction to Hadoop ecosystem technologies: Serialization: AVRO, Co-ordination: Zookeeper, Databases: HBase, Hive, Scripting language: Pig, Streaming: Flink, Storm.

| UNIT IV | SPARK FRAMEWORK | 10 |
|---|---|---|

Overview of Spark – Hadoop vs Spark – Cluster Design – Cluster Management – performance, Application Programming interface (API): Spark Context, Resilient Distributed Datasets, Creating RDD, RDD Operations, Saving RDD - Lazy Operation – Spark Jobs.

| UNIT V | DATA ANALYSIS WITH SPARK SHELL | 8 |
|---|---|---|

| | | |
|---|---|---|
| Writing Spark Application - Spark Programming in Scala, Python, R, Java - Application Execution.GSQL Context– Importing and Saving data – Data frames – using SQL – GraphX overview – Creating Graph . | | |
| **Total Periods** | | **45** |
| **Suggestive Assessment Methods** | | |
| **Continuous Assessment Test (30 Marks)** | **Formative Assessment Test (10 Marks)** | **End Semester Exams (60 Marks)** |
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO 1 Discuss the challenges and their solutions in Big Data

CO 2 Understand and work on Hadoop Framework and eco systems.

CO 3 Analyse the Big Data using Map-reduce programming in both Hadoop and Spark framework.

CO 4 Demonstrate spark programming with different programming languages.

CO 5Demonstrate the graph algorithms and live streaming data in Spark

**Text Books**

1. Mike Frampton, “Mastering Apache Spark”, Packt Publishing,2015.

2. TomWhite,“Hadoop:TheDefinitiveGuide”,O’Reilly,4thEdition,2015.

**Reference Books**

1. Nick Pentreath, Machine Learning with Spark, Packt Publishing, 2015.

2. Mohammed Guller, Big Data Analytics with Spark, Apress,2015

3. Donald Miner, Adam Shook, “Map Reduce Design Pattern”, O’Reilly, 2012

**Web Resources**

1. https://www.oracle.com/big-data
2. https://nptel.ac.in/courses/106104189
3. https://www.javatpoint.com › java-big-data-frameworks

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | | | | 1 | | | | | | | 3 | 3 | 1 |
| 2 | 3 | | | | 2 | 1 | | | 1 | 1 | | 1 | 3 | 1 | 1 |
| 3 | 3 | 2 | 1 | | 2 | | | | 1 | | | 1 | 3 | 3 | 2 |
| 4 | 3 | 2 | | 1 | 1 | | 1 | | 1 | 1 | | 1 | 3 | 3 | 3 |
| 5 | 3 | 2 | | 1 | 1 | | 1 | | 1 | | 1 | 1 | 2 | 2 | 1 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: Students will be able to Predict the suitable method for...(Apply)**

**Course Outcome 1 (CO1):**

3. Describe the Characteristics of Big Data. (Understand)
4. What is the significance of big data frameworks? (Understand)
5. Summarize the Challenges in Big Data Analytics. (Evaluate)

**Course Outcome 2 (CO2):**

1. Discuss the functions of Hadoop Components. (Understand)

2. Analyze the uses of HDFS Commands. (Analysis)

**Course Outcome 3 (CO3):**

3. Write elaborately on Hadoop ecosystem technologies. (Understand)
4. Identify Scripting languages used for Hadoop ecosystem technologies. (Remember)

**Course Outcome 4 (CO4):**

3. Analyse on Hadoop vs Spark. (Analyse)
4. List out the Datasets used for Spark. (Remember)
5. Give some steps in Lazy Operation. (Understand)

**Course Outcome 5 (CO5):**

3. Write a simple Spark Application. (create)
4. How do you create a graph using spark shell? (Understand)

**Theory cum Practical Courses**

| 21CB6S01 | MINING MASSIVE DATA | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 4 | 4 |

**Pre requisites for the course**

NIL

**Objectives**

1. To provide comprehensive knowledge on developing
2. To apply machine learning algorithms for massive real-world datasets in distributed frameworks.
3. To demonstrate the use of big data analytics tools like Spark and Mahout for mining massive datasets.
4. To impart in depth knowledge on Deep Learning and Extreme Learning concepts

| UNIT I | MapReduce Based Machine Learning | 7 |
|---|---|---|

K-Means, PLANET, Parallel SVM, Association Rule Mining in MapReduce, Inverted Index, Page Ranking, Expectation Maximization, Bayesian Networks

| UNIT II | Classification and Regression models | 5 |
|---|---|---|

linear support vector machines - Naive Bayes model- Decision Trees – Least square regression Decision trees for regression.

| UNIT III | Clustering in Spark and Mahout | 6 |
|---|---|---|

Hierarchical Clustering in a Euclidean and Non-Euclidean Space - The Algorithm of Bradley, Fayyad, and Reina - Processing Data in BFR Algorithm CURE algorithm - Clustering models with Spark - Spectral clustering using Mahout

| UNIT IV | Mining Social-Network Graphs | 6 |
|---|---|---|
| Clustering of Social-Network Graphs - Direct Discovery of Communities - Partitioning of Graphs Finding Overlapping Communities - Counting Triangles using MapReduce Neighborhood Properties of Graphs | | |
| **UNIT V** | **Semi-Supervised Learning , Deep Learning** | **6** |
| Introduction to Semi-Supervised Learning, Semi-Supervised Clustering, Transductive Support Vector Machines, Deep Neural Networks, Deep Belief Networks | | |

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | K-means implementation in MapReduce | CO1 |
| 2 | Association Rule Mining with MapReduce | CO1 |
| 3 | Decision trees in Spark | CO2 |
| 4 | Naive bayes classification using Spark | CO2 |
| 5 | Advanced text processing with Spark | CO3 |
| 6 | Representing social-network data using Graphs | CO4 |
| 7 | Implementing Semi-supervised Clustering | CO4 |
| 8 | Predictive analysis using H2O tool | CO4 |
| 9 | SVM Classification using Mahout | C05 |
| 10 | Building a recommendation engine with Sparkling water | CO5 |
| | **Total Periods** | **30 Theory+30 Lab** |

**Laboratory Requirements**

- 60 Systems with windows/LINUX operating system with Hadoop, Mahout, Spark and H2O tool.

**Suggestive Assessment**

| Continuous Assessment Test (30Marks) | Lab Components Assessments (20Marks) | End Semester Exams (50Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. LAB EXPERIMENTS<br>2. MODEL EXAMINATION | **1. DESCRIPTIVE QUESTIONS** |

**Outcomes**

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

CO1. Identify right machine learning / mining algorithm for handling massive data
CO2. Apply classification and regression models with Spark and Mahout
CO3. Implement clustering models using Spark and Mahout
CO4. Mine social Network graphs using MapReduce
CO5. Apply semi supervised learning for clustering and classification

**Text Books**

1. Joao Gama, "Knowledge Discovery from Data Streams", CRC Press, 2010.
2. David Luckham, "The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems", Addison Wesley, 2002.
3. Charu C. Aggarwal, "Data Streams: Models And Algorithms", Kluwer Academic Publishers, 2007.

**Reference Books**

1. Guidovan Rossum, FredL.DrakeJr.,"AnIntroductiontoPython–RevisedandUpdatedforPython3.2", Network Theory Ltd., 2011.
2. John v Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition,2016.
4. Timothy A. Budd, "Exploring Python",Mc-Graw Hill Education (India)PrivateLtd.,2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs",Cengage Learning,2012.

**Web Resources**

1.https://nptel.ac.in/courses/106/106/106106182/

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 1 | 1 | 1 | | | | | | | | 2 | | |
| 2 | 1 | 2 | 2 | 2 | 2 | | | | | | | | 2 | 1 | 2 |
| 3 | 1 | 2 | 2 | 2 | 1 | | | | | | | | 1 | 1 | 1 |
| 4 | 2 | 1 | 1 | 1 | 1 | | | | | | | | | | 1 |
| 5 | 1 | 2 | 2 | 2 | 1 | | | | | | | | | | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |

| | | | | | |
|---|---|---|---|---|---|
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSEOUTCOME 1:**

1. Define data mining.
2. what are the different tasks of data?

**COURSEOUTCOME 2:**

1. Explain linear support vector machines
2. Describe Naive Bayes model
3. Discuss about Decision Trees

COURSEOUTCOME 3:

1. Differentiate Hierarchical Clustering in a Euclidean and Non-Euclidean Space
2. Implement a variant of K-means algorithm
3. Demonstrate a Processing Data in BFR

COURSEOUTCOME 4:

1. Examine Clustering of Social-Network Graphs
2. Test the Overlapping Communities
3. Compare the properties of Graphs.

COURSEOUTCOME 5

1. Design Semi-Supervised Learning,
2. Construct Semi-Supervised Clustering,
3. Develop a Deep Neural Networks

| **21CB7S01** | **BIG DATA COMPUTING FOR BUSINESS ANALYTICS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | 0 | 4 | 4 |
| **Prerequisites for the course** | | | | | |
| • **NIL** | | | | | |
| **Objectives** | | | | | |

1. Providing fundamental concepts and significance of big data analytics
2. To know how organizations can leverage information to gain competitive advantage
3. Providing an understanding of the application of Big data analytics methods and techniques
4. To address strategic business problems

| UNIT I | INTRODUCTION TO BIG DATA ANALYTICS | 4 |
|---|---|---|
| Big Data Overview – Characteristics of Big Data –Business Intelligence v/s Data Analytics – Need of Data Analytics – Data Analytics in Industries – Role of the Data Scientist – Data Analytics Life Cycle– Main phases of the lifecycle | | |
| **UNIT II** | **PREDICTIVE AND DESCRIPTIVE ANALYTICS WITH BIG DATA** | **6** |
| Linear Regression – Logistic Regression – Decision Trees – Support Vector Machines – Ensemble Methods – Multi-class Classification Techniques – Evaluating Predictive Models- Association Rules – Sequence Rules – Segmentation – Visualization Charts | | |
| **UNIT III** | **BATCH ANALYSIS, REAL-TIME ANALYSIS AND SOCIAL NETWORK ANALYTICS** | **10** |
| Batch Analysis –with Hadoop MapReduce – Sensor Data – New articles – Real-time analysis with Streaming – Sensor data and social media data -Social Network Metrics – Social Network Learning – Relational Neighbour Classifier –Collective Inferencing – Egonets - Bigraphs. | | |
| **UNIT IV** | **GRAPH ANALYTICS FOR BIG DATA** | **6** |
| What is a Graph?- Why Graphs?-What are the impact of Big Data's V's on Graphs?- Focusing on Graph Analytics Techniques- Path Analytics-Applying Dijkstra's Algorithm- Inclusion and Exclusion Constraints- Connectivity Analytics- Disconnecting a Graph- Use cases and Case studies | | |
| **UNIT V** | **COMMUNITY AND CENTRALITY ANALYTICS FOR BIG DATA** | **4** |
| Community Analytics and Local Properties- Global Property: Modularity- Centrality Analytics. | | |

| S.No | List of Experiments | CO |
|---|---|---|
| 1 | Setting up Hadoop environment and Hadoop cluster | CO1 |
| 2 | Working with Hadoop, spark | CO2 |
| 3 | Implementation of Machine learning, algorithms using graph analytics. | CO3 |
| 4 | Mapreduce Programs in Hadoop Environment | CO4 |

| | | |
|---|---|---|
| 5 | Design, Develop and implement Machine Learning algorithms in Big Data environment using SPARK architecture | CO5 |
| 6 | Design, Develop and implement Graph analytics algorithms using GraphX in SPARK architecture | CO4 |
| **Total Periods** | | **30 Theory +30 Lab** |

**Laboratory Requirements**

- Hadoop

**Suggestive Assessment Methods**

| **Continuous Assessment Test (30Marks)** | **Lab Components Assessments (10 Marks)** | **End Semester Exams (50 Marks)** |
|---|---|---|
| **1. DESCRIPTIVE QUESTIONS** | 1. LAB EXPERIMENTS<br>2. MODEL EXAMINATION | **1. DESCRIPTIVE QUESTIONS** |

**Outcomes**

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

**CO 1** Assess the role of big data analytics within an organization and the challenges
**CO 2** Apply Big data analytics methods and techniques in addressing strategic business problems
**CO 3**Acquire an understanding of machine learning algorithms and how it can be applied in addressing strategic business problems
**CO 4**Acquire an understanding of graph analytics in the context of big data
**CO 5**Use Hadoop, spark architecture, machine learning, graph analytics and other big data tools for the model development and interpreting the outputs

**Text Books**


1. Thomas Davenport et.al, (2010), Analytics at Work: Smarter Decisions, Better Results, 3rd edition, Harvard Business School Press, Boston, Massachusetts.
2. Zikopoulos P, Eaton C, (2011), Understanding big data: Analytics for enterprise class Hadoop and streaming data, McGraw-Hill Osborne Media.
3. Viktor Mayer-Schönberger, Kenneth Cukier (2014), Big Data: A Revolution That Will Transform How We Live, Work, and Think, Mariner Books


**Reference Books**


1. Pramod J. Sadalage, Martin Fowler, (2012), NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley.
2. Sammer E, (2012), Hadoop Operations, 1st edition, O'Reilly Media, Inc.

3. Marz N, Warren J, (2015), Big Data: Principles and best practices of scalable real-time data systems, Manning Publications Co.
4. Miner D, Shook A, (2012), MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems, O'Reilly Media, Inc.
5. Rajaraman A, Ullman J. D, (2014), Mining of massive datasets, Cambridge: Cambridge University Press.


**Web Resources**

1. https://www.iare.ac.in/sites/default/files/NEW%20LECHURE%20NOTES.pdf
2. https://mrcet.com/downloads/digital_notes/CSE/IV%20Year/(R17A0528%20)%20Big%20Data%20Analytics%20Digital%20notes.pdf
3. https://www.aalimec.ac.in/wp-content/uploads/2020/01/CS8091-BIGDATA-ANALYTICS-
4. https://www.iare.ac.in/sites/default/files/lecture_notes/BDBA-Question%20bank.pdf

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO1 1 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 3 | 2 | 3 | 1 | 3 | 1 | 1 | | | 2 | 2 | | |
| 2 | | 3 | 3 | 3 | 2 | 3 | | | | 3 | 3 | 2 | 2 | 1 | 2 |
| 3 | 3 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | | | 1 | 1 | 1 | 1 |
| 4 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | | 3 | 3 | 2 | | | 1 |
| 5 | 1 | 3 | 2 | | | | 2 | 3 | 2 | 3 | 2 | 1 | | | 2 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

**1.** What are the various applications of big data analytics? (Understand)

**2.** Enumerate the terms a. OLAP b. OLTP c. RTAP(Understand)

3. Define streaming data? (Remember)

**Course Outcome 2 (CO2):**

1. Express the term bucketing data? (Understand)
2. Discuss Why Hadoop came into an existence in processing big data? (Apply)
3. Implement the processing data with Hadoop? (Apply)

**Course Outcome 3 (CO3):**

1. List out the basic Files ystem Operations? (Understand)
2. Implement the Master-Slave architecture? (Analyse)
3. Extrapolate the Master components: Name node, Secondary Node and Job Tracker? (Create)

**Course Outcome 4 (CO4):**

1. How to explore the Scale-out architecture? (Analyse)
2. Design Reducer Phase? (Create)
3. Can MapReduce be used to solve any kind of computational problems? if not, explain the cases where MapReduce is not applicable? (Evaluate)

**Course Outcome 5 (CO5):**

1. Discuss the use of the FOREACH and ASSERT operator in Pig Latin? (Evaluate)
2. Write a shell command in Hive to list all the files in the current directory? (Create)

**Electives:**

| | | | | | |
|---|---|---|---|---|---|
| **21CB5S01** | **Exploratory Data Analysis** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **Prerequisites for the course** | | | | | |
| NIL | | | | | |
| **Objectives** | | | | | |

1. To introduce the methods for data preparation and data understanding.

2.Covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.

3. To Summarize the insurers use of predictive analytics, data science and Data Visualization

4 .Know about outlier analysis.

| | | |
|---|---|---|
| **UNIT I** | **Introduction To Exploratory Data Analysis** | **9** |
| Data Analytics lifecycle, Exploratory Data Analysis (EDA)– Definition, Motivation, Steps in data exploration, The basic data types Data Type Portability | | |
| **UNIT II** | **Pre processing-Traditional Methods and Maximum Likelihood Estimation** | **9** |
| Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, Improving the accuracy of analysis | | |
| **UNIT III** | **Preprocessing Bayesian Estimation** | **9** |
| Introduction to Bayesian Estimation ,Multiple Imputation-Imputation Phase, Analysis and Pooling Phase,Practical Issues in Multiple Imputation, Models for Missing Notation Random Data | | |
| **UNIT IV** | **Data Summarization & Visualization** | **10** |
| Statistical data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, N- D Statistical data analysis | | |
| **UNIT V** | **Outlier Analysis** | **8** |
| Introduction, Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| **Continuous Assessment Test (30 Marks)** | **Formative Assessment Test (10 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO 1 Handle missing data in the real world data sets by choosing appropriate methods.

CO 2 Summarize the data using basic statistics. Visualize the data using basic graphs and plots.

CO 3 Identify the outliers if any in the data set.

CO 4Choose appropriate feature selection and dimensionality reduction

CO 5 Techniques for handling multi-dimensional data

**Text Books**

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", 8th Edition, Tata McGraw Hill Edition, 2015.

**Reference Books**

1. Charu C. Aggarwal, "Data Mining The Text book", Springer, 2015.
2. Craig K. Enders, "Applied Missing Data Analysis", The Guilford Press, 2010.
3. Inge Koch, "Analysis of Multivariate and High dimensional data", Cambridge University Press, 2014.
4. Michael Jambu, "Exploratory and multivariate data analysis", Academic Press Inc. 1990.
5. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC press, 2015

**Web Resources**

1. https://www.tutorialspoint.com/software_engineering/index.htm
2. https://nptel.ac.in/courses/106/105/106105182/
3. https://www.javatpoint.com/software-engineering-tutorial
4. www.mhhe.com/pressman

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | | | | 1 | | | | | | | 3 | 3 | 1 |
| 2 | 3 | | | | 2 | 1 | | | 1 | 1 | | 1 | 3 | 1 | 1 |
| 3 | 3 | 2 | 1 | | 2 | | | | 1 | | | 1 | 3 | 3 | 2 |
| 4 | 3 | 2 | | 1 | 1 | | 1 | | 1 | 1 | | 1 | 3 | 3 | 3 |
| 5 | 3 | 2 | | 1 | 1 | | 1 | | 1 | | 1 | 1 | 2 | 2 | 1 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: Students will be able to Predict the suitable method for...(Apply)**

**Course Outcome 1 (CO1):**

1. Define Data Analytics lifecycle
2. Describe basic data types

**Course Outcome 2 (CO2):**

1. Explain Missing data,
2. Discuss Traditional methods for dealing with missing data
3. Summarize Maximum Likelihood Estimation

**Course Outcome 3 (CO3):**

1. Analysis Phase,Practical Issues in Multiple Imputation
2. Draw Models for Missing Notation
3. Describe Random Data

**Course Outcome 4 (CO4):**

1. Compare 1-D Statistical data analysis, 2-D Statistical data Analysis
2. Examine N- D Statistical data analysis
3. Examine Statistical data elaboration

**Course Outcome 5 (CO5):**

1. Design Extreme Value Analysis
2. Plan a Clustering based
3. Design Distance Based and Density Based outlier

| 21CB5S02 | INFORMATION VISUALIZATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Prerequisites for the course**

- Nil

**Objectives**

1. To understand the various types of data, apply and evaluate the principles of data visualization.
2. Acquire skills to apply visualization techniques to a problem and its associated dataset.
3. To apply structured approach to create effective visualizations.
4. To learn how to bring valuable insight from the massive dataset using visualization.
5. To learn how to build visualization dashboard to support decision making.

| UNIT I | Introduction to Data Visualization | 9 |
|---|---|---|

Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Human Visual Perception

| UNIT II | Visualization Techniques – I | 9 |
|---|---|---|

Scalar and point techniques – vector visualization techniques – matrix visualization

| UNIT III | Visualization Techniques – II | 10 |
|---|---|---|

Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data

| UNIT IV | Visual Analysis of data from various domains | 10 |
|---|---|---|

Time-oriented data visualization – Spatial data visualization and case studies
Text data visualization – Multivariate data visualization, and case studies

| UNIT V | Designing Effective Visualizations | 7 |
|---|---|---|
| Guidelines for designing successful visualizations, Data visualization dos and don'ts | | |
| **Total Periods** | | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES | 1.DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO 1. Identify the data types and its associated visualization mechanisms.

CO2. Apply the various scalar and vector visualization techniques to create suitable visualization for real life applications.

CO 3. Handle and analyse multidimensional data and hierarchical data for visualization.

CO4. Perform multivariate data analysis and visualization.

CO5. Apply the visualization guidelines for effective information visualization.

**Text Books**

1. Matthew O. Ward, Georges Grinstein, Daniel Keim"Interactive Data Visualization: Foundations, Techniques, and Applications", CRC Press, Second Edition, 2015.

2.Dr.Chun-hauh Chen, W.K.Hardle, A. Unwin, "Handbook of Data Visualization",

**Reference Books**

1. Tamara Munzer, "Visualization Analysis and Design", CRC Press, 2014.

2. Stephen Few, "Now You See It", Analytics Press, 2009.

3. Stephen Few, "Information Dashboard Design: the effective visual communication of data", Oreilly, 2006.

4. Ben Fry, "Visualizing Data", O'Reilly Media, 2008

5ki. Winston Chang, "R Graphics Cookbook", O'Reilly, 2012.

**Web Resources**

http://www.fusioncharts.com/whitepapers/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PS O1 | PSO 2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | | | | 1 | | | | | | | 3 | 3 | 1 |
| 2 | 3 | | | | 2 | 1 | | | 1 | 1 | | 1 | 3 | 1 | 1 |
| 3 | 3 | 2 | 1 | | 2 | | | | 1 | | | 1 | 3 | 3 | 2 |
| 4 | 3 | 2 | | 1 | 1 | | 1 | | 1 | 1 | | 1 | 3 | 3 | 3 |
| 5 | 3 | 2 | | 1 | 1 | | 1 | | 1 | | 1 | 1 | 2 | 2 | 1 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**COURSE OUTCOME 1: Students will be able to Predict the suitable method for. (Apply)**

**Course Outcome 1 (CO1):**

1. Describe data visualization (create)
2. Define Data Abstraction (Remember)
3. List Four Levels for Validation(understand)

**Course Outcome 2 (CO2):**

1. Discuss Scalar and point techniques(Remember)
2. Analyse matrix visualization(understand)

**Course Outcome 3 (CO3):**

1. Write elaborately visualization Techniques for Trees(Remember)
2. Write elaborately Multidimensional data. (understand)

**Course Outcome 4 (CO4):**

1. Analyse on Time-oriented data visualization(create)
2. List out the Spatial data visualization(Remember)
3. Give some steps toMultivariate data visualization (Understand)

**Course Outcome 5 (CO5):**

1. Write a Guidelines for designing successful visualizations. (create)
2. Write a Data visualization dos and don'ts? (Understand)

| 21CB5S03 | PREDICTIVE ANALYTICS IN BUSINESS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Prerequisites for the course**

- NIL

**Objectives**

1. To introduce theoretical foundations, algorithms, methodologies
2. Study in Risk Management and Operational Hedging
3. Know about financial time series analytics
4. To analyze data in various domains such Retail, Risk and Healthcare.

| UNIT I | RETAIL ANALYTICS | 9 |
|---|---|---|

Understanding Customer: Profiling and Segmentation, Modelling Churn. Modelling Lifetime Value, Modelling Risk, Market Basket Analysis.

| UNIT II | RISK ANALYTICS | 9 |
|---|---|---|

Risk Management and Operational Hedging: An Overview, Supply Chain Risk Management, A Bayesian Framework for Supply Chain Risk Management, Credit Scoring and Bankruptcy Prediction

| UNIT III | FINANCIAL DATA ANALYTICS | 9 |
|---|---|---|

Financial News analytics: Framework, techniques, and metrics, News events impact market sentiment, Relating news analytics to stock returns

| UNIT IV | FINANCIAL TIME SERIES ANALYTICS | 9 |
|---|---|---|

Financial Time Series and Their Characteristics, Common Financial Time Series models, Autoregressive models, Markov chain models, Time series models with leading indicators, long term forecasting

| **UNIT V** | **HEALTH CARE ANALYTICS** | **9** |
|---|---|---|

Introduction to Healthcare Data Analytics, Electronic Health Records, Privacy-Preserving Data Publishing Methods in Healthcare, Clinical Decision Support Systems

| **Total Periods** | **45** |
|---|---|

**Suggestive Assessment Methods**

| **Continuous Assessment Test (30 Marks)** | **Formative Assessment Test (10 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1.ASSIGNMENT<br>2. ONLINE QUIZZES | 1.DESCRIPTIVE QUESTIONS |

**Course Outcomes**

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

**CO 1**Recognize challenges in dealing with data sets in domains such as finance, risk and healthcare.

**CO 2**Identify real-world applications of machine learning in domains such as finance, risk and healthcare

**CO 3**Identify and apply appropriate algorithms for analyzing the data for variety of problems in finance, risk and healthcare

**CO 4**Make choices for a model for new machine learning tasks based on reasoned argument

**Text Books**

1. Chris Chapman, Elea McDonnell Feit "R for Marketing Research and Analytics", Springer, 2015.
2. Olivia Parr Rud “Data Mining Cookbook: Modeling Data for Marketing, Risk, and Customer Relationship Management”, Wiley, 2001.

**Reference Books**

1. Chandan K. Reddy, Charu C. Aggarwal "Healthcare Data Analytics", CRC Press,2015.
2. Rene Carmona "Statistical Analysis of Financial Data in R", Springer, 2014.
3. James B. Ayers “Handbook of Supply Chain Management” Auerbach Publications, 2006.
4. Panos Kouvelis, Ling xiu Dong, Onur Boyabatli, Rong Li "The Handbook of Integrated Risk Management in Global Supply Chains", Wiley, 2012.

**Web Resources**

1. https://www.predictiveanalyticsworld.com/book/notes.php
2. https://www.slideshare.net/machinepulse/predictive-analytics-an-overview
3. https://nptel.ac.in/courses/110104086
4. https://www.vskills.in/certification/big-data/predictive-analytics-certification

CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 3 | 1 | 1 | 2 | | | | | | | 3 | 1 | |
| 2 | 3 | 3 | 3 | 3 | | | | 3 | 3 | 3 | 2 | | 3 | | 2 |
| 3 | 2 | 3 | 2 | | | 2 | 2 | 2 | 2 | | | | | 2 | 2 |
| 4 | 3 | 3 | 2 | 2 | 2 | | | | | 2 | 2 | 3 | | 3 | 3 |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |
| APPLY | 40 | 50 | 5 | 5 | 50 |
| ANALYZE | | 20 | 5 | 5 | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

**COURSE LEVEL ASSESSMENT QUESTIONS**

**Course Outcome 1 (CO1):**

1. What are the two most prominent open-source tools for predictive analytics?(Understand)
2. Which important measure do we gain by using PERT? (Analyse)

**Course Outcome 2 (CO2):**

**1.** What is the primary role of statistics in predictive analytics? (understand)

**2.** When dealing with a continuous variable, what is the appropriate statistics calculation? (apply)

**3.** When gathering data from noncentralized data, when should regular extraction activity take place? (anlyze)

**Course Outcome 3 (CO3):**

1. Explain - Financial News analytics (Understand)
2. How can you apply techniques, and metrics in financial news analytics? (apply)

**Course Outcome 4 (CO4):**

1. List the Characteristics of Financial Time Series. (Apply)
2. Compare and contrast Autoregressive models, Markov chain models (Analyse)
3. Construct long term forecasting model (create)

**Course Outcome 5 (CO5):**

1. Explain Healthcare Data Analytics (Remember)
2. List Privacy-Preserving Data Publishing Methods in Healthcare (apply)

**List of value-added courses**

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **Value Added Courses** | | | | | | | | |
| 1 | 21CB1V01 | IT Software Solutions for Business Using Power BI | VAC | 2 | 0 | 0 | 4 | 2 |
| 2 | 21CB2V01 | Predictive Analytics in Digital Marketing | VAC | 2 | 0 | 0 | 4 | 2 |
| 3 | 21CB3V01 | Web Application Development using Angular JS. | VAC | 2 | 0 | 0 | 4 | 2 |
| 4 | 21CB4V01 | Software testing using Selenium. | VAC | 2 | 0 | 0 | 4 | 2 |
| 5 | 21CB5V01 | Mobile Application Development using Flutter | VAC | 2 | 0 | 0 | 4 | 2 |

| 21CB1V01 | IT SOFTWARE SOLUTIONS FOR BUSINESS USING POWER BI | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |
| **Prerequisites for the course** | | | | | |

- Basic programming Language

**Objectives**

- To learn how to remove duplicate records using Power BI Query Editor.
- To learn the incredible number of features dedicated to cleaning and preparing data.
- To learn how to share content, including reports and dashboards, and how to distribute an App.
- To Use AI visuals and other added features to create deeper and meaningful data insights.

| **Module I** | **INTRODUCTION TO POWER BI** | **20** |
|---|---|---|

Data Visualization, Reporting -Business Intelligence (BI), Traditional BI, Self-Serviced BI - Cloud Based BI, On Premise BI - Power BI Products - Power BI Desktop (Power Query, Power Pivot, Power View) - Flow of Work in Power BI Desktop - Power BI Report Server, Power BI Service, Power BI Mobile Flow - of Work in Power BI / Power BI Architecture - A Brief History of Power BI

| **Module II** | **DAX** | **20** |
|---|---|---|

What is DAX, Calculated Column, Measures - DAX Table and Column Name Syntax - Creating Calculated Columns, Creating Measures Calculated - Columns Vs Measures - DAX Syntax & Operators - DAX Operators - Types of Operators - Arithmetic Operators, Comparison Operators, Text Concatenation Operator, Logical Operators-DAX function types.

| **Module III** | **VISUALIZATIONS** | **20** |
|---|---|---|

Visualizing Data, Why Visualizations - Visualization types, Create and Format Bar and Column Charts - Create and Format Stacked Bar Chart Stacked Column Chart Create and Format Clustered Bar Chart, Clustered Column Chart - Line and Area Charts -Combo Charts –Gauge chart- Create and Format Ribbon Chart, Waterfall Chart, Funnel Chart

| | **Total Periods** | **60** |
|---|---|---|

| **S.NO** | **List of Test project** |
|---|---|
| 1. | Product Sales Data Analysis. |
| 2. | Marketing Campaign Insights Analysis. |
| 3. | Financial Performance Analysis. |
| 4. | Customer Churn Analysis. |
| 5. | Global Health Expenditure Analysis. |
| 6. | Energy Trade Analysis. |
| 7. | Anomaly Detection in Credit Card Transactions. ... |
| 8. | Covid insight analysis. |
| 9. | Airport Performance Analysis |
| 10. | Life Expectancy Data Analysis |

| **Outcomes** |
|---|
| **Upon completion of the skill course, the students will be able to:** |
| **CO1:** Understand the basic concepts of data visualization using Power BI platform.<br>**CO2:** Assess the quality of the data and perform exploratory analysis.<br>**CO3:** Develop simple applications of C using Structures, Union, File Processing |
| **Text Books** |
| 1. Alberto Ferrari and Marco Russo "Introducing Microsoft Power BI", Microsoft Press, 1 st Edition, 2016.<br>2. Chris Webb," Power Query for Power BI and Excel". Apress; 1st Edition, 2014. |
| **Web Recourses**<br>1. https://www.tutorialspoint.com/power_bi/power_bi_pdf_version.htm<br>2. https://data-flair.training/blogs/table-in-power-bi |

CO MAPPING:

| CO No | PO 1 | PO2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO 11 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 2 | 2 | | | | | 1 | 1 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 2 | | | | | | 2 | 3 | 2 | 2 | 2 |
| 3 | 3 | 2 | 3 | 2 | 3 | 2 | | | | | 2 | 2 | 1 | 2 | |

**1-Low 2-Medium 3-High**

| **21CB2V01** | **PREDICTIVE ANALYTICS IN DIGITAL MARKETING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **4** | **2** |

| **Prerequisites for the course** |
|---|
| • Java Programming |
| **Objectives** |
| 1. The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.<br>2. It also focusses on how digital marketing can be utilised by organisations<br>3. To learn how the effectiveness of a digital marketing campaign can be measured |

| **Module I** | **INTRODUCTION TO ONLINE MARKET** | **20** |
|---|---|---|
| Online Market space- Digital Marketing Strategy- Components -Opportunities for building Brand Website - Planning and Creation- Content Marketing. | | |

| Module II | SEARCH ENGINE OPTIMISATION | 20 |
|---|---|---|
| Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement | | |
| **Module III** | **SOCIAL MEDIA MARKETING** | **20** |
| Social Media Marketing - Social Media Channels- Leveraging social media for brand conversations and buzz. Successful /benchmark social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing. | | |
| | **Total Periods** | **60** |

| S.NO | List of Test project |
|---|---|
| 1. | Customer Satisfaction for a Digital Marketing Agency |
| 2. | Return on Investment for Various Digital Marketing Strategies |
| 3. | Google Search Engine Marketing Case Study Analysis |
| 4. | Analysis of New Product Launch Using Google Double Click |
| 5. | Social Media Strategies for Online Shopping Cart |
| 6. | Analytical Comparison of Traditional Marketing to Digital Marketing |
| 7. | Facebook Analytics for Targeted Marketing |
| 8. | Customer Preferences on Coupon Code-Based Promotional Activities |
| 9. | Report on Tools to Analyze Digital Marketing Competitors |
| 10. | Analysis of Visual Keyword Tools for Search Engine Marketing |

**Outcomes**

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

**CO1:** To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.

**CO2:** To focusses on how digital marketing can be utilized by organizations and how its effectiveness can measure

**CO3:** To know the key elements of a digital marketing strategy.

**Text Books**

3. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition ( July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.

**Web Recourses**

3. https://nptel.ac.in/courses/110104070
4. https://www.naukri.com/learning/digital-marketing-courses-certification-training-by-nptel-st593-tg301

CO MAPPING:

| CO No | PO 1 | PO2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO 11 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 2 | 2 | 2 | | | | | 1 | 1 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 2 | | | | | | 2 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 2 | 3 | | | | | | 2 | 2 | 3 | 3 | 3 |

**1-Low 2-Medium 3-High**

| 21CB3V01 | Web Application Development using Angular JS. | P | C |
|---|---|---|---|
| | | 4 | 2 |

**Prerequisites for the course**

**1. HTML**

**2. CSS**

**Objectives**

1. To understand the basics of working with objects in JavaScript: creating objects, accessing and modifying object properties, and using constructors.

| Module I | JAVASCRIPT - BASICS | 20 |
|---|---|---|

Overview - Syntax-Enabling- Placement-Variables- Operators- If-Else-Switch-Case -While Loop - For Loop-For-in Loop- Functions-Events-Cookies-Page Redirect-Dialog Box-Void Keyword - Page Printing,

| Module II | JAVASCRIPT – Objects | 20 |
|---|---|---|

JAVASCRIPT – Objects :Objects– Number– Boolean– String– Arrays– Date– Math– Regular Exp– DOM

| Module III | ANGULAR JS | 20 |
|---|---|---|

Angular JS Introduction – Expressions – Modules – Directives – Model – Data binding – Controllers – scope-filters

| | Total Periods | 60 |
|---|---|---|

| S.NO | List of Test project |
|---|---|

| | |
|---|---|
| 11. | **JavaScript Calculator** |
| 12. | **Build a Clock using JavaScript** |
| 13. | **Grocery List** |
| 14. | **JavaScript Form Validation** |
| 15. | **Guess the number game** |
| 16. | **JavaScript Quiz** |
| 17. | **E-Commerce** |
| 18. | **Notes/To-Do List App** |
| 19. | **Budget Application** |
| 20. | **Resume Generator** |

**Outcomes**

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

**CO1:** Understand Java script programming concepts such as variables, arrays, conditionals, and loops.

**CO2:** Design applications using cookies.

**CO3:** Design applications using String concepts.

**CO4:** Understand basic Angular JS expressions , Directives.

**CO5:** Design and validate user input using Angular JS

**Text Books**


1. David Flanagan "Javascript The Definitive guide " , O'Reilly Media publisher, 6th edition,2020.
2. Nathan Clark "Javascript: Advanced Features and Programming Techniques" , Nathan clark publisher, 2018.
3. Shyam Seshadri " Angular: Up and Running: Learning Angular,step by step",O'Reilly Media publisher , 1St Edition 2018.


**Web Recourses**

1. https://nptel.ac.in/courses/106105084
2. https://archive.nptel.ac.in/courses/106/105/106105084/
3. https://freevideolectures.com/course/2308/internet-technology/25
4. https://www.udemy.com/course/angularjs-for-beginners-udemy/

**CO MAPPING:**

| CO No | PO 1 | PO2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO 11 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 2 | 1 | 2 | | | | | | 1 | 1 | 3 | | 1 |
| 2 | 1 | 2 | 2 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |
| 3 | 1 | 2 | 2 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |
| 4 | 2 | 2 | 2 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |
| 5 | 2 | 3 | 3 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |

**1-LOW 2-MEDIUM 3-HIGH**

| 21CB4V01 | SOFTWARE TESTING USING SELENIUM | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- Basic knowledge on JAVA programming

**Objectives**

- To interact with web components and carry out tasks using test scripts to automate the testing procedure.
- To offer a trustworthy and adaptable platform for automating web application testing.
- To gain knowledge about how to use a testing framework to organize and manage tests in a structured manner.

| Module I | SELENIUM IDE | 20 |
|---|---|---|

Introduction to Selenium Automation Testing – Components of Selenium - Installation of Selenium IDE - Basis Driver Scripts - Driver scripts for Event handling - Creating first Selenium IDE script - Using Locators in Selenium IDE - Enhancing a script using Selenium IDE - Creating and Running Tests and Test Suites - Perform operations on GUI Elements.

| Module II | SELENIUM WEBDRIVER | 20 |
|---|---|---|

Introduction to WebDriver - Installing Selenium WebDriver - Architecture of selenium Webdriver – Selenium Page Object Model - FindElements in Selenium WebDriver - Selenium Form WebElement: TextBox, Submit Button, sendkeys(), click() - Locate Elements by Link Text & Partial Link Text - Alert & Popup Window Handling - Handling Dynamic Web Tables – Verify Tooltip.

| Module III | TESTING FRAMEWORK AND TOOLS | 20 |
|---|---|---|

Introduction to Testing framework - Types of frameworks - Tools for developing Test Framework - TestNG introduction and Configuration with eclipse - TestNG Annotations and Data Providers - Creating Test Suit with TestNG - TestNG Groups: Include, Exclude - TestNG @Test Priority - TestNG Listeners - Session Handling & TestNG Dependency - TestNG Report Generation.

| | Total Periods | 60 |
|---|---|---|

| S.NO | LIST OF TEST PROJECTS |
|---|---|
| 1. | Automated Testing of E-commerce Websites |
| 2. | Form Validation and Error Handling |

| | |
|---|---|
| 3. | Automated Testing of Social Media Websites |
| 4. | Mobile compatibility Testing |
| 5. | Automated Testing of Healthcare Websites |
| 6. | User Interface Regression Testing |
| 7. | Data-Driven Automation |
| 8. | Automated Testing of Banking Websites |
| 9. | SMS Bomber |
| 10. | Automated Testing of Travel Websites |

**OUTCOMES**

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

**CO1:** Understand the core concepts of Selenium IDE by practicing with selenium scripts.

**CO2:** Effectively automate the web application testing using selenium webdriver to ensure the quality and reliability of web applications.

**CO3:** Design and evaluate the test cases using TestNG Framework.

**Text Books**

1. Dimo Kovalenko, "Selenium Design Patterns and Best Practices", Packet Publishing Limited, 2014.
2. Rex Allen Jones, "Selenium WebDriver for Functional Automation Testing (Part-I and Part-II)", 2016.

**Web Recourses**

1. https://www.tutorialspoint.com/selenium/selenium_tutorial.pdf
2. https://www.selenium.dev/documentation/webdriver/getting_started/
3. https://www.guru99.com/selenium-tutorial.html

CO-PO & C0-PSO MAPPING:

| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 3 | 2 | 3 | 1 | | | | 1 | 1 | 3 | 2 | 2 | 1 |
| 2 | 2 | 3 | 3 | 2 | 3 | 1 | | | | 1 | 1 | 3 | 2 | 2 | 1 |
| 3 | 2 | 2 | 3 | 1 | 3 | 1 | | | | 1 | 1 | 3 | 2 | 2 | 1 |

**1-LOW 2-MEDIUM 3-HIGH**

| 21CB5V01 | Mobile Application Development using Flutter | P | C |
|---|---|---|---|
| | | 4 | 2 |

**Prerequisites for the course**

**NIL**

**Objectives**

2. Understand the basic OOPS concepts in Dart language
3. Understand the basic of flutter and widgets
4. Understand Material Apps, Scaffold and layouts in Flutter
5. Understand advanced flutter concepts to create native mobile applications
6. Understand Firebase and Location Aware Apps Using GPS and Google Maps

| | | |
|---|---|---|
| **Module I** | **Introduction to Dart Programming Language**<br>Importance of Flutter, Introduction to Dart, Writing Dart code, DartPad, Installing Dart SDK, IntelliJ IDEA, Creating a Dart Project Using IntelliJ IDEA, main( ) function, Dart Variables, Dart Data Types, Input of Information to Dart Program, Dart Conditional Operators, For Loops, While Loops, Switch Case Statement, Functions, Object, Class, Adding Methods to Classes, Providing Constructors for Your Classes | **20** |
| **Module II** | **Introduction to Flutter and Widgets**<br>Understanding Flutter, Flutter SDK, Installing and Configuring Flutter SDK, Creating a New Flutter Project, Setup an Android Virtual Device, Run a Flutter App, Introduction to Flutter Widgets, Creating a Flutter App Using Widgets, MaterialApp widget, Scaffold Widget, Image Widget, Container Widget, Column and Row Widgets, Icon Widget, Layouts in Flutter, Card Widget, Hot Reload and Hot Restart, Stateful and Stateless Widgets. | **20** |
| **Module III** | **Advanced Flutter Concepts** | **20** |

Button Widget, App Structure and Navigation, Navigate to a New Screen and Back, Navigate with Named Routes, Send and Return Data Among Screens, Animate a Widget Across Screens, WebView Widget in Flutter, BottomNavigatorBar Widget , TabBarView Widgets, ListTile Widget, Drawer Widget, SelectableText Widget, Input and Selections, Dialogs, Alerts, and Panels, FireBase, Location Aware Apps Using GPS and Google Maps, Deployment of android application on the play store.

| | |
|---|---|
| **Total Periods** | **60** |

| S.NO | List of Test project |
|---|---|
| 11. | Develop a Pizza Order Program using Dart Language |
| 12. | Create a Small Overtime Payment Program . |

| | |
|---|---|
| 13. | Develop a Simple Flutter App |
| 14. | Design a Restaurant Menu using Flutter widgets |
| 15. | Design a Pizza Store App Using Navigation and Routing in Flutter |
| 16. | Creating a Flutter App using BottomNavigatorBar Navigation Technique |
| 17. | Develop a App Using DataTable Sorting Built-in function |
| 18. | Design a Interactive Hotel Reservation App |
| 19. | Create a User Profile Interface using Firebase |
| 20. | Design a Location-Aware Apps Using GPS and Google Maps |

**Outcomes**

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

**CO1:** Apply the concepts of OOPS in Dart Language to write simple programs

**CO2:** Apply the concepts of Flutter Widgets to Create Simple Apps in Flutter

**CO3:** Develop interactive mobile apps using motion-rich widgets

**CO4:** Demonstrate their ability to develop mobile apps using navigation and routing

**CO5**: Demonstrate their ability to develop interactive apps using Flutter API, firebase

**Text Books**


1. Alessandro Biessek Flutter for Beginners: An Introductory Guide to Building Cross-platform Mobile Applications with Flutter and Dart 2 Packt Publishing Ltd. ISBN. 9781788990523
2. Marco L. Napoli Beginning Flutter: A Hands On Guide to App Development, John Wiley &Sons,ISBN:- 1119550823, 9781119550822
3. Rap Payne Beginning App Development with Flutter: Create Cross-Platform Mobile Apps Apress, ISBN 978-1-4842-5181-2


**Web Recourses**

1.https://flutter.dev/docs/reference/tutorials
2.https://codelabs.developers.google.com/codelabs/first-flutter-app-pt1/#0
3.https://flutter.dev/docs/reference/tutorials https://flutter.dev/docs/get-started/learn-more

CO MAPPING:

| CO No | PO 1 | PO2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO 11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 2 | 1 | 2 | | | | | | 1 | 1 | 3 | | 1 |
| 2 | 1 | 2 | 2 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |
| 3 | 1 | 2 | 2 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 2 | 2 | 2 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |
| 5 | 2 | 3 | 3 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | | 2 |

**1-LOW 2-MEDIUM 3-HIGH**

## I – V SEMESTER SKILL CURRICULUM AND SYLLABI

| S.No | Skill Code | Skill Name | Semester | Contact Periods | C |
|---|---|---|---|---|---|
| 1. | 21CB1SK01 | Working with Multimedia Softwares | 01 | 60 | 2 |
| 2. | 21CB2SK01 | Front End Web Development | 02 | 60 | 2 |
| 3. | 21CB3SK01 | Data Visualization Using Tableau | 03 | 60 | 2 |
| 4. | 21CB4SK01 | Business Analytics with R Studio | 04 | 60 | 2 |
| 5. | 21CB5SK01 | Data Exploration Using Python | 05 | 60 | 2 |

| 21CB1SK01 | WORKING WITH MULTIMEDIA SOFTWARES | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- Computer Fundamentals**.**

**Objectives**

- To gain knowledge and hands on experience with audio and video processing.
- To gain knowledge and hands on experience with multimedia software's.

| Module I | Audio Processing | 20 |
|---|---|---|

Import audio, Select and edit the sound, Create fade-in fade-out effects, Label audio segments, Use noise remove filter, Mix audio, Change stereo to mono tracks, Export audio to different format and save

| **Module II** | **Video Processing** | **20** |
|---|---|---|

Trim video clips, crop video, rotate video, join video, add subtitles, and edit video dimension, bit rate, frame rate, sample rate, channel, and video/audio quality tasks on a video.

| **Module III** | **ANIMATION** | **20** |
|---|---|---|

Creating a 3D image of an object, Giving Animation effect, compress / decompress audio / video files. convert audio / video to different formats. split, join, rip audio / video.

| | **Total Periods** | **60** |
|---|---|---|

| **S.NO** | **List of Test project** |
|---|---|
| **1.** | PIDGIN ENGLISH USAGE AND MEANING PLACEMENT IN SELECT PIDGIN ENGLISH PROGRAM ON RADIO |
| **2.** | CONSUMERS' PERCEPTION OF TRUTH IN ADVERTISING |
| **3.** | THE INFLUENCE OF FOREIGN TELEVISION CONTENT ON AUN STUDENTS |
| **4.** | SOCIAL MEDIA USAGE PATTERN & USERS CONTENT AMONG IDPS IN JIMETA-YOLA REGION, NORTHEASTERN PART OF NIGERIA |
| **5.** | ROLE, PORTRAYAL AND PERCEPTION OF WOMEN IN SELECTED HAUSA MOVIES |

**Outcomes**

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

**CO1:** Understand Formulas & formatting to show you cells that pass or fail your business rules. (K2)

**CO2:** Create simple forms and reports and import from and export data to Excel and Access (K3)

**CO3:** Show Plans in different views through multimedia presentation, training, marketing, advertising, product demos, catalogues, networked communication and voicemail. (k3)

**Text Books**

- Multimedia : Making It Work - With CD - 8th edition

**Web Recourses**

1. https://developer.mozilla.org/en-US/docs/Web/API/Web_Audio_API
2. https://www.youtube.com/watch?v=CBJp82tlR3M

| 21CB2SK01 | FRONT END WEB DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- Computer Fundamentals**.**

**Objectives**

- To Create a link within a web page.
- Learn to Insert ordered and unordered lists within a web page.
- To Use cascading style sheets.
- To Create a web page
- To validate a web page

| Module I | HTML | 20 |
|---|---|---|

Basic Tags(Formatting Tags, Heading Tags), Phrase Tag, Anchor ,Image Tag, HTML Tables, HTML Lists, HTML Form, HTML Form, HTML iframes, HTML Layouts, HTML Responsive,Computer Code, HTML Attributes, HTML5(Advance) Tables, HTML 5 (Advance)Forms, TML HTML 5 (Advance)Audio Tag, HTML 5 (Advance) video Tag, HTML 5 (Advance)SVG, HTML 5 (Advance)Canvas, HTML color, HTML Space, Date, HTML List box, Button Types, Create Simple HTML page.

| Module II | CSS | 20 |
|---|---|---|

CSS Introducton , Syntax, CSS Selector, How to add CSS?, CSS Background, CSS Border, CSS border-radius property, CSS display-Cursor, CSS Buttons, CSS Float- Font, CSS background color , Attachment property, CSS Margin, CSS opacity-Filter, CSS Padding- Position, CSS Box Shadow, CSS Text Shadow,CSS text-decoration, CSS outline-Visibility, CSS Counters, CSS Icons,Justify, CSS 2D,3D Transform, CSS Lists, CSS Border Image.

| Module III | JAVASCRIPT | 20 |
|---|---|---|

JavaScript Basics, JavaScript Statements, JavaScript Objects, JavaScript Browser Objects Model(BOM), JavaScript Validation, JavaScript OOPs, JavaScript Cookies, Cookie with multiple Name-Value pairs, JavaScript Events, Exception Handling, JavaScript this keyword, JavaScript String, JavaScript Debugging, JavaScript Hoisting, Javascript Date objects, Javascript JSON objects, JavaScript RegExp Object, Javascript Form.

| | Total Periods | 60 |
|---|---|---|

| S.NO | List of Test project |
|---|---|
| 1. | A Tribute webpage |
| 2. | A survey form |
| 3. | Event page |
| 4. | Personal portfolio page |

| | |
|---|---|
| **5.** | Photography website |
| **6.** | Revamp an existing site using modern CSS themes |
| **7.** | Music Store Page |
| **8.** | Parallax Website |
| **9.** | Restaurant Website |
| **10.** | JavaScript clock |
| **11.** | JavaScript Calculator |
| **12.** | JavaScript Hangman Game project |

**Outcomes**

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

**CO1:** Apply basic HTML tags to create an efficient webpage. (K2)

**CO2:** Create customized, organized and styled web pages. (K3)

**CO3:** Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms (k3)

**Text Books**

1. Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program||,Prentice Hall, 5th Edition, 2018.

**Web Recourses**

5. https://www.tutorialspoint.com/internet_technologies/internet_useful_resources.htm
6. https://www.txcte.org/course-binder/web-technologies
7. https://nptel.ac.in/courses/106105084

| 21CB3SK01 | DATA VISUALIZATION USING TABLEAU | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- MS Office

**Objectives**

1. Understanding of the key techniques and theory used in visualization, including data models, graphical perception and techniques for visual encoding and interaction.
2. Exposure to a number of common data domains and corresponding analysis tasks, including multivariate data, networks, text and cartography.
3. Familiarize the learners with practical experience building and evaluating visualization systems.

| **Module I** | **LEARN TABLEAU CHARTS** | **20** |
|---|---|---|

Area chart – Bar chart – Box chart –Bubble chart - Bump chart - Circle views- Heat maps - Cross tabs - Pie chart – Grouped Bar or Side by Side Bars chart - Stacked Bar Chart - Line chart – Scatter plot – Tree Map

| **Module II** | **LEARN TABLEAU CALCUTATIONS AND MAPPING** | **20** |
|---|---|---|

***Tableau calculations:*** Data Calculations - Aggregate Calculations - User Calculations - Table Calculations - Logical Calculations - String Calculations - Number Calculations

***Tableau Mapping:*** Basic Maps - Symbol Map - Use Google Maps - Map box Maps as a Background Map - WMS Server Map as a Background Map

| **Module III** | **LEARN TABLEAU DASHBOARD** | **20** |
|---|---|---|

Create a Dashboard - Format Dashboard Layout - Create a Device Preview of a Dashboard – Using Storytelling - Creating your first dashboard and Story Design for different displays - Adding interactivity to your Dashboard - Tableau file types - Publishing to Tableau Online - Sharing your visualization - Printing and exporting.

| | |
|---|---|
| **Total Periods** | **60** |

| **S.NO** | **List of Test project** |
|---|---|
| **8.** | Patient Risk Healthcare Dashboard |
| **9.** | Sales Forecast Analysis Dashboard |
| **10.** | Marketing Campaign Dashboard |
| **11.** | **Product Availability Dashboard** |
| **12.** | Flight Price Analysis Dashboard |
| **13.** | Crime Analysis Dashboard |
| **14.** | Air Quality and Pollution Analysis Dashboard |

| 15. | **Stock Exchange Analysis Dashboard** |
|---|---|

**Outcomes**

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

**CO1:** Understand the basic concepts of data visualization using tableau pltaform. (K2)

**CO2:** Assess the quality of the data and perform exploratory analysis. (K3)

**CO3:** Implement and design visualizations and dashboards for your intended audience (k3)

**Text Books**

2. Daniel G.Murray, "Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software", John Wiley & Sons, Inc., 1st Edition, 2013.
3. Ryan sleeper, "Practical Tableau", O"Reilly Media, 1 st Edition, 2018.

**Web Recourses**

16. https://youtu.be/kELHEcDqbAY
17. https://youtu.be/eFByJkA3ti4
18. https://youtu.be/aHaOIvR00So

| 21CB4SK01 | **BUSINESS ANALYTICS WITH R STUDIO** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **4** | **2** |

**Prerequisites for the course**

- Python Programming

**Objectives**

- To understand the fundamentals of statistical analysis in R programming.
- To analysis data for the purpose of exploration using Descriptive and Inferential Statistics.
- To utilize and R Data types for developing programs.

| **Module I** | **INTRODUCTION INTO THE R ECOSYSTEM** | **20** |
|---|---|---|

Downloading and installing R, History of R, R packages, CRAN - R community, R-bloggers, StackOverflow, Coursera, DataCamp, R User Groups & meetups. Constants, operators, functions, variables, Random numbers, Vectors and vector indexing, Simple descriptive stats, Loops - Conditional expressions Applying PCA on an image for outlier-detection, Visualizing MDS on a distance matrix

| Module II | DATA.TABLE FOR MORE COMPLEX DATA TRANSFORMATIONS | 20 |
|---|---|---|
| Levels of measurement (nominal, ordinal, interval, ratio scale) , Vector types, data.frame objects, rows and columns, indexing , Characteristics of tidy data Filtering and ordering data , Summaries and aggregates , New variables , Relational data , Joins on Keys , Introduction into fuzzy joins, Transforming wide and long tables Why not Use Pie Charts , Plots outside of Excel: dotchart and violinplot examples , The Grammar of Graphics in R with ggplot2, Using labels for variable names | | |
| **Module III** | **NON-TABULAR DATA TYPES** | **20** |
| Time-series - Spatial data, Network data Big Data Problems: What is Big Data, 4V: volume, variety, velocity, veracity Data Transformations: Converting Numeric Variables into Factors Date Operations, String Parsing, Geocoding Dirty Data Problems: missing values data imputation duplicates, forms of data dates, outliers, spelling | | |
| | **Total Periods** | **60** |

| S.NO | List of Test project |
|---|---|
| 1. | Sentiment Analysis |
| 2. | **Uber Data Analysis** |
| 3. | **Credit Card Fraud Detection** |
| 4. | **Movie Recommendation** |
| 5. | **Music Recommendation** |
| 6. | **Customer Segmentation** |
| 7. | **Product Bundle Identification** |
| 8. | **Wine Quality Prediction** |

**Outcomes**

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

**CO1:** Understand the basic concepts of data visualization using tableau pltaform. (K2)

**CO2:** Analyse the datasets using R programming capabilities. (K3)

**CO3:** Develop programming logic using R (k3)

**Text Books**


- Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, 2 nd Edition, Pearson Education, 2018.
- S. R. Mani Sekhar and T. V. Suresh Kumar, Programming with R,1 st Edition, CENGAGE, 2017

**Web Recourses**

- https://www.r-project.org/
- https://www.tutorialspoint.com/r/index.htm
- https://nptel.ac.in/courses/111104100

| 21CB5SK01 | DATA EXPLORATION USING PYTHON | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Prerequisites for the course**

- Python Programming

**Objectives**

- To analyze different types of data using Python.
- To prepare data for analysis and perform simple statistical analysis,
- To create meaningful data visualizations and predict future trends from data using ML concepts.

| Module I | INTRODUCTION TO DATA UNDERSTANDING AND PREPROCESSING | 20 |
|---|---|---|

Knowledge domains of Data Analysis, understanding structured and unstructured data, Data Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

| Module II | DATA PROCESSING AND VISUALIZATION | 20 |
|---|---|---|

Numpy and Scipy Package, Understanding and creating N-dimensional arrays, Basic indexing and slicing, Boolean indexing, Fancy indexing, Universal functions, Data processing using arrays, File input and output with arrays.

| Module III | ANALYSING WEB DATA AND MODEL DEVELOPMENT | 20 |
|---|---|---|

Data wrangling, Web scrapping, Combing and merging data sets, Reshaping and pivoting, Data transformation, String Manipulation, case study for web scrapping. Introduction to machine learning-Supervised and Unsupervised Learning, Model development using Linear Regression, Model Visualization, Prediction and Decision Making, Model Evaluation: Over-fitting, Under-fitting and Model Selection.

| | Total Periods | 60 |
|---|---|---|

| S.NO | List of Test project |
|---|---|

| | |
|---|---|
| 1 | Churn Prediction in Telecom Industry using Logistic Regression |
| 2 | Market Basket Analysis in Python using Apriori Algorithm |
| 3 | Building a Resume Parser Using NLP(Spacy) and Machine Learning |
| 4 | Price Recommendation for Online Sellers |
| 5 | Credit Card Fraud Detection as a Classification Problem |
| 6 | Stock Market Prediction |
| 7 | Personalized Medicine Recommending System |
| 8 | Recommendation System for Retail Stores |

**Outcomes**

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

**CO1:** Understanding basics of python for performing data analysis. (K2)

**CO2:** Understanding the data, performing preprocessing, processing and data visualization to get insights from data. (K3)

**CO3:** Develop the model for data analysis and evaluate the model performance (k3)

**Text Books**

1. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media.
2. Reema Thareja, "Python Programming using Problem Solving approach",Oxford University press

**Web Recourses**

- https://onlinecourses.nptel.ac.in/noc21_cs45/preview
- https://onlinecourses.nptel.ac.in/noc22_cs32/preview

| RH199 | RedHat Certified System Administration – RHEL v9 | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**Preamble**

This course Red Hat Certified System Administrator (RHCSA) has proven the skills and knowledge required in Red Hat Enterprise Linux environments. Red Hat Certified System Administrator (RHCSA) is able to perform the following tasks: Understand and use essential tools for handling files, directories, command-line environments, and documentation. Create simple shell scripts.

**Prerequisites for the course**

- Nil

**Objectives**

- To introduce the key role of an Linux Operating system
- To Emphasize the importance of Server Management concepts of an Enterprise Linux Operating system
- To Realize the significance of Software repositories and management
- To understand the commands for processes, files and its operations.
- To insist the File system Management of a Linux Operating system
- Comprehend the need of Security vulnerability and explore the Containerized platform offered by the Linux Operating system

| UNIT I | INTRODUCTION LINUX OS | 6 |
|---|---|---|

Introduction - Access Systems and Obtaining Support- Edit Text Files from the Shell Prompt- Configure SSH Key-based Authentication- Get Help From Red Hat Customer Portal- Detect and Resolve Issues with Red Hat Insights-manage Files from the Command Line -Describe Linux File System Hierarchy Concepts - Make Links Between Files- Match File Names with Shell Expansions

**SUGGESTED ACTIVITIES:**

- Quiz: Describe Linux File System Hierarchy Concepts

**SUGGESTED EVALUATION METHODS:**

- Assessments with MCQ

| UNIT II | Managing User , group accounts and files | 6 |
|---|---|---|

Manage Local Users and Groups - Describe User and Group Concepts- Gain Superuser Access- Manage Local User Accounts- Manage Local Users and Groups- Manage Local User Accounts- Managing user password- Control Access to Files- Manage File System Permissions from the Command Line- Manage Default Permissions and File Access.

**SUGGESTED ACTIVITIES:**

- Quiz: Describe User and Group Concepts

**SUGGESTED EVALUATION METHODS:**

- Assignment on Local and Global user , user accounts and File system permission

| UNIT III | SECURITY IN LINUX | 6 |
|---|---|---|

Manage SELinux Security- Change the SELinux Enforcement Mode- Control SELinux File Contexts- Adjust SELinux - Policy with Booleans- Tune System Performance- Kill Processes - Monitor Process

Activity- Adjust Tuning Profiles - Influence Process Scheduling - Schedule Future Tasks - Schedule Recurring User Jobs - Manage Temporary Files.

**SUGGESTED ACTIVITIES:**

- Activity of securing the file
- Working with files, process and scheduling.

**SUGGESTED EVALUATION METHODS:**

Assignment on files and process

| **UNIT IV** | **Software Repositories and File Systems** | **6** |
|---|---|---|

Install and Update Software Packages - Register Systems for Red Hat Support - Register Systems for Red Hat Support- Install and Update Software Packages with DNF - Enable DNF Software Repositories - Manage Basic Storage - Add Partitions, File Systems, and Persistent Mounts- Manage Storage Stack - Create and Extend Logical Volumes - Manage Layered Storage- Identify Automatically Started System Processes- Control System Services- Reset the Root Password- Repair File System Issues at Boot.

**SUGGESTED ACTIVITIES:**

- Team projects can be given as demo
- Quiz: Register Systems

**SUGGESTED EVALUATION METHODS:**

- MCQ assessment
- Assinemnet on " Working with repositories and File system concepts".

| **UNIT V** | **CONTAINERS and FIREWALLS** | **6** |
|---|---|---|

Analyze and Store Logs - Describe System Log Architecture- Review Syslog Files- Review System Journal Entries- Preserve the System Journal - Maintain Accurate Time-Manage Networking- Validate Network Configuration -Configure Networking from the Command Line -Edit Network Configuration Files-Access Network-Attached Storage -Manage Server Firewalls -Container Concepts -Deploy Containers -Manage Containers as System Services.

**SUGGESTED ACTIVITIES:**

- Need for organization wide standards adoption of firewalls.
- Learning software tools.

**SUGGESTED EVALUATION METHODS:**

- Working with containers and firewalls.
- Assignment on selection of appropriate containers for any software development.

| | **Total Periods** | **45** |
|---|---|---|

**Suggestive Assessment Methods**

| **Continuous Assessment Test (20 Marks)** | **Formative Assessment Test (20 Marks)** | **End Semester Exams (60 Marks)** |
|---|---|---|
| **1. DESCRIPTIVE QUESTIONS** | **1.ASSIGNMENT**<br>**2. ONLINE MCQ**<br>**3.PROBLEM-SOLVING ACTIVITIES** | **1. DESCRIPTIVE QUESTIONS** |

**Course Outcomes**

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

CO1: Understand the need of a Linux Operating system, basic commands and process management functions.

CO2: Apply the concept creating user and group account.

CO3: Understand the commands for working with process and file system in linux.

CO4: Apply the File system concepts and significance of Software repositories and management.

CO5: Apply the concept of containers for different applications.

**Text Books**

1. Rhcsa Red Hat Enterprise Linux 8: Training and Exam Preparation Guide sa Red Hat Enterprise Linux 8: Training and Exam Preparation Guide ,ASGHAR GHORI,first Edition.

**Reference Books**

**Web Resources**

- www.redhat.com
- https://www.youtube.com/watch?v=TmrS7FhaaRA&list=PLlr7wO747mNrUoTuXhZ0REJw3hL4oWvLm

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | | | | 2 | | 2 | 3 | |
| 2 | 2 | 3 | 3 | 2 | 3 | 2 | | | | | | | 2 | 3 | |
| 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | 2 | | 1 | 1 | 2 | 3 | |
| 4 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | | 2 | | 2 | 3 | |
| 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | 2 | | 1 | 1 | 2 | 3 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 10 | 5 | 5 | 10 |
| UNDERSTAND | 40 | 20 | 10 | 10 | 20 |

| | | | | | |
|---|---|---|---|---|---|
| **APPLY** | **40** | **50** | **5** | **5** | **50** |
| **ANALYZE** | | **20** | **5** | **5** | **20** |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| **S.NO** | **NAME OF EXPERIMENTS** | **CO** |
|---|---|---|
| Do the following exercises given in the list: | | |
| **Suggested List of Applications** | | |
| 1. Edit Text Files from the Shell Prompt<br>2. Configure SSH Key-based Authentication<br>3. Get Help from Red Hat Customer Portal<br>4. Make Links Between Files and Match File Names with Shell Expansions<br>5. Gain Superuser Access and Manage Local Group Accounts & Manage User Passwords<br>6. Manage File System Permissions from the Command Line and Manage Default Permissions and File Access<br>7. Change the SELinux Enforcement Mode and Control SELinux File Contexts<br>8. Adjust SELinux Policy with Booleans and Investigate and Resolve SELinux Issues<br>9. Monitor Process Activity and Adjust Tuning Profiles<br>10. Influence Process Scheduling and Schedule Recurring User Jobs and Manage Temporary Files<br>11. Install and Update Software Packages with DNF and Mount and Unmount File Systems<br>12. Add Partitions, File Systems, and Persistent Mounts and Manage Swap Space<br>13. Create and Extend Logical Volumes and Manage Layered Storage<br>14. Identify Automatically Started<br>15. Review Syslog Files and Review System Journal Entries<br>16. Preserve the System Journal and Maintain Accurate Time<br>17. Validate Network Configuration and Configure Networking from the Command Line<br>18. Access Network-Attached Storage and Run Containers | | |