SVSU/CSE/2025/424 (a)

# B tech

# Scheme and Syllabus

of

# B. TECH. COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

By

Skill Department of Computer Science & Engineering

Skill Faculty of Engineering & Technology

**w.e.f. Academic Session 2025-26**


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**It is certified that this version of Scheme and Syllabus, revised and checked by us, is completed in all respects.**

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## VISION AND MISSION

### VISION OF UNIVERSITY

To emerge as one of the foremost institutions of quality in skill education acknowledges by industry, nationally and internationally.

### MISSION OF UNIVERSITY

To focus on quality of skill education, aspired by students and admired by industry, nationally and internationally.

### VISION OF THE DEPARTMENT

To build highly skilled and competent professionals with a futuristic outlook for research and innovation who can also generate sustainable employment with virtuous professional values.

### MISSION OF THE DEPARTMENT

- To impart skill education and training as per industry needs in the domain of Computer Science & Engineering.
- To develop and maintain the state of art infrastructure for building sustainable skilled IT ecosystem in the domain.
- To cultivate the environment for fostering new ideas, research and innovations leading to emergence of skilled entrepreneurs, leaders, innovators and professionals.

## Program Outcomes (POs)

The following are the PO's defined for the Graduate program in Engineering by NBA:

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

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

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

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

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

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

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

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

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

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

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

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

## Program Educational Objectives (PEOs)

PEO 1: To produce engineering graduates with skill and knowledge in basic science, Mathematics & Engineering for the application in the domain.

PEO 2: To produce engineering graduates who can demonstrate technical competence in the field of Computer Science in order to develop solutions to the complex problems.

PEO 3: To produce engineering graduates who will continue to learn and adapt latest technologies to solve real life problems.

PEO 4: To produce graduates who contribute to the development of nation effectively in a multi-disciplinary environment.

PEO 5: To produce graduates who pursue research for sustainable development of self and nation.

**Program Specific Objectives (PSOs)**

At the end of course, Student:

PSO 1: should be able to understand the concepts of computer science and their applications in the field of Artificial intelligence, Machine Learning, and other relevant areas.

PSO 2: Should have an ability to apply technical knowledge and usage of latest tools and technologies related to computer Science and engineering for solving real world problems.

PSO 3: Should have the capability to analyze, comprehend, design & develop sustainable and efficient solution for computer science and engineering for a variety of engineering applications and thus demonstrating professional ethics & concern for societal well being

**Mapping of PO, PEO and PSO's**

| Mapping | PEO1 | PEO2 | PEO3 | PEO4 | PEO5 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|
| PO1 | 3 | 2 | 1 | 1 | - | 1 | - | 2 |
| PO2 | 1 | 3 | 2 | 1 | - | 3 | 3 | 1 |
| PO3 | - | 3 | 3 | - | - | 3 | 3 | 2 |
| PO4 | - | 2 | 3 | 1 | - | - | 2 | - |
| PO5 | - | 3 | 2 | 2 | - | 1 | 3 | 2 |
| PO6 | - | - | - | 1 | 3 | - | 1 | 3 |
| PO7 | - | - | - | - | 3 | - | - | 3 |
| PO8 | - | - | - | - | 3 | - | 1 | 3 |
| PO9 | | 2 | 3 | 2 | 2 | - | 1 | 2 |
| PO10 | | 2 | 3 | 2 | 3 | 1 | 2 | - |
| PO11 | - | - | - | 2 | 3 | - | 2 | 3 |
| PO12 | | | | | | | | |

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# Scheme and Syllabus
# of
# B. TECH. COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

## w.e.f. Academic Session 2024-25

**Semester I**

| Sr. No. | Course Code | Course Title | L | T | P | Credits | Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | I | E | Total | | |
| 1 | 24UPHY03 | Applied Physics | 3 | 1 | 0 | 4 | 15 | 35 | 50 | BS | |
| 2 | 24UPHY04 | Applied Physics Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | BS | |
| 3 | 24UCSE01 | Programming with C | 2 | 0 | 0 | 2 | 30 | 70 | 100 | ES | |
| 4 | 24UCSE02 | Programming with C Lab | 0 | 0 | 4 | 2 | 35 | 15 | 50 | ES | |
| 5 | 24UBEE01 | Basic Electrical & Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 | ES | |
| 6 | 24UBEE02 | Basic Electrical & Electronics Engineering Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | ES | |
| 7 | 24UENG01 | English Language and Business Communication | 1 | 0 | 0 | 1 | 15 | 35 | 50 | HS | |
| 8 | 24UENG02 | English Language and Business Communication Practical | 0 | 0 | 2 | 1 | 35 | 15 | 50 | HS | |
| 9 | 24UMTH03 | Engineering Mathematics-I | 3 | 1 | 0 | 4 | 30 | 70 | 100 | BS | |
| 10 | 24UENV01 | Sustainability | 2 | 0 | 0 | 2 | 30 | 70 | 100 | HS | |
| 11 | 24UCEH01 | Design Thinking | 0 | 0 | 2 | 1 | 35 | 15 | 50 | HS | |
| | | **Total** | **15** | **0** | **12** | **21** | | | | | |

**Semester II**

| Sr. No. | Course Code | Course Title | L | T | P | Credits | Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | I | E | Total | | |
| 1 | 24UMTH04 | Engineering Mathematics - II | 3 | 1 | 0 | 4 | 30 | 70 | 100 | BS | |
| 2 | 24UCEE02 | Digital Electronics | 3 | 0 | 0 | 3 | 30 | 70 | 100 | ES | |
| 3 | 24UCEE03 | Digital Electronics Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | ES | |
| 4 | 24UCSE03 | Data Structures | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 24UCSE04 | Data Structures Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 6 | 24UCHM03 | Applied Chemistry | 3 | 0 | 0 | 3 | 15 | 35 | 50 | HS | |
| 7 | 24UCHM04 | Applied Chemistry Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | BS | |
| 8 | 24UCEC02 | Python Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 | ES | |
| 9 | 24UCEC03 | Python Programming lab | 0 | 0 | 4 | 2 | 35 | 15 | 50 | ES | |
| 10 | 24UCSE05 | Design Project-I | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PW | |
| | | **Total** | **16** | **0** | **12** | **22** | | | | | |

*** Summer Internship (4-6 weeks) will be between 2nd and 3rd semester and will be evaluated in 3rd semester via viva voce.**

**Semester III**

| Sr. No. | Course Code | Course Title | L | T | P | Credits | Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | I | E | Total | | |
| 1 | 24UCSE06 | Discrete Mathematics | 4 | 0 | 0 | 4 | 30 | 70 | 100 | PC | |
| 2 | 24UCSE07 | Computer Organization and Architecture | 4 | 0 | 0 | 4 | 30 | 70 | 100 | PC | |
| 3 | 24UCSE08 | Database Management Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 4 | 24UCSE09 | Database Management Systems Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 5 | 24UCSE10 | Artificial Intelligence | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 6 | 24UCSE11 | Artificial Intelligence Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 7 | 24UCSE12 | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 8 | 24UCSE13 | Design and Analysis of Algorithm Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 9 | 24UCEW01 | Summer Internship I (4-6 weeks)* | - | - | - | 2 | 35 | 15 | 50 | PW | |
| 10 | 24UYHS01 | Yoga and Health Skills-II | 2 | 0 | 0 | 2 | 30 | 70 | 100 | AEC | |
| | | **Total** | **19** | **0** | **6** | **24** | | | | | |

**Semester IV**

| Sr. No. | Course Code | Course Title | L | T | P | Credits | Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | I | E | Total | | |
| 1 | 24UCSE14 | Operating Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 2 | 24UCSE15 | Operating System Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 3 | 24UCSE16 | Computer Networks | 4 | 0 | 0 | 4 | 30 | 70 | 100 | PC | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 24UCSE17 | Machine Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 5 | 24UCSE18 | Machine Learning Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 6 | 24UCSE19 | Object Oriented Programming using C++ | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 7 | 24UCSE20 | Object Oriented Programming using C++ Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 8 | 24UCSE21 | Software Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 9 | 24UHPE01 | Human Values and Professional Ethics | 2 | 0 | 0 | 2 | 30 | 70 | 100 | HS | |
| 11 | 24UCEW02 | Minor Project-I | 0 | 0 | 4 | 2 | 35 | 15 | 50 | PW | |
| | | **Total** | **18** | **0** | **10** | **23** | | | | | |

**Students have to go for summer Internship for 6 weeks and the report will be evaluated in V semester via viva voce**

**Semester V**

| Sr. No. | Course Code | Course Title | L | T | P | Credits | Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | I | E | Total | | |
| 1 | 24UCSE22 | Theory of Computation | 4 | 0 | 0 | 4 | 30 | 70 | 100 | PC | |
| 2 | 24UCSE23 | Deep Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 3 | 24UCSE24 | Deep Learning Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 4 | 24UCSE25 | Optimization Techniques | 4 | 0 | 0 | 4 | 30 | 70 | 100 | PC | |
| 5 | 24UCSE26-28 | Program Elective-I | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PE | |
| 6 | 24UCSE29-31 | Program Elective- I Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 7 | 24UCSE32 | Natural Language Processing | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 8 | 24UCSE33 | Natural Language Processing Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 9 | 24UENG03 | Employability skills | 1 | 0 | 0 | 1 | 15 | 35 | 50 | AEC | |
| 10 | 24UENG04 | Employability skills Practical | 0 | 0 | 2 | 1 | 35 | 15 | 50 | AEC | |
| 11 | 24UCEW04 | Summer Internship II( 6 weeks) * | - | - | - | 3 | 70 | 30 | 100 | CS | |
| 12 | 24UCEW03 | Minor Project-II | 0 | 0 | 4 | 2 | 70 | 30 | 100 | PW | |
| | | **Total** | **18** | **0** | **12** | **27** | | | | | |

**Semester VI**

| Sr. No. | Course Code | Course Title | L | T | P | Credits | Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | I | E | Total | | |
| 1 | 24UCSE34 | Advanced ML | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 5 | 24UCSE35 | Advanced ML Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 24UCSE36 | Compiler Design | 4 | 0 | 0 | 4 | 30 | 70 | 100 | PC | |
| 3 | 24UCSE37-39 | Program Elective II | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PE | |
| 6 | 24UCSE40-42 | Program Elective II Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PE | |
| 4 | | Open Elective-I | 3 | 0 | 0 | 3 | 30 | 70 | 100 | OE | |
| 7 | 24UCEW05 | Capstone Project - I | 0 | 0 | 10 | 5 | 210 | 90 | 300 | PW | |
| 8 | 24UBPM10 | Entrepreneurship | 1 | 1 | 0 | 2 | 30 | 70 | 100 | AEC | |
| | | **Total** | **14** | **1** | **14** | **22** | | | | | |
| **Students have to go for summer Internship for 6 weeks and the report will be evaluated in VII semester via viva voce** | | | | | | | | | | | |
| **Semester VII** | | | | | | | | | | | |
| **Sr. No.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** | **Marks** | | | | |
| | | | | | | | **I** | **E** | **Total** | | |
| 1 | 24UCSE43 | Soft Computing | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PC | |
| 2 | 24UCSE44 | Soft Computing Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PC | |
| 2 | 24UCSE45-48 | Program Elective III | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PE | |
| 5 | 24UCSE49-52 | Program Elective III Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PE | |
| 3 | 24UCSE53-56 | Program Elective IV | 3 | 0 | 0 | 3 | 30 | 70 | 100 | PE | |
| 6 | 24UCSE57-60 | Program Elective IV Lab | 0 | 0 | 2 | 1 | 35 | 15 | 50 | PE | |
| 7 | 24UCEW06 | Capstone Project - II | 0 | 0 | 10 | 5 | 210 | 90 | 300 | PW | |
| 8 | 24UCEW07 | Summer Internship III( 6 weeks) * | - | - | - | 3 | 70 | 30 | 100 | PW | |
| | | **Total** | **9** | **0** | **16** | **20** | | | | | |
| **Semester VIII** | | | | | | | | | | | |
| **Sr. No.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** | **Marks** | | | | |
| | | | | | | | **I** | **E** | **Total** | | |
| 1 | 24UCEW08 | Internship | - | - | | 10 | 350 | 150 | 500 | PW | |
| 2 | 24UCSE61 | Open Elective-II via (MOOC) | 3 | 0 | 0 | 3 | 30 | 70 | 100 | OE | |
| | | **Total** | **3** | **0** | **20** | **13** | | | | | |
| **TOTAL CREDITS** | | | | | | **172** | | | | | |

## List of Professional/ Program Elective courses for B. Tech. CSE (AI/ML) Program

**Program Elective I**

| Code* | Program Elective |
|---|---|
| 24UCSE26 | AI in Healthcare |

| | |
|---|---|
| 24UCSE27 | AI in Agriculture |
| 24UCSE28 | May be decided at the time of offering by the department |
| 24UCSE29 | AI in Healthcare Lab |
| 24UCSE30 | AI in Agriculture Lab |
| 24UCSE31 | May be decided at the time of offering by the department |
| | |

**Program Elective II**

| **Code*** | **Program Elective** |
|---|---|
| 24UCSE37 | Big Data Analytics |
| 24UCSE38 | Data Warehouse and data Mining |
| 24UCSE39 | Cloud Computing |
| 24UCSE40 | Big Data Analytics Lab |
| 24UCSE41 | Data Warehouse and data Mining Lab |
| 24UCSE42 | Cloud Computing Lab |
| | May be decided at the time of offering by the department |

**Program Elective III**

| **Code*** | **Program Elective** |
|---|---|
| 24UCSE45 | Multi-agent Intelligent |
| 24UCSE46 | Web Technologies |
| 24UCSE47 | Feature Engineering |
| 24UCSE48 | Modelling and simulation |
| 24UCSE49 | Multi-agent Intelligent Lab |
| 24UCSE50 | Web Technologies Lab |
| 24UCSE51 | Feature Engineering Lab |
| 24UCSE52 | Modelling and simulation Lab |
| | May be decided at the time of offering by the department |

**Program Elective IV**

| **Code*** | **Program Elective** |
|---|---|
| 24UCSE53 | Digital Image Processing |
| 24UCSE54 | Information Retrieval |
| 24UCSE55 | Internet of Things |
| 24UCSE56 | Wireless Communication |
| 24UCSE57 | Digital Image Processing Lab |
| 24UCSE58 | Information Retrieval Lab |
| 24UCSE59 | Internet of Things Lab |
| 24UCSE60 | Wireless Communication Lab |
| | May be decided at the time of offering by the department |

- Codes may be assigned by the department committee at the time of offering the courses and also the more courses may be added at the time of offering the PE based on emerging technologies.

**Table 5. List of Open Elective courses**

| | | | |
|---|---|---|---|
| 1 | Entrepreneurship Development | 6 | Rural Technology & Community Development |

| | | | |
|---|---|---|---|
| 2 | Bioinformatics | 7 | Economics |
| 3 | Real Time Operating System | 8 | Game Theory with Engineering Applications |
| 4 | Embedded Systems | 9 | Cyber Law and Ethics |
| 5 | Computational Neuroscience | 10 | |

*May be decided at the time of offering by the department. #

The Elective may be chosen at the time of offering

**Category Wise Courses:**

| **1. Humanity and Social Science Courses** | | | | | | |
|---|---|---|---|---|---|---|
| **S.No.** | **Course** | **L** | **T** | **P** | **To** | |
| 1 | English Language and Business Communication | 1 | 0 | 0 | 1 | HS |
| 2 | Sustainability | 2 | 0 | 0 | 2 | HS |
| 3 | English Language and Business Communication Lab | 0 | 0 | 2 | 1 | HS |
| 4 | Design Thinking | 0 | 0 | 2 | 1 | HS |
| | | | | **Total** | **5** | |
| **2. Basic Science Course** | | | | | | |
| **S. No.** | **Course** | **L** | **T** | **P** | **To** | |
| 1 | Applied Physics | 3 | 0 | 0 | 3 | BS |
| 2 | Engineering Mathematics-I | 4 | 0 | 0 | 4 | BS |
| 3 | Applied Physics Lab | 0 | 0 | 2 | 1 | BS |
| 4 | Engineering Mathematics - II | 4 | 0 | 0 | 4 | BS |
| 5 | Applied Chemistry | 3 | 0 | 0 | 3 | BS |
| 6 | Applied Chemistry Lab | 0 | 0 | 2 | 1 | BS |
| | | | | **Total** | **16** | |
| **3. Engineering Science Course** | | | | | | |

| **S.No.** | **Course** | **L** | **T** | **P** | **To** | |
|---|---|---|---|---|---|---|
| 1 | Programming with C | 2 | 0 | 0 | 2 | ES |
| 2 | Basic Electrical & Electronics Engineering | 3 | 0 | 0 | 3 | ES |
| 3 | Basic Electrical & Electronics Engineering Lab | 0 | 0 | 2 | 1 | ES |
| 4 | Digital Electronics | 3 | 0 | 0 | 3 | ES |
| 5 | Python Programming | 3 | 0 | 0 | 3 | ES |
| 6 | Digital Electronics Lab | 0 | 0 | 2 | 1 | ES |
| 7 | Python Programming Lab | 0 | 0 | 4 | 2 | ES |
| 8 | Programming with C Lab | 0 | 0 | 4 | 2 | ES |
| | | | | **Total** | **17** | |

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| 4. Program Core Course | | | | | | |
|---|---|---|---|---|---|---|
| Sr. No. | Course Title | L | T | P | Credits | |
| 1 | Data Structures | 3 | 0 | 0 | 3 | PC |
| 2 | Data Structures Lab | 0 | 0 | 2 | 1 | PC |
| 3 | Discrete Mathematics | 4 | 0 | 0 | 4 | PC |
| 4 | Computer Organization and Architecture | 4 | 0 | 0 | 4 | PC |
| 5 | Database Management Systems | 3 | 0 | 0 | 3 | PC |
| 6 | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | PC |
| 7 | Artificial Intelligence | 3 | 0 | 0 | 3 | PC |
| 8 | Database Management Systems Lab | 0 | 0 | 2 | 1 | PC |
| 9 | Design and Analysis of Algorithm Lab | 0 | 0 | 2 | 1 | PC |
| 10 | Artificial Intelligence Lab | 0 | 0 | 2 | 1 | PC |
| 11 | Operating Systems | 3 | 0 | 0 | 3 | PC |
| 12 | Object Oriented Programming using C++ | 3 | 0 | 0 | 3 | PC |
| 13 | Machine Learning | 3 | 0 | 0 | 3 | PC |
| 14 | Computer Networks | 4 | 0 | 0 | 4 | PC |
| 15 | Software Engineering | 3 | 0 | 0 | 3 | PC |
| 16 | Operating System Lab | 0 | 0 | 2 | 1 | PC |
| 17 | Object Oriented Programming using C++ Lab | 0 | 0 | 2 | 1 | PC |
| 18 | Machine Learning Lab | 0 | 0 | 2 | 1 | PC |
| 19 | Theory of Computation | 4 | 0 | 0 | 4 | PC |
| 20 | Deep Learning | 3 | 0 | 0 | 3 | PC |
| 21 | Optimization Techniques | 4 | 0 | 0 | 4 | PC |
| 22 | Natural Language Processing | 3 | 0 | 0 | 3 | PC |
| 23 | Deep Learning Lab | 0 | 0 | 2 | 1 | PC |
| 24 | NLP Lab | 0 | 0 | 2 | 1 | PC |
| 25 | Advanced ML | 3 | 0 | 0 | 3 | PC |
| 26 | Compiler Design | 4 | 0 | 0 | 4 | PC |
| 27 | Advanced ML Lab | 0 | 0 | 2 | 1 | PC |
| 28 | Soft Computing | 3 | 0 | 0 | 3 | PC |
| 29 | Soft Computing Lab | 0 | 0 | 2 | 1 | PC |
| | | | | **Total** | **71** | |
| **5. Professional Elective Course** | | | | | | |
| | **Course Title** | **L** | **T** | **P** | **Credits** | |
| 1 | Program Elective I | 3 | 0 | 2 | 4 | PE |
| 2 | Program Elective II | 3 | 0 | 2 | 4 | PE |
| 3 | Program Elective III | 3 | 0 | 2 | 4 | PE |
| 4 | Program Elective IV | 3 | 0 | 2 | 4 | PE |
| | | | | **Total** | **16** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **6. Open elective Course** | | | | | | |
| | **Course Title** | **L** | **T** | **P** | **Credits** | |
| 1 | Open Elective-I | 3 | 0 | 0 | 3 | OE |
| 2 | Open Elective-II | 3 | 0 | 0 | 3 | OE |
| | | | | **Total** | 6 | |
| **7. Project Work, Seminar and Internship in Industry** | | | | | | |
| | **Course Title** | **L** | **T** | **P** | **Credits** | |
| 1 | Design Project-I | 0 | 0 | 2 | 1 | PW |
| 2 | Minor Project-I | 0 | 0 | 4 | 2 | PW |
| 3 | Minor Project -II | 0 | 0 | 4 | 2 | PW |
| 4 | Summer Internship I(4-6 weeks) | - | - | - | 2 | PW |
| 5 | Summer Internship II(6 weeks) | - | - | - | 3 | PW |
| 6 | Summer Internship III(6 weeks) | - | - | - | 3 | PW |
| 7 | Internship | - | - | - | 10 | PW |
| 8 | Capstone Project - I | 0 | 0 | 10 | 5 | PW |
| 9 | Capstone Project - II | 0 | 0 | 10 | 5 | PW |
| | | | | **Total** | **33** | |
| **8. Ability Enhancement Course** | | | | | | |
| **SNo** | **Course Title** | **L** | **T** | **P** | **Credits** | |
| 1 | Yoga and Health Skills-II | 2 | 0 | 0 | 2 | AEC |
| 3 | Employability Skills | 1 | 0 | 2 | 2 | AEC |
| 4 | Entrepreneurship | 1 | 1 | 0 | 2 | AEC |
| 5 | Human Values and Professional Ethics | 2 | 0 | 0 | 2 | AEC |
| | | | | **Total** | **8** | |

Monika

# Evaluation Scheme

## w.e.f. Academic Session 2024-25

| Type of Exam | Internal | External | Total |
|---|---|---|---|
| Theory Subject | 30 | 70 | 100 |
| Practical Subject | 35 | 15 | 50 |

**Division of Theory Internal Marks**

| Class Attendance | Assignment / Quiz / Presentation / Class Performance / Conduct | Sessional 1 | Sessional 2 | Total |
|---|---|---|---|---|
| 5 | 15 | 5 | 5 | 30 |

**Division of Practical Internal Marks**

| Lab Attendance | Practical Performance / Conduct | Practical File | Viva -Voce | Total |
|---|---|---|---|---|
| 5 | 10 | 10 | 10 | 35 |

**Division of Practical External Marks**

| Lab Written Exam | Practical Performance | Viva -Voce | Total |
|---|---|---|---|
| 5 | 5 | 5 | 15 |

**Table 1. Division of Internal Marks**

| Examination | Attendance/ Conduct | Synopsis | Presentation | Report | Viva -Voce | Total |
|---|---|---|---|---|---|---|
| Summer Internship - I | 5 | - | 10 | 10 | 10 | 35 |
| Minor Project - I | 5 | 5 | 5 | 10 | 10 | 35 |
| Minor Project - II | 10 | 10 | 10 | 20 | 20 | 70 |
| Summer Internship - II and III | 10 | - | 20 | 20 | 20 | 70 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Capstone Project - I and II | 30 | 30 | 30 | 30 | 90 | 210 |

**Table 2. Division of Internship / OJT Internal Marks**

| Examination | Attendance / Conduct | Internship / OJT Performance or Presentation | | | | Report | Mid Term Viva -Voce | End Term Viva -Voce | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | After Ist month | After 2nd month | After 3rd month | After 4th month | | | | |
| Internship / OJT | 30 | 30 | 30 | 30 | 30 | 40 | 80 | 80 | 350 |

**Table 3. Division of External Marks**

| Examination | Presentation | Report | Viva -Voce | Total |
|---|---|---|---|---|
| Summer Internship - I | 5 | 5 | 5 | 15 |
| Minor Project - I | 5 | 5 | 5 | 15 |
| Minor Project - II | 10 | 10 | 10 | 30 |
| Summer Internship - II and III | 10 | 10 | 10 | 30 |
| Capstone Project - I and II | 20 | 20 | 50 | 90 |
| Internship / OJT | 30 | 30 | 90 | 150 |

**Instruction for External Practical Examination*:**

Exams duration will be as following:

1. Theory exams will be of 03 hours duration.
2. External Practical exams will be of 03 hours duration.
3. External Summer Internships / Minor Projects / Capstone Projects / Internship / OJT exams will be of 02 hours duration.

**Instruction for Theory Paper Examination*:**

1. There should be 09 questions in the End Term Examination question paper.
2. The Question paper consists of two Sections. All sections are compulsory.
3. Section A comprises 1 question and 10 sub-parts / sub-questions of short answer type and covers the entire syllabus. All questions are compulsory. Each question carries 2 marks.
4. Section B comprises 8 long answer type questions out of which students must attempt any 5. Each question carries 10 marks. The paper shall consist of 5 units as per the syllabus. Every unit shall have two questions. Individual questions may contain sub-parts / sub-questions.
5. Each unit shall have a marks weightage of 14.
6. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.

7. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

*- Format of the Question Paper may be changed as per University Examination Ordinance / Policy in vogue at the time of examination.

# Syllabus

of

B. TECH. COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

## Semester 1

| Programming with C (24UCSE01) | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – I | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 2 | 0 | 0 | 2 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hours |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The Students will try to learn:**

- To acquire problem solving skills
- To be able to develop flowcharts
- To understand structured programming concepts
- To be able to write programs in C Language **Course Outcomes:**

**After completion of the course, the student will be able to:**

CO1. Recall and understand the basics constructs of a programming language.
CO2. Demonstrate the problem solving and critical thinking skills.
CO3. Applying the knowledge of programming skills in problem solving using C language.
CO4. Analyzing the Different programs in terms of their complexity and efficiency
CO5. Test the program for its correctness from all possible inputs.
CO6. Design the program in C language to solve any problem.

**Course Content:**

**Unit 1**

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, Hexadecimal. Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements, Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

**Unit-2**

Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do- While and Examples. Continue, Break and Go to statements. Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

**Unit 3**

Preprocessors: Preprocessor Commands
Arrays: Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

**Unit 4**

Pointers: Introduction, Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, L value and R value, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command- line Arguments. Strings - Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions.

**Unit 5**

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types.
Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions.

**Textbook:**

1. B.A. Forouzan and R.F. Gilberg, "*A Structured Programming Approach in C*", Cengage Learning, 2007

**Reference:**

1. Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2006.
2. Rajaraman V, "The Fundamentals of Computer", 4th Edition, Prentice-Hall of India, 2006.

Monika

| Programming with C Lab (24UCSE02) | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-1 | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 4 | 2 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Objectives:**

The objective of the course is to give exposure to the student about the implementation of different algorithm in C language.

**Course Outcome:**

At the end of the course, the student will be able to
CO1. Understand the fundamentals of programming in C Language
CO2. Write, compile and debug programs in C
CO3. Formulate given problems and give solutions by programming it in C.
CO4. To be able to effectively choose programming components to solve computing problems in real-world.

**Course Content:**

1. Finding the maximum and minimum of given set of numbers
2. Finding Roots of a Quadratic Equation
3. Sin x and Cos x values using series expansion
4. Conversion of Binary to Decimal, Octal, Hexa and Vice versa
5. Generating a Pascal triangle and Pyramid of numbers
6. Recursion: Factorial, Fibonacci, GCD
7. Matrix addition and multiplication using arrays
8. Bubble Sort, Selection Sort
9. Programs on Linear Search and Binary Search using recursive and non-recursive procedures.
10. Functions for string manipulations
11. Finding the No. of characters, words and lines of given text file
12. File Handling programs.

**Textbook:**

1. B.A. Forouzan and R.F. Gilberg, "*A Structured Programming Approach in C*", Cengage Learning, 2007

**Reference:**

1. Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2006.
2. Rajaraman V, "The Fundamentals of Computer", 4th Edition, Prentice-Hall of India, 2006.

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| Basic Electrical & Electronics Engineering<br>24UBEE01 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-1 | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hours |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

To introduce the fundamentals of Electrical and electronics engineering including circuit analysis, transformers, machines, analog and digital electronics **Course Outcome:**

After completion of the course, the student will be able to:

CO1. Acquire knowledge about the electric circuit and electronics
CO2. Develop skills in analyzing electrical circuits, and transformers
CO3. Understand the DC machines and its working principle
CO4. Explain the theory, construction, and operation of electronic devices **Course**

**Content:**

**Unit I**

**Electrical Circuit Analysis:** Voltage & Current sources: dependent & independent source, source conversion. Analysis of D.C. circuits: Mesh & Loop analysis, Nodal analysis. Network Theorems: Thevenin's, Norton's, superposition theorem etc. Star- Delta circuits. 1-Φ AC Circuits: Review of 1-Φ phase AC circuits under sinusoidal steady state conditions, Resonance, Active, Reactive and Apparent power, Power factor. 3-Φ AC circuits: Balanced and Unbalanced supply, Star and Delta connections, power measurement.

**Unit II**

**Transformers:** Magnetic Circuits: Review of laws of electromagnetism, Flux, MMF and their relation, analysis of magnetic and electric circuit. Single-phase transformer: Basic concepts, constructional features, EMF equation, voltage, current and impedance transformation, Equivalent circuits.

**Unit III**

**Electrical Machine:** DC Machines: Constructional features, working principle, emf equation, types of DC machines and their characteristics.

Induction Machines: Constructional features, working principle, emf equation, concept of slip and torque–slip characteristics. Synchronous Machines: Constructional features, working principle and emf equation.

**Unit IV**

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**Digital Electronics:** Number systems: decimal, binary, octal, hexadecimal, their complements, operation and conversion, floating point and signed numbers. Demorgan's theorem, Logic Gates: Basic and Universal Gates, their representation, truth table and realization, Half and Full adder circuits, Flip-Flops etc.

**Unit V**

**Electronic Devices and Circuits:** Introduction to semiconductors, Diodes: types of diodes and their characteristic. Bipolar Junction Transistors: working, configurations (CC, CB & CE) and mode of operation.

**Text books:**


1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. S. Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Publications.
3. J.B. Gupta, "Text book of Basic Electrical and Electronics Engineering", S. K. Kataria Publications
4. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009. **References books:**

1. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India.
2. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. Hughes Edward, Electrical & Electronic Technology, Pearson Education, 2007.
4. Alexander.C. K. & Mathew. N. O. Sadiku, Fundamentals of Electrical circuits, Tata McGraw Hill, 2008.
5. P.S. Bhimbhara, "Electrical Machinery" Khanna Publishers
6. Milmann & Halkias, "Integrated Electronics" TMH
7. M.Morris Mano, "Digital Logic and Computer Design" Pearson

| Basic Electrical & Electronics Engineering Lab<br>24UBEE02 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-1 | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hr |
| **Prerequisite** | | | | | | | |

**Course Objectives:**

The students will be able to have hands-on experience on the topics related to curriculum of Basic Electrical and Engineering.

**Course Outcomes:**

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

CO1. Recall the theoretical concept and corelate to practical
CO2. Understand the application of theory concepts
CO3. Implement and verify theories and concepts covered in theory like Kirchhoff's laws, Norton Theorem and Superposition Theorem
CO4. Calculate different parameters of transformer **Course**

**Content:**

**List of practicals:**

1. Study of the Cathode Ray Oscilloscope (CRO).
2. Verification of Kirchhoff's laws
3. Verification of Norton Theorem 4. Verification of Superposition Theorem
5. Verification of Thevenin Theorem.
6. Determination of parameters and losses using open-circuit and short-circuit tests on a single-phase transformer.
7. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single-phase transformer
8. Determination of open circuit characteristics of a separately excited DC generator.
9. Characteristics of separately excited and self-excited dc generators
10. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, singlephase induction machine and synchronous machine.
11. Study of electronic components and equipment's.
    a. Resistor Colour coding using digital multi-meter.
    b. Assembling electronic components on bread board.
12. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
13. Soldering and desoldering practice.
14. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
15. Implementation of half adder circuit using logic gates.

**Text books:**


1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. S. Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Publications.

3. J.B. Gupta, "Text book of Basic Electrical and Electronics Engineering", S.K.Kataria Publications
4. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

**Reference Books:**

1. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India.
2. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. Hughes Edward, Electrical & Electronic Technology, Pearson Education, 2007.
4. Alexander.C. K. & Mathew. N. O. Sadiku, Fundamentals of Electrical circuits, Tata McGraw Hill, 2008.
5. P.S. Bhimbhara, "Electrical Machinery" Khanna Publishers
6. Milmann & Halkias, "Integrated Electronics" TMH
7. M.Morris Mano, "Digital Logic and Computer Design" Pearson

| English Language and Business Communication<br>24UENG01 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-1 | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 15 |
| 1 | 0 | 0 | 1 | | **External Examination** | : | 35 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hours |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

To train students to enhance their skills in written as well as oral communication through practical conduct of this course. This course will help students in understanding the principles and techniques of business communication.

**Course Outcome:**

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

CO1. Students would be able to understand the nature, structure, types and process of various dimensions of communication and apply them in communication.

CO 2. Students would be able to make effective presentations in various business/professional situations incorporating the ethics of good negotiations and assertive behavior.

CO 3. Students would develop competency to understand and perform the diversity of the globalized multicultural world.

CO 4. Students would be able to draft various types of documents used inside the organization for various types of communication.

CO 5. Students would develop interview skills and competency incorporating the use of different social media platforms for networking.

**Course Contents**

**Unit I Communication Skills** - Meaning, Process and Types of Communication; Principles of Effective Communication;

**Unit II Grammar and Vocabulary** - Use of Tenses, Articles, Prepositions, Conjunctions, Subject-verb concord, Word formation: Base, Prefixes, Suffixes Synonyms, Antonyms, One-word substitutes

**Unit III Listening Skills** - Process and types of listening, deterrents to listening process, Essentials of good listening. Listening Comprehension and Note Taking

**Unit IV Writing Skills** - Report writing, Agenda and Minutes; Letter Writing: Business letters,

Cover letters, Electronic mail; Resume Writing



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**Unit V Speaking Skills** - Preparing for interviews- Types of interviews, Group discussion; Effective ways of performing well in interviews; Public Speaking **Recommended Readings:**


- Joseph, C. J., Myall, E. G., and A. Biswas, eds. A Comprehensive Grammar of Current English. New Delhi: Inter University P, 2014.
- Lata, Pushp, and Sanjay Kumar. Communication Skills. 2 nd ed. New Delhi: OUP, 2019.
- Monippally, Matthukutty, M. Business Communication: From Principles to Practice. NewDelhi: McGraw Hill Pub., 2018.
- Mukerjee, H. S. Business Communication: Connecting at Workplace. New-Delhi: Oxford University Press, 2012. • Murphy, H. A., Hildebrandt, H.W., and Thomas, J.P. Effective Business Communication. Boston: McGraw-Hill Companies, 1997.
- Ramesh, Gopalaswamy, and Mahadevan Ramesh. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Noida: Pearson, 2019.
- Sandra, M. O. Handbook of Corporate Communication and Strategic Public Relations: Pure and Applied. New Delhi: Routledge, 2004.
- Sinha, K. K. Taxmann's Business Communication.4th Revised ed. New Delhi: Taxmann's Pub., 2018.
- Sinha, R. P. Current English and Usage with Composition. New Delhi: OUP, 2013.
- Taylor, Grant. English Conversation Practice. Indian ed. Chennai: McGraw Hill Education Pvt. Ltd.

| English Language and Business Communication Lab<br>24UENG02 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-1 | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hrs. |
| **Prerequisite** | | | | | | | |

**Course Objectives:**

This course is designed to strengthen the communication abilities of the learners by providing them hands-on practice.

**Course Outcome:**

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

1) Demonstrate knowledge and understanding of a range of professional or public communication situations.

2) Perform effectively in diverse professional and public communication situations like interviews and negotiations, drafting emails and resume etc.

**Course Contents:**

1. Situational Conversations
2. Listening Skills
3. Resume Writing
4. Mock Interviews
5. Group Discussion
6. Presentation Skills
7. Negotiation Skills
8. Email Writing
9. Public Speaking

Note: The teacher should play the role of the facilitator and allow the learners maximum time to practice these activities. The focus should be primarily on helping the learners overcome the LSWR barrier and gradually move towards honing these skills to enable the learners use them in professional communication situations.

| Sustainability<br>24UENV01 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-<br>I | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 2 | 0 | 0 | 2 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 hrs. |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The students will try to learn:**

- To the design, manufacture and use of chemical products so as to reduce or eliminate chemical hazards intentionally.
- To create better, safer, chemicals while choosing the safest, most efficient ways to synthesis them.
- The main goal of Green Technology is to eliminate hazards right at the design stage.
- To demonstrate how chemical production could be achieved without posing hazard to human health and environment.

**Course Outcome:**

**After completion of the course, the student will be able to:**

CO1. Recall and demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns

CO2. Understand the need of green technology and its sustainability

CO3. Demonstrate critical thinking skills in relation to environmental affairs

CO4. Demonstrate an integrative approach to environmental issues with a focus on sustainability

CO5. Analyze the purpose and basic difference among various waste management techniques

CO6. Develop awareness on maintaining healthy environment **Course Content:**

**Unit-1**

**Ecosystem**: Structure of ecosystem, Biotic & Abiotic components, Food chain and food web, Aquatic (Lentic and Lotic) and terrestrial ecosystem, Carbon, Nitrogen, Sulphur, Phosphorus cycle. Global warming -Causes, effects, process, Green House Effect, Ozone depletion.

**Unit–2**

**Air and, Noise Pollution**: Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler). Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator). Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution

due to Refrigerants, I.C., Boiler. Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.

**Unit-3**

**Water and Soil Pollution**: Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation. Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis). Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

**Unit– 4**

Renewable sources of Energy, Solar Energy: Basics of Solar energy, Flat plate collector (Liquid & Air). Theory of flat plate collector, Importance of coating, Advanced collector, Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas. Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy. New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.

**Unit- 5**

**Solid Waste Management, ISO 14000 & Environmental Management-** Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste, Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries, Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.

Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board. Concept of Carbon Credit, Carbon Footprint. Environmental management in fabrication industry. ISO14000: Implementation in industries, Benefits.

**Text Books:**


1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi.
2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.


**References Books:**


1. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control
2. Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099-
2. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN 10: 0471144940.
3. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
4. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
5. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07- 451871-8.
6. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York; 1978, ISBN: 9780070354760. 10. Aldo Vieira, Da Rosa, Fundamental.

| Design Thinking 24UCEH01 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-I | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Objective:**

The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

**Course Outcome:**

CO1. Compare and classify the various learning styles and memory techniques and Apply them in their engineering education

CO2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products

CO3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products

CO4. Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development **Course Contents: Unit 1**

An Insight to Learning Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting. Remembering Memory Understanding the Memory process, Problems in retention, Memory enhancement techniques. Emotions: Experience & Expression Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

**Unit 2**

Basics of Design Thinking Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test. Being Ingenious & Fixing Problem Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving

**Unit 3**

Process of Product Design Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design. Prototyping & Testing What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing

**Unit 4**

Celebrating the Difference Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences Unit. Design Thinking & Customer Centricity Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

**Unit 5**

Feedback, Re-Design & Re-Create Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution".

# Semester-2

| Digital Electronics<br>24UCEE02 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester<br>– II | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | w.e.f. 2024-2025 | **Total** | : | 100 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hrs. |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:** The objectives of the course are -

- To understand the basics of Boolean algebra.
- To understand the combinational and sequential circuit with the difference between them.
- To understand A/D and D/A converters.

**Course Outcomes:**

The course will enable the student to:

CO1. Recall the basic concepts of digital logic and systems

CO2. Understand the working of digital logic families and logic gates.

CO3. Design and implement Combinational and Sequential logic circuits.

CO4. Understand the process of Analog to Digital conversion and Digital to Analog conversion.

CO5. Be able to use PLDs to implement the given logical problem.

**Course Contents:**

**Unit I: Fundamentals of Digital Systems and Boolean Algebra**

Information Representation: Number Systems - binary, signed binary, octal, decimal, hexadecimal; Binary Arithmetic, one's and two's complements arithmetic, Fixed-point and Floating-point representation of numbers, BCD

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Codes, Error detecting and correcting codes, Character Representation – ASCII, EBCDIC, Unicode.

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations.

Binary Logic: Boolean Algebra, Boolean Theorems, Boolean Functions and Truth Tables, Canonical and Standard forms of Boolean functions, Simplification of Boolean Functions –Venn Diagram, Karnaugh Maps

**Unit II: Combinational Digital Circuits**

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, DeMultiplexer / Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker / generator, code converters.

**Unit III: Sequential circuits and systems**

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K, T- and D-types flip flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

**Unit IV: A/D and D/A Converters**

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

**Unit V: Digital logic families, Semiconductor memories and PLDs**

Digital logic families: Examples of IC gates, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

**Suggested Text Book(s):**


1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.


**Reference Books:**


1. "Digital Principles and applications", Donald P Leach, Albert Paul Malvino, GoutamSaha. McGrawHill , 8th Edition,2015.
2. Digital Logic & State Machine Design, David J. Comer, Oxford University Press, 3rd Reprinted Indian Edition, 2012.
3. Digital Logic Design, R.D. Sudhakar Samuel, Elsevier.

| Digital Electronics Lab 24UCEE03 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-II | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hrs. |
| **Prerequisite** | | | | | | | |

**Course Objective:**

The objectives of the course are to make students aware about the practical implementation of Boolean logics, combinational and sequential circuits.

**Course Outcomes:**

At the end of this course, students will demonstrate the ability to

CO1. Recall theory and correlate with the practical

CO2. Understand working of logic families and logic gates

CO3. Design and implement Combinational and Sequential logic circuits for a given problem

CO4. Demonstrate the implementation of various flip-flops and their applications.

**Course Content:**

1. Implementation of AND, OR and NOT gate
2. Implement NAND and NOR gate, and show these are universal gates
3. To study and perform logic gates.
4. To study and perform De'Morgan's Theorem.
5. To study and perform NAND and NOR as a universal gate.
6. To design and implement a circuit that converts binary code to Grey code.
7. To study and perform about Half Adder and full Adder.
8. To study and perform about Half substractor and full substractor.
9. To design a 3-bit odd/even parity generator and checker.
10. To study and perform R-S and D flip flops.
11. To study and perform a J-K and T flip flop.
12. To study and perform a Master slave JK flip flop.
13. To realize Boolean functions using a multiplexer.
14. To study and perform about Decoder and Demultiplexer.
15. To study the use of decoder for BCD to seven segment LED display.

**Text books:**


1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.


**References books:**


1. "Digital Principles and applications", Donald P Leach, Albert Paul Malvino, Goutam Saha, McGrawHill , 8th Edition,2015.
2. Digital Logic & State Machine Design, David J. Comer, Oxford University Press, 3rd Reprinted Indian Edition, 2012
3. Digital Logic Design, R.D. Sudhakar Samuel, Elsevier

| Data Structures 24UCSE03 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-II | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | **22-7-24** | **Duration of Exam** | : | 3 Hrs. |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper as per the Revised Bloom Taxonomy. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The students will try to learn:**

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

**Course Outcomes:**

At the end of this course, the student will be able to:

CO1. Recall all the data structures and their operations
CO2. Understand the fundamental difference among different data structures
CO3. Analyse the algorithms to determine the time and computation complexity and justify the correctness.
CO4. Implement suitable representation (in form of a data structure) of given data for a given problem.
CO5. Differentiate among the various data structure and their time and space requirements

**Course Content:**

**Unit 1**

**Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

**Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

**Unit 2**

**Stacks and Queues:** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

**Unit 3**

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**Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching,
Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

**Unit 4**

**Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

**Unit 5**

**Sorting and Hashing:** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

**Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

**Text books:**

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, and Computer Science Press.

**Reference books:**

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.

| Data Structure Lab 24UCSE04 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-II | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Objective:**

To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees

**Course Outcome:**

At the end of this course, the student will be able to:

CO1. Recall the basic theory concepts
CO2. Implement basic data structure and its various operations to represent given data
CO3. Differentiate among the use of data structure
CO4. Provide an algorithm with suitable data structure to solve a given problem.

**Course Content:**

1. Write a program to search an element in an array using: linear search and binary search
2. Write a menu-driven program to perform array operations: search, insert at beginning, insertion at end, insertion after a given number, insertion before a given number, deletion from beginning, deletion from t end, deletion after a given number, deletion before a given number,
3. Write a Program to implement the operations of Singly Linked Lists.
4. Write a Program to implement the operations of doubly Linked Lists.
5. Write a Program to implement the operations of Circular Linked Lists.
6. Write a C program that uses stack operations to convert a given infix expression into its Postfix
7. Write a Program to Implement Queue Operations by using Array and Linked Lists.
8. Write a Program to implement factorial of n using stack.
9. Write a Program to Implement Circular Queue operations by using array and linked list.
10. Write a Program to Sort the set of elements: (i.e., numbers or strings)
    i). Quick Sort ii). Heap Sort. iii). Merge Sort
11. Write a Program to Implement the Binary Search Tree Operations.
12. Write a Program to Perform the Tree Traversal Techniques by using the Iterative Method 13. Write C programs for implementing the following graph traversal algorithms:
    a) Depth first traversal b) Breadth first traversal **Text**

**books:**

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

**References books:**

Monika

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education

| Python Programming<br>24UCEC02 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML)<br>Semester-II | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | 22 -7- 2024 | **Duration of Exam** | : | 3hr |
| **Prerequisite** | | | | | | | |

**Course Objective:**

The objective of this course is to introduce students to the Python programming language.

- To understand various data structures
- To visualize data in 2D
- To read files and handle exceptions

**Course Outcomes:**

The course will enable the student to:

CO1. Create, run and manipulate Python programs using core data structures like lists, tuples, dictionaries and use regular expressions.

CO2. Demonstrate proficiency in handling strings and file systems.

CO3. Implement Object Oriented Programming concepts in Python.

CO4. Analyze data with Python libraries. CO5. Understand the basic concepts of scripting and construct scripts in Python language.

**Course Contents:**

**Unit I: Fundamentals of Python Programming**

Python Introduction: Overview of Python, Features, History and versions, Applications, Installing and setting Python environment, Execution of Python program, Working in console and Python shell, Editor for Python code, Basic Syntax, Identifiers, Variables and Data Types, Keywords, Literals and Comments, Numbers, Strings, List, Tuple, Dictionary, Sets, Booleans, Operators and precedence, Built-in Functions, Related Modules.

Numbers: Introduction, Integers, Long, Floating Point Real Numbers, Complex Numbers, Conversion and functions.

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Control Statements: If, If-else, Nested If, For, While, range() function, Break, Continue, Pass.

Python: Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types.

**Unit II: Python Programming Constructs**

Sequences: Strings, Lists, Tuples, Sets, Dictionary.

Strings: Sequence operations, String Methods, Pattern Matching.

Regular Expressions: Introduction, Special Symbols and Characters, RE and Python, Pattern matching and searching, Password, email, url validation using regular expression.

Lists: Basic Operations, Iteration, Indexing, Slicing and Matrixes, List Functions and Methods.

Tuples: Basic Operations, Iteration, Indexing, Slicing And Matrices, Tuple Functions.

Sets; Dictionaries: Basic dictionary operations, Dictionary Functions and Methods.

Functions: Definition, Call, Arguments, Return statement, Scope rules, Name resolution, Passing Function to Functions, Python Built-In Functions, Related Modules.

**Unit III: Object oriented Programming and Modules in Python**

Object Oriented Programming in Python: Classes, Objects, Accessing Attributes, Inheritance, Polymorphism, Constructors and Destructors, Overloading operators and functions, Overriding methods, Data Hiding.

Modules: Modules and Files, Namespaces and scoping, Module Coding Basics, Creating and importing modules and attributes, Module Built-in Functions, dir(), globals(), locals(), reload(), Executing Modules as Scripts, Compiled Python files(.pyc), Standard Modules: OS, SYS, Math, Random, Statistics, Packages, Package creation and importing, Other features of modules, Date and Time modules.

**Unit IV: File and Exception Handling**

File Handling: File Objects, Built-in Functions, Methods and Attributes, Standard Files, Commandline Arguments, File System, Directories, File Execution, Persistent Storage Modules, Related Modules.

Exception Handling: Errors and Exception detection and handling, Context Management, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, Creating Exceptions, Exceptions and the sys Module, Related Modules, User-Defined Exceptions, Default Exception Handler, Regular expressions, User Defined Package with Python.

**Unit V: Python Frameworks, Packages and Libraries** Install

Python frameworks, packages and libraries.

Django: Overview, MVT design pattern, History; Create, run and modify a Project and App; Django

Model, Views and Templates, Render function, DTL (Django Template Language), Operations on Records, Tags and References, QuerySets, Sessions and Cookies, Integrate frameworks and libraries.

NumPy: Introduction, Mathematical and Statistical Analysis with NumPy, Arrays and array operations, functions and files.

Introduction to Pandas.

| Python Programming Lab<br>24UCEC03<br>B. Tech. CSE (AI/ML) Semester-II | | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 4 | 2 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | 22 -7- 2024 | **Duration of Exam** | : | 3hr |
| **Prerequisite** | | | | | | | |

**Objective:**

The objective of this course is to do hands-on practice of the Python programming language concepts and its frameworks and libraries.

**List of Laboratory / Practical**

1. Write a Python program to demonstrate different data types in Python.
2. Write a Python program to find the factorial of a number using recursion.
3. Write a program that asks the user for their name and greets them with their name.
4. Write a program that asks the user for a number n and gives them the possibility to choose between computing the sum and computing the product of 1,…,n.
5. Write a function that checks whether an element occurs in a list.
6. Write three functions that compute the sum of the numbers in a list: using a for-loop, a while-loop and recursion.
7. Given two strings, write a program that efficiently finds the longest common subsequence.
8. Write a NumPy program to compute the cross product of two given vectors
9. Write a NumPy program to calculate the QR decomposition of a given matrix
10. Write a Pandas program to convert a Panda Module Series to Python list and it's type.
11. Write a Pandas program to convert a NumPy array to a Pandas series
12. Create a Python project to get the citation from Google scholar using title and year of publication, and volume and pages of journal.
13. Create a Python project to get total Covid-19 cases, total deaths due to Covid-19, total Covid-19 patients recovered in the world.
14. Create a web application project using the Django framework.
15. Plot histogram and cumulative frequency of n input numbers.

16. Write a menu-driven program to create mathematical 3D objects: Curve, Sphere, Cone, Arrow, Ring, Cylinder.
17. Display different curves like, log(), exp(), sin(), cos().

**Suggested Text Books:**


1. Downey, A.B., (2015), Think Python – How to think like a Computer Scientist, 3rd edition. O'Reilly Media.
2. Taneja, S. & Kumar, N., (2017), Python Programming- A Modular Approach. Pearson Education.


**Reference Books:**


1. Head First Python by Paul Barry, O'Reilly, 2010.
2. Taming Python by Programming, Jeeva Jose, Khanna Book Publishing Co., Delhi.
3. Learning Python, 5th Edition, by Mark Lutz, O'Reilly Media, Inc., ISBN: 9781449355739.
4. Guttag, J.V.(2016), Introduction to computation and programming using Python. MIT Press.
5. Liang, Y.D. (2013), Introduction to programming using Python. Pearson Education.
6. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.


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# Semester 3

| Discrete Mathematics 24UCSE06 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech CSE(AI/ML) Semester – III | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 4 | 0 | 0 | 4 | | **External Examination** | : | 70 |
| **To be effect from:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **BoS approval Date:** | | | | 22 -7- 2024 | **Duration of Exam** | : | 3 Hours |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The Students will try to learn:**

1. To introduce the concept of Mathematical Logic, concepts of sets, relation and functions
2. to understand the induction principle and counting technique
3. To introduce the concept of propositional logic
4. To understand Group theory and related examples
5. To use Graph theory for solving problems **Course Outcomes:**

**After the completion of this course students will be able to:**

CO1. Ability for constructing mathematical logic to solve problems

CO2. Ability to analyse/ quantify the efficiency of a developed solution (algorithm) of a computational problem

CO3. Ability to understand mathematical preliminaries to be used in the subsequent courses of the curriculum. This includes Boolean algebra, number theory, group theory, and combinatorics.

CO4. Ability to understand diverse relevant topics in discrete mathematics and computation theory with an emphasis on their applicability as mathematical tools in computer science.

**Course Content:**

**Unit 1: Sets, Relation and Function**

Operations and Laws of Sets, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets Cartesian Products, Disjunctive and Conjunctive Normal Form Binary Relation : representation of relations, Partial Ordering Relation, Equivalence Relation, Image of a Set, Function: Sum and Product of Functions, Bijective functions, Inverse and Composite.

**Unit -2: Principles of Mathematical Induction**

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The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic **Basic counting techniques**-inclusion and exclusion, pigeon-hole principle, permutation and combination. Introduction to recurrence relations and generating functions.

**Unit-3: Propositional Logic**

Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof, Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

**Unit 4: Algebraic Structures and Morphism**

Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function. **Unit 5: Graph Theory** Graph Terminology, Planar graphs, Euler's formula (proof), Euler and Hamiltonian path/circuit. Chromatic number of a graph, five color theorem (proof), Shortest path and minimal spanning trees and algorithms, Depth-first and breadth first search, trees associated with DFS & BFS, Connected components. Complexity Analysis of the graph MST.

**Text Books:**


1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.


**Reference Books:**


1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science" , TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.
3. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson, Discrete Mathematics, Tata McGraw - Hill


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| Computer organization and Architecture<br>24UCSE07 |
|---|
| B. Tech. CSE(AI/ML) Semester<br>– III |

| L | T | P | Credits | Core Course | Internal Examination | : | 30 |
|---|---|---|---|---|---|---|---|
| 4 | 0 | 0 | 4 | | External Examination | : | 70 |
| To be effect from: | | | | w.e.f. 2023-2024 | Total | : | 100 |
| BoS approval Date: | | | | 22 -7- 2024 | Duration of Exam | : | 3 Hrs. |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The students will try to learn:**

1. Understand the organization and architecture of computer systems and electronic computers.
2. Study the assembly language program execution, instruction format and instruction cycle.
3. Design a simple computer using hardwired and micro-programmed control methods.
4. Study the basic components of computer systems besides the computer arithmetic.
5. Understand input-output organization, memory organization and management, and pipelining.

**Course Outcome:**

**After completion of the course the students are able to:**

CO1. To understand the functional blocks of a computer and their working.
CO2. Analyse the CPU organization along with Instruction Level Architecture, different addressing modes
CO3. Apply and analyse the pipelining for speed-up processing CO4.
Understand the working principles of I/O devices.
CO5. Understand and the current state of art in memory system design.
CO6. Analyse the suitable computer architecture for the real life application.

**Course Content:**

**Unit 1: Functional blocks of a Computer**

CPU, Memory, input/output subsystems, control unit, Multilevel viewpoint of a machine: digital logic, micro architecture, ISA, operating systems, high level language , RTL Computer Buses ( basic design using multiplexers), Bus width, Bus clocking( synchronous , asynchronous), bus arbitration, Bus examples( ISA bus, PCI bus, Universal serial bus) . Data representation: signed number representation, fixed and floating point representations.

**Unit 2: CPU Organization:**

Instruction set architecture of a CPU, interpretation of instructions, Instruction set based classification of processors (RISC, CISC, and their comparison). CPU Architecture types (accumulator, register, stack, memory/ register) Instruction cycle (Fetch-Decode-Execute)
Addressing modes (register, immediate, direct, indirect, indexed); Operations in the instruction set; Arithmetic and Logical, Data Transfer, Control Flow; Instruction set formats (fixed, variable, hybrid)

**Unit 3: Pipelining**

Manika

Basic concepts, throughput and speedup, hazards, Arithmetic Pipeline, Instruction Pipeline, Pipeline conflicts: Resource conflict, Data dependency, Branch Instructions. Solution for the data dependency: hardware interlock, operand forwarding, delayed load. Solution for branch instruction: prefetch target instruction, branch target buffer, loop buffer, branch prediction, delayed branch

**Unit 4: Input /Output & Control Unit**

Input Output Interface, Asynchronous data transfer (Strobe control, handshaking, serial transfer); Serial Vs parallel data transmission; Modes of data transfer, Programmed I/O, Interrupt driven, Direct Memory access (DMA). **Control Unit design:** Control unit design methods (hardwired & microprogrammed) Control Memory, Address Sequencing, Micro instructions.

**Unit 5: Memory Organization:**

Memory device characteristics (access/ cycle time, cost per bit, volatility, storage density); Memory hierarchy; Main memory Design (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types, their comparison); Associative memory Design, Match logic, Locality of reference principle (Temporal & Spatial) Cache mapping (Direct, associative, set associative); Cache writing policies (Copy-Back, Write-through); Virtual Memory (Address space, memory space, Address mapping using pages, Page replacement)

**Text Books:**


1. Computer System Architecture by M. Mano, Prentice-Hall.
2. Structured Computer Organisation by A.S. Tanenbaum, 6th edition, Prentice-Hall of India, Eastern Economic Edition **Reference Books:**

1. Computer Organization, 5th Edi, by Carl Hamacher, Zvonko Vranesic,2002, SafwatZaky.
2. Computer Organization and Design, 2nd Ed., by David A. Patterson and John L. Hennessy, Morgan 1997, Kauffmann.
3. Computer Architecture and Organization, 3rd Edi, by John P. Hayes, 1998, TMH
4. Computer Organisation& Architecture: Designing for performance by W. Stallings, 4th edition, 1996, Prentice-Hall International edition.


Monika

| B. Tech. CSE(AI/ML) Semester – III | | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| **3** | **0** | **0** | **3** | | **External Examination** | : | 70 |
| **To be effect from:** | | | | w.e.f. 2024-2025 | **Total** | : | 100 |
| **BoS approval Date:** | | | | 22 -7- 2024 | **Duration of Exam** | : | 3 Hrs. |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 20 marks.
3. Apart from question 1 which is compulsory, the rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

The objectives are:

- To inculcate the basic understanding of the basic concepts and applications of database systems
- To inculcate understanding of the relational database design principles **Course Outcome:**

After completion of the course, the student will be able to:

CO1. Recite the fundamental concepts of database management system
CO2. Understand basics of database systems, need of normalization
CO3. Demonstrate the basic elements of a relational database management system
CO4. Identify a suitable data model for a given problem
CO5. Explain the main issues related to transaction and data storage with probable solution

**Course Content:**

**Course Content:**

**Unit 1**

Database system architecture: - Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: - Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

**Unit 2**

Entity Relationship Modelling: Entity Type, Entity Set, Attributes, Keys, Relationship Degree, Role Names, and Recursive Relationships, Weak Entity Sets, ER Modelling, subclasses, Superclass, inheritance. ER to Relational Mapping

**Unit 3**

Relational query languages:- Relational algebra, Tuple and domain relational calculus, SQL latest version, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB latest version, SQL server. Relational database design: - Domain and data dependency, Armstrong's axiom, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: - Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

**Unit 4**

Database consistency, ACID properties.

Concurrency control Techniques: Two-Phase Locking Techniques for Concurrency Control-Basic, Conservative, Strict, and Rigorous Two-Phase Locking. Deadlock Prevention Protocol, Deadlock Detection, Concurrency Control Based on Timestamp Ordering

**Unit 5**

Disk Storage: Secondary Storage Device, Buffering of Blocks, Records and Record Types. Allocating File Blocks on Disk, and its operations, Hashing Techniques: Internal and External Hashing Techniques, Parallelizing Disk Access Using RAID Technology

File structure: Indexing structure for files, Primary Indexes, Clustering Indexes, Secondary Indexes, Multilevel Indexes, Indexes on Multiple Keys

**Text Books:**

1. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education.

**REFERENCES BOOKS:**

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.2.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, AddisonWesley

| |
|---|
| **Database Management System lab**<br>**24UCSE09** |
| **B. Tech. CSE(AI/ML) Semester – III** |

| L | T | P | Credits | Core Course | Internal Examination | : | 35 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 2 | 1 | | External Examination | : | 15 |
| To be effect from: | | | | w.e.f. 2024-2025 | Total | : | 50 |
| BoS approval Date: | | | | 22 -7- 2024 | Duration of Exam | : | 3 Hrs. |

**Course Objective:**

**The students will try to learn:**

- To create a database and query it using SQL, design forms and generate reports
- Understand the significance of integrity constraints, referential integrity constraints, triggers, assertions.

**Course Outcome:**

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

CO1. Recite the syntax of different type of query languages like, data manipulation language, data control language and data definition language

CO2. Understand the database creation and imposing different constraints on the database

CO3. Fetch the required data from the database by writing appropriate query CO4.

Differentiate among the different types of normalization and join operations **Course Content:**

Tentative list of practical's:

**Create the following schemas:**

**EMPLOYEE Schema**

| Field | Type | NULL | KEY |
|---|---|---|---|
| Empno | char(3) | NO | PK |
| Ename | VARCHAR(10) | NO | NIL |
| Job | VARCHAR(9) | NO | NIL |
| Mgr | INT | YES | FK |
| Hiredate | DATE | NO | NIL |
| Salary | NUMERIC(7,2) | NO | NIL |
| Commission | NUMERIC(7,2) | YES | NIL |
| Deptno | INT | NO | FK |

**DEPARTMENT Schema**

| Field | Type | NULL | KEY |
|---|---|---|---|
| deptno | INT | NO | PK |
| deptName | VARCHAR(50) | YES | NIL |
| Location | VARCHAR(30) | YES | NIL |

**Perform the following queries:**

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.



Recruiter.

3. Query to display the Employee Name concatenated by a Job separated by a comma.
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than $2850.
6. Query to display Employee Name and Department Number for the Employee No= 7900.
7. Query to display Employee Name and Salary for all employees whose salary is not in the range of $1500 and $2850.
8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
9. Query to display Name and Hire Date of every Employee who was hired in 1981.
10. Query to display Name and Job of all employees who don't have a current Manager.
11. Query to display the Name, Salary and Commission for all the employees who earn commission.
12. Sort the data in descending order of Salary and Commission.
13. Query to display Name of all the employees where the third letter of their name is 'A'.
14. Query to display Name of all employees who either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Manager's Employee No = 7788.
15. Query to display Name, Salary and Commission for all employees whose Commission amount is 14 greater than their Salary increased by 5%.
16. Query to display the Current Date.
17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
18. Query to display Name and calculate the number of months between today and the date each employee was hired.
19. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.
20. Query to display Name with the 1st letter capitalized and all other letters lowercase and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.
21. Query to display Name, Hire Date and Day of the week on which the employee started.
22. Query to display Name, Department Name and Department No for all the employees.
23. Query to display Unique Listing of all Jobs that are in Department # 30.
24. Query to display Name, Dept Name of all employees who have an 'A' in their name.
25. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.
26. Query to display Name and Employee no. Along with their Manager's Name and the Manager's employee no; along with the Employees' Name who do not have a Manager.
27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies $100.
29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees
30. Query to display the number of employees performing the same Job type functions.
31. Query to display the no. of managers without listing their names.
32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
33. Query to display Name and Hire Date for all employees in the same dept. as Blake.
34. Query to display the Employee No. And Name for all employees who earn more than the average salary.



Manila

35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.
36. Query to display the names and salaries of all employees who report to King.
37. Query to display the department no, name and job for all employees in the Sales department

**Text Book:**

1. Elmasri, R., & Navathe, S.B. (2015). *Fundamentals of Database Systems.* 7th edition. Pearson Education.

**References:**

1. Date, C. J. (2004). *An Introduction to database systems.* 8th edition. Pearson Education.
2. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2010). *Database System Concepts.* 6th edition. McGrawHill

| Design and Analysis of Algorithms<br>24UCSE12 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE(AI/ML) Semester<br>– III | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **To be effect from:** | | | | w.e.f. 2024-25 | **Total** | : | 100 |
| **BoS approval Date:** | | | | 22 -7- 2024 | **Duration of Exam** | : | 3 Hours |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

The objective of this paper is to teach the students various problem solving strategies like divide and conquer, Greedy method, Dynamic programming and also the mathematical background for various algorithms. After doing this course, students will be able to select an appropriate problem solving strategies for real world problems. This will also help them to calculate the time, complexity and space complexity of various algorithms.

**Course Outcome:**

**After Completion of the course students will be able to:**

CO1. To be able to analyse a problem in terms of processing steps, time and space complexity.
CO2. To be able to design and implement the algorithms for any given application.
CO3. To be able to develop software applications using various programming languages in collaborative groups.
CO4. To apply the principles learnt in solving problems encountered in career or real-life situations.

**Course Content:**

**Unit-I**

Brief Review of Graphs, Sets and disjoint sets, union, sorting and searching algorithms and their analysis in terms of space and time complexity. Divide and Conquer: General method, binary search, merge sort, quick sort, selection sort, Strassen's matrix multiplication algorithms and analysis of algorithms for these problems.

**Unit-II**

Greedy Method: General method, knapsack problem, job sequencing with deadlines, minimum spanning trees, single source paths and analysis of these problems.

Dynamic Programming: General method, optimal binary search trees, O/I knapsack, the traveling salesperson problem.

**Unit-III**

Back Tracking: General method, 8 queen's problem, graph colouring, Hamiltonian cycles, analysis of these problems.

**Unit-IV**

Branch and Bound: Method, O/I knapsack and traveling salesperson problem, efficiency considerations. Techniques for algebraic problems, some lower bounds on parallel computations.

**Unit-V**

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph and NP scheduling problems some simplified NP hard problems.

**Text books:**

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publ., 2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson And Ronald L Rivest: 1990, TMH

**Reference books:**


1. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
2. Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986. Johan Wiley & Sons,
3. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetnieni, 1997, MGH.
4. Introduction to Computers Science- An algorithms approach, Jean Paul Trembley, Richard B.Bunt, 2002, T.M.H. .


Mamita

| Design and Analysis of Algorithms Lab<br>24UCSE13 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE(AI/ML) Semester – III | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | **35** |
| 0 | 0 | 2 | 1 | | **External Examination** | : | **15** |
| **To be effect from:** | | | | **w.e.f. 2024-2025** | **Total** | : | **50** |
| **BoS approval Date:** | | | | 22 -7- 2024 | **Duration of Exam** | : | - |

**List of Practical's:**

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using OpenMP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Obtain the Topological ordering of vertices in a given digraph.
4. Compute the transitive closure of a given directed graph using Warshall's algorithm
5. Implement 0/1 Knapsack problem using Dynamic Programming.
6. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
7. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
8. i) Print all the nodes reachable from a given starting node in a digraph using BFS method.
   ii) Check whether a given graph is connected or not using DFS method.
9. Find a subset of a given set S = {sl, s2, .... ,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1, 2, 6} and {1, 8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
10. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
11. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
12. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
13. Implement N Queen's problem using Back Tracking **Text books:**

**1.** Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publ., **2.** Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson And Ronald L Rivest: 1990, TMH

**Reference books:**

1. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
2. Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986. Johan Wiley & Sons,
3. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetnieni, 1997, MGH.
4. Introduction to Computers Science- An algorithms approach, Jean Paul Trembley, Richard B.Bunt, 2002, T.M.H

| Artificial Intelligence (24UCSE10) | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE(AI/ML) Semester – III | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **To be effect from:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |

| BoS approval Date: | 22 -7- 2024 | Duration of Exam | : | 3 Hrs. |
|---|---|---|---|---|

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

This course will give an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science. This course will give the students a rigorous, advanced and professional graduate-level foundation in Artificial Intelligence (AI).

**Course Outcome:**

After undergoing this course, the students will be able to: CO1. Recognize the basic concept of AI

CO2. Understand different searching algorithms and the difference among their working principal. Also, basic understanding of probability theory

CO3. Identify a search algorithm for a given problem and estimate its time and space complexities

CO4. Learn optimization and inference algorithms for model learning

CO5. Model a given scenario in the form of knowledge representation and frames

CO6. Implement basics AI programming in python **Course Content:**

**Unit-1**

**Introduction:** Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

**Unit-2**

**Search Algorithms:** Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

**Unit-3**

**Probabilistic Reasoning:** Probability, conditional probability, Bayes Rule, Bayesian Networks-representation, construction and inference, temporal model, hidden Markov model.

**Unit-4**

**Knowledge Representation and Reasoning**

First Order Logic, building knowledge-bases, Logic based Reasoning Systems, Semantic Networks, Frames

**Unit-5**

**Prolog Programming Prolog Programming:** Introduction to Programming in Logic (PROLOG), Lists, Operators, basic Input and Output.

**Text Books:**

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall
3. Bratko, I. (2011). *Prolog Programming for Artificial Intelligence.* 4th edition. Pearson Education

**References:**

1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press.

Mamta

| **Artificial Intelligence Lab (24UCSE11)** |
| --- |
| **B. Tech. Semester – III AI/ML**<br>**w.e.f. 2023-2024** |

| L | T | P | Credits | Core Course | Internal Examination | : | 35 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 2 | 1 | | External Examination | : | 15 |
| To be effect from: | | | | w.e.f. 20242025 | Total | : | 50 |
| BoS approval Date: | | | | 22 -7- 2024 | Duration of Exam | : | - |

**Course Objective:**

This course will give an opportunity to learn programming in PROLOG.

**Course Outcome:**

After undergoing this course, the students will be able to:

CO1. Recall the basic syntax and semantics of PROLOG
CO2. Understand the knowledge representation in PROLOG
CO3. Implement small programs in PROLOG
CO4. Differentiate the basic difference between AI programming and programming in other languages

**List of Practicals:**

1. Write a prolog program to calculate the sum of two numbers.
2. Write a Prolog program to implement max(X, Y, M) so that M is the maximum of two numbers X and Y.
3. Write a program in PROLOG to implement factorial (N, F) where F represents the factorial of a number N
4. Write a Prolog program to implement member(A, S): to check whether A is a member of S or not.
5. Write a Prolog program to implement multiply(X1, X2, M) : where X1 and X2 denotes the numbers to be multiplied and M represents the result.
6. Write a Prolog program to implement GCD of two numbers
7. Write a program in PROLOG to implement palindrome (S) which checks whether a list S is a palindrome or not
8. Write a Prolog program to implement maxlist(S, M); minList(S, M) so that M is the maximum/minimum number in the list.
9. Write a Prolog program to merge two lists.
10. Write a prolog program to implement insert_nth (I, N, S, R) that inserts an item I into Nth position of list S to generate a list R
11. Write a prolog program to implement delete_nth (N, S, R) that removes Nth position item of list S to generate a list R.

**Text Books:**


1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall
3. Bratko, I. (2011). *Prolog Programming for Artificial Intelligence*. 4th edition. Pearson Education

**References books:**

1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

# Semester- 4

| Operating system<br>24UCSE14 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester<br>– IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

**The students will try to learn:**

1. Problem-solving through programming
2. Programming language, programming, reading a set of Data, stepwise refinement, concepts of Loops, Functions, Control structure, Arrays, Structure, Pointer and File concept.
3. To build efficient programs in 'C' language essential for future programming and software engineering courses.

**Course Outcome:**

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

CO1. Understand how an operating system manages all the resources in a computer system efficiently.
CO2. Learn algorithms for CPU scheduling, deadlock handling, page replacement and disk scheduling used by an operating system.
CO3. Use shell commands to efficiently operate a computer system.
CO4. Learn and use system calls for process creation and termination, inter-process communication, process synchronization, memory management and file system management.
CO5. analyses segmentation and paging techniques.
CO6. Compare file naming in Linux and Windows

**Course Content:**

**Unit-I**

Introduction: Introduction to Operating System Concepts (including Multitasking, multiprogramming, multi user, Multithreading etc)., Types of Operating Systems: Batch operating system, Time-sharing systems, Distributed OS, Network OS, Real Time OS; Various Operating system services, architecture, System programs and calls.



Mamta

**Unit–II**

Process Management: Process concept, process scheduling, operation on processes; CPU scheduling, scheduling criteria, scheduling algorithms -First Come First Serve (FCFS), Shortest-Job-First (SJF), Priority Scheduling, Round Robin(RR), Multilevel Queue Scheduling.

**Unit–III**

Memory Management: Logical & Physical Address Space, swapping, contiguous memory allocation, non-contiguous memory allocation paging and segmentation techniques, segmentation with paging; virtual memory management - Demand Paging & Page-Replacement Algorithms; Demand Segmentation.

**Unit–IV**

Process-Synchronization & Deadlocks: Critical Section Problems, semaphores; methods for handling deadlocks-deadlock prevention, avoidance & detection; deadlock recovery.
File System: Different types of files and their access methods, directory structures, various allocation methods, disk scheduling and management and its associated algorithms, Introduction to distributed file system.

**Unit V**

I/O Systems: I/O Hardware, Application I/O Interface, Kernel, Transforming I/O requests, Performance Issues. Unix System And Windows NT Overview: Unix system call for processes and file system management, Shell interpreter, Windows NT architecture overview, Windows NT file system.

**Text Books:**


1. Operating System Concepts by Silberchatz et al, 5th edition, 1998, Addison-Wesley.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings,4thedition, 2001, Prentice Hall


**Reference Books:**


1. Operating System by Peterson, 1985, AW.
2. Operating System by Milankovic, 1990, TMH.
3. Operating System Incorporating With Unix& Windows By Colin Ritche, 1974, TMH.
4. Operating Systems by Mandrik & Donovan, TMH
5. Operating Systems – Advanced Concepts By MukeshSinghal , N.G. Shivaratri, 2003, T.M.H


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| Operating System Lab 24UCSE15 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | - |
| **Prerequisite** | | | | | | | |

**Course Objective:**

**The students will try to learn:**

Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.

**Course Outcome:**

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

CO1. Understand how an operating system manages all the resources in a computer system efficiently.
CO2. Learn algorithms for CPU scheduling, deadlock handling, page replacement and disk scheduling used by an operating system.
CO3. Use shell commands to efficiently operate a computer system.
CO4. Learn and use system calls for process creation and termination, inter-process communication, process synchronization, memory management and file system management.

**List of Practical's**

1. Write a program to implement CPU scheduling for first come first serve.
2. Write a program to implement CPU scheduling for shortest job first.
3. Write a program to perform priority scheduling.
4. Write a program to implement CPU scheduling for Round Robin.
5. Write a program for page replacement policy using a) LRU b) FIFO c) Optimal.
6. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
7. Write a program to implement reader/writer problem using semaphore.
8. Write a program to implement Banker's algorithm for deadlock avoidance

**Text Books:**


1. Operating System Concepts by Silberchatz et al, 5th edition, 1998, Addison-Wesley.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings,4thedition, 2001, PrenticeHall


**Reference Books:**


1. Operating System by Peterson, 1985, AW.
2. Operating System by Milankovic, 1990, TMH.
3. Operating System Incorporating With Unix& Windows By Colin Ritche, 1974, TMH.
4. Operating Systems by Mandrik & Donovan, TMH
5. Operating Systems – Advanced Concepts By MukeshSinghal , N.G. Shivaratri, 2003, T.M.H

| Object Oriented Programming using C++<br>24UCSE19 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester<br>– IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 202 4-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs. |
| **Prerequisite** | | | | Programing with C | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The students will try to learn:**

1. To introduce the basic Concepts of Object Oriented Programming (data types, operators and functions) using C++
2. To introduce concepts of Classes and Objects with the examples of C++ programming
3. To understand object oriented features such as Inheritance and Polymorphism
4. To use various object oriented concepts (exceptional handling) to solve different problems

**Course Outcomes:**

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

CO1: Ability to have an in-depth knowledge of object-oriented programming paradigm
CO2: To be able to develop basic C++ programming skills
CO3: To be able to apply various object-oriented features using C++
CO4: Ability to understand generic programming & standard templates **Course**

**Contents:**

**Unit 1: Basic Concepts of Object Oriented Programming**

Procedural Vs. Object oriented Programming, C++ Standard Library, Pre-processor Directives, illustrative Simple C++ Programs. Header Files and Namespaces, library files. Object Oriented Concepts: Introduction to Objects and Classes, Data Abstraction, Encapsulation (Information Hiding), Access Modifiers: Controlling access to a class, method, or variable (public, protected, private), Polymorphism, Inheritance, and Reusability
Classes: - Introduction, Structure Vs. Class, Class Scope and Accessing Class Members

**Unit 2: Constructors in a class**

Specifying a class, Member Functions, Encapsulation, information hiding, abstract data types, objects & classes, Arrays of Objects, Constructors & Destructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, identity and behaviour of an object, C++ garbage collection, dynamic memory allocation, Explicit Type Conversions.

**Unit 3: Function and Overloading**

Static Member function: Friend Function and Friend Classes, Using This Pointer, Container Classes and Iterators, Function overloading, Fundamentals of Operator Overloading, Restrictions on Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading Binary Operators (+,-,*, /,=),Overloading Unary Operators(-,++,--,)

**Unit 4: Inheritance and Virtual Functions**

Introduction, Types of Inheritance, Base Classes and Derived Classes, Virtual Base class, Casting Base Class Pointers to Derived- Class Pointers, Using Member Functions, Overriding Base - Class Members in a Derived Class, Public, Protected and Private Inheritance, Using Constructors and Destructors in derived Classes, Composition Vs. Inheritance, Overloading Vs. Overriding. Run Time Polymorphism, Introduction to Virtual Functions, Pure Virtual Functions, Abstract Base Classes and Concrete Classes, Dynamic Binding, Virtual Destructors, Dynamic Binding.

**Unit 5: Files, Templates and Exception Handling**

Files and I/O Streams and various operation on files. Stream Input/output Classes and Objects, Stream Output, Stream Input, Unformatted I/O (with read and write), Stream Manipulators, Stream Format States, Stream Error States.

**Templates & Exception Handling**: - Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters, Templates and Inheritance, Templates and Friends.

**Basics of C++ Exception Handling:** - Try Throwing, Catch, and Throwing an Exception; - Catching an Exception, Re-throwing an Exception, Processing Unexpected Exceptions, Constructors, Destructors and Exception Handling.

**Text Books:**


1. Object Oriented Programming in Turbo C++ by Robert Lafore ,1994, The WAITE Group Press.
2. Programming with C++ By D Ravichandran, 2003, T.M.H 3. Object oriented Programming with C++ by E Balagurusamy, 2001, Tata McGraw-Hill.


**Reference Books:**


1. C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall 2.
Computing Concepts with C++ Essentials by Horstmann, 2003, John Wiley, 3.
The Complete Reference in C++ By Herbert Schildt, 2002, TMH.
4. C++ Programming Fundamentals by Chuck Easttom, Firewall Media

| Object Oriented Programming using C++ Lab<br>24UCSE20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML)<br>Semester-IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Objectives:**

**The students will try to learn:**

1. To introduce the basic Concepts of Object-oriented Programming (data types, operators and functions) using C++
2. To introduce concepts of Classes and Objects with the examples of C++ programming
3. To understand object-oriented features such as Inheritance and Polymorphism
4. To use various object-oriented concepts (exceptional handling) to solve different problems

**Course Outcomes:**

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

CO1. understand an in-depth knowledge of object-oriented programming paradigm
CO2. Develop basic C++ programming skills
CO3. Apply various object-oriented features using C++
CO4. Understand generic programming & standard templates CO5.
Understand and implement Function and Operator Overloading

**List of Practical's:**

1. Write a program for multiplication of two matrices using OOP.
2. Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imag parts to equal values and third which takes two argument is used to initialized real and imag to two different values.
3. Write a program to find the greatest of two given numbers in two different classes using friend function.
4. Implement a class string containing the following functions: - Overload + operator to carry out the concatenation of strings. - Overload = operator to carry out string copy. - Overload <= operator to carry out the comparison of strings. - Function to display the length of a string. - Function tolower( ) to convert upper case letters to lower case. - Function toupper( ) to convert lower case letters to upper case.

Monika

5. Create a class called LIST with two pure virtual function store() and retrieve().To store a value call store and to retrieve call retrieve function. Derive two classes stack and queue from it and override store and retrieve.
6. Write a program to define the function template for calculating the square of given numbers with different data types.
7. Write a program to demonstrate the use of special functions, constructor and destructor in the class template. The program is used to find the bigger of two entered numbers.
8. Write a program to perform the deletion of white spaces such as horizontal tab, vertical tab, space, line feed, new line and carriage return from a text file and store the contents of the file without the white spaces on another file.
9. Write a program to read the class object of student info such as name , age ,sex ,height and weight from the keyboard and to store them on a specified file using read() and write() functions. Again the same file is opened for reading and displaying the contents of the file on the screen.
10. Write a program to raise an exception if any attempt is made to refer to an element whose index is beyond the array size.

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| Machine Learning 24UCSE17 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first ( 1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The students will try to learn:**

1. Learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
2. Design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. Explore Deep learning technique and various feature extraction strategies **Course Outcomes:**

**After Completion of this course the students will be able to:**

CO1. Understand use of the basic methods of supervised learning with linear models and binary classification included in multi-class outputs.
CO2. Understand decision trees, support vector machines in optimizing basic methods of regression
CO3. Apply the key issues and applications in clustering and dimensionality reduction.
CO4. Apply matrix factorization used to process reduction in unsupervised learning.
CO5. Apply algorithms in optimizing statistical learning theory and methods in machine learning.

**Detailed Contents:**

**UNIT-1: Supervised Learning (Regression/Classification)**

**Basic methods:** Distance-based methods, Nearest-Neighbors, Decision Trees, Naive Bayes
**Linear models:** Linear Regression, Logistic Regression, Generalized Linear Models
Support Vector Machines, Nonlinearity and Kernel Methods
**Beyond Binary Classification:** Multi-class/Structured Outputs, Ranking

**UNIT-2: Unsupervised Learning**

**Clustering:** K-means/Kernel K-means
**Dimensionality Reduction:** PCA and kernel PCA



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Matrix Factorization and Matrix Completion
Generative Models (mixture models and latent factor models)

**UNIT-3: Machine Learning**

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

**UNIT-4: Modelling Techniques**

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

**UNIT-5: Scalable Machine Learning**

Scalable Machine Learning (Online and Distributed Learning)
A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference
Recent trends in various learning techniques of machine learning and classification methods for IOT applications, various models for IOT applications.

**Text Books:**

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

**Reference Books:**

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

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| Machine Learning Lab 24UCSE18 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Objectives:**

**The students will try to learn:**

1. Learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
2. Design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. Explore Deep learning technique and various feature extraction strategies **Course Outcomes:**

**After Completion of this course the students will be able to:**

CO1. Understand use of the basic methods of supervised learning with linear models and binary classification included in multi-class outputs.
CO2. Understand decision trees, support vector machines in optimizing basic methods of regression
CO3. Apply the key issues and applications in clustering and dimensionality reduction.
CO4. Apply matrix factorization used to process reduction in unsupervised learning.
CO5. Apply algorithms in optimizing statistical learning theory and methods in machine learning.

**List of Practical's:**

1. Study and Implement the Naive Bayes learner. (The datasets taken can be: Breast Cancer data file or Reuters data set).
2. Study and Implement the Decision Tree learners. (The datasets taken can be: Breast Cancer data file or Reuter"s data set).
3. Estimate the accuracy of decision classifier on breast cancer dataset using 5-fold cross-validation. (You need to choose the appropriate options for missing values).
4. Estimate the precision, recall, accuracy, and F-measure of the decision tree classifier on the text classification task for each of the 10 categories using 10-fold cross-validation.
5. Develop a machine learning method to classifying your incoming mail.
6. Develop a machine learning method to Predict stock prices based on past price variation.
7. Develop a machine learning method to predict how people would rate movies, books, etc.
8. Develop a machine learning method to Cluster gene expression data, how to modify existing methods to solve the problem better
9. Select two datasets Each dataset should contain examples from multiple classes. For training purposes assume that the class label of each example is unknown (if it is known, ignore it). Implement the Kmeans algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of Euclidean distance of each example from its class centre. Test the performance of the algorithm as a function of the parameter k.

10. Implement the EM algorithm assuming a Gaussian mixture. Apply the algorithm to your datasets and report the parameters you obtain. Evaluate performance by measuring the sum of Mahalanobis distance of each example from its class centre. Test performance as a function of the number of clusters.
11. Suggest and test a method for automatically determining the number of clusters. Using a dataset with known class labels compare the labelling error of the K-means and EM algorithms. Measure the error by assigning a class label to each example. Assume that the number of clusters is known.

**Text book/Reference Books:**


1. Stephen Marsland, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC; 2nd edition (8 October 2014)
2. Bishop, C.M., Pattern recognition and machine learning. Springer; 1st ed. 2006. Corr. 2nd printing 2011 edition (15 February 2010)
3. Tom Mitchell, Machine Learning, McGraw Hill Education; First edition (1 July 2017)


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| Computer Networks 24UCSE16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 4 | 0 | 0 | 4 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

**The students will try to learn:**

1. The modern network architectures from a design and performance irrespective.
2. The basics and challenges of network communication.
3. Provide an opportunity to do network programming using TCP/IP.
4. The operation of the protocols that are used inside the Internet.

**Course outcomes:**

**After Completion of this course students will be able to:**

CO1. Acquire a thorough understanding of the state-of-the-art in modern network architecture, protocols, networked systems and applications

CO2. Understand proficient to develop software for modern networking devices

CO3. To have sufficient background knowledge to conduct networking research and develop innovative ideas.

CO4. Analyze Congestion Control Techniques LAN

CO5. Understand and Implement Protocols of Application Layers **Course**

**Content:**

**Unit 1: Introduction**

Fundamentals of Digital Communication, Network Classification, Protocol Architecture: Design Issues for the Layers, The TCP/IP Protocol Architecture, The ISO/OSI Model, Other protocols such as SNA, Appletalk, Netware etc.

Physical Layer: Data Transmission Concepts, Transmission Media, Signal Encoding Techniques, Digital Data Communication Techniques - Asynchronous and Synchronous Transmission, Error Detection, Error Correction, Multiplexing – FDM, TDM, ADSL, xDSL



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**Unit 2: Data Link Layer**

Main Functions, Framing, Error Control, Flow Control, Error Correcting Codes, Error-Detecting Codes, Data Link Protocols: Stop-and-Wait Protocol, One-Bit Sliding Window Protocol, Go Back N, Selective Repeat,
Medium Access Control Sublayer: Channel Allocation: Static, Dynamic, MAC PROTOCOLS – ALOHA, CSMA, Collision-Free Protocols, Limited-Contention Protocols, Detailed Study of Ethernet, 802.11 WIRELESS LANS

**Unit 3: Network Layer**

Functions, Design Issues, Internetworks: Principle, Protocols and Operations, IP Protocol: IPv4 Header, Addresses, Operation, Subnetting, Classless Interdomain Routing, Network Address Translation, Internet Control Protocol - ARP, RARP, BOOTP, DHCP, OSPF, BGP, IGMP; Problems of IPv4, IPv6, Routing Algorithms.

**Unit 4: Congestion Control Techniques LAN**

Topologies and Transmission Media, Protocol Architecture, Bridges, Switches WAN: Switched Communications Networks, ATM Communication
**Transport Layer:** Functions, Design Issues, TCP, UDP

**Unit 5: Application Layer**

Internet Applications: FTP, Telnet, DNS, HTTP, SMTP, SNMP Security in Computer Networks: Fundamentals of Network Security, Encryption, Cryptography, Securing E-mail, Securing TCP Connections: SSL
Network-Layer Security: IPsec, Securing Wireless LANs, Operational Security: Firewalls and Intrusion Detection Systems.

**Text Books:**

1. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education **Reference**

**Books**

1. William Stallings, "Data and Computer Communication", 10th Edition, Pearson Education
2. James F. Kurose & Keith W. Ross, "Computer Networking: A Top –down approach", 6th Edition, Pearson Education
3. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education.

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| Software Engineering<br>24UCSE21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester<br>– IV | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives**

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

**Course Outcomes:**

After Completion of this course students will be able to:

CO1. Understand the basic principles of Software engineering and its development processes. CO2. Analyze the software requirement in terms of functional and non-functional

CO3. Create and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.

CO4. Evaluate and experience and/or awareness of testing problems and will be able to develop a simple testing report

CO5. Apply and evaluate the metrics for the assessment of the software quality **Course**

**Contents:**

**UNIT – I: Introduction to Software Engineering**

The evolving role of software, changing nature of software, Software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

**UNIT – II: Software Requirements**

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Functional and non-functional requirements, user requirements, system Requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.
System models: Context models, behavioral models, data models, object models, structured methods.

**UNIT – III: Design Engineering**

Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modelling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

**UNIT – IV: Testing Strategies**

A strategic approach to software testing, test strategies for conventional software, black-box and whitebox testing, validation testing, system testing, the art of debugging.
**Product metrics:** Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

**UNIT – V: Metrics for Process and Products**

Software measurement, metrics for software quality. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

**Text Books:**


1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2ndEd., New Age International,2005
3. Software Engineering- Sommerville, 7th edition, Pearson Education.
4. The unified modelling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.


**Reference Books:**


1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson


Manika

# Semester 5

| Theory of Computation 24UCSE22 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – V | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 4 | 0 | 0 | 4 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

**The students will try to learn:**

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing 3. To explain the hierarchy of problems arising in the computer sciences.
4. To familiarize Regular grammars, context frees grammar.

**Course Outcome:**

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

CO1. Demonstrate advanced knowledge of formal computation and its relationship to languages.
CO2. Distinguish different computing languages and classify their respective types.
CO3. Recognize and comprehend formal reasoning about languages.
CO4. Understand operation and application of Turing Machine
CO5. Apply the Recursive and recursively enumerable languages **Course**

**Content:**

**Unit-I**

Basic Computational Constructs: Finite State Systems, Basic Definitions Non-Deterministic finite automata (NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA Finite automata with E-moves, Regular Expressions, Equivalence of finite automata and Regular

Expressions, Regular expression conversion and vice versa. Conversion of NFA to DFA by Arden's Method Concept of basic Machine, Properties and limitations of FSM, Moore and Mealy Machines, Equivalence of Moore and Mealy machines.

**Unit-II**

Regular Sets& Grammars: The Pumping Lemma for Regular Sets, Applications of the pumping lemma, Closure properties of regular sets, Myhill-Nerode Theorem and minimization of finite Automata, Minimization Algorithm.
Context free and Context sensitive grammar, Ambiguity regular grammar, Reduced forms, Removal of useless Symbols and unit production, Chomsky Normal Form (CNF), Griebach Normal Form (GNF).

**Unit-III**

Pushdown Automata &Turing Machines: Introduction to Pushdown Machines, Applications of Pushdown Machines Deterministic and Non-Deterministic

**Unit IV: Turing Machines**

Definitions of Turing machines, Computable languages and functions, Techniques for Turing machine construction, Multi head and Multi tape Turing Machines, The Halting problem, Partial Solvability, Problems about Turing machine- Chomsky hierarchy of languages.

**Unit-V**

Unsolvable Problems and Computable Functions, Primitive recursive functions, Recursive and recursively enumerable languages, Universal Turing machine, Measuring and classifying complexity - Tractable and Intractable problems, Tractable and possibly intractable problems, P and NP completeness, Polynomial time reductions, NP-complete problems from other domains: graphs (clique, vertex cover, independent sets, Hamiltonian cycle), number problem (partition), set cover.

**Text book:**

1. Introduction to automata theory, language & computations- Hopcroaft & O. D. Ullman, R Mothwani, Addison Wesley Publishers

**Reference books:**

1. Theory of Computer Sc.(Automata, Languages and computation): K. L. P. Mishra & N. Chandrasekaran, 2000, PHI.
2. Introduction to formal Languages & Automata-Peter Linz, 2001, NarosaPubl.
3. Fundamentals of the Theory of Computation- Principles and Practice by Ramond Greenlaw and H. James Hoover, 1998, Harcourt India Pvt. Ltd.

Manika

| Deep Learning 24UCSE23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – V | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | **Machine Learning** | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short term memory cells and convolutional neural networks. The course also requires students to implement programming assignments related to these topics.

**Course Outcome:**

At the end of this course, the student will be able to:

CO1. Understand the fundamental principles of deep learning.
CO2. Analyse the deep learning algorithms for various types of learning tasks in various domains.
CO3. Apply deep learning algorithms and solve real-world problems CO4. Evaluate the performance of different optimization techniques.
CO5. Analyse the uses of CNNS and RNN
CO6. Create an application using Deep Learning Models.

**Course Content:**

**UNIT - I**

**Basics:** Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.
**Feedforward Networks:** Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders.

**UNIT – II**

**Deep Neural Networks:** Difficulty of training deep neural networks, Greedy layer wise training.

Monika

**Better Training of Neural Networks:** Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

**UNIT - III**

**Recurrent Neural Networks:** Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs
**Convolutional Neural Networks:** LeNet, AlexNet.

**UNIT - IV**

**Generative models:** Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.
**Recent trends:** Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning

**UNIT - V**

**Applications:** Vision, NLP, Speech (just an overview of different applications in 2-3 lectures)

**Textbooks**

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

**References Books:**

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

Mamta

**Optimization Technique 24UCSE25**

| B. Tech. CSE (AI/ML) Semester – V | | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 4 | 0 | 0 | 4 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | **Machine Learning** | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examination question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

1. Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).
2. The problem formulation by using linear, dynamic programming, game theory and queuing models.
3. The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.
4. Formulation of mathematical models for quantitative analysis of managerial problems in industry.

**Course Outcome:**

At the end of this course, the student will be able to:

CO1. Understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function.
CO2. Analyse differential calculus in finding the maxima and minima of functions of several variables.
CO3. Evaluate real-life problems with Linear Programming.
CO4. Apply the Linear Programming models using graphical and simplex methods.
CO5. apply real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms
CO6. Analyse the Queuing model for effective customer satisfaction
CO7. Apply dynamic programming to optimize multi stage decision problems.

**Course Content:**

**UNIT - I**

**Introduction to Classical Optimization Techniques**: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

**Classical Optimization Techniques**: Single variable Optimization, Multi variable Optimization with and without constraints, Multivariable Optimization with equality constraints - solution by method of Lagrange multipliers, Multivariable Optimization with inequality constraints - Kuhn – Tucker conditions. **UNIT – II**

**Linear Programming**: Various definitions, statements of basic theorems and properties, Advantages, Limitations and Application areas of Linear Programming, Graphical method of Linear Programming problem.

**Simplex Method** : Phase I and Phase II of the Simplex Method, The Revised Simplex method, Primal and Dual Simplex Method, Big –M method.

**UNIT - III**

**Transportation Problem**: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. (Including assignment and travelling salesman problems) (No degeneracy problems)

**Queuing**: Queuing Models : Essential features of queuing systems, operating characteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M/M/1 : ¥ /FCFS,M/M/1 : N/FCFS, M/M/C : ¥/FCFS, M/M/C : N/FCFS.

**UNIT - IV**

**Dynamic Programming**: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

**Integer Programming**: Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

**UNIT - V**

**Simulation Modeling**: Introduction, Definition and types, Limitations, Various phases of modeling, Monte Carlo method, Applications, advantages and limitations of simulation **Text Books:**


1. Engineering optimization: Theory and practice"-by S.S.Rao, New Age International (P) Limited.
2. Operations Research: An Introduction" by H A Taha, 5th Edition, Macmillan, New York.
3. Operations Research by NVR Naidu, G Rajendra, T Krishna Rao, I K International Publishing house, New Delhi.


**Reference Books:**


1. Optimization Methods in Operations Research and systems Analysis" – by K.V. Mittal and C. Mohan, New Age, International (P) Limited, Publishers
2. Operations Research – by S.D.Sharma, Kedarnath Ramanath & Co 3. Linear programming, G. Hadley, Narosa Publishing House, New Delhi.
4. Industrial Engineering and Production Management, M. Mahajan, DhanpatRai & co


| Natural Language Processing 24UCSE32 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – V | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |

| | | | | |
|---|---|---|---|---|
| **Effective from Session:** | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | **Machine Learning** | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examination question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

The students should be able to study language and the tools that are available to efficiently study and analyse large collections of text. They should learn about and discuss the effects of electronic communication on our language.

**Course Outcome:**

At the end of this course, the student will be able to:

CO1. Understand language and the tools that are available to efficiently study and analyse large collections of text.

CO2. Analyse and discuss the effects of electronic communication on our language CO3. Analyse natural language processing with manual and automated approaches. CO4. Apply computational frameworks for natural language processing.

**Course Content:**

**UNIT I**

A computational framework for natural language, description of English or an Indian language in the frame work, lexicon, algorithms and data structures for implementation of the framework. Finite state automata, the different analysis levels used for NLP (morphological, syntactic, semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.

**UNIT II**

Word level and syntactic analysis Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine-readable dictionaries and lexical databases, RTN, ATN.

**UNIT III**

Semantic analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.

**UNIT IV**

Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.

**UNIT V**

Information Retrieval: Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net, Frame Net, Stemmer.

**Text Books:**


1. Natural Language understanding by James Allen, Pearson Education, 2002.
2. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, 2016.


**Suggested References:**


3. Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
4. An Introduction to Natural Language Processing, Computational Linguistics, and Speech 5. Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.
6. Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley
7. https://www.coursera.org/specializations/natural-language-processing

| B. Tech. CSE (AI/ML) Semester-V | | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course outcome**

CO1: To understand the fundamentals of artificial intelligence and machine learning and their applications in medicine.
CO2: To explore advanced AI techniques, including deep learning, reinforcement learning, and natural language processing.
CO3: To learn about the use of AI in medical imaging, diagnostics, disease prediction, and treatment planning.
CO4: To examine the ethical, legal, and social implications of AI in medicine, including issues of bias, privacy, and equity.
CO5: To gain hands-on experience with AI tools and platforms through practical exercises and projects.
CO6: To critically evaluate research studies and applications of AI in healthcare.

Unit 1:
Introduction to Artificial Intelligence in Medicine, Definition and scope of AI in healthcare, Historical perspective and milestones in AI research, Applications of AI in clinical practice and biomedical research.
Unit 2:
AI in Medical Imaging, Image classification, segmentation, and registration, Radiomics and quantitative imaging biomarkers, Applications of AI in radiology, pathology, and ophthalmology. AI in Diagnostics and Disease Prediction, Predictive modeling for disease risk assessment, Diagnostic decision support systems, Early detection of diseases using AI algorithms Unit
3:
Natural Language Processing (NLP) in Healthcare, Text mining and information extraction from clinical notes, Clinical language understanding and medical coding, Applications of NLP in electronic health records (EHR) analysis and clinical documentation Unit 4:
AI in Personalized Medicine and Treatment Planning, Pharmacogenomics and precision medicine, Treatment recommendation systems, Drug discovery and repurposing using AI approaches.
Unit 5
Ethical, Legal, and Social Implications (ELSI) of AI in Medicine, Bias and fairness in AI algorithms, Privacy and security of healthcare data, Regulation and policy considerations for AI in healthcare

**Textbooks**
Mesko, B., 2017. A guide to artificial intelligence in healthcare. Budapest, Hungary: The Medical Futurist. leanpub. com.
**Reference Books**

1. Artificial Intelligence in Healthcare by Dr Parag Suresh Mahajan MD
2. AI in Health: A Leader's Guide to Winning in the New Age of Intelligent Health Systems (HIMSS Book Series) by Tom Lawry

| Program Elective I - AI in Healthcare Lab (24UCSE29) | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-V | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course outcome**

CO1: To understand the fundamentals of artificial intelligence and machine learning and their applications in medicine.
CO2: To explore advanced AI techniques, including deep learning, reinforcement learning, and natural language processing.
CO3: To learn about the use of AI in medical imaging, diagnostics, disease prediction, and treatment planning.
CO4: To examine the ethical, legal, and social implications of AI in medicine, including issues of bias, privacy, and equity.
CO5: To gain hands-on experience with AI tools and platforms through practical exercises and projects.
CO6: To critically evaluate research studies and applications of AI in healthcare.

**Project**

Students have a make a project based on the use case for AI in Health care.

| Program Elective I - AI in Agriculture (24UCSE27) | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-V | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Outcomes**

At the end of this training course participants will have better understanding on:

CO1: Advantage of implementing AI in Agriculture and Food Industry.

CO2:AI for improved crop management practices - efficient ways to produce, harvest and sell essential crops.

CO3:AI solutions to solve the challenges like climate variation, soil nutrition, infestation of pests and weeds that reduces yields by farmers.

CO4: Strengthened knowledge on efficient and sustainable agro-based businesses using AI and other ICT tools.

Unit 1

Introduction to AI (Artificial Intelligence) - A brief introduction to AI, Types of AI capabilities & techniques used, AI and its potential for different types of organizations (public and private), Understanding the limitations of AI

Unit 2

AI in Agri-Business and Food Industry, Appropriate AI techniques and operational opportunities, Technology available for AI relevant to Agro-Industry and Food Supply, AI in decision making for agricultural professionals and farmers

Unit 3

The Future of AI- - A positive future with AI and ML (Machine Learning), the Symbiosis of Distributed Ledger and Machine Learning as a Relevance for Autonomy in the Internet of Things (IoT),

Unit 4:

Benefits and Risks of AI, Impact and Benefits of AI for a sustainable future Agri-Business and Food Industry

Unit 5

Case Studies on application of AI in Agriculture and Food Supply -- Autonomous Tractors and Agricultural Robots, Crop and Soil Monitoring, Controlling Pest Infestation, Precision Farming with Predictive Analytics

**Textbooks**

Artificial Intelligence In Agriculture (1) Hardcover – 26 June 2020 by Rajesh Singh & Anita Gehlot Mahesh Pratap Gehlot & Bhupendra Singh

**Reference Books**

1. Artificial Intelligence in Indian Agriculture by R. K Naresh., Sudhir Kumar, S.K. Gupta, Jairam Choudhary
2. IoT and AI in Agriculture: Self- sufficiency in Food Production to Achieve Society 5.0 and SDG's Globally Hardcover by Tofael Ahamed

| Program Elective I - AI in Agriculture Lab (24UCSE30) | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-V | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Outcomes**

At the end of this training course participants will have better understanding on:

CO1: Advantage of implementing AI in Agriculture and Food Industry.

CO2:AI for improved crop management practices - efficient ways to produce, harvest and sell essential crops.

CO3:AI solutions to solve the challenges like climate variation, soil nutrition, infestation of pests and weeds that reduces yields by farmers.

CO4: Strengthened knowledge on efficient and sustainable agro-based businesses using AI and other ICT tools.

**Project**

Students have a make a project based on the use case for AI in Health care.

| Program Elective II- Big Data Analytics 24UCSE37 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Outcomes:**

The students will be able to:

CO1: Identify Big Data and its Business Implications.

CO2: List the components of Hadoop and Hadoop Eco-System and process Data on Distributed File System

CO3: Manage Job Execution in Hadoop Environment CO4:

Develop Big Data Solutions using Hadoop Eco System

CO5: Analyze Infosphere BigInsights Big Data Recommendations.

CO6: Apply Machine Learning Techniques using R

**Syllabus**

**Unit I : Introduction To Big Data And Hadoop**

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

**Unit II : HDFS(Hadoop Distributed File System)**

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

**UNIT III: Map Reduce**

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map

Reduce Types and Formats, Map Reduce Features.

**Unit IV: Hadoop Eco System**

Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL: Introduction

**UNIT V : Data Analytics with R**

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

**Text Books**


- Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
- Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.


**Reference Book**


- Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
- Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
- Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
- Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press


Monika

| Program Elective II- Big Data Analytics Lab 24UCSE40 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Objectives:** This course is designed to:

1. Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks
2. Experiment MapReduce in Hadoop frameworks
3. Implement MapReduce programs in variety applications
4. Understand different approaches for building Hadoop MapReduce programs for real-time applications

**Experiments:**

1. Install Apache Hadoop
2. Develop a MapReduce program to calculate the frequency of a given word in agiven file.
3. Develop a MapReduce program to find the maximum temperature in each year.
4. Develop a MapReduce program to find the grades of student's.
5. Develop a MapReduce program to implement Matrix Multiplication.
6. Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.
7. Develop a MapReduce to analyze weather data set and print whether the day is shinny or cool day.
8. Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like

| Tranction Date | Product | Price | Payment Type | Name | City | State | Country | Account Created | Last Login | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|

9. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.

Manika

| Program Elective II- Data Warehouse and Data Mining 24UCSE38 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Outcomes:**

After undergoing the course, Students will be able to understand

CO1: Design a data mart or data warehouse for any organization

CO2: Develop skills to write queries using DMQL CO3:

Extract knowledge using data mining techniques

CO4: Adapt to new data mining tools.

CO5: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data

UNIT - I

INTRODUCTION TO DATA MINING: Motivation, Importance, Definition of Data Mining, Kind of Data,Data Mining Functionalities, Kinds of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of A Data Mining System With A Database or Data Warehouse System, Major Issues In Data Mining, Types of Data Sets and Attribute Values, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity.

PREPROCESSING: Data Quality, Major Tasks in Data Preprocessing, Data Reduction, Data Transformation and Data Discretization, Data Cleaning and Data Integration.

UNIT - II

DATA WAREHOUSING AND ON-LINE ANALYTICAL PROCESSING: Data Warehouse basic concepts, Data Warehouse Modeling - Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

DATA CUBE TECHNOLOGY: Efficient Methods for Data Cube Computation, Exploration and Discovery in Multidimensional Databases.

UNIT - III

MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Are All the Pattern Interesting, Pattern Evaluation Methods, Applications of frequent pattern and associations.

FREQUENT PATTERN AND ASSOCIATION MINING: A Road Map, Mining Various Kinds of Association Rules, Constraint-Based Frequent Pattern Mining, Extended Applications of Frequent Patterns.

UNIT - IV

CLASSIFICATION: Basic Concepts, Decision Tree Induction, Bayesian Classification Methods, RuleBased Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy:

Ensemble Methods, Handling Different Kinds of Cases in Classification, Bayesian Belief Networks, Classification by Neural Networks, Support Vector Machines, Pattern-Based Classification, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

UNIT - V

CLUSTER ANALYSIS: Basic Concepts of Cluster Analysis, Clustering structures, Major Clustering Approaches, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Model Based Clustering - The Expectation-Maximization Method, Other Clustering Techniques, Clustering HighDimensional Data, Constraint-Based and User-Guided Cluster Analysis, Link-Based Cluster Analysis, Semi-Supervised Clustering and Classification, Bi-Clustering, Collaborative Clustering.

OUTLIER ANALYSIS: Why outlier analysis, Identifying and handling of outliers, Distribution Based Outlier Detection: A Statistics-Based Approach, Classification-Based Outlier Detection, ClusteringBased Outlier Detection, Deviation-Based Outlier Detection, Isolation-Based Method: From Isolation Tree to Isolation Forest.

**Text Books:**

1. Jiawei Han, MichelineKamber, Jian Pei (2012), Data Mining: Concepts and Techniques, 3rd edition,

Elsevier, United States of America.

**Reference Books:**

1. Margaret H Dunham (2006), Data Mining Introductory and Advanced Topics, 2nd edition,Pearson Education, New Delhi, India.

2. Amitesh Sinha (2007), Data Warehousing, Thomson Learning, India.

3. Xingdong Wu, Vipin Kumar (2009), the Top Ten Algorithms in Data Mining, CRC Press, UK.

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| Program Elective II- Data Warehouse and Data Mining Lab 24UCSE41 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Outcomes:**

Students can able

- To evaluate the different models of OLAP and data preprocessing.
- To enlist various algorithms used in information analysis of Data Mining Techniques.
- To demonstrate the knowledge retrieved through solving problems

**List of Experiments**

1. Explore various commands given in PL/SQL in Oracle 8.0
2. Execute multi-dimensional data model using SQL queries.
3. Implement various OLAP operations such as slice, dice, roll up, drill up, pivot etc.
4. Implementation of Text Mining on the data warehouse
5. Explore the correlation-ship analysis between the data set
6. Evaluate attribute relevance analysis on a weather data warehouse
7. Evaluate Information Gain of an attribute in the student database
8. Experiment to predict the class using the Bayesian classification
9. Find out a weight & bias updating using the Back Propagation Neural Network
10. To perform various data mining algorithms on the give data base using

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| Program Elective II- Cloud Computing 24UCSE39 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Outcomes:**

At the end of this course student will:

CO1: Understand the concept of virtualization and how this has enabled the development of Cloud Computing

CO2: Know the fundamentals of cloud, cloud Architectures and types of services in cloud

CO3: Understand scaling, cloud security and disaster management

CO4: Design different Applications in cloud

CO5: Explore some important cloud computing driven commercial systems

UNIT 1

Introduction to Cloud: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments. Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- VMware and Microsoft Hyper-V. Before the Move into the Cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications

UNIT 2

Cloud Computing Architecture : Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance. Ready for the Cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management, Data Security, Network Security, Host Security, Compromise Response.

UNIT 3

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Defining the Clouds for Enterprise: Storage as a service, Database as a service, Process as a service, Information as a service, Integration as a service and Testing as a service. Scaling a cloud infrastructure - Capacity Planning, Cloud Scale. Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.

UNIT 4

Aneka: Cloud Application Platform Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools.

UNIT 5

Cloud Applications: Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming. Cloud Platforms in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure

**Text Books**

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. George Reese Cloud Application Architectures, First Edition, O''Reilly Media 2009.

**References**

1. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
2. Cloud Computing 2nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
3. Cloud Computing – web based Applications that change the way you work and collaborate Online – Micheal Miller.Pearson Education

| Program Elective II- Cloud Computing Lab 24UCSE42 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | Core Course | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BOS approval:** | | | | **22-7-2024** | **Duration of Exam** | : | |
| **Prerequisite** | | | | | | | |

**Course Objective:**

To develop web applications in cloud

To learn the design and development process involved in creating a cloud based application To learn to implement and use parallel programming using Hadoop

**List of Experiments:**

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top ofwindows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not presenting CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

# Semester 6

| Advanced ML 24UCSE34 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. To design and implement various machine learning algorithms in a range of real-world applications.

**Course Outcomes:**

After successfully completion of this course students will be able to:

CO1. Understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation.
CO2. Apply various machine learning algorithms in a range of real-world applications.
CO3. Integrate and apply their expertise to produce solutions for real-world problems.
CO4. Interpret and Analyze results with reasoning using different ML techniques.
CO5. Apply Ensemble Methods **Course Contents:**

**Unit 1: Artificial Neural Network**

Introduction to ANN, Perceptron, Cost Function, Gradient Checking, multi-layer perceptron and backpropagation algorithm that is used to help learn parameters for a neural network, Random Initialization

**Unit II: Bayesian Learning**

Probability theory and Bayes rule, Naive Bayes learning algorithm, Bayes nets.

**Unit III: Decision Trees**

Representing concepts as decision trees, Recursive induction of decision trees, best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, and pruning.

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**Unit V: Reinforcement Learning**

Reinforcement earning through feedback network, function approximation.

**Unit V: Ensemble Methods**

Bagging, boosting, stacking and learning with ensembles. Random Forest.

**Text Book:**

1. Tom Mitchell, Machine Learning, McGraw Hill, 1997.

**Reference Books:**

1. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
2. Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
3. Ethem Apaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010.
4. Kevin P. Murphy, Machine Learning: a Probabilistic Perspective, The MIT Press, 2012.

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| Advanced ML Lab 24UCSE35 | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester-VI | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 35 |
| 0 | 0 | 2 | 1 | | **External Examination** | : | 15 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 50 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | |
| **Prerequisite** | | | | **Machine Learning** | | | |

**Course Objective:**

To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. To design and implement various machine learning algorithms in a range of real-world applications.

**Course Outcomes:**

**After successfully completion of this course students will be able to:**

CO1. Understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation.
CO2. Apply various machine learning algorithms in a range of real-world applications.
CO3. Integrate and apply their expertise to produce solutions for real-world problems. CO4. Interpret and Analyze results with reasoning using different ML techniques.

**List of Experiments:**

Implementation of following machine learning algorithms in various projects using Python:

1. Classification and regression algorithms.
2. K-Means Clustering.
3. Artificial Neural Network (with back-propagation).
4. Decision Trees.
5. Random Forest.

*The experiments may be added at the time of implementing.

**Text Book:**

1. Tom Mitchell, Machine Learning, McGraw Hill, 1997.

**Reference Books:**

1. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
2. Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
3. Ethem Apaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010.

| Compiler Design 24UCSE36 |
|---|

| B. Tech. CSE (AI/ML) Semester – VI | | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 4 | 0 | 0 | 4 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | Theory of Computation | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objective:**

1. To teach concepts of language translation and phases of compiler design
2. To describe the common forms of parsers
3. To inculcate knowledge of parser by parsing LL parser and LR parser
4. To demonstrate intermediate code using technique of syntax directed translation
5. To Illustrate the various optimization techniques for designing various optimizing compilers **Course Outcome:**

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

CO1. Understand the compiler construction tools and describes the Functionality of each stage of compilation process

CO2. Apply Grammars for Natural Languages and find the Syntactical Errors/Semantic errors during the compilations using parsing techniques

CO3. Analyse different representations of intermediate code.

CO4. Create new compiler for new languages.

CO5. Apply and evaluate code generation and code optimization techniques

**Course Content:**

**UNIT - I**

Introduction to compilers: Definition of compiler, interpreter and its differences, the phases of a compiler, role of lexical analyser, regular expressions, finite automata, from regular expressions to finite automata, pass and phases of translation, bootstrapping, LEX-lexical analyser generator.

Parsing: Parsing, role of parser, context free grammar, derivations, parse trees, ambiguity, elimination of left recursion, left factoring, eliminating ambiguity from dangling-else grammar, classes of parsing, top down parsing - backtracking, recursive descent parsing, predictive parsers, LL(1) grammars.

**UNIT - II**

Bottom up parsing: Definition of bottom up parsing, handles, handle pruning, stack implementation of shift-reduce parsing, conflicts during shift-reduce parsing, LR grammars, LR parsers-simple LR,

canonical LR(CLR) and Look Ahead LR (LALR) parsers, error recovery in parsing, parsing ambiguous grammars, YACC-automatic parser generator.

**UNIT - III**

Syntax directed translation: Syntax directed definition, construction of syntax trees, S-attributed and Lattributed definitions, translation schemes, emitting a translation.

Intermediate code generation: intermediate forms of source programs– abstract syntax tree, polish notation and three address code, types of three address statements and its implementation, syntax directed translation into three-address code, translation of simple statements, Boolean expressions and flow-ofcontrol statements.

**UNIT - IV**

Type checking: Definition of type checking, type expressions, type systems, static and dynamic checking of types, specification of a simple type checker, equivalence of type expressions, type conversions, overloading of functions and operators.

Run time environments: Source language issues, Storage organization, storage-allocation strategies, access to non-local names, parameter passing, symbol tables and language facilities for dynamic storage allocation.

**UNIT - V**

Code optimization: Organization of code optimizer, basic blocks and flow graphs, optimization of basic blocks, the principal sources of optimization, the directed acyclic graph (DAG) representation of basic block, global data flow analysis.

Code generation: Machine dependent code generation, object code forms, the target machine, a simple code generator, register allocation and assignment, peephole optimization.

**Text Books:**

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (2007), Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India.

**Reference Books:**

1. Alfred V. Aho, Jeffrey D. Ullman (2001), Principles of compiler design, Indian student edition,
2. Pearson Education, New Delhi, India.
3. Kenneth C. Louden (1997), Compiler Construction– Principles and Practice, 1st edition, PWS
4. Publishing.
5. K. L. P Mishra, N. Chandrashekaran (2003), Theory of computer science- Automata Languages
6. and computation, 2nd edition, Prentice Hall of India, New Delhi, India.
7. Andrew W. Appel (2004), Modern Compiler Implementation C, Cambridge University Press,UK.

## Semester 7

| Soft Computing (24UCSE43) | | | | | | | |
|---|---|---|---|---|---|---|---|
| B. Tech. CSE (AI/ML) Semester – VII | | | | | | | |
| **L** | **T** | **P** | **Credits** | **Core Course** | **Internal Examination** | : | 30 |
| 3 | 0 | 0 | 3 | | **External Examination** | : | 70 |
| **Effective from Session:** | | | | **w.e.f. 2024-2025** | **Total** | : | 100 |
| **Date of BoS approval:** | | | | | **Duration of Exam** | : | 3 Hrs |
| **Prerequisite** | | | | | | | |

**Instruction for Paper Setter:**

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

**Course Objectives:**

The students will try to learn:

1. The fuzzy logic and reasoning for handling uncertainty in problem solving
2. Introduce the ideas of neural networks, fuzzy logic.
3. The basics of intelligence techniques and methodologies of soft computing
4. The design and analysis of problem-solving using concepts of neural networks, neuro modeling, several neural networks paradigms.

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

CO1. Apply the importance of knowledge representation and processing in intelligent system CO2. Understand the characteristics and constitutes of soft computing for decision making systems.

CO3. Apply the models of artificial neural systems for classification problems.

CO4. Apply the learning rules and its working principle for computer vision and image processing applications.

CO5. Apply the importance of auto and hetero associative memories for distinct cases of neural network systems.

**Course Contents:**

**UNIT-1: Introduction to Neural Networks**

Introduction: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, back propagation network, radial basis function network.

**UNIT-2: Associative Memory and Unsupervised Learning Networks & Fuzzy Logic**

Associative memory networks: Training algorithms for pattern association, auto associative memory network, hetero associative memory network, bidirectional associative memory, Hopfield networks,

iterative auto associative memory network, temporal associative memory network; Unsupervised learning networks: Kohonen self-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network. Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, noniterative fuzzysets. Membership functions: Fuzzification, methods of membership value assignments, defuzzification, and Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.

**UNIT-3: Neural Networks**

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

**UNIT-4: Genetic Algorithms**

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition

**UNIT-5: Matlab/Python Lib**

Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm, Implementation of recently proposed soft computing techniques **Text Books:**


1. Jyh: Shing Roger Jang, Chuen: Tsai Sun, Eiji Mizutani, Neuro: Fuzzy and Soft Computing, Prentice: Hall of India, 2003.
2. J.S.R .Jang, C. T. Sun, E. Mizutani, Neuro, "Fuzzy and Soft Computing", PHI, Pearson Education, 1st Edition, 2004.
3. S. N. Sivanandan, S. N. Deepa, "Principles of Soft Computing", Wiley India, 2nd Edition, 2007.


**Reference Books:**


1. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, Prentice Hall, 1995.
2. MATLAB Toolkit Manual
3. 1. S. Rajasekaran, G.A.V.Pai,"Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 1st Edition,2003.
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3rd Edition, 1997.
5. Stamatios V. Kartalopoulos "Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications", IEEE Press, PHI, New Delhi, 2004.